



Working Report 2006-63

GPS Operations at Olkiluoto, Kivetty and Romuvaara in 2005

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GPS operations at Olkiluoto, Kivetty and Romuvaara in 2005

ABSTRACT

The GPS based deformation studies has been made at the investigation areas of Posiva since 1995, when the network of ten GPS pillars was established at Olkiluoto. The network of seven GPS pillars was built at Kivetty and Romuvaara during the year 1996. One pillar in each investigation area belongs to the Finnish permanent GPS network, FinnRef[®].

Twenty GPS measurement campaigns have been carried out at Olkiluoto since 1995, and fourteen campaigns at Kivetty and Romuvaara. According to the time series of the GPS results 1/3 of the baselines at Olkiluoto have statistically significant change rates. However, the observed movements are smaller than ± 0.22 mm/a. There are no statistically significant movements at Kivetty and Romuvaara except one pillar at Romuvaara.

There are five pillars, which have statistically significant horizontal velocities at Olkiluoto. The local velocity components are small but taking into account the standard deviations the largest velocity components seems to be reliable (maximum velocity is -0.25 mm/a ± 0.025 mm/a).

The uniform scale for the GPS measurements made in different years is the basic condition for reliable results in the deformation analyses. At Olkiluoto a baseline for electronic distance measurements (EDM) was built in 2002. The baseline has been measured using EDM instruments simultaneously with the GPS observations. The comparison between the GPS and EDM results to show a possible scale error of the GPS.

The GPS network at Olkiluoto was enlarged in 2003. The new pillars were built close to Kuivalahti village and on a small island of Iso Pyrekari, both north from Olkiluoto. According to the geological evidence it is expected that a fracture zone is located between the new stations, thus enabling the determination of possible deformations along the fracture zone. The new pillars have been observed five times since 2003, but the time series are still too short for reliable deformation studies.

Including the new pillars the local GPS network at Olkiluoto consists of 12 stations. The whole network is measured twice a year. The EDM measurements will be done simultaneously with the GPS observations. Even if the studies are concentrated at Olkiluoto, the GPS observations at Kivetty and Romuvaara investigation areas will be made once per year. Because the stability of these networks has been confirmed by GPS observations in previous years, we may regard the observations at Kivetty and Romuvaara as a reference for the stability of our GPS determinations.

Keywords: Deformation studies, GPS measurements, crustal movements.

Olkiluodon, Kivetyyn ja Romuvaaran tutkimusalueilla vuonna 2005 tehtyjen GPS-mittausten tulokset

TIIVISTELMÄ

GPS-satelliittipaikannukseen perustuvaa deformaatiotutkimusta on tehty Posivan tutkimusalueilla vuodesta 1995 lähtien, jolloin Olkiluotoon perustettiin kymmenen pilaria käsittävä paikallisverkko. Romuvaaralle ja Kivettyyn rakennettiin seuraavana vuonna seitsemän pilarin GPS-verkot. Kaikista tutkimusalueista yksi pilari kuuluu Suomen pysyvään GPS-verkkoon (FinnRef[®]), jossa rekisteröintiä tehdään jatkuvasti.

Olkiluodon verkko on mitattu 20 kertaa vuodesta 1995 lähtien. Romuvaaralla ja Kivetyssä mittauksia on kertynyt 14. Mittauksista lasketut pilarien väliset etäisyydet muodostavat aikasarjan, jonka mukaan kolmanneksella Olkiluodon verkon pilaripareilla on tilastollisesti merkittävä etäisyyden muutosnopeus. Kaikki havaitut liikkeet ovat kuitenkin alle ± 0.22 mm/a. Mittaustulosten mukaan Kivetyssä ei ole havaintotarkkuuden ylittäviä liikkeitä. Romuvaaralla verkko näyttää myös olevan liikkumaton yhtä pilaria lukuunottamatta.

Viidellä Olkiluodon asemalla on havaittu tilastollisesti merkittävä vaakaliike. Paikalliset liikenopeudet ovat pieniä, mutta niitä voidaan keskivirheiden perusteella pitää luotettavina (maksimi liikenopeus - 0.25 mm/a ± 0.025 mm/a).

Olkiluodon tutkimusalueelle rakennettiin v. 2002 perusviiva, jonka pituus on mitattu elektronisilla etäisyydenmittauslaitteilla (EDM) aina GPS-mittauskampanjan yhteydessä. Perusviivalla tehtävien EDM-mittausten tarkoituksena on varmistaa GPS:n avulla tehtyjen mittausten mittakaavan yhdenmukaisuus vuodesta toiseen.

Olkiluodon tutkimusalueelle rakennettiin v. 2003 kaksi uutta GPS-mittauspilaria ja uuden ydinvoimalan rakennustyömaan alle jäävän aseman tilalle rakennettiin uusi GPS-havaintopilari. Uudet pilarit rakennettiin Kuivalahteen ja Iso Pyrekarille, molemmat Olkiluodosta pohjoiseen. Molemmat asemat sijaitsevat Eurajoensalmen ruhjevyöhykkeellä ja niiden sijaintien muutoksien avulla voidaan seurata mahdollisia ruhjevyöhykkeen liikkeitä. Uudet pilarit on havaittu viidesti, mutta aikasarja on vielä liian lyhyt luotettavien deformaatioanalyysien tekemiseen.

Uusien pilarien rakentamisen jälkeen Olkiluodon tutkimusalueella on 12 GPS-pilaria, joiden sijainti mitataan kahdesti vuodessa. Samanaikaisesti GPS-mittausten kanssa tehdään EDM-mittaukset perusviivalla. Vaikka tutkimukset ovat keskittyneet Olkiluotoon, Kivetyyn ja Romuvaaran GPS-verkot mitataan edelleen kerran vuodessa. Aikaisempien GPS-mittausten perusteella voidaan Kivetyyn ja Romuvaaran paikallisverkkoja pitää erittäin stabiileina. Nyt näitä pisteverkkoja voidaan käyttää GPS-mittausten ja laskennan testikenttinä.

Avainsanat: Deformaatiotutkimus, GPS-mittaukset, maankuoren liikkeet.

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1. INTRODUCTION

The Finnish Geodetic Institute (FGI) has studied crustal deformations in co-operation with the Posiva Ltd. (previously Teollisuuden Voima, TVO). The studies have been made at the investigation areas, which were selected as candidates for the final disposal sites of spent nuclear fuel. The studies started in 1994, when a network of ten pillars for GPS observations was established at Olkiluoto. In 1995 the GPS networks of seven pillars were built at Kivetty and at Romuvaara. One pillar at each investigation area belongs to the Finnish permanent GPS network FinnRef[®] and are used for continuous GPS observations.

The measurements started at Olkiluoto in 1995, while the first observations were carried out at Romuvaara and at Kivetty in 1996. The baselines between GPS pillars (0.5-3.5 km) have been observed twice a year except the year 2000 because of high ionospheric activity. The studies are now concentrated at Olkiluoto, because the Government and the Parliament have ratified the decision, which enables to establish the final disposal site close to Olkiluoto nuclear power stations. After the decision, since 2002, observations were carried out at Kivetty and at Romuvaara once per year only. We have not finished the studies at these investigation areas, because those areas are the reference networks for Olkiluoto. The time series of the GPS observations provide the relative movements of the GPS pillars, which are then used to determine the local deformations.

Every GPS pillar has two reserve markers. We determine regularly the distances and angles between the pillars and their control markers in order to check the stability of the concrete pillars. The measurements have been made using tacheometer in 2000, 2001 and 2004.

According to the GPS analysis the lengths of all vectors deviate in some sessions systematically from the mean of all observations. The scale difference is mainly caused by errors in the ionosphere modelling. Because of this scaling problem we have established a 511 m long baseline for electronic distance measurement (EDM) between the pillars GPS7 and GPS8 at Olkiluoto. The distance has been measured with Kern ME5000 mekometer, which is the most accurate EDM instrument. The owner of the mekometer is the Institute of Geodesy, Department of Surveying, Helsinki University of Technology. The Mekometer has been calibrated at the Nummela Standard Baseline every year to ensure the quality of the results. The electronic distance measurements have been performed during the GPS observations since 2002. By using the EDM observations to reduce the GPS results to the common scale may improve the reliability of the GPS results.

In 2003 Posiva decided to expand the Olkiluoto GPS network to the north for monitoring possible crustal movements at an old fracture zone, which is going from NW to SE along Eurajoensalmi. Two new pillars were established in August 2003. They are located at Kuivalahti and at Iso Pyrekari. The distances from the permanent GPS station are about 8.5 and 4.8 km. The pillar GPS10 was destroyed when Teollisuuden Voima Oy started to build a new nuclear power station at Olkiluoto in the

end of year 2003. The pillar GPS10 was replaced with a new one located about 300 m to the west from the original pillar.

GPS measurements are suitable to determine the horizontal deformations, but the accuracy of height determination is not adequate. The FGI started to determine possible vertical deformations at Olkiluoto with precise levelling in 2003. Leveling campaigns will be performed every second year and they will be reported in a separate working report (Lehmuskoski 2004 and 2006).

2. OPERATIONS AT THE PERMANENT GPS STATIONS IN 2005

Three out of 13 FinnRef[®] GPS stations (Ollikainen et al., 2004), viz. Olkiluoto, Romuvaara, and Kivetty, are located in investigation areas of Posiva. They collect continuously GPS data with 30 second observing interval.

The data transfer has been made once a day via a modem connection except from Olkiluoto, where we began to use an ADSL internet connection with hourly data transfer in October 21, 2005. Occasionally there are one-day breaks in data caused by the errors in data transfer. Longer breaks are mostly caused by the thunderstorms that damage the receiver or the modem. In some cases the data are lost because of faulty telephone lines. In 2005 a break longer than 3 days occurred only in Kivetty where there was a break from May 17 to June 2.

The GPS data are processed with Bernese 4.2 Software as described in Ollikainen et al., 2004. The data are used in 24-hour sessions together with the IGS final orbits. Finally the daily solutions are combined into weekly solution. Nine years of GPS data of all 12 GPS stations are included in our processing. In figures 2-1, 2-2 and 2-3 we show the time series of Olkiluoto, Kivetty and Romuvaara relative to Metsähovi. There exist some erroneous values especially in the height component. The snow accumulating on the antenna radome leading to bad ambiguity resolution or/and bad troposphere estimation can explain this behavior. We solved for trends from the coordinate time series by fitting iteratively for the trend with least squares. At each iteration round the coordinates with residuals larger than 14 mm were rejected. The rejection value is twice the root-mean-square scatter in summer solutions (April to October) for Kevo, the furthest station from Metsähovi. Iteration was continued until the change rates did not change from the previous iteration round.

Time series have an obvious annual periodicity, which can be seen on the periodograms on the left columns of the Figures 2-1, 2-2, and 2-3. This behaviour was discussed more detailed in Ollikainen et al., 2004. The velocity components for Olkiluoto, Kivetty and Romuvaara are summarized in the Table 2-1. Compared to the previous report we notice, that one extra year of data did not change the rates. Mainly all the rates changed less than 0.04 mm/a. Only the height rate of Romuvaara changed slightly more, namely 0,24 mm/a. This can be explained with a larger scatter in the height component resulting from a longer baseline to the base station (Metsähovi) and ambiguous results on the winter seasons when the antennas may be covered by snow. Distance rates are due to the land uplift which increase all distances when the GPS network recedes from the center of the Earth.

Table 2-1. *The relative movements in respect to Metsähovi IGS station from 10 years time series.*

Station	North component (mm/a)	East component (mm/a)	Height component (mm/a)	Distance rates (mm/a)
Olkiluoto	-0.50±0.02	-0.47±0.03	+2.28±0.06	+0.03±0.03
Kivetty	+0.17±0.03	-0.58±0.02	+1.20±0.08	+0.01±0.03
Romuvaara	+0.66±0.05	-0.95±0.03	-0.83±0.10	+0.16±0.05

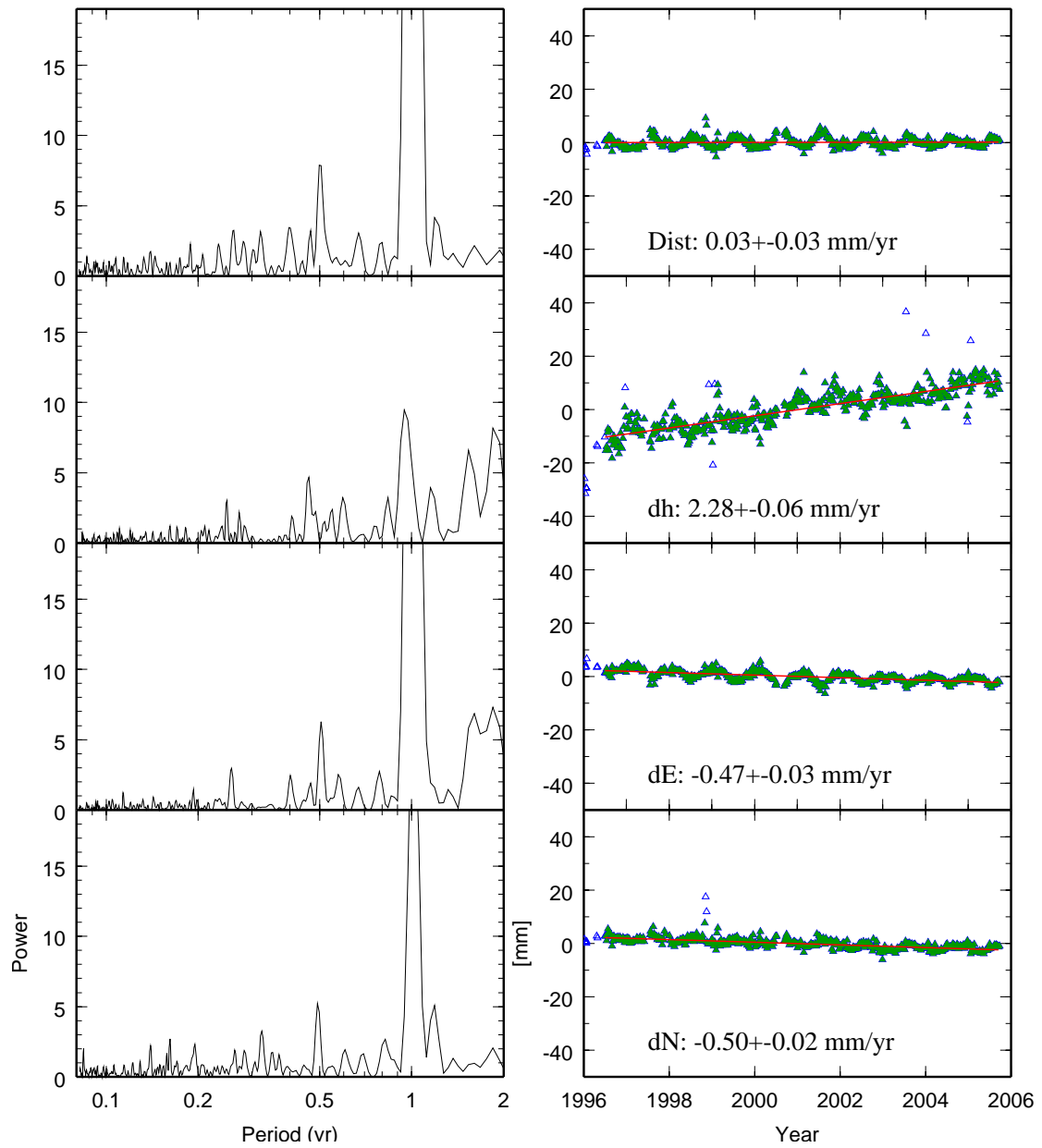


Figure 2-1. Time series of Metsähovi-Olkiluoto vector components. Right: Series of baseline length, height, East and North components. Left: Periodograms of the time series.

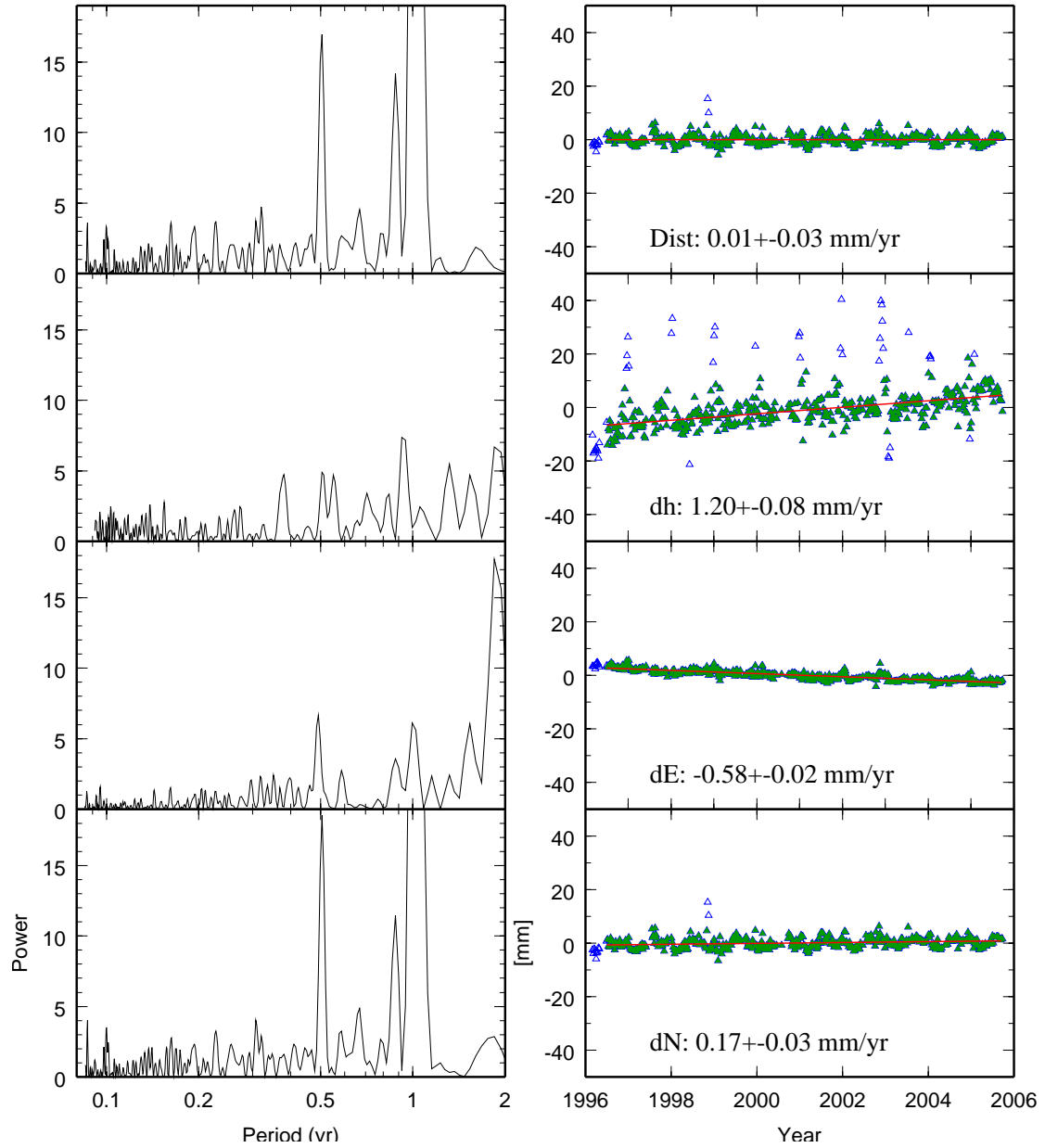


Figure 2-2. Time series of Metsähovi-Kivetty vector components. Right: Series of baseline length, height, East and North components. Left: Periodograms of the time series.

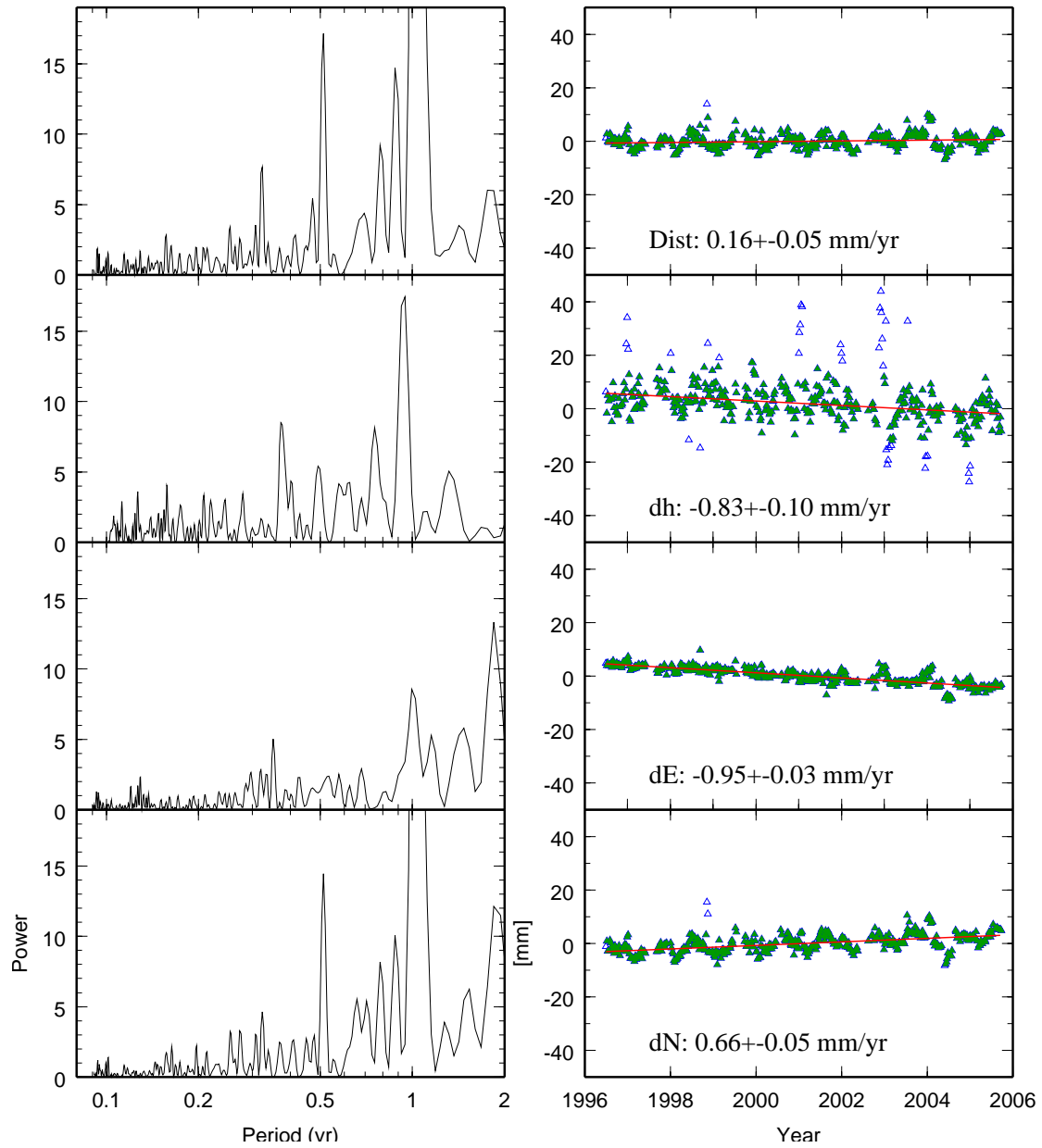


Figure 2-3. Time series of Metsähovi-Romuvaara vector components. Right: Series of baseline length, height, East and North components. Left: Periodograms of the time series.

3. GPS OPERATIONS AT THE LOCAL NETWORKS

3.1 The local networks

3.1.1 Olkiluoto network

The Olkiluoto GPS monitoring network was established in 1994 (Chen and Kakkuri, 1995). The original network (Figure 3-1) includes ten reinforced concrete pillars (GPS1-GPS10). The pillars stand on solid bedrock and according to geological studies they are located on different geological blocks. The distances between pillars are from 0.5 to 3.5 km. The station GPS1 belongs to the Finnish permanent GPS network, FinnRef[®] (Ollikainen *et al.* 1997) in which the abbreviation OLKI is used for the station.

In 2003 Posiva decided to expand the Olkiluoto GPS network to the north for monitoring possible crustal movements at an old fracture zone, which is going from NW to SE along Eurajoensalmi. Two new pillars were established in August 2003. They are located at Kuivalahti (GPS11) and at Iso Pyrekari (GPS12) 8.5 and 4.8 km away from the GPS station.

The pillar GPS10 was destroyed in the end of year 2003 when Teollisuuden Voima Oy started to build a new nuclear power station at Olkiluoto. A new pillar GPS13 was established about 300 m west from the pillar GPS10 in August 2003. Previously the name GPS10B was used for the pillar (Ollikainen *et al.* 2004), but according to the recommendation by Posiva it was renamed in 2005.

The construction work and different pillar types were described in Ollikainen *et al.* 2004.



Figure 3-1. The local GPS monitoring network at the investigation area of Olkiluoto.

3.1.2 Kivetty and Romuvaara networks

The networks at Kivetty and Romuvaara were established in 1995 (Chen and Kakkuri, 1996). There are seven pillars at Kivetty (Figure 3-2) and Romuvaara (Figure 3-3). They were built using the same principles than at Olkiluoto. One of the stations (GPS1) at the both investigation areas belongs to the Finnish permanent GPS network, FinnRef[®].

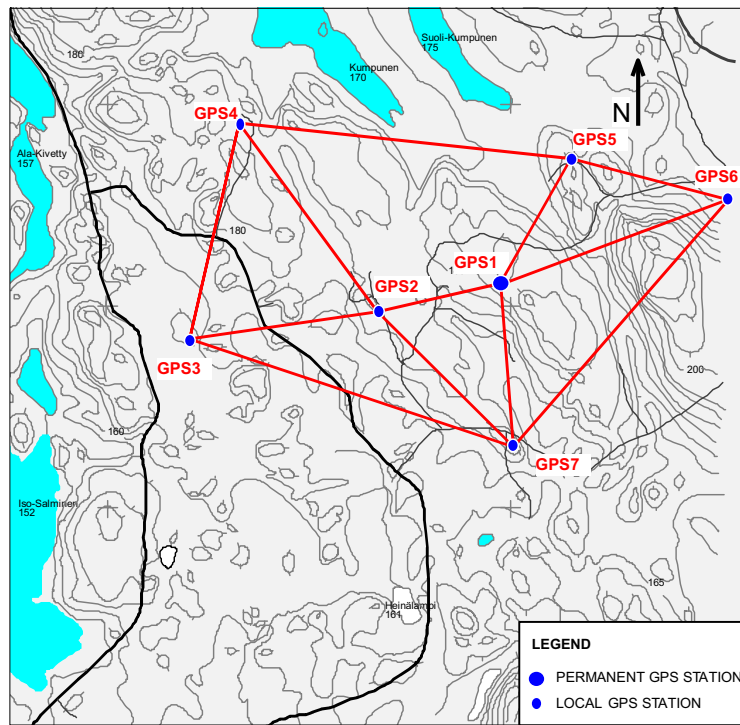


Figure 3-2. The local GPS network at Kivetty.

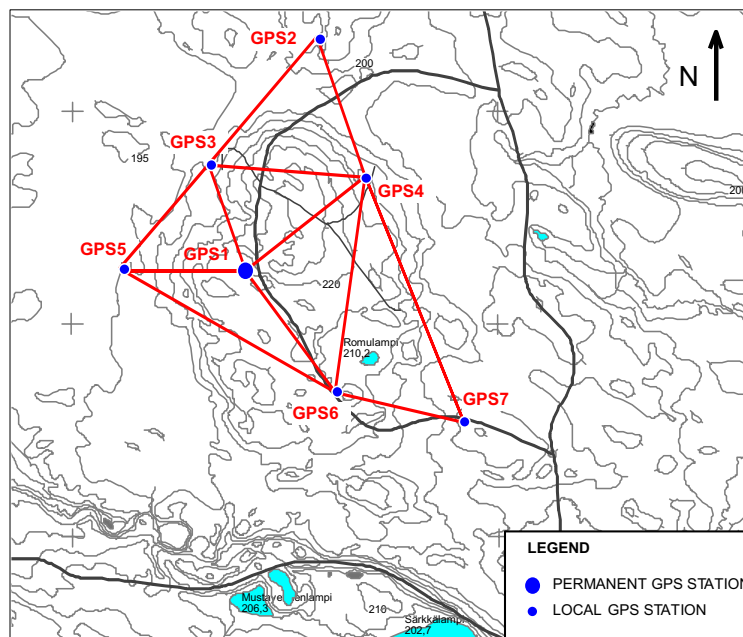


Figure 3-3. The local GPS network at Romuvaara.

3.2 The measurement campaigns in 2005

3.2.1 The measurements at Olkiluoto

The local GPS monitoring network at Olkiluoto has been observed twice a year since 1995 with the exception of the year 2000 (Chen and Kakkuri, 1996, 1997 and 1998, Ollikainen and Kakkuri, 1999 and 2000, Ollikainen *et al.* 2001, 2002 and 2004, Ahola *et al.* 2005).

As in the previous years two GPS measurement campaigns were carried out at Olkiluoto in 2005. The first measurements were performed on 6-11 April (Figure 3-4) and the second one on 4-10 October (Table 3-1).

The session I includes observations at the pillars GPS1, GPS4, GPS5, GPS6, GPS7, GPS8, GPS9 and GPS13 in both campaigns. The GPS equipments were moved from the pillars GPS4 and GPS7 to the pillars GPS2 and GPS3 for the session II.



Figure 3-4. The GPS measurement at Olkiluoto (GPS6). (Photograph J. Ahola 2005.)

Table 3-1. Observation sessions for the GPS measurements at Olkiluoto in 2005.

Campaign	Session	Observation day		Observation windows (UT)
		Calendar day	GPS day	
I / 2005	I	6 April	096	10.00-24.00
		7 April	097	0.00-10.00
	II	8 April	098	8.00-24.00
		9 April	099	0.00-11.00
	III	9 April	099	15.30-24.00
		10 April	100	0.00-24.00
11 April		101	0.00-13.30	
II / 2005	I	7 October	280	9.00-24.00
		8 October	281	0.00-10.00
	II	9 October	282	9.00-24.00
		10 October	283	0.00-10.00
	III	4 October	277	14.00-24.00
		5 October	278	0.00-24.00
		6 October	279	0.00-24.00
7 October	280	0.00-5.00		

The session III includes only the observations at the permanent station GPS1 and two new pillars GPS11 at Kuivalahti and GPS12 at Iso Pyrekari. It was not possible to make observations at Iso Pyrekari island in spring 2005. During the campaign the ice condition and stormy weather made it impossible to reach Iso Pyrekari by boat. The substitutive measurements were not carried out later because the pillar is located at the nature reserve, which is not allowed to be accessed after the bird nesting on Mid April.

The observations were made using seven Ashtech Z-12 receivers equipped with Dorne Margolin-type choke ring antennas (Table 3-2). Same antennas were used at the stations in previous campaigns. The observations at Iso Pyrekari (GPS12) and Kuivalahti (GPS11) were made using Ashtech μ Z GPS receivers, which have larger memory.

Table 3-2. The GPS equipments used at Olkiluoto in 2005.

Station	I / 2005 Receiver S/N	II / 2005 Receiver S/N	Antenna S/N
GPS1*	03176	03176	321
GPS2	03398	03436	11761
GPS3	03436	03398	11959
GPS4	03398	03436	11761
GPS5	04293	LP00164U	11988
GPS6	LP01087	LP01087	11772
GPS7	03436	03398	11959
GPS8	04098	04108	11963
GPS9	LP00106U	04293	11770
GPS11	04098	ZR20001907	11754
GPS12	-	ZR20000701	11194
GPS13	LP01092	04300	11754

*Permanent station

3.2.2 The measurements at Kivetty and Romuvaara

The observations of the local GPS monitoring networks at Kivetty and Romuvaara were started in 1996. Until 2001 the networks were measured twice a year. Posiva concentrates now all studies on Olkiluoto, because the Government and Parliament have ratified the decision that makes possible to establish the final disposal near Olkiluoto nuclear power stations. However, Posiva and FGI decided to continue measurements also at Kivetty and Romuvaara, because those form good reference networks for Olkiluoto studies. In both networks one measurement campaign a year will be done for reference studies. The observation dates in 2005 are shown in Table 3-3. The length of the observation sessions was 24 hours.

The observations were made using six Ashtech Z-12 receivers equipped with Dorne Margolin-type choke ring antennas (Table 3-4). Same antennas were used as in previous campaigns.

Table 3-3. Observation sessions for the GPS measurements at Kivetty and Romuvaara in 2005.

Year	Network	Observation day		Observation windows (UT)
		Calendar day	GPS day	
2005	Romuvaara	15 Sept.	258	10.00-24.00
		16 Sept.	259	0.00-10.00
	Kivetty	17 Sept.	260	10.35-24.00
		18 Sept.	261	0.00-10.35

Table 3-4. The GPS equipments used at Kivetty and Romuvaara in 2005.

Station	Romuvaara		Kivetty	
	Receiver S/N	Antenna S/N	Receiver S/N	Antenna S/N
GPS1*	03175	11987	LP00174	11203
GPS2	LP00164U	11959	LP00164U	11963
GPS3	04293	11754	04293	11959
GPS4	03176	11770	03176	11988
GPS5	LP01087	11988	LP01087	11772
GPS6	04108	11963	04108	11754
GPS7	03436	11772	03436	11770

*Permanent station

4. DATA ANALYSIS OF THE LOCAL NETWORKS

4.1 GPS computation

The GPS computation has been made using Bernese software. The campaigns until 2003 were processed using version 4.0 (Rothacher and Mervart 1996) and 4.2 (Hugentobler *et al.* 2001). A new Bernese version 5.0 (Hugentobler *et al.* 2004) was used for computations since 2004, when the computation environment was changed from Linux to Windows.

The observations were processed using the same principles as in the previous computations:

- Observations were processed using independent L1 and L2 observations, rather than any linear-combinations, in order to obtain lower measurement noises and smaller effects of multipath errors.
- The ionospheric refraction was modelled and L1 and L2 observations were corrected with the estimated ionospheric models in order to remove the absolute scale errors resulting from the ionospheric refraction.
- A global standard atmospheric model, which approximately represents the atmospheric conditions at the observation time, was used to correct the tropospheric refraction in order to remove the scale errors. Local tropospheric parameters were solved in the final solution in order to obtain an unbiased estimation of the height component.

The Bernese GPS software version 5.0 is slightly different than the earlier versions. However, the computation procedure is the same as earlier. The formulas and algorithms are basically the same, but they have some improvements. We compared the differences between results of Bernese versions 4.0 and 5.0 in the previous working report (Ahola *et al.* 2005). The comparison proves that the versions are compatible and it is not necessary to recompute campaigns.

However, we have noticed that GPS solutions may be biased by scale errors (Ollikainen and Kakkuri, 1999). This scale error is mainly caused by errors in ionosphere modelling. We decided to reprocess all campaigns of Olkiluoto since 1995 using Bernese version 5.0, because the new version may determine ionosphere and troposphere parameters better than earlier.

The lengths of the baseline GPS1-GPS2, which have been computed with versions 4.0 and 5.0, are shown in Figure 4-1. The example shows, that the results are almost identical.

The results of the GPS computation of campaigns in 2005 are given in Appendices I-III and VI-IX.

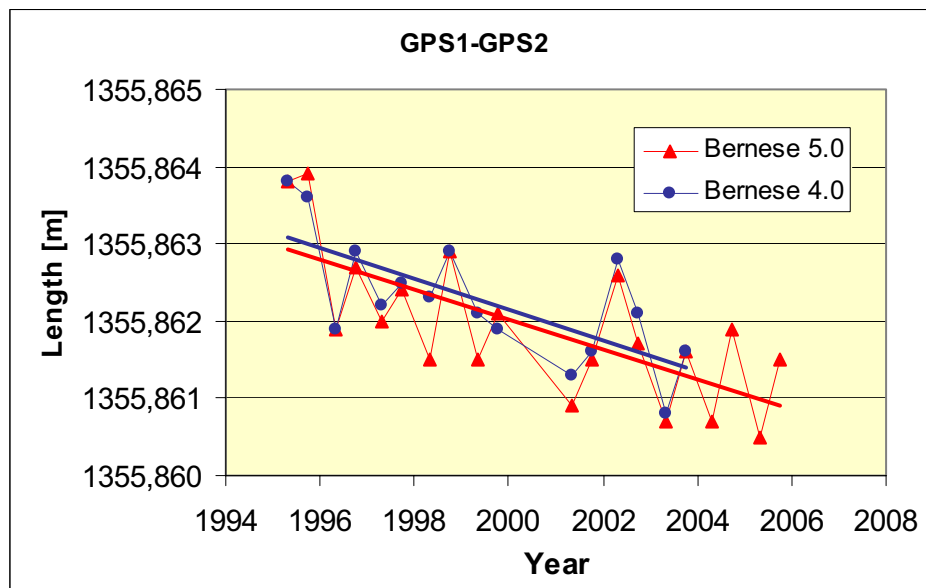


Figure 4-1. Comparison of the Bernese software versions 5.0 and 4.0. The results of the vector GPS1-GPS2 at Olkiluoto are almost identical. Both change rates are $-0.20 \text{ mm/a} \pm 0.05 \text{ mm/a}$.

4.2 Change rates of the baselines

The local networks at each investigation area has been measured several times since 1995: we have had twenty campaigns at Olkiluoto and fourteen campaigns at Kivetty and Romuvaara. The time series enable to determine the change rates for the baselines. The change rates were computed as in previous campaigns (Ollikainen *et al.* 2004).

The accuracy of the GPS determinations depends on how well scale-affecting factors have been eliminated. In some cases the estimation of an ionosphere model can be difficult, or even impossible. The errors in the ionosphere modelling affect to the resulting baseline lengths, like a scale error, which was clearly explained already in Ollikainen and Kakkuri, 1999. Because of a possible scale bias the observations were scaled with a scale factor, which is computed comparing the results to the mean of all observations. The determination of the scale factor was explained in detail in Ollikainen *et al.* 2004.

The results are given in Tables 4-1, 4-2 and 4-3.

One third of the baselines at Olkiluoto have statistically significant change rates at the confidence level of 95% (Table 4-1). However, all rates are smaller than $\pm 0.22 \text{ mm/a}$. The rates have diminished year after year when the time series has grown longer and the determination of the change rates has become more reliable. The scaled change rates indicate that the pillar GPS2 is moving, which is not clear according to the unscaled change rates. The most significant change rate is between the pillars GPS1 and GPS8 (Figure 4-2).

Table 4-1. Change rates of 36 baselines at Olkiluoto. The change rates and estimated errors are obtained from least squares solutions from the results of twenty measurements performed in 1995-2005. The change rates were computed using both unscaled and scaled vector lengths. Baselines with statistically significant change rates are highlighted.

Baseline	No scale correction				Scale correction added			
	Change rate (mm/a)	St. dev. (mm/a)	Length of the baseline at zero epoch (1995.0)	St. dev. (mm)	Change rate (mm/a)	St. dev. (mm/a)	Length of the baseline at zero epoch (1995.0)	St. dev. (mm)
GPS1-GPS2	-0.19	±0.05	1355862.99	±0.30	-0.22	±0.04	1355863.14	±0.25
GPS1-GPS3	-0.01	0.06	1006191.89	0.36	-0.03	0.05	1006192.00	0.32
GPS1-GPS4	0.18	0.05	643446.91	0.31	0.17	0.05	643446.97	0.33
GPS1-GPS5	0.03	0.07	1131621.26	0.42	0.01	0.05	1131621.38	0.35
GPS1-GPS6	0.10	0.03	1264824.59	0.21	0.07	0.04	1264824.73	0.24
GPS1-GPS7	0.11	0.03	1482992.56	0.17	0.08	0.04	1482992.69	0.25
GPS1-GPS8	0.22	0.03	1594500.60	0.21	0.19	0.04	1594500.77	0.27
GPS1-GPS9	0.09	0.03	2343595.30	0.20	0.04	0.04	2343595.58	0.27
GPS2-GPS3	-0.04	0.07	1609847.52	0.44	-0.08	0.06	1609847.70	0.38
GPS2-GPS4	0.09	0.04	1856923.47	0.28	0.05	0.04	1856923.67	0.25
GPS2-GPS5	-0.14	0.05	1477355.82	0.32	-0.17	0.04	1477355.95	0.26
GPS2-GPS6	-0.11	0.04	2436724.51	0.24	-0.16	0.04	2436724.78	0.27
GPS2-GPS7	-0.09	0.04	2811673.70	0.24	-0.14	0.04	2811674.01	0.26
GPS2-GPS8	0.03	0.05	2949496.39	0.32	-0.03	0.05	2949496.72	0.29
GPS2-GPS9	-0.10	0.05	3649885.72	0.30	-0.17	0.04	3649886.12	0.25
GPS3-GPS4	0.14	0.06	756323.90	0.37	0.12	0.05	756323.98	0.35
GPS3-GPS5	0.05	0.10	2094203.97	0.65	0.01	0.08	2094204.19	0.53
GPS3-GPS6	0.05	0.06	2126842.83	0.40	0.01	0.05	2126843.05	0.33
GPS3-GPS7	-0.02	0.04	2073048.68	0.26	-0.06	0.04	2073048.91	0.26
GPS3-GPS8	0.13	0.05	1924578.57	0.36	0.09	0.05	1924578.78	0.35
GPS3-GPS9	-0.03	0.04	2914435.38	0.29	-0.09	0.04	2914435.72	0.25
GPS4-GPS5	0.15	0.07	1734651.99	0.46	0.11	0.06	1734652.18	0.38
GPS4-GPS6	-0.02	0.04	1418664.16	0.27	-0.04	0.04	1418664.31	0.26
GPS4-GPS7	-0.16	0.03	1317485.82	0.19	-0.18	0.04	1317485.96	0.24
GPS4-GPS8	-0.04	0.04	1216240.12	0.27	-0.07	0.05	1216240.23	0.29
GPS4-GPS9	-0.18	0.03	2165877.48	0.22	-0.22	0.04	2165877.73	0.27
GPS5-GPS6	0.06	0.03	1284565.74	0.20	0.04	0.03	1284565.88	0.22
GPS5-GPS7	0.14	0.05	1894752.50	0.32	0.11	0.04	1894752.71	0.25
GPS5-GPS8	0.18	0.06	2256070.28	0.37	0.14	0.04	2256070.55	0.24
GPS5-GPS9	0.12	0.05	2571611.24	0.32	0.07	0.03	2571611.53	0.21
GPS6-GPS7	0.11	0.04	683009.54	0.28	0.09	0.04	683009.61	0.25
GPS6-GPS8	0.12	0.04	1157814.83	0.29	0.10	0.04	1157814.92	0.23
GPS6-GPS9	0.05	0.05	1290279.58	0.30	0.02	0.04	1290279.72	0.23
GPS7-GPS8	-0.05	0.04	511257.21	0.23	-0.06	0.04	511257.25	0.23
GPS7-GPS9	-0.01	0.03	868575.54	0.17	-0.03	0.02	868575.62	0.14
GPS8-GPS9	-0.15	0.04	1057915.55	0.25	-0.17	0.04	1057915.68	0.25
RMS:		±0.05		±0.31		±0.04		±0.28

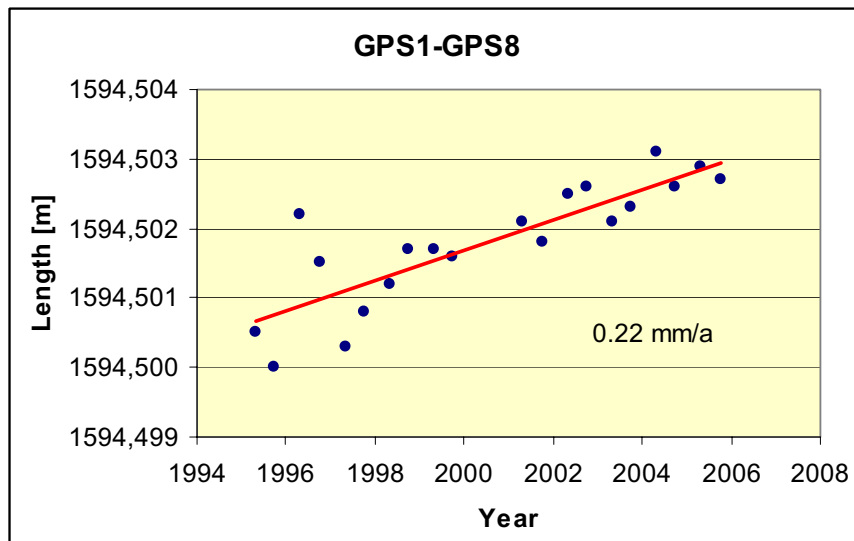


Figure 4-2. The most significant change rate ($0.22 \text{ mm/a} \pm 0.03 \text{ mm/a}$) at Olkiluoto is between the pillars GPS1 and GPS8.

Table 4-2. Change rates of 21 baselines for the local GPS network at Kivetty. The change rates and estimated errors are obtained from least squares solutions of fourteen measurements performed in 1996-2005. The change rates were computed using both unscaled and scaled vector lengths. Baselines with statistically significant change rates are highlighted.

Baseline	No scale correction				Scale correction added			
	Change rate (mm/a)	St. dev. (mm/a)	Length of the baseline at zero epoch (1996.0)	St. dev. (mm)	Change rate (mm/a)	St. dev. (mm/a)	Length of the baseline at zero epoch (1996.0)	St. dev. (mm)
GPS1-GPS2	0.09	± 0.04	659083.95	± 0.23	0.07	± 0.04	659084.04	± 0.22
GPS1-GPS3	-0.01	0.04	1613486.03	0.23	-0.06	0.04	1613486.24	0.19
GPS1-GPS4	0.01	0.05	1591096.37	0.26	-0.04	0.04	1591096.59	0.19
GPS1-GPS5	-0.08	0.04	672046.90	0.22	-0.10	0.04	672046.99	0.20
GPS1-GPS6	0.13	0.03	1180588.14	0.17	0.10	0.04	1180588.31	0.21
GPS1-GPS7	0.06	0.06	735563.33	0.29	0.03	0.05	735563.43	0.25
GPS2-GPS3	-0.09	0.06	955938.79	0.29	-0.12	0.05	955938.94	0.28
GPS2-GPS4	0.04	0.07	1198884.07	0.38	0.01	0.07	1198884.23	0.35
GPS2-GPS5	0.01	0.05	1167283.88	0.28	-0.02	0.05	1167284.04	0.25
GPS2-GPS6	0.19	0.06	1829810.28	0.30	0.13	0.06	1829810.55	0.31
GPS2-GPS7	0.05	0.06	901317.59	0.30	0.03	0.04	901317.71	0.23
GPS3-GPS4	0.10	0.11	1102331.60	0.56	0.06	0.10	1102331.76	0.50
GPS3-GPS5	-0.07	0.07	2031115.36	0.37	-0.14	0.06	2031115.66	0.30
GPS3-GPS6	0.10	0.06	2770064.60	0.32	0.00	0.06	2770064.99	0.32
GPS3-GPS7	0.02	0.06	1693397.79	0.33	-0.04	0.05	1693398.02	0.28
GPS4-GPS5	-0.07	0.05	1608741.90	0.24	-0.12	0.04	1608742.12	0.21
GPS4-GPS6	0.03	0.05	2462388.46	0.29	-0.05	0.06	2462388.81	0.34
GPS4-GPS7	0.08	0.09	2089326.28	0.48	0.01	0.06	2089326.57	0.33
GPS5-GPS6	0.12	0.04	854744.93	0.23	0.09	0.05	854745.06	0.27
GPS5-GPS7	-0.03	0.07	1379384.71	0.38	-0.07	0.05	1379384.91	0.28
GPS6-GPS7	0.15	0.06	1604962.41	0.31	0.10	0.04	1604962.63	0.23
RMS:		± 0.06		± 0.32		± 0.05		± 0.28

The GPS network at Kivetty is stable. None of the baselines has statistically significant change rate with and without scale correction (Table 4-2). However, according to the unscaled observations the station GPS6 is moving, but there are not any signs about movements when we use the scale corrected observations.

The investigation area at Romuvaara is also quite stable. There are only two baselines with statistically significant change rates (Table 4-3). Both of these vectors are connected to the pillar GPS4. According to the results the pillar GPS4 is moving east. A probable explanation for the movement is the instability of pillar GPS4. We will measure the distances and angles between the pillar and control markers during the next years to ensure the reason of the movement.

Table 4-3. Change rates of 21 baselines for the local GPS network at Romuvaara. The change rates and the estimated errors are obtained from least squares solutions of fourteen measurements performed in 1996-2005. The change rates were computed using both unscaled and scaled vector lengths. Baselines with statistically significant change rates are highlighted.

Baseline	No scale correction				Scale correction added			
	Change rate (mm/a)	St. dev. (mm/a)	Length of the baseline at zero epoch (1996.0)	St. dev. (mm)	Change Rate (mm/a)	St. dev. (mm/a)	Length of the baseline at zero epoch (1996.0)	St. dev. (mm)
GPS1-GPS2	0.02	±0.11	1176417.61	±0.57	-0.04	±0.05	1176417.88	±0.29
GPS1-GPS3	-0.05	0.06	541205.23	0.33	-0.08	0.05	541205.36	0.27
GPS1-GPS4	0.25	0.10	731895.86	0.52	0.21	0.08	731896.03	0.43
GPS1-GPS5	0.00	0.03	614734.42	0.18	-0.03	0.05	614734.58	0.24
GPS1-GPS6	-0.05	0.07	678196.48	0.38	-0.09	0.05	678196.63	0.25
GPS1-GPS7	0.03	0.07	1222388.62	0.38	-0.04	0.04	1222388.91	0.20
GPS2-GPS3	0.07	0.07	783976.11	0.37	0.02	0.05	783976.31	0.26
GPS2-GPS4	0.11	0.10	692374.62	0.54	0.07	0.07	692374.76	0.36
GPS2-GPS5	0.10	0.09	1397223.21	0.47	0.02	0.04	1397223.54	0.22
GPS2-GPS6	-0.04	0.17	1686681.90	0.87	-0.13	0.08	1686682.31	0.40
GPS2-GPS7	0.03	0.18	1940414.04	0.93	-0.08	0.07	1940414.50	0.36
GPS3-GPS4	0.33	0.11	717506.35	0.58	0.29	0.10	717506.50	0.50
GPS3-GPS5	0.03	0.06	616536.01	0.29	0.00	0.05	616536.17	0.25
GPS3-GPS6	-0.11	0.10	1204805.34	0.54	-0.17	0.05	1204805.62	0.27
GPS3-GPS7	-0.02	0.11	1679302.21	0.56	-0.11	0.04	1679302.61	0.22
GPS4-GPS5	0.36	0.11	1225010.60	0.60	0.30	0.09	1225010.89	0.49
GPS4-GPS6	0.00	0.10	1045309.62	0.51	-0.05	0.05	1045309.85	0.25
GPS4-GPS7	-0.08	0.10	1248362.88	0.53	-0.15	0.07	1248363.19	0.34
GPS5-GPS6	-0.09	0.06	1188022.53	0.32	-0.15	0.05	1188022.80	0.29
GPS5-GPS7	-0.01	0.07	1795939.97	0.36	-0.11	0.07	1795940.40	0.36
GPS6-GPS7	0.06	0.04	636487.67	0.22	0.02	0.04	636487.81	0.23
RMS:		±0.10		±0.51		±0.06		±0.32

4.3 Change rates of the baselines from the pillar GPS13 at Olkiluoto

The pillar GPS13 (earlier GPS10B) was established at in 2003 (Ollikainen *et al.* 2004). We have observed it twice a year during sessions I and II since autumn 2003 (Tables 3-1 and 3-2) and have made the computation together with other pillars (GPS1-GPS9). However, five measurements are not enough for reliable deformation studies. That is why we have studied the baselines from the pillar GPS13 separately.

The determination of the change rates has been made using same principles as in the previous chapter, but it is not possible to determine scale corrections using only five observations. The results are given in the Table 4-4. The most of the standard deviations are much higher than the change rates, but there is one exception. The change rate $0.30 \text{ mm/a} \pm 0.01 \text{ mm/a}$ between the pillars GPS9 and GPS13 is statistically significant (Figure 4-3.), but we have to remember that the time series is still too short for reliable deformation analysis.

Table 4-4. Change rates of 9 baselines from the pillar GPS13 at Olkiluoto. The change rates and the estimated errors are obtained from least squares solutions of only five measurements performed in 2003-2005. Baseline with statistically significant change rate is highlighted.

Baseline	No scale correction			
	Change rate (mm/a)	St. dev. (mm/a)	Length of the baseline at zero epoch (2003.0)	St. dev. (mm)
GPS1-GP13	0.04	±0.14	2407027.77	±0.20
GPS2-GP13	-0.15	0.37	3597908.05	0.55
GPS3-GP13	0.04	0.45	3159423.47	0.66
GPS4-GP13	-0.17	0.09	2406325.67	0.13
GPS5-GP13	-0.33	0.26	2326729.91	0.39
GPS6-GP13	0.02	0.18	1166024.02	0.27
GPS7-GP13	0.16	0.22	1126412.87	0.32
GPS8-GP13	0.18	0.27	1520688.80	0.39
GPS9-GP13	0.30	0.01	665040.19	0.02
RMS:		±0.25		±0.38

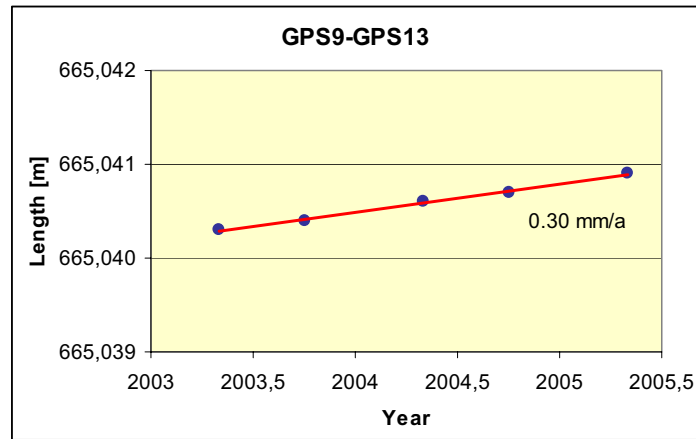


Figure 4-3. The change rate of the baseline GPS9-GPS13 is statistically significant ($0.30 \text{ mm/a} \pm 0.01 \text{ mm/a}$), but the time series is so short that the deformation analysis is not reliable.

4.4 Horizontal velocities of the GPS stations at Oikiluoto

The analysis of the change rates is based on the vectors lengths, which have been computed using 3-dimensional coordinates of each measurement campaigns. The change rates represent only deformations between pillar pairs. If we want to know how the different GPS stations are moving against each other, we have to study the plane coordinates of the campaigns and confirm that all coordinates are located in a common coordinate system.

At first we selected the coordinates of the stations obtained in autumn 2005 (session 2005.75) as a reference session. All other coordinate sets were transformed to this session using 7-parameter *Helmert* transformation. The transformation parameters of the coordinate differences of the origins and the rotation angles around the coordinate axes were solved by the least squares method from the coordinates obtained in different sessions. The scale factor was not solved. This means that the results represent the same situation as the change rates in Table 4-1, which were obtained with unscaled observations.

Because the horizontal movements are the main interest, the 3-dimensional Cartesian coordinates in common coordinate system were transformed into ellipsoidal coordinates, which were projected to plane coordinates using Gauss-Krüger projection. The conversion from ellipsoidal coordinates to plane coordinates was done using the GRS-80 ellipsoidal parameters. In order to minimize the projection errors the 21° central meridian was used in the projections.

The components of the station velocities according to the permanent station (GPS1) were computed by linear regression from the plane coordinates obtained from the different sessions. The linear regressions were made separately for the N- and E-coordinates of the pillars. The results are given in Table 4-5 and illustrated in Figure 4-4.

Table 4-5. The horizontal velocities of the GPS stations in mm/a with respect to the permanent GPS station (GPS1) at Olkiluoto. The velocities and the estimated errors are obtained from least squares solutions of measurements performed in 1995-2005. The stations with statistically significant velocities are highlighted.

Station	North component		East component	
	Velocity [mm/a]	St.dev. [mm/a]	Velocity [mm/a]	St.dev. [mm/a]
GPS1	0.000	0.000	0.000	0.000
GPS2	0.039	0.035	-0.197	0.039
GPS3	0.055	0.056	-0.091	0.040
GPS4	0.124	0.048	-0.246	0.024
GPS5	-0.031	0.066	-0.017	0.043
GPS6	-0.032	0.042	-0.102	0.039
GPS7	0.109	0.022	-0.087	0.029
GPS8	0.079	0.029	-0.213	0.041
GPS9	0.111	0.021	-0.075	0.032
RMS:		±0.40		±0.34

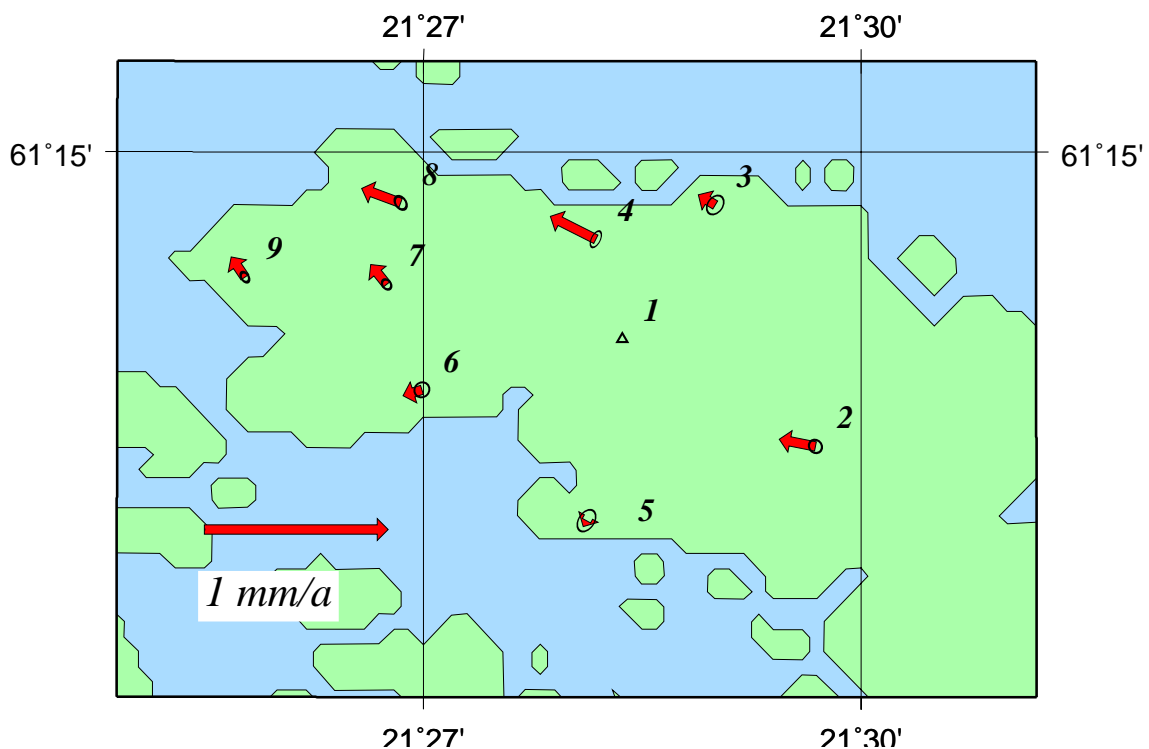


Figure 4-4. The horizontal velocities of the GPS stations at Olkiluoto with respect to the permanent GPS station (1). Numbers refer to GPS-station numbers, i.e. number 1 is GPS1, 2 is GPS2, etc.

According to deformation analysis there are five stations, which have statistically significant velocities at Olkiluoto. The pillars GPS2, GPS4 and GPS8 are mainly moving to the west with respect to the permanent GPS station (GPS1). The pillar GPS7

has the velocity to the north-west and the pillar GPS9 is moving northwards. The local velocity components are small but taking into account the standard deviations, the largest velocity components seems to be reliable (max. velocity - 0.25 mm/a \pm 0.025 mm/a).

4.5 Computation and results of the stations GPS12 and GPS13 at Olkiluoto

The pillars GPS11 at Kuivalahti and GPS12 at Iso Pyrekari were established at in 2003 (Ollikainen *et al.* 2004). The stations GPS11 and GPS12 were measured twice a year since autumn 2003. We have five measurements at these stations now except to the station GPS12, where it was not possible to observe during spring 2005.

Earlier the measurements have been computed using same principles as in the computation of the original network (Ahola *et al.* 2005). We decided to change a computation strategy and compute all measurement again, because we have other deformation measurements at Satakunta also (Ahola and Poutanen 2006). We wish to combine the observations at the same pillars in both campaigns, what is why we have to use the same computation strategy, too.

The observations have been processed using Bernese software version 5.0. The main difference between earlier computations and a new strategy is the ionosphere modelling. The new computation has been made without ionosphere models. The ambiguities have been solved baseline by baseline using QIF method. Previously resolved ambiguities are introduced to the final solution using ionosphere free L3 linear combination.

The results of the measurement in 2005 are given in Appendixes IV-V.

The pillar GPS11 has been measured five times, while the pillar GPS12 only four times (not in spring 2005). The lengths of the observed vectors are between 4.8 and 11.6 km. The time series is still too short for reliable deformation studies. However, the change rates of the vectors are given in Table 4-6. The standard deviations are almost same size as the change rates. According to the first measurements the baseline GPS11-GPS12 is shortening, but we need more measurements to reveal, if the deformation is real.

Three measurements are not enough to make reliable deformation analysis. We need at least a few years longer time series before we can give any change rates for these baselines. The observed distances between the new stations and the permanent GPS station in 2003 and 2004 are given in Table 4-6.

Table 4-6. Change rates of the baselines from the pillars GPS11 and GPS12 at Olkiluoto. The change rates and the estimated errors are obtained from least squares solutions of only five or four (GPS12) measurements performed in 2003-2005. Baseline with statistically significant change rate is highlighted.

Baseline	No scale correction			
	Change rate (mm/a)	St. dev. (mm/a)	Length of the baseline at zero epoch (2003.0)	St. dev. (mm)
GPS1-GP11	-0.64	±0.31	8478268.81	±0.46
GPS1-GP12	-0.47	0.37	4817826.51	0.52
GP11-GP12	-0.78	0.19	11574239.62	0.27
RMS:		±0.30		±0.43

5. EDM BASELINE AT OLKILUOTO

5.1 Background

We have noticed that GPS solutions may be significantly biased by scale errors (Ollikainen and Kakkuri, 1999). This systematic scale error is mainly caused by errors in ionosphere modelling. The scale error has varied from -0.4 to $+0.4$ ppm at Olkiluoto. However in 2002 measurements at Romuvaara it was as large as $+1.8$ ppm.

The FGI and Posiva decided to establish a baseline for electronic distance measurements (EDM), because of this scaling problem of GPS observations. The baseline was established between pillars GPS7 and GPS8 in 2002.

Accuracy of high precision EDM is about $\pm(0.2 \text{ mm} + 0.2 \text{ ppm})$ (1σ). The estimated accuracy for GPS is about $\pm 0.8 \text{ mm}$ (1σ) obtained at the microne networks of Posiva. According to these figures EDM is more accurate than GPS when the baselines are as short as at Olkiluoto. The EDM baseline is measured simultaneously with the GPS measurement. The scale factor problem is expected to be solved by deriving the uniform scale for the GPS observations using the EDM results.

5.2 Electronic distance measurements

A Kern ME5000 mekometer is the most accurate EDM instrument, which is suitable for fieldwork. The mekometer of the Institute of Geodesy, Department of Surveying, Helsinki University of Technology was used in the baseline measurements. We have calibrated the mekometer at the Nummela Standard Baseline at least once a year and the results are given in Certificates of Calibration of the National Standards Laboratory of the Finnish Geodetic Institute (Table 5-1).

Table 5-1. Mekometer calibrations at Nummela Standard Baseline in 2005.

Year	Date	Certificate of Calibration
2005	May 2 and 4	21 / 2005
	August 8 and 28	29 / 2005

The EDM baseline at Olkiluoto has been measured twice a year during the both GPS measurement campaigns since 2002. The first measurements in 2005 were performed on April 10-11 and the second measurements on October 5-6. We observed three times ten single distances from both observation pillars during the campaigns as in the previous years (Figure 5-1).

The weather observations were made with calibrated instruments at the mekometer site and at the reflector site. Dry and wet temperatures have been observed with psychrometers and air pressure with aneroids (Table 5-2).



Figure 5-1. The mekometer Kern ME5000 at the pillar GPS8 during baseline observation on October 2005. (Photograph T. Ahola 2005.)

Table 5-2. The equipments at the mekometer and at the reflector sites.

	Equipment at the mekometer site	Equipment at the reflector site
Kern Mekometer ME5000	S/N 357094	-
Kern prism reflector	-	S/N 374414
Thies Clima psychrometer	S/N 6530 / 6540	S/N 6544 / 6527
Thommen Hoehenmesser aneroid	S/N 120413	S/N 126533

5.3 Computation

The results of mekometer measurements depend on weather conditions. Therefore, a computation strategy is to compute first velocity corrections according to weather conditions for observed distances. The result is a mean of corrected distances with standard error. The computation and used formulas were given in Ollikainen *et al.* 2004.

5.4 Results

The results of electronic distance measurements at the baseline GPS7-GPS8 are the means of observed distances after the first velocity corrections. These values with standard errors ($1-\sigma$) are given in the Table 5-3. In addition to the standard deviation, the standard uncertainty includes errors of the centring and the adjusting of the instruments (± 0.1 mm), the calibration of the instruments (± 0.1 mm) and the determination of the refraction correction (± 0.1 mm).

Table 5-3. The space distances between the pillars GPS7-GPS8 measured by the GPS and the Kern Mekometer ME5000. The mean of the GPS observations includes 20 measurement campaigns since 1995.

Measurement	Distance (mm)	Standard deviation (mm)	Total standard uncertainty (mm)	Certificate of Calibration
Mean of GPS obs.	511256.9	± 0.5	-	-
Apr 28 2002	511256.4	± 0.3	± 0.3	5 / 2002
Oct 12-13 2002	511255.7	± 0.1	± 0.2	9 / 2002
Apr 26-27 2003	511256.1	± 0.1	± 0.2	5 / 2003
Oct 11-12 2003	511256.6	± 0.1	± 0.2	19 / 2003
Apr 4-5 2004	511256.5	± 0.1	± 0.3	19 / 2004
Oct 9-10 2004	511255.9	± 0.1	± 0.2	20 / 2004
Apr 10-11 2005	511256.1	± 0.3	± 0.3	20 / 2005
Oct 5-6 2005	511256.1	± 0.2	± 0.3	32 / 2005

The electronic distance measurements are traceable to the definition of the metre through the Nummela Standard Baseline, which has been measured by the Väisälä light interference method. The last interference measurement was performed in 1996 (Jokela and Poutanen, 1998). Last mekometer calibrations in Nummela have been performed in 2005. Procedures meet the requirements of the standards ISO 9001 and ISO 17025. The results are given also in Certificates of Calibration of the National Standards Laboratory of the Finnish Geodetic Institute. Since 2003 the results are given with extended uncertainty ($2-\sigma$), which is two times total standard uncertainty.

The comparison of the EDM and GPS results is given in Figure 5-2. Each EDM distance is shorter than the GPS result from same campaign. According to four years period GPS gives us on an average 0.64 mm longer distances between pillars GPS7 and GPS8 than EDM. That is over 1 ppm scale difference.

The scale difference between GPS and Mekometer measurements is obvious, but we do not know yet, what is the reason for this behaviour. At first we thought that the different phase centre offsets of the GPS antennas can be an explanation. In fact that is why we use the same antennas at the pillars in every GPS campaign. We tested the effect of the

phase centre offsets to the GPS results in autumn 2005. Then we made extra GPS observations at the pillars GPS7 and GPS8.

The normal GPS measurement gives to us about 0.6 mm too long distance comparing the mekometer observations at the baseline. If the scale difference is caused by phase centre offsets of the GPS antennas, the distance should be 0.6 mm shorter than the result of mekometer, when we change the GPS antennas between pillars. That was not happened when we made the test measurements. The observed distance was even 0.9 mm longer than the mekometer result. It proves that the reason of the scale difference must be elsewhere.

According to eight measurements the shapes of the time series, which are computed with different methods, are very similar. That is very interesting, because it should mean that the obtained deformation is real, even if the distance changes back and forth. However, it is too early to make any specific conclusion. We need more studies and observations at the baseline and it is obvious that we will continue the electronic distance measurements simultaneously with GPS measurements.

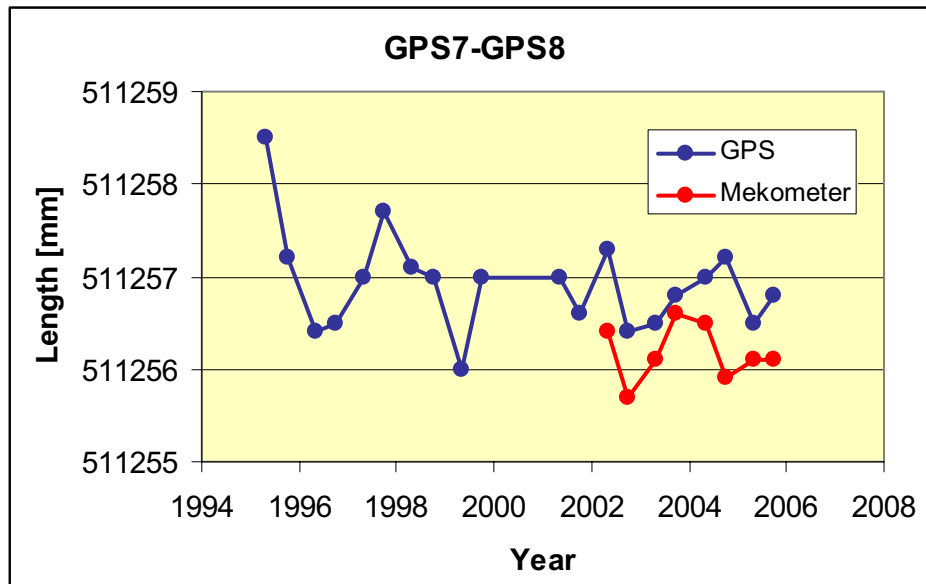


Figure 5-2. The GPS and the EDM results from the baseline GPS7-GPS8.

6. CONTROL MARKERS AT OLKILUOTO

6.1 Background

Each GPS pillar has two control markers. The benchmarks are founded in solid bedrock near the station. Because the benchmarks are used to determine the possible horizontal displacements of the pillars, the ideal location is such that the lines between the concrete pillar and the markers intersect in 90 degrees angle. The distances between pillars and control markers are from 4.5 m to 12.5 m.

The Olkiluoto GPS network was expanded in 2003, when three new GPS pillars were built. In autumn 2004 we established control markers for pillars GPS11 and GPS13 (Ahola *et al.* 2005).

The distances and angles between pillars and control markers were observed in 2001 and 2004. The small differences between the campaigns in 2001 and 2004 prove that the concrete pillars have been stable during the measurement period (Ahola *et al.* 2005).

We will continue the measurements at the reserve markers in three years intervals. The next measurement will be carried out in 2007.

6.2 Control markers at Iso Pyrekari

We established the control markers for the pillar GPS12 at Iso Pyrekari in 2005. The height of the pillar is only 0.5 m and because of that it should be very stable. However, we founded two benchmarks in solid bedrock near the pillar, because pack ice can cause damage for the concrete pillar during hard winter.

We made the establishment and the measurements on July 23, 20045 at Olkiluoto (Figure 6-1). The distances between the concrete pillar and control markers were measured using the Distomat Wild DI2002 EDM instrument, S/N 180206. The horizontal and vertical angles were observed with the theodolite Theomat Wild T2002, S/N 346317. These instruments are owned by the FGI.

The horizontal angles, distances and height differences between the control markers and the pillar GPS12 are given in Table 6-1.

Table 6-1. The horizontal angles and distances and height differences from tacheometer measurement between the control markers (A,B) and the concrete pillar (O) at the station GPS12, Iso Pyrekari.

Horizontal angles (gon)	O-A-B 36.1645	A-B-O 40.4604	B-O-A 123.3746
Horizontal distances (m)	AB 18.9935	AO 12.0803	BO 10.9484
Height differences (m)	AB 0.1252	AO 0.6550	BO 0.5298



Figure 6-1. The distances between pillars and reserve markers were measured using the Distomat Wild DI2002 EDM instrument. The horizontal and vertical angles were observed with the theodolite Theomat Wild T2002. (Photograph T. Ahola 2005.)



Figure 6-2. The determinations of the azimuths have been made using GPS observations. (Photograph J. Ahola 2004.)

6.3 Coordinates of the reserve markers and the GPS stations

We have observed the orientations of the reserve markers during the angle and distance measurement, too. The determinations of the azimuths have been made using GPS observations (Figure 6-2.). All stations at Olkiluoto have been measured in 2004 and 2005.

Using those measurements and the coordinates of the GPS pillars (Ollikainen *et al.* 2001) we can compute the coordinates for the reserve markers in the National Grid Coordinate system (KKJ). The coordinates are given in the Table 6.2. The internal accuracy of the coordinates is about ± 2 mm. The orthometric N60 heights have been leveled (Lehmuskoski 2005).

Table 6-2. The coordinates (x,y) of the pillars and the reserve markers at Olkiluoto in the National Grid Coordinate system. The levelled orthometric heights (H) are in N60 height system.

Station	x [m]	y [m]	H [m]
GPS1	6792440.206	1525568.475	11.233
GPS1A	6792447.410	1525575.838	8.843
GPS1B	6792431.757	1525576.525	9.149
GPS2	6791792.176	1526759.462	13.546
GPS2A	6791783.662	1526763.066	11.153
GPS2B	6791791.899	1526752.126	11.195
GPS3	6793274.363	1526131.163	8.360
GPS3A	6793276.752	1526138.575	5.830
GPS3B	6793282.079	1526128.544	5.904
GPS4	6793062.571	1525405.091	9.797
GPS4A	6793065.832	1525416.039	7.243
GPS4B	6793074.810	1525402.789	7.296
GPS5	6791328.589	1525356.750	-
GPS5A	6791327.655	1525351.169	-
GPS5B	6791335.815	1525355.745	-
GPS6	6792124.747	1524344.836	5.720
GPS6A	6792132.470	1524346.564	3.435
GPS6B	6792127.932	1524339.109	3.237
GPS7	6792765.372	1524121.557	13.063
GPS7A	6792758.008	1524124.898	10.733
GPS7B	6792762.599	1524113.485	10.811
GPS8	6793269.473	1524206.572	6.466
GPS8A	6793273.215	1524209.034	4.017
GPS8B	6793268.873	1524211.798	4.440
GPS9	6792809.122	1523254.077	12.336
GPS9A	6792817.698	1523259.486	9.767
GPS9B	6792813.935	1523246.264	9.242
GPS11	6793697.879	1533953.034	-
GPS11A	6793696.421	1533946.293	-
GPS11B	6793703.867	1533952.090	-
GPS12	6796290.822	1522672.862	-
GPS12A	6796289.613	1522684.882	-
GPS12B	6796301.382	1522669.974	-
GPS13	6792148.313	1523179.189	10.521
GPS13A	6792143.751	1523172.031	9.251
GPS13B	6792139.394	1523183.356	8.927

7. FUTURE PLANS

According to our quality manual (Ahola 2006) and the consultations between Posiva and the FGI we will continue geodetic observations at Olkiluoto, Kivetty and Romuvaara annually. The studies of each year will be reported in Posiva working report series.

The permanent GPS stations continue observations at the investigation areas. The Olkiluoto local GPS network will be measured twice a year. Even if the studies are concentrated at Olkiluoto, one measurement campaign will be carried out at Kivetty and Romuvaara annual. The observations at Kivetty and Romuvaara are important reference investigations for the studies at Olkiluoto.

The EDM baseline GPS7-GPS8 at Olkiluoto will be measured with the mekometer during every GPS campaign to improve the reliability of the GPS results. The mekometer will be calibrated at the Nummela Standard Baseline at least once a year to ensure the quality of the results.

Every GPS station has two reserve markers. We will determine the distances and the angles between the stations and the reserve markers in order to check the stability of the concrete pillars at Olkiluoto in three years interval. Next measurements will be carried out in 2007.

The heights of Olkiluoto GPS network have been measured with precise levelling in 2003 and 2005. The levelling is the most accurate method to observe the possible vertical deformations at the investigation area. The levelling campaigns will be performed every second year and results will be published in a separate working report of Posiva. We will establish two levelling networks at Olkiluoto in 2006 for specific deformation studies. The networks are located above the excavation area of the ONKALO and the repository for low- and medium-level waste (the VLJ repository).

8. SUMMARY

Twenty GPS observation campaigns have been carried out at Olkiluoto since 1995 and fourteen campaigns at Kivetty and Romuvaara since 1996. Two measurements were performed at Olkiluoto in 2005. The networks of Kivetty and Romuvaara were observed once during 2005.

The computation was made with Bernese version 5.0. All observations since 1995 at Olkiluoto have been processed again with new software version. However, the results are almost similar as in previous computations.

According to the GPS deformation analysis one third of the baselines at Olkiluoto have statistically significant change rates at the confidence level of 95%. However, all of these change rates are smaller than ± 0.22 mm/a. The change rates have diminished year after year when the time series has grown longer and the determination of the change rates has become more reliable.

There are five stations, which have statistically significant horizontal velocities at Olkiluoto. The local velocity components are small but taking into account the standard deviations the largest velocity components seems to be reliable (max. velocity - 0.25 mm/a ± 0.025 mm/a).

The GPS network at Kivetty is very stable and there is no significant movement. There are two baselines with statistically significant change rates at Romuvaara. Both of these vectors are connected to the pillar GPS4. According to the results the station GPS4 is moving east. A probable explanation for the movement is the instability of pillar GPS4.

Electronic distance measurements were performed at Olkiluoto at the baseline GPS7-GPS8 using the mekometer since 2002. The measurements have been made simultaneous with GPS campaigns to improve the reliability of the GPS results. According to four years period GPS gives us on an average 0.64 mm longer distances between pillars GPS7 and GPS8 than EDM. That is over 1 ppm scale difference. The similarity of the GPS and EDM time series is very interesting, but it is too early to make specific conclusion. The results are promising, but more studies are needed before we can use the EDM results to scale the GPS observations.

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APPENDICES

Appendix Ia. Results of 20 measurements at Olkiluoto. Deviations of the vector lengths from their mean in millimeters. Unscaled observations.

Vector	Mean length [mm]	Time [a]																				RMS
		95.3	95.8	96.3	96.8	97.3	97.8	98.3	98.8	99.3	99.8	1.3	1.8	2.3	2.8	3.3	3.8	4.3	4.8	5.3	5.8	
GPS1-GPS2	1355861.9	1.9	2.0	0.0	0.8	0.1	0.5	-0.4	1.0	-0.4	0.2	-1.0	-0.4	0.7	-0.2	-1.2	-0.3	-1.2	0.0	-1.4	-0.4	±0.9
GPS1-GPS3	1006191.8	-0.6	1.7	-0.1	-0.5	-0.5	-0.4	0.6	-0.3	-0.3	0.3	0.5	1.3	0.8	-1.9	-0.2	0.4	-0.4	0.9	-0.6	-0.3	0.8
GPS1-GPS4	643447.9	-1.5	-1.8	-0.1	-0.2	-0.4	-0.2	0.4	-1.3	-1.0	0.0	0.4	0.2	0.0	2.3	0.8	0.7	0.9	-0.1	0.5	0.3	0.9
GPS1-GPS5	1131621.6	-1.4	2.2	-0.7	0.3	0.2	0.1	-1.3	0.1	-1.3	0.5	-0.3	1.3	-0.9	-0.4	0.1	0.3	-0.5	1.4	-1.0	1.3	0.9
GPS1-GPS6	1264825.1	-1.7	-0.9	0.2	0.3	0.0	-0.5	-0.4	0.3	0.5	-0.3	0.4	0.3	0.7	-0.2	0.5	0.3	0.6	0.3	0.2	0.2	0.6
GPS1-GPS7	1482993.2	-1.0	-1.1	-0.1	-0.1	0.6	-0.1	-0.5	-0.5	0.2	-0.7	0.2	-0.3	0.3	0.2	0.2	0.1	1.0	0.4	0.9	0.4	0.5
GPS1-GPS8	1594501.8	-1.3	-1.8	0.4	-0.3	-1.5	-1.0	-0.6	-0.1	-0.1	-0.2	0.3	0.0	0.7	0.8	0.3	0.5	1.3	0.8	1.1	0.9	0.9
GPS1-GPS9	2343595.8	-1.2	-0.7	1.0	-0.1	0.0	0.0	-0.5	-0.4	-0.1	-0.3	-0.2	-0.5	0.2	0.1	0.0	0.3	0.6	0.7	0.4	0.8	0.5
GPS2-GPS3	1609847.3	-0.2	2.6	-0.4	-0.4	-0.4	-0.4	1.3	0.1	-1.1	-0.8	0.0	0.3	0.8	-0.8	-1.3	0.0	-0.2	1.9	-0.8	-0.4	1.0
GPS2-GPS4	1856924.0	-0.3	-0.3	-0.8	0.1	-0.5	0.0	-0.3	-0.6	-1.3	-0.1	-0.3	0.1	1.3	1.8	-0.5	0.3	0.0	0.6	-0.5	0.5	0.7
GPS2-GPS5	1477355.1	-0.3	1.3	1.2	1.3	1.1	0.8	-0.4	0.7	-1.1	-0.1	-0.9	0.1	0.1	-1.8	-0.3	0.2	-1.0	-0.2	-1.2	0.5	0.8
GPS2-GPS6	2436723.9	0.4	0.5	0.4	0.9	0.4	0.1	-0.7	1.2	0.3	-0.3	-0.4	-0.4	1.3	-0.9	-0.3	-0.2	-0.5	-0.2	-0.9	-0.6	0.6
GPS2-GPS7	2811673.2	0.9	0.8	0.0	0.8	0.6	0.5	-0.9	0.6	-0.3	-0.4	-0.9	-0.6	0.8	0.0	-0.9	-0.2	-0.3	0.2	-0.5	-0.1	0.6
GPS2-GPS8	2949496.5	0.5	0.3	0.4	0.6	-1.4	-0.5	-1.1	0.8	-0.4	0.0	-0.6	-0.4	1.4	0.7	-0.9	0.2	0.0	0.9	-0.2	0.5	0.7
GPS2-GPS9	3649885.2	0.5	1.2	1.0	0.8	0.0	0.5	-1.1	0.5	-0.5	-0.1	-1.3	-0.9	0.8	-0.2	-1.0	0.0	-0.7	0.5	-1.0	0.2	0.7
GPS3-GPS4	756324.7	-1.0	-0.1	-1.0	-0.9	-0.8	-0.5	-1.0	-0.6	0.3	0.4	0.4	1.8	2.1	-1.6	-0.1	0.4	-0.2	0.8	-0.1	0.9	0.9
GPS3-GPS5	2094204.2	-2.4	3.4	-0.5	-0.2	-0.2	-0.4	-0.2	-0.3	-1.6	0.4	0.4	2.5	0.0	-2.3	-0.1	0.8	-0.5	2.3	-1.3	1.0	1.4
GPS3-GPS6	2126843.1	-1.8	0.8	-0.1	0.2	-0.7	-0.7	-0.5	0.2	0.3	0.5	0.4	1.6	1.4	-1.8	0.1	0.8	-0.4	0.8	-0.8	0.1	0.9
GPS3-GPS7	2073048.6	-0.1	0.5	0.0	0.0	0.4	0.1	-1.2	-0.2	0.4	0.2	0.2	0.5	1.2	-1.6	-0.4	0.0	-0.2	0.2	-0.3	0.1	0.6
GPS3-GPS8	1924579.3	-1.2	-0.8	0.7	0.2	-1.6	-1.3	-1.9	0.1	0.9	0.7	0.2	0.7	1.5	-0.4	0.0	0.3	0.1	0.3	0.2	0.8	0.9
GPS3-GPS9	2914435.2	-0.4	0.6	1.1	0.0	-0.1	0.1	-0.9	-0.2	0.3	0.6	0.0	0.4	1.0	-1.4	-0.5	0.2	-0.6	0.5	-0.8	0.6	0.6
GPS4-GPS5	1734652.8	-2.2	0.9	-0.8	0.3	-0.2	-0.1	-0.8	-1.0	-2.2	0.6	0.0	1.4	-1.2	2.1	0.7	0.9	0.2	1.0	-0.7	1.1	1.1
GPS4-GPS6	1418664.1	-1.2	0.0	0.6	1.1	-0.2	-0.2	0.0	0.2	-0.5	0.3	-0.2	-0.1	-0.8	1.1	0.4	0.6	-0.1	-0.4	-0.7	-0.5	0.6
GPS4-GPS7	1317484.9	0.9	0.8	1.0	0.9	1.2	0.6	-0.2	0.4	0.1	-0.2	-0.2	-1.2	-0.9	-0.1	-0.3	-0.4	0.0	-0.5	-0.2	-0.8	0.7
GPS4-GPS8	1216239.9	0.0	0.3	1.5	0.7	-0.9	-0.9	-0.7	1.0	0.6	0.0	-0.2	-0.8	-0.5	-0.1	-0.3	-0.2	0.1	0.0	0.2	-0.2	0.6
GPS4-GPS9	2165876.5	0.5	1.0	2.1	0.7	0.6	0.5	0.1	0.5	0.0	0.0	-0.5	-1.3	-1.1	-0.4	-0.5	-0.3	-0.5	-0.2	-0.8	-0.4	0.8

GPS5-GPS6	1284566.1	-0.3	0.4	-1.1	-0.4	-0.1	-0.6	-1.1	0.3	0.4	0.0	0.5	0.6	0.1	0.2	0.4	-0.2	0.5	0.5	-0.1	-0.2	0.5
GPS5-GPS7	1894753.3	-1.0	0.9	-1.6	-0.2	-0.4	-0.4	-1.6	-0.3	-0.6	0.3	-0.2	1.2	-0.7	1.4	0.3	0.4	0.4	1.2	0.1	0.8	0.8
GPS5-GPS8	2256071.3	-0.7	0.9	-1.4	-0.5	-1.7	-0.6	-1.6	0.0	-1.4	0.6	-0.1	1.4	-0.3	1.3	0.1	0.7	0.5	1.8	-0.1	1.2	1.0
GPS5-GPS9	2571611.9	-0.8	1.2	-0.8	-0.3	-0.9	-0.2	-1.9	-0.3	-0.5	0.5	-0.6	0.6	-0.2	1.3	0.1	0.6	0.3	1.4	-0.1	0.7	0.8
GPS6-GPS7	683010.1	-1.1	0.4	-0.6	0.3	-0.9	-0.2	-0.4	-0.3	-0.7	0.5	-0.7	0.9	-0.6	1.6	0.1	1.0	-0.1	0.6	0.1	0.8	0.7
GPS6-GPS8	1157815.5	-0.4	0.0	-0.8	-0.1	-1.6	0.1	-0.3	-0.1	-1.5	0.6	-0.6	0.7	-0.1	1.1	-0.2	1.1	0.0	0.9	-0.2	0.8	0.7
GPS6-GPS9	1290279.8	-0.4	1.0	0.4	0.1	-0.7	0.4	-0.8	-0.6	-0.9	0.5	-1.1	0.0	-0.4	1.1	-0.3	0.8	-0.2	0.9	0.0	0.9	0.7
GPS7-GPS8	511256.9	1.6	0.3	-0.5	-0.4	0.1	0.8	0.2	0.1	-0.9	0.1	0.1	-0.3	0.4	-0.5	-0.4	-0.1	0.1	0.3	-0.4	-0.1	0.5
GPS7-GPS9	868575.5	-0.4	0.3	1.0	-0.1	-0.6	0.0	0.1	-0.1	-0.2	0.3	-0.3	-0.2	-0.1	-0.1	-0.2	0.2	-0.5	0.4	-0.5	0.4	0.4
GPS8-GPS9	1057914.7	1.3	0.8	0.3	-0.3	1.3	1.5	1.0	-0.1	-0.8	0.0	-0.2	-0.4	-0.6	-0.7	-0.5	-0.3	-0.6	0.1	-1.0	0.0	0.7
Mean:		-0.5	0.5	0.1	0.2	-0.3	-0.1	-0.6	0.0	-0.4	0.1	-0.2	0.3	0.3	0.0	-0.2	0.3	-0.1	0.6	-0.4	0.3	
St.dev.:		±1.0	1.1	0.9	0.5	0.8	0.6	0.7	0.6	0.7	0.4	0.5	0.9	0.9	1.2	0.5	0.4	0.5	0.6	0.6	0.6	
RMS:		±1.1	1.2	0.8	0.5	0.8	0.6	0.9	0.5	0.8	0.4	0.5	0.9	0.9	1.2	0.5	0.5	0.5	0.9	0.7	0.6	±0.8

Appendix Ib. Results of 20 measurements at Oikiluoto. Deviations of the vector lengths from their mean in millimeters. Scaled observations.

Vector	Mean length [mm]	Time [a]																				RMS
		95.3	95.8	96.3	96.8	97.3	97.8	98.3	98.8	99.3	99.8	1.3	1.8	2.3	2.8	3.3	3.8	4.3	4.8	5.3	5.8	
GPS1-GPS2	1355861.9	2.3	1.6	0.0	0.7	0.4	0.5	0.0	1.1	0.1	0.1	-0.9	-0.7	0.5	-0.2	-1.1	-0.6	-1.2	-0.5	-1.1	-0.7	±0.9
GPS1-GPS3	1006191.8	-0.3	1.4	-0.1	-0.5	-0.3	-0.4	0.9	-0.3	0.0	0.2	0.6	1.1	0.7	-1.9	-0.1	0.2	-0.4	0.5	-0.4	-0.5	0.7
GPS1-GPS4	643447.9	-1.3	-2.0	-0.1	-0.2	-0.3	-0.2	0.6	-1.3	-0.8	-0.1	0.5	0.1	-0.1	2.3	0.9	0.6	0.9	-0.3	0.6	0.2	0.9
GPS1-GPS5	1131621.4	-1.0	1.9	-0.7	0.3	0.4	0.1	-0.9	0.2	-0.8	0.4	-0.1	1.0	-1.0	-0.3	0.2	0.2	-0.4	1.0	-0.7	1.0	0.8
GPS1-GPS6	1264825.1	-1.3	-1.3	0.2	0.2	0.3	-0.5	0.0	0.4	0.9	-0.4	0.5	0.0	0.5	-0.2	0.6	0.0	0.6	-0.2	0.5	-0.1	0.6
GPS1-GPS7	1482993.1	-0.5	-1.5	0.0	-0.1	0.9	0.0	-0.1	-0.3	0.7	-0.8	0.3	-0.5	0.1	0.2	0.3	-0.2	1.0	-0.2	1.2	0.1	0.6
GPS1-GPS8	1594501.8	-0.8	-2.3	0.4	-0.4	-1.2	-1.0	-0.1	0.0	0.4	-0.4	0.5	-0.4	0.5	0.7	0.4	0.2	1.3	0.2	1.4	0.5	0.9
GPS1-GPS9	2343595.8	-0.5	-1.4	1.1	-0.2	0.5	0.1	0.2	-0.3	0.7	-0.5	0.0	-1.0	-0.1	0.0	0.2	-0.2	0.7	-0.2	0.9	0.3	0.6
GPS2-GPS3	1609847.3	0.3	2.1	-0.4	-0.5	-0.1	-0.4	1.8	0.2	-0.5	-1.0	0.2	-0.1	0.6	-0.9	-1.2	-0.3	-0.2	1.3	-0.5	-0.8	0.9
GPS2-GPS4	1856924.0	0.4	-0.9	-0.8	0.1	-0.1	0.2	0.3	-0.5	-0.7	-0.3	-0.1	-0.3	1.1	1.8	-0.3	-0.1	0.1	-0.1	-0.1	0.2	0.6
GPS2-GPS5	1477355.0	0.2	0.8	1.2	1.2	1.4	0.8	0.1	0.8	-0.5	-0.2	-0.7	-0.2	-0.1	-1.7	-0.1	-0.1	-0.9	-0.7	-0.8	0.2	0.8
GPS2-GPS6	2436723.9	1.1	-0.2	0.5	0.8	0.9	0.2	0.0	1.3	1.1	-0.6	-0.2	-0.9	1.0	-1.0	-0.1	-0.7	-0.4	-1.1	-0.4	-1.1	0.8
GPS2-GPS7	2811673.2	1.7	-0.1	0.1	0.7	1.2	0.6	-0.1	0.7	0.7	-0.7	-0.6	-1.2	0.4	-0.1	-0.7	-0.8	-0.2	-0.9	0.1	-0.7	0.8
GPS2-GPS8	2949496.5	1.4	-0.6	0.5	0.5	-0.8	-0.4	-0.3	0.9	0.6	-0.3	-0.3	-1.1	1.0	0.6	-0.6	-0.4	0.1	-0.2	0.4	-0.2	0.7
GPS2-GPS9	3649885.2	1.7	0.2	1.2	0.5	0.8	0.7	-0.1	0.8	0.9	-0.5	-0.9	-1.7	0.4	-0.3	-0.7	-0.8	-0.6	-0.9	-0.2	-0.6	0.8
GPS3-GPS4	756324.7	-0.8	-0.3	-1.0	-0.9	-0.6	-0.5	-0.8	-0.6	0.6	0.3	0.5	1.6	2.0	-1.6	0.0	0.2	-0.2	0.5	0.1	0.7	0.9
GPS3-GPS5	2094204.2	-1.8	2.8	-0.5	-0.3	0.2	-0.3	0.4	-0.2	-0.9	0.2	0.6	2.0	-0.3	-2.4	0.1	0.4	-0.5	1.5	-0.8	0.5	1.2
GPS3-GPS6	2126843.1	-1.2	0.2	-0.1	0.1	-0.3	-0.6	0.1	0.3	1.0	0.3	0.6	1.1	1.1	-1.9	0.3	0.4	-0.4	0.0	-0.3	-0.4	0.7
GPS3-GPS7	2073048.6	0.5	-0.1	0.0	-0.1	0.8	0.2	-0.6	-0.1	1.1	0.0	0.4	0.0	0.9	-1.7	-0.2	-0.4	-0.2	-0.6	0.1	-0.4	0.6
GPS3-GPS8	1924579.3	-0.6	-1.4	0.7	0.1	-1.2	-1.2	-1.4	0.2	1.6	0.5	0.4	0.3	1.2	-0.5	0.2	-0.1	0.1	-0.4	0.6	0.4	0.8
GPS3-GPS9	2914435.2	0.5	-0.3	1.2	-0.1	0.5	0.2	-0.1	-0.1	1.3	0.3	0.3	-0.2	0.6	-1.5	-0.2	-0.4	-0.5	-0.6	-0.2	-0.1	0.6
GPS4-GPS5	1734652.8	-1.7	0.4	-0.8	0.2	0.2	-0.1	-0.3	-0.9	-1.6	0.4	0.2	1.0	-1.4	2.0	0.9	0.5	0.2	0.3	-0.3	0.7	0.9
GPS4-GPS6	1418664.1	-0.8	-0.4	0.6	1.0	0.1	-0.2	0.4	0.3	0.0	0.2	-0.1	-0.4	-1.0	1.1	0.5	0.3	-0.1	-0.9	-0.4	-0.8	0.6
GPS4-GPS7	1317484.9	1.3	0.4	1.0	0.8	1.5	0.6	0.2	0.5	0.6	-0.3	-0.1	-1.5	-1.1	-0.1	-0.2	-0.7	0.0	-1.0	0.1	-1.1	0.8
GPS4-GPS8	1216239.9	0.4	-0.1	1.5	0.6	-0.7	-0.9	-0.4	1.1	1.0	-0.1	-0.1	-1.1	-0.7	-0.1	-0.2	-0.5	0.1	-0.5	0.5	-0.5	0.7
GPS4-GPS9	2165876.5	1.2	0.3	2.2	0.6	1.0	0.6	0.7	0.6	0.7	-0.2	-0.3	-1.8	-1.4	-0.5	-0.3	-0.8	-0.5	-1.0	-0.3	-0.9	1.0

GPS5-GPS6	1284566.1	0.1	0.0	-1.1	-0.5	0.2	-0.6	-0.7	0.4	0.8	-0.1	0.6	0.3	-0.1	0.2	0.5	-0.5	0.5	0.0	0.2	-0.5	0.5
GPS5-GPS7	1894753.3	-0.4	0.3	-1.6	-0.3	0.0	-0.3	-1.1	-0.2	0.1	0.1	0.0	0.8	-1.0	1.3	0.5	0.0	0.4	0.5	0.5	0.4	0.7
GPS5-GPS8	2256071.3	0.0	0.2	-1.3	-0.6	-1.2	-0.5	-1.0	0.1	-0.6	0.4	0.1	0.9	-0.6	1.2	0.3	0.2	0.6	0.9	0.4	0.7	0.7
GPS5-GPS9	2571611.9	0.0	0.4	-0.7	-0.4	-0.4	-0.1	-1.2	-0.2	0.4	0.2	-0.3	0.0	-0.6	1.2	0.3	0.1	0.4	0.4	0.5	0.1	0.5
GPS6-GPS7	683010.1	-0.9	0.2	-0.6	0.3	-0.8	-0.2	-0.2	-0.3	-0.5	0.4	-0.6	0.7	-0.7	1.6	0.2	0.9	-0.1	0.3	0.2	0.6	0.6
GPS6-GPS8	1157815.7	-0.1	-0.4	-0.8	-0.2	-1.4	0.1	0.0	0.0	-1.1	0.5	-0.5	0.4	-0.3	1.1	-0.1	0.9	0.0	0.5	0.1	0.5	0.6
GPS6-GPS9	1290279.8	0.0	0.6	0.4	0.0	-0.4	0.4	-0.4	-0.5	-0.5	0.4	-1.0	-0.3	-0.6	1.1	-0.2	0.5	-0.2	0.4	0.3	0.6	0.5
GPS7-GPS8	511256.9	1.8	0.1	-0.5	-0.4	0.2	0.8	0.3	0.1	-0.7	0.0	0.1	-0.4	0.3	-0.5	-0.4	-0.2	0.1	0.1	-0.3	-0.2	0.5
GPS7-GPS9	868575.5	-0.1	0.0	1.0	-0.1	-0.4	0.0	0.3	-0.1	0.1	0.2	-0.2	-0.4	-0.2	-0.1	-0.1	0.0	-0.5	0.1	-0.3	0.2	0.3
GPS8-GPS9	1057914.8	1.6	0.5	0.3	-0.4	1.5	1.5	1.3	-0.1	-0.5	-0.2	-0.2	-0.7	-0.8	-0.8	-0.5	-0.6	-0.7	-0.4	-0.9	-0.3	0.8
Mean:		0.1	0.0	0.1	0.1	0.1	0.0	-0.1	0.1	0.2	-0.1	0.0	-0.1	0.0	-0.1	0.0	-0.1	0.0	-0.1	0.0	-0.1	
St.dev.:		±1.1	1.1	0.9	0.5	0.8	0.6	0.7	0.6	0.8	0.4	0.5	0.9	0.8	1.2	0.5	0.5	0.5	0.7	0.6	0.6	
RMS:		±1.1	1.1	0.9	0.5	0.8	0.6	0.7	0.6	0.8	0.4	0.5	0.9	0.8	1.2	0.5	0.5	0.5	0.7	0.6	0.6	±0.7

Appendix II. Results of the first measurements at Olkiluoto in 2005.

```

=====
Program : GPSEST                               Bernese GPS Software Version 5.0
Purpose : Parameter estimation
Campaign: ${P}/OLKI05K                         Default session: 0960 year 2005
Date    : 05-Jul-2005 14:58                   User name      : ja
=====

```

OLKI05K

```

1${P}/OLKI05K                                PROGRAM GPSEST   05-JUL-05 14:58
OLKI05K                                       BERNESE GPS SOFTWARE VERSION 5.0
-----

```

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 2. OBSERVATION FILES
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 10. CONSTANTS
 11. PARAMETER CHARACTERIZATION LIST
 12. TEST OUTPUT
 13. RESULTS (PART 1)
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```

1${P}/OLKI05K                                PROGRAM GPSEST   05-JUL-05 14:58
OLKI05K                                       BERNESE GPS SOFTWARE VERSION 5.0
-----

```

INPUT AND OUTPUT FILENAMES

```

Session table          : ${P}/OLKI05K\STA\SESSIONS.SES

```

```

General constants      : ${X}/GEN\CONST.
Geodetic datum        : ${X}/GEN\DATUM.
Station information    : ${P}/OLKI05K\STA\OLKI05K.STA
Earth rotation parameters : ${P}/OLKI05K\ORB\C04_2005.ERP
Subdaily pole model   : ${X}/GEN\IERS2000.SUB
Nutation model        : ${X}/GEN\IAU2000.NUT
Satellite information  : ${X}/GEN\SATELLIT.
Receiver information   : ${X}/GEN\RECEIVER.
Satellite problems    : ${X}/GEN\SAT_2005.CRX
Phase center eccentricities : ${X}/GEN\PHAS_IGS.REL
SINEX general input file : ${X}/GEN\SINEX.
IONEX control file    : ${X}/GEN\IONEX.
Difference GPS-UTC     : ---
A priori station coordinates: ${P}/OLKI05K\STA\OLKI.CRD
GNSS standard orbits  : ${P}/OLKI05K\ORB\OLKI05K.STD
GNSS orbit partials   : ---
Ionosphere models     : ${P}/OLKI05K\ATM\OLKI05K.ION
Troposphere estimates : ---
Station sigma factors : ---
Station eccentricities : ---
Ocean loading tables  : ---
GNSS clock corrections : ---
Differential code biases : ---
Receiver antenna orientation: ---
Kinematic coordinates : ---
Kinematic velocities  : ---
Standard orbit(s)     : ---
Orbit partials        : ---
Attitude data         : ---
Precise orbit(s)      : ---
LEO orbital elements  : ---
Station coordinates   : ${P}/OLKI05K\STA\TOLKI05K.CRD
GNSS orbital elements : ---
Troposphere estimates : ---
Troposphere SINEX     : ---
Ionosphere models     : ---
IONEX                 : ---
Residuals             : ---
Coordinate covariance matrix: ---
Full covariance matrix : ---
Normal equations      : ---
Bernese ERP file      : ---
IERS ERP file         : ---
GNSS clock corrections : ---
Clock RINEX           : ---
Kinematic coordinates : ---
Differential code biases : ---
Phase center variations (gri: ---
Phase center variations (har: ---
Scratch file          : ${U}/WORK\GPSEST.SCR
Scratch files         : ${U}/WORK\GPSEST.SC1
Program output        : ${P}/OLKI05K\OUT\GPSEST.L28
Error message         : ${U}/WORK\ERROR.MSG

```

1\${P}/OLKI05K
OLKI05K

PROGRAM GPSEST 05-JUL-05 14:58
BERNESE GPS SOFTWARE VERSION 5.0

1. CAMPAIGNS

CAMPAIGN NAME	NUM	STATION NAME	NUM	STATION NAME	NUM	STATION NAME	NUM	STATION NAME	NUM	STATION NAME
\${P}/OLKI05K	1	GPS1	2	GPS2	3	GPS3	4	GPS4	5	GPS5
	6	GPS6	7	GPS7	8	GPS8	9	GPS9	10	GP13

2. OBSERVATION FILES

\${P}/OLKI05K

MAIN CHARACTERISTICS:

FILE	OBSERVATION FILE HEADER	OBSERVATION FILE	SESS	RECEIVER 1	RECEIVER 2
1	\${P}/OLKI05K/OBS/01020980.PSH	\${P}/OLKI05K/OBS/01020980.PSO	0980	ASHTECH Z-XII3	ASHTECH Z-XII
2	\${P}/OLKI05K/OBS/01020990.PSH	\${P}/OLKI05K/OBS/01020990.PSO	0990	ASHTECH Z-XII3	ASHTECH Z-XII
3	\${P}/OLKI05K/OBS/01030980.PSH	\${P}/OLKI05K/OBS/01030980.PSO	0980	ASHTECH Z-XII3	ASHTECH Z-XII
4	\${P}/OLKI05K/OBS/01030990.PSH	\${P}/OLKI05K/OBS/01030990.PSO	0990	ASHTECH Z-XII3	ASHTECH Z-XII
5	\${P}/OLKI05K/OBS/01040960.PSH	\${P}/OLKI05K/OBS/01040960.PSO	0960	ASHTECH Z-XII3	ASHTECH Z-XII
6	\${P}/OLKI05K/OBS/01040970.PSH	\${P}/OLKI05K/OBS/01040970.PSO	0970	ASHTECH Z-XII3	ASHTECH Z-XII
7	\${P}/OLKI05K/OBS/01050960.PSH	\${P}/OLKI05K/OBS/01050960.PSO	0960	ASHTECH Z-XII3	ASHTECH Z-XII
8	\${P}/OLKI05K/OBS/01050970.PSH	\${P}/OLKI05K/OBS/01050970.PSO	0970	ASHTECH Z-XII3	ASHTECH Z-XII
9	\${P}/OLKI05K/OBS/01050980.PSH	\${P}/OLKI05K/OBS/01050980.PSO	0980	ASHTECH Z-XII3	ASHTECH Z-XII
10	\${P}/OLKI05K/OBS/01050990.PSH	\${P}/OLKI05K/OBS/01050990.PSO	0990	ASHTECH Z-XII3	ASHTECH Z-XII
11	\${P}/OLKI05K/OBS/01060960.PSH	\${P}/OLKI05K/OBS/01060960.PSO	0960	ASHTECH Z-XII3	ASHTECH Z-XII
12	\${P}/OLKI05K/OBS/01060970.PSH	\${P}/OLKI05K/OBS/01060970.PSO	0970	ASHTECH Z-XII3	ASHTECH Z-XII
13	\${P}/OLKI05K/OBS/01060980.PSH	\${P}/OLKI05K/OBS/01060980.PSO	0980	ASHTECH Z-XII3	ASHTECH Z-XII
14	\${P}/OLKI05K/OBS/01060990.PSH	\${P}/OLKI05K/OBS/01060990.PSO	0990	ASHTECH Z-XII3	ASHTECH Z-XII
15	\${P}/OLKI05K/OBS/01070960.PSH	\${P}/OLKI05K/OBS/01070960.PSO	0960	ASHTECH Z-XII3	ASHTECH Z-XII
16	\${P}/OLKI05K/OBS/01070970.PSH	\${P}/OLKI05K/OBS/01070970.PSO	0970	ASHTECH Z-XII3	ASHTECH Z-XII
17	\${P}/OLKI05K/OBS/01080960.PSH	\${P}/OLKI05K/OBS/01080960.PSO	0960	ASHTECH Z-XII3	ASHTECH Z-XII
18	\${P}/OLKI05K/OBS/01080970.PSH	\${P}/OLKI05K/OBS/01080970.PSO	0970	ASHTECH Z-XII3	ASHTECH Z-XII
19	\${P}/OLKI05K/OBS/01080980.PSH	\${P}/OLKI05K/OBS/01080980.PSO	0980	ASHTECH Z-XII3	ASHTECH Z-XII
20	\${P}/OLKI05K/OBS/01080990.PSH	\${P}/OLKI05K/OBS/01080990.PSO	0990	ASHTECH Z-XII3	ASHTECH Z-XII

21	{P}/OLKI05K/OBS/06090960.PSH	{P}/OLKI05K/OBS/06090960.PSO	0960	ASHTECH Z-XII	ASHTECH Z-XII
22	{P}/OLKI05K/OBS/06090970.PSH	{P}/OLKI05K/OBS/06090970.PSO	0970	ASHTECH Z-XII	ASHTECH Z-XII
23	{P}/OLKI05K/OBS/06090980.PSH	{P}/OLKI05K/OBS/06090980.PSO	0980	ASHTECH Z-XII	ASHTECH Z-XII
24	{P}/OLKI05K/OBS/06090990.PSH	{P}/OLKI05K/OBS/06090990.PSO	0990	ASHTECH Z-XII	ASHTECH Z-XII
25	{P}/OLKI05K/OBS/06130960.PSH	{P}/OLKI05K/OBS/06130960.PSO	0960	ASHTECH Z-XII	ASHTECH Z-XII
26	{P}/OLKI05K/OBS/06130970.PSH	{P}/OLKI05K/OBS/06130970.PSO	0970	ASHTECH Z-XII	ASHTECH Z-XII
27	{P}/OLKI05K/OBS/06130980.PSH	{P}/OLKI05K/OBS/06130980.PSO	0980	ASHTECH Z-XII	ASHTECH Z-XII
28	{P}/OLKI05K/OBS/06130990.PSH	{P}/OLKI05K/OBS/06130990.PSO	0990	ASHTECH Z-XII	ASHTECH Z-XII

FILE	TYP	FREQ.	STATION 1	STATION 2	SESS	FIRST	OBSERV.TIME	#EPO	DT	#EF	#CLK	ARC	#SAT	AMB. I. + S.			#CLUSTERS				RM	
														W	12	#AMB	L1	L2	L5			
1	P	L1,L2	GPS1	GPS2	0980	5-04-08	6:33:30	2093	30	0	E	E	1	28	N	Y	Y	51	16	16	51	0
2	P	L1,L2	GPS1	GPS2	0990	5-04-09	0:00:30	1312	30	0	E	E	1	28	N	Y	Y	40	14	14	40	0
3	P	L1,L2	GPS1	GPS3	0980	5-04-08	7:06:00	2028	30	0	E	E	1	28	N	Y	Y	53	19	19	53	0
4	P	L1,L2	GPS1	GPS3	0990	5-04-09	0:00:30	1382	30	0	E	E	1	28	N	Y	Y	39	12	12	39	0
5	P	L1,L2	GPS1	GPS4	0960	5-04-06	6:42:00	2076	30	0	E	E	1	28	N	Y	Y	62	26	26	62	0
6	P	L1,L2	GPS1	GPS4	0970	5-04-07	0:00:30	1345	30	0	E	E	1	28	N	Y	Y	47	21	21	47	0
7	P	L1,L2	GPS1	GPS5	0960	5-04-06	10:49:00	1582	30	0	E	E	1	27	N	Y	Y	42	10	10	42	0
8	P	L1,L2	GPS1	GPS5	0970	5-04-07	0:00:30	1409	30	0	E	E	1	28	N	Y	Y	43	13	13	43	0
9	P	L1,L2	GPS1	GPS5	0980	5-04-08	8:40:00	1840	30	0	E	E	1	27	N	Y	Y	52	17	17	52	0
10	P	L1,L2	GPS1	GPS5	0990	5-04-09	0:00:30	1097	30	0	E	E	1	27	N	Y	Y	33	10	10	33	0
11	P	L1,L2	GPS1	GPS6	0960	5-04-06	9:25:00	1750	30	0	E	E	1	28	N	Y	Y	50	19	19	50	0
12	P	L1,L2	GPS1	GPS6	0970	5-04-07	0:00:30	1176	30	0	E	E	1	28	N	Y	Y	38	15	15	38	0
13	P	L1,L2	GPS1	GPS6	0980	5-04-08	8:17:30	1885	30	0	E	E	1	28	N	Y	Y	53	20	20	53	0
14	P	L1,L2	GPS1	GPS6	0990	5-04-09	0:00:30	1561	30	0	E	E	1	28	N	Y	Y	46	16	16	46	0
15	P	L1,L2	GPS1	GPS7	0960	5-04-06	7:49:00	1942	30	0	E	E	1	28	N	Y	Y	56	22	22	56	0
16	P	L1,L2	GPS1	GPS7	0970	5-04-07	0:00:30	1260	30	0	E	E	1	28	N	Y	Y	42	17	17	42	0
17	P	L1,L2	GPS1	GPS8	0960	5-04-06	7:15:30	2009	30	0	E	E	1	28	N	Y	Y	63	29	29	63	0
18	P	L1,L2	GPS1	GPS8	0970	5-04-07	0:00:30	1311	30	0	E	E	1	28	N	Y	Y	54	25	25	54	0
19	P	L1,L2	GPS1	GPS8	0980	5-04-08	7:34:30	1971	30	0	E	E	1	28	N	Y	Y	58	25	25	58	0
20	P	L1,L2	GPS1	GPS8	0990	5-04-09	0:00:30	1454	30	0	E	E	1	28	N	Y	Y	52	19	19	52	0
21	P	L1,L2	GPS6	GPS9	0960	5-04-06	9:25:00	1750	30	0	E	E	1	28	N	Y	Y	46	14	14	46	0
22	P	L1,L2	GPS6	GPS9	0970	5-04-07	0:00:30	1176	30	0	E	E	1	28	N	Y	Y	35	12	12	35	0
23	P	L1,L2	GPS6	GPS9	0980	5-04-08	8:17:30	1885	30	0	E	E	1	28	N	Y	Y	50	17	17	50	0
24	P	L1,L2	GPS6	GPS9	0990	5-04-09	0:00:30	1527	30	0	E	E	1	28	N	Y	Y	42	13	13	42	0
25	P	L1,L2	GPS6	GP13	0960	5-04-06	9:25:00	1750	30	0	E	E	1	28	N	Y	Y	48	17	17	48	0
26	P	L1,L2	GPS6	GP13	0970	5-04-07	0:00:30	1176	30	0	E	E	1	28	N	Y	Y	36	13	13	36	0
27	P	L1,L2	GPS6	GP13	0980	5-04-08	8:17:30	1885	30	0	E	E	1	28	N	Y	Y	51	18	18	51	0
28	P	L1,L2	GPS6	GP13	0990	5-04-09	0:00:30	1561	30	0	E	E	1	28	N	Y	Y	44	14	14	44	0

SATELLITES:

FILE	#SAT	SATELLITES																														
1	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
2	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
3	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
4	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31			

5	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
6	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
7	27	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	31	
8	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
9	27	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	31	
10	27	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
11	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
12	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
13	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
14	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
15	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
16	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
17	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
18	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
19	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
20	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
21	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
22	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
23	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
24	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
25	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
26	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
27	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31
28	28	1	2	3	4	5	6	8	9	10	11	13	14	15	16	18	19	20	21	22	23	24	25	26	27	28	29	30	31

OBSERVATION SELECTION:

SAMPLING RATE : 30 SEC
 ELEVATION CUT-OFF ANGLE : 20 DEGREES
 SATELLITE SYSTEM : GPS
 SPECIAL DATA SELECTION : NO

1\${P}/OLKI05K
 OLKI05K

PROGRAM GPSEST 05-JUL-05 14:58
 BERNESE GPS SOFTWARE VERSION 5.0

3. GENERAL OPTIONS

TIDAL CORRECTION OF STATION COORDINATES : IERS CONVENTIONS 2000

A PRIORI SIGMA OF UNIT WEIGHT:

A PRIORI SIGMA OF UNIT WEIGHT : 0.001 M (SIGMA OF ONE-WAY L1 PHASE OBSERVABLE AT ZENITH)

MODEL FOR ELEVATION-DEPENDENT WEIGHTING : 1/COS(Z)

CORRELATIONS AND SESSIONS:

STRATEGY : CORRELATIONS CORRECTLY MODELLED
 TIME INTERVAL : 0.10000 SEC (TO IDENTIFY EPOCH)

SESS #FILE FILE NUMBERS

0980 7 1 3 9 13 19 23 27
 0990 7 2 4 10 14 20 24 28
 0960 7 5 7 11 15 17 21 25
 0970 7 6 8 12 16 18 22 26

AMBIGUITY RESOLUTION STRATEGY:

AMBIGUITIES PRE-ELIMINATED EVERY 30 SECONDS

SYNCHRONIZATION ERRORS:

STRATEGY : SYNCHRONIZATION ERRORS NOT APPLIED

4. STATIONS

Local geodetic datum: \${X}/GEN\DATUM.

Datum name	Ell. param./ Scale	Shifts to WGS-84	Rotations to WGS-84
WGS - 84	A = 6378137.000 m 1/F= 298.2572236 SC = 0.00000D+00	DX = 0.0000 m DY = 0.0000 m DZ = 0.0000 m	RX = 0.00000 arcsec RY = 0.00000 arcsec RZ = 0.00000 arcsec

A priori station coordinates: \${P}/OLKI05K\STA\OLKI.CRD

A priori station coordinates
WGS-84

A priori station coordinates
Ellipsoidal in local geodetic datum

num	Station name	obs e/f/h	X (m)	Y (m)	Z (m)	Latitude	Longitude	Height (m)
1	GPS1	Y ESTIM	2863210.1067	1126271.4390	5568267.2990	61 14 22.754183	21 28 21.633926	30.5520
2	GPS2	Y ESTIM	2863312.4876	1127586.4513	5567953.2561	61 14 1.535088	21 29 41.145601	32.8443
3	GPS3	Y ESTIM	2862323.4428	1126533.7706	5568664.0772	61 14 49.568852	21 28 59.767954	27.6613
4	GPS4	Y ESTIM	2862758.9415	1125923.2376	5568566.0154	61 14 42.897724	21 28 10.980705	29.1133
5	GPS5	Y ESTIM	2864192.3764	1126421.6871	5567725.8796	61 13 46.892454	21 28 6.906786	22.2982
6	GPS6	Y ESTIM	2863910.3892	1125229.5963	5568112.5408	61 14 12.686451	21 26 59.459035	25.0654

7	GPS7	Y	ESTIM	2863465.8530	1124819.7828	5568430.2557	61 14 33.586772	21 26 44.784815	32.4126
8	GPS8	Y	ESTIM	2863019.7046	1124739.5538	5568666.6848	61 14 49.853077	21 26 50.715669	25.8084
9	GPS9	Y	ESTIM	2863742.0387	1123996.6145	5568453.4720	61 14 35.187574	21 25 46.644762	31.7025
10	GP13	Y	ESTIM	2864309.0028	1124134.0361	5568134.1930	61 14 13.855835	21 25 41.334054	29.8962

A priori sigma:

Station coordinates a priori sigma
in local geodetic datum

num	Station name	N (m)	E (m)	U (m)
1	GPS1	0.00010	0.00010	0.00100

1\${P}/OLKI05K
OLKI05K

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5. SATELLITE ORBITS

ARC CHARACTERISTICS:

ARC	START OF ARC	END OF ARC	SOURCE	#SAT	SATELLITES																		
1	05-04-06 00:00:00	05-04-10 00:00:00	PR2005. 99	29	1	2	3	4	5	6	7	8	9	10	11	13	14	15	16	18	19	20	
					21	22	23	24	25	26	27	28	29	30	31								

OSCULATING ELEMENTS:

\${P}/OLKI05K\ORB\OLKI05K.STD

REFERENCE SYSTEM: J2000.0
REFERENCE EPOCH : 53466.2791667 MJD (2005 4 6 6 42 0.00)

SAT	S.MAJ.AXIS	ECCENTRIC.	INCLINAT.	NODE	PERIGEE	M. ANOMALY	PER.PASS.TIME
1	26560062.3	0.00595723	56.367458	41.401221	-94.437861	-45.956049	53466.3428141
2	26561191.7	0.00960269	54.701034	-80.298821	103.027962	45.907546	53466.2155823
3	26562123.5	0.00676185	53.130701	-145.113972	34.628505	-8.715152	53466.2912382
4	26561150.8	0.00697697	54.682049	-79.149254	2.303403	-177.606910	53466.5251609
5	26559714.3	0.00593346	53.689993	155.223113	-306.402026	168.565576	53466.0457141
6	26559049.1	0.00631674	53.555755	-141.942959	249.315386	-122.124360	53466.4482948
7	26559072.1	0.01305821	53.648311	-143.501704	-103.348176	2.524392	53466.2756707
8	26562056.9	0.00916455	55.470048	101.748377	145.094794	-116.246135	53466.4401815


```

 9  26558938.9  0.01658379  54.735231  97.539074  65.037748 -141.881351 53466.4756547
10  26557895.2  0.00655053  56.039344 -19.343058  18.785955  66.368429 53466.1872601
11  26559231.7  0.00409840  51.658923 -87.363139  14.277077 -90.008972 53466.4038200
13  26560309.1  0.00252480  56.607261  40.484613  51.370557  69.921626 53466.1823264
14  26558977.2  0.00169234  56.282171  39.861906 -101.004672 -2.384153 53466.2824684
15  26560697.4  0.00900473  55.087103 -76.019564  135.548913 -122.978128 53466.4494930
16  26559180.4  0.00283577  55.114111 159.817965 -67.142059 165.844989 53466.0494888
18  26562627.2  0.00563312  55.119191 -17.742358 -160.940718 148.387701 53466.0736253
19  26562072.2  0.00317846  54.965877 -137.187315 -96.993883  95.267033 53466.1472103
20  26561879.6  0.00254222  55.102650 -20.750143 -279.412749 131.320424 53466.0972740
21  26559806.5  0.00965584  54.313994 -77.839970 179.288864 -129.079895 53466.4579350
22  26560799.4  0.00480361  54.972113 -17.223458 -85.202466  45.378443 53466.2163166
23  26561497.5  0.00380085  55.261861  39.498028 127.675072  21.205958 53466.2497948
24  26559898.1  0.00869857  55.269789 -77.443853 -67.408301 -70.924740 53466.3773939
25  26561854.6  0.01206716  54.349697  94.567479 274.969918 -95.123602 53466.4109227
26  26560900.2  0.01628681  56.509669  40.594518  38.305426 -39.432266 53466.3337815
27  26559415.2  0.01906958  54.606608  96.281409 -117.618726 172.149067 53466.0407552
28  26560670.3  0.01001662  55.001657 160.399515 -133.626003  98.301206 53466.1430184
29  26560998.4  0.00881620  56.330020  38.681270 -65.850862  81.153965 53466.1667654
30  26562728.5  0.00792983  54.080721 157.716966 -286.820290 115.762651 53466.1188155
31  26558435.2  0.01221126  53.618134 -143.571626  62.986495 -147.115320 53466.4828973

```

SATELLITE PROBLEMS:

```

SAT PROBLEM TYPE ACTION FROM TO
-----
118 BAD PHASE+CODE OBS. REMOVED 05-04-07 00:00:00 05-05-04 23:59:59

```

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1${P}/OLKI05K PROGRAM GPSEST 05-JUL-05 14:58
OLKI05K BERNESE GPS SOFTWARE VERSION 5.0
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6. ATMOSPHERE

TROPOSPHERE MODEL

A priori troposphere model: Saastamoinen
Meteo/Trop.delay values : Extrapolated

Reference height : 0.00 m Temperature at ref. height: 18.00 C
 Pressure at ref. height: 1013.25 mbar
 Humidity at ref. height: 50.00 %

SITE-SPECIFIC TROPOSPHERE PARAMETERS

Mapping function used for delay estimation: 1/cos(zenith-distance)
 Troposphere gradient estimation : No

Par	Station name	Reference epoch	sig_n (m)	sig_e (m)	sig_u (m)	abs/rel
1	GPS2	2005 04 06 06 00 00			0.00000	abs
2	GPS2	2005 04 06 08 00 00			0.00000	rel
3	GPS2	2005 04 06 10 00 00			0.00000	rel
4	GPS2	2005 04 06 12 00 00			0.00000	rel
5	GPS2	2005 04 06 14 00 00			0.00000	rel
6	GPS2	2005 04 06 16 00 00			0.00000	rel
7	GPS2	2005 04 06 18 00 00			0.00000	rel
8	GPS2	2005 04 06 20 00 00			0.00000	rel
9	GPS2	2005 04 06 22 00 00			0.00000	rel
10	GPS2	2005 04 07 00 00 00			0.00000	rel
11	GPS2	2005 04 07 02 00 00			0.00000	rel
12	GPS2	2005 04 07 04 00 00			0.00000	rel
13	GPS2	2005 04 07 06 00 00			0.00000	rel
14	GPS2	2005 04 07 08 00 00			0.00000	rel
15	GPS2	2005 04 07 10 00 00			0.00000	rel
16	GPS2	2005 04 07 12 00 00			0.00000	rel
17	GPS2	2005 04 07 14 00 00			0.00000	rel
18	GPS2	2005 04 07 16 00 00			0.00000	rel
19	GPS2	2005 04 07 18 00 00			0.00000	rel
20	GPS2	2005 04 07 20 00 00			0.00000	rel
21	GPS2	2005 04 07 22 00 00			0.00000	rel
22	GPS2	2005 04 08 00 00 00			0.00000	rel
23	GPS2	2005 04 08 02 00 00			0.00000	rel
24	GPS2	2005 04 08 04 00 00			0.00000	rel
25	GPS2	2005 04 08 06 00 00			0.00000	rel
26	GPS2	2005 04 08 08 00 00			0.00000	rel
27	GPS2	2005 04 08 10 00 00			0.00000	rel
28	GPS2	2005 04 08 12 00 00			0.00000	rel
29	GPS2	2005 04 08 14 00 00			0.00000	rel
30	GPS2	2005 04 08 16 00 00			0.00000	rel
31	GPS2	2005 04 08 18 00 00			0.00000	rel
32	GPS2	2005 04 08 20 00 00			0.00000	rel
33	GPS2	2005 04 08 22 00 00			0.00000	rel
34	GPS2	2005 04 09 00 00 00			0.00000	rel
35	GPS2	2005 04 09 02 00 00			0.00000	rel
36	GPS2	2005 04 09 04 00 00			0.00000	rel
37	GPS2	2005 04 09 06 00 00			0.00000	rel
38	GPS2	2005 04 09 08 00 00			0.00000	rel
39	GPS2	2005 04 09 10 00 00			0.00000	rel
40	GPS2	2005 04 09 12 00 00			0.00000	rel
41	GPS2	2005 04 09 14 00 00			0.00000	rel
42	GPS3	2005 04 06 06 00 00			0.00000	abs
43	GPS3	2005 04 06 08 00 00			0.00000	rel
44	GPS3	2005 04 06 10 00 00			0.00000	rel
45	GPS3	2005 04 06 12 00 00			0.00000	rel
46	GPS3	2005 04 06 14 00 00			0.00000	rel

47	GPS3	2005 04 06 16 00 00	0.00000	rel
48	GPS3	2005 04 06 18 00 00	0.00000	rel
49	GPS3	2005 04 06 20 00 00	0.00000	rel
50	GPS3	2005 04 06 22 00 00	0.00000	rel
51	GPS3	2005 04 07 00 00 00	0.00000	rel
52	GPS3	2005 04 07 02 00 00	0.00000	rel
53	GPS3	2005 04 07 04 00 00	0.00000	rel
54	GPS3	2005 04 07 06 00 00	0.00000	rel
55	GPS3	2005 04 07 08 00 00	0.00000	rel
56	GPS3	2005 04 07 10 00 00	0.00000	rel
57	GPS3	2005 04 07 12 00 00	0.00000	rel
58	GPS3	2005 04 07 14 00 00	0.00000	rel
59	GPS3	2005 04 07 16 00 00	0.00000	rel
60	GPS3	2005 04 07 18 00 00	0.00000	rel
61	GPS3	2005 04 07 20 00 00	0.00000	rel
62	GPS3	2005 04 07 22 00 00	0.00000	rel
63	GPS3	2005 04 08 00 00 00	0.00000	rel
64	GPS3	2005 04 08 02 00 00	0.00000	rel
65	GPS3	2005 04 08 04 00 00	0.00000	rel
66	GPS3	2005 04 08 06 00 00	0.00000	rel
67	GPS3	2005 04 08 08 00 00	0.00000	rel
68	GPS3	2005 04 08 10 00 00	0.00000	rel
69	GPS3	2005 04 08 12 00 00	0.00000	rel
70	GPS3	2005 04 08 14 00 00	0.00000	rel
71	GPS3	2005 04 08 16 00 00	0.00000	rel
72	GPS3	2005 04 08 18 00 00	0.00000	rel
73	GPS3	2005 04 08 20 00 00	0.00000	rel
74	GPS3	2005 04 08 22 00 00	0.00000	rel
75	GPS3	2005 04 09 00 00 00	0.00000	rel
76	GPS3	2005 04 09 02 00 00	0.00000	rel
77	GPS3	2005 04 09 04 00 00	0.00000	rel
78	GPS3	2005 04 09 06 00 00	0.00000	rel
79	GPS3	2005 04 09 08 00 00	0.00000	rel
80	GPS3	2005 04 09 10 00 00	0.00000	rel
81	GPS3	2005 04 09 12 00 00	0.00000	rel
82	GPS3	2005 04 09 14 00 00	0.00000	rel
83	GPS4	2005 04 06 06 00 00	0.00000	abs
84	GPS4	2005 04 06 08 00 00	0.00000	rel
85	GPS4	2005 04 06 10 00 00	0.00000	rel
86	GPS4	2005 04 06 12 00 00	0.00000	rel
87	GPS4	2005 04 06 14 00 00	0.00000	rel
88	GPS4	2005 04 06 16 00 00	0.00000	rel
89	GPS4	2005 04 06 18 00 00	0.00000	rel
90	GPS4	2005 04 06 20 00 00	0.00000	rel
91	GPS4	2005 04 06 22 00 00	0.00000	rel
92	GPS4	2005 04 07 00 00 00	0.00000	rel
93	GPS4	2005 04 07 02 00 00	0.00000	rel
94	GPS4	2005 04 07 04 00 00	0.00000	rel
95	GPS4	2005 04 07 06 00 00	0.00000	rel
96	GPS4	2005 04 07 08 00 00	0.00000	rel
97	GPS4	2005 04 07 10 00 00	0.00000	rel
98	GPS4	2005 04 07 12 00 00	0.00000	rel
99	GPS4	2005 04 07 14 00 00	0.00000	rel

100	GPS4	2005 04 07 16 00 00	0.00000	rel
101	GPS4	2005 04 07 18 00 00	0.00000	rel
102	GPS4	2005 04 07 20 00 00	0.00000	rel
103	GPS4	2005 04 07 22 00 00	0.00000	rel
104	GPS4	2005 04 08 00 00 00	0.00000	rel
105	GPS4	2005 04 08 02 00 00	0.00000	rel
106	GPS4	2005 04 08 04 00 00	0.00000	rel
107	GPS4	2005 04 08 06 00 00	0.00000	rel
108	GPS4	2005 04 08 08 00 00	0.00000	rel
109	GPS4	2005 04 08 10 00 00	0.00000	rel
110	GPS4	2005 04 08 12 00 00	0.00000	rel
111	GPS4	2005 04 08 14 00 00	0.00000	rel
112	GPS4	2005 04 08 16 00 00	0.00000	rel
113	GPS4	2005 04 08 18 00 00	0.00000	rel
114	GPS4	2005 04 08 20 00 00	0.00000	rel
115	GPS4	2005 04 08 22 00 00	0.00000	rel
116	GPS4	2005 04 09 00 00 00	0.00000	rel
117	GPS4	2005 04 09 02 00 00	0.00000	rel
118	GPS4	2005 04 09 04 00 00	0.00000	rel
119	GPS4	2005 04 09 06 00 00	0.00000	rel
120	GPS4	2005 04 09 08 00 00	0.00000	rel
121	GPS4	2005 04 09 10 00 00	0.00000	rel
122	GPS4	2005 04 09 12 00 00	0.00000	rel
123	GPS4	2005 04 09 14 00 00	0.00000	rel
124	GPS5	2005 04 06 06 00 00	0.00000	abs
125	GPS5	2005 04 06 08 00 00	0.00000	rel
126	GPS5	2005 04 06 10 00 00	0.00000	rel
127	GPS5	2005 04 06 12 00 00	0.00000	rel
128	GPS5	2005 04 06 14 00 00	0.00000	rel
129	GPS5	2005 04 06 16 00 00	0.00000	rel
130	GPS5	2005 04 06 18 00 00	0.00000	rel
131	GPS5	2005 04 06 20 00 00	0.00000	rel
132	GPS5	2005 04 06 22 00 00	0.00000	rel
133	GPS5	2005 04 07 00 00 00	0.00000	rel
134	GPS5	2005 04 07 02 00 00	0.00000	rel
135	GPS5	2005 04 07 04 00 00	0.00000	rel
136	GPS5	2005 04 07 06 00 00	0.00000	rel
137	GPS5	2005 04 07 08 00 00	0.00000	rel
138	GPS5	2005 04 07 10 00 00	0.00000	rel
139	GPS5	2005 04 07 12 00 00	0.00000	rel
140	GPS5	2005 04 07 14 00 00	0.00000	rel
141	GPS5	2005 04 07 16 00 00	0.00000	rel
142	GPS5	2005 04 07 18 00 00	0.00000	rel
143	GPS5	2005 04 07 20 00 00	0.00000	rel
144	GPS5	2005 04 07 22 00 00	0.00000	rel
145	GPS5	2005 04 08 00 00 00	0.00000	rel
146	GPS5	2005 04 08 02 00 00	0.00000	rel
147	GPS5	2005 04 08 04 00 00	0.00000	rel
148	GPS5	2005 04 08 06 00 00	0.00000	rel
149	GPS5	2005 04 08 08 00 00	0.00000	rel
150	GPS5	2005 04 08 10 00 00	0.00000	rel
151	GPS5	2005 04 08 12 00 00	0.00000	rel
152	GPS5	2005 04 08 14 00 00	0.00000	rel

153	GPS5	2005 04 08 16 00 00	0.00000	rel
154	GPS5	2005 04 08 18 00 00	0.00000	rel
155	GPS5	2005 04 08 20 00 00	0.00000	rel
156	GPS5	2005 04 08 22 00 00	0.00000	rel
157	GPS5	2005 04 09 00 00 00	0.00000	rel
158	GPS5	2005 04 09 02 00 00	0.00000	rel
159	GPS5	2005 04 09 04 00 00	0.00000	rel
160	GPS5	2005 04 09 06 00 00	0.00000	rel
161	GPS5	2005 04 09 08 00 00	0.00000	rel
162	GPS5	2005 04 09 10 00 00	0.00000	rel
163	GPS5	2005 04 09 12 00 00	0.00000	rel
164	GPS5	2005 04 09 14 00 00	0.00000	rel
165	GPS6	2005 04 06 06 00 00	0.00000	abs
166	GPS6	2005 04 06 08 00 00	0.00000	rel
167	GPS6	2005 04 06 10 00 00	0.00000	rel
168	GPS6	2005 04 06 12 00 00	0.00000	rel
169	GPS6	2005 04 06 14 00 00	0.00000	rel
170	GPS6	2005 04 06 16 00 00	0.00000	rel
171	GPS6	2005 04 06 18 00 00	0.00000	rel
172	GPS6	2005 04 06 20 00 00	0.00000	rel
173	GPS6	2005 04 06 22 00 00	0.00000	rel
174	GPS6	2005 04 07 00 00 00	0.00000	rel
175	GPS6	2005 04 07 02 00 00	0.00000	rel
176	GPS6	2005 04 07 04 00 00	0.00000	rel
177	GPS6	2005 04 07 06 00 00	0.00000	rel
178	GPS6	2005 04 07 08 00 00	0.00000	rel
179	GPS6	2005 04 07 10 00 00	0.00000	rel
180	GPS6	2005 04 07 12 00 00	0.00000	rel
181	GPS6	2005 04 07 14 00 00	0.00000	rel
182	GPS6	2005 04 07 16 00 00	0.00000	rel
183	GPS6	2005 04 07 18 00 00	0.00000	rel
184	GPS6	2005 04 07 20 00 00	0.00000	rel
185	GPS6	2005 04 07 22 00 00	0.00000	rel
186	GPS6	2005 04 08 00 00 00	0.00000	rel
187	GPS6	2005 04 08 02 00 00	0.00000	rel
188	GPS6	2005 04 08 04 00 00	0.00000	rel
189	GPS6	2005 04 08 06 00 00	0.00000	rel
190	GPS6	2005 04 08 08 00 00	0.00000	rel
191	GPS6	2005 04 08 10 00 00	0.00000	rel
192	GPS6	2005 04 08 12 00 00	0.00000	rel
193	GPS6	2005 04 08 14 00 00	0.00000	rel
194	GPS6	2005 04 08 16 00 00	0.00000	rel
195	GPS6	2005 04 08 18 00 00	0.00000	rel
196	GPS6	2005 04 08 20 00 00	0.00000	rel
197	GPS6	2005 04 08 22 00 00	0.00000	rel
198	GPS6	2005 04 09 00 00 00	0.00000	rel
199	GPS6	2005 04 09 02 00 00	0.00000	rel
200	GPS6	2005 04 09 04 00 00	0.00000	rel
201	GPS6	2005 04 09 06 00 00	0.00000	rel
202	GPS6	2005 04 09 08 00 00	0.00000	rel
203	GPS6	2005 04 09 10 00 00	0.00000	rel
204	GPS6	2005 04 09 12 00 00	0.00000	rel
205	GPS6	2005 04 09 14 00 00	0.00000	rel

206	GPS7	2005 04 06 06 00 00	0.00000	abs
207	GPS7	2005 04 06 08 00 00	0.00000	rel
208	GPS7	2005 04 06 10 00 00	0.00000	rel
209	GPS7	2005 04 06 12 00 00	0.00000	rel
210	GPS7	2005 04 06 14 00 00	0.00000	rel
211	GPS7	2005 04 06 16 00 00	0.00000	rel
212	GPS7	2005 04 06 18 00 00	0.00000	rel
213	GPS7	2005 04 06 20 00 00	0.00000	rel
214	GPS7	2005 04 06 22 00 00	0.00000	rel
215	GPS7	2005 04 07 00 00 00	0.00000	rel
216	GPS7	2005 04 07 02 00 00	0.00000	rel
217	GPS7	2005 04 07 04 00 00	0.00000	rel
218	GPS7	2005 04 07 06 00 00	0.00000	rel
219	GPS7	2005 04 07 08 00 00	0.00000	rel
220	GPS7	2005 04 07 10 00 00	0.00000	rel
221	GPS7	2005 04 07 12 00 00	0.00000	rel
222	GPS7	2005 04 07 14 00 00	0.00000	rel
223	GPS7	2005 04 07 16 00 00	0.00000	rel
224	GPS7	2005 04 07 18 00 00	0.00000	rel
225	GPS7	2005 04 07 20 00 00	0.00000	rel
226	GPS7	2005 04 07 22 00 00	0.00000	rel
227	GPS7	2005 04 08 00 00 00	0.00000	rel
228	GPS7	2005 04 08 02 00 00	0.00000	rel
229	GPS7	2005 04 08 04 00 00	0.00000	rel
230	GPS7	2005 04 08 06 00 00	0.00000	rel
231	GPS7	2005 04 08 08 00 00	0.00000	rel
232	GPS7	2005 04 08 10 00 00	0.00000	rel
233	GPS7	2005 04 08 12 00 00	0.00000	rel
234	GPS7	2005 04 08 14 00 00	0.00000	rel
235	GPS7	2005 04 08 16 00 00	0.00000	rel
236	GPS7	2005 04 08 18 00 00	0.00000	rel
237	GPS7	2005 04 08 20 00 00	0.00000	rel
238	GPS7	2005 04 08 22 00 00	0.00000	rel
239	GPS7	2005 04 09 00 00 00	0.00000	rel
240	GPS7	2005 04 09 02 00 00	0.00000	rel
241	GPS7	2005 04 09 04 00 00	0.00000	rel
242	GPS7	2005 04 09 06 00 00	0.00000	rel
243	GPS7	2005 04 09 08 00 00	0.00000	rel
244	GPS7	2005 04 09 10 00 00	0.00000	rel
245	GPS7	2005 04 09 12 00 00	0.00000	rel
246	GPS7	2005 04 09 14 00 00	0.00000	rel
247	GPS8	2005 04 06 06 00 00	0.00000	abs
248	GPS8	2005 04 06 08 00 00	0.00000	rel
249	GPS8	2005 04 06 10 00 00	0.00000	rel
250	GPS8	2005 04 06 12 00 00	0.00000	rel
251	GPS8	2005 04 06 14 00 00	0.00000	rel
252	GPS8	2005 04 06 16 00 00	0.00000	rel
253	GPS8	2005 04 06 18 00 00	0.00000	rel
254	GPS8	2005 04 06 20 00 00	0.00000	rel
255	GPS8	2005 04 06 22 00 00	0.00000	rel
256	GPS8	2005 04 07 00 00 00	0.00000	rel
257	GPS8	2005 04 07 02 00 00	0.00000	rel
258	GPS8	2005 04 07 04 00 00	0.00000	rel

259	GPS8	2005 04 07 06 00 00	0.00000	rel
260	GPS8	2005 04 07 08 00 00	0.00000	rel
261	GPS8	2005 04 07 10 00 00	0.00000	rel
262	GPS8	2005 04 07 12 00 00	0.00000	rel
263	GPS8	2005 04 07 14 00 00	0.00000	rel
264	GPS8	2005 04 07 16 00 00	0.00000	rel
265	GPS8	2005 04 07 18 00 00	0.00000	rel
266	GPS8	2005 04 07 20 00 00	0.00000	rel
267	GPS8	2005 04 07 22 00 00	0.00000	rel
268	GPS8	2005 04 08 00 00 00	0.00000	rel
269	GPS8	2005 04 08 02 00 00	0.00000	rel
270	GPS8	2005 04 08 04 00 00	0.00000	rel
271	GPS8	2005 04 08 06 00 00	0.00000	rel
272	GPS8	2005 04 08 08 00 00	0.00000	rel
273	GPS8	2005 04 08 10 00 00	0.00000	rel
274	GPS8	2005 04 08 12 00 00	0.00000	rel
275	GPS8	2005 04 08 14 00 00	0.00000	rel
276	GPS8	2005 04 08 16 00 00	0.00000	rel
277	GPS8	2005 04 08 18 00 00	0.00000	rel
278	GPS8	2005 04 08 20 00 00	0.00000	rel
279	GPS8	2005 04 08 22 00 00	0.00000	rel
280	GPS8	2005 04 09 00 00 00	0.00000	rel
281	GPS8	2005 04 09 02 00 00	0.00000	rel
282	GPS8	2005 04 09 04 00 00	0.00000	rel
283	GPS8	2005 04 09 06 00 00	0.00000	rel
284	GPS8	2005 04 09 08 00 00	0.00000	rel
285	GPS8	2005 04 09 10 00 00	0.00000	rel
286	GPS8	2005 04 09 12 00 00	0.00000	rel
287	GPS8	2005 04 09 14 00 00	0.00000	rel
288	GPS9	2005 04 06 06 00 00	0.00000	abs
289	GPS9	2005 04 06 08 00 00	0.00000	rel
290	GPS9	2005 04 06 10 00 00	0.00000	rel
291	GPS9	2005 04 06 12 00 00	0.00000	rel
292	GPS9	2005 04 06 14 00 00	0.00000	rel
293	GPS9	2005 04 06 16 00 00	0.00000	rel
294	GPS9	2005 04 06 18 00 00	0.00000	rel
295	GPS9	2005 04 06 20 00 00	0.00000	rel
296	GPS9	2005 04 06 22 00 00	0.00000	rel
297	GPS9	2005 04 07 00 00 00	0.00000	rel
298	GPS9	2005 04 07 02 00 00	0.00000	rel
299	GPS9	2005 04 07 04 00 00	0.00000	rel
300	GPS9	2005 04 07 06 00 00	0.00000	rel
301	GPS9	2005 04 07 08 00 00	0.00000	rel
302	GPS9	2005 04 07 10 00 00	0.00000	rel
303	GPS9	2005 04 07 12 00 00	0.00000	rel
304	GPS9	2005 04 07 14 00 00	0.00000	rel
305	GPS9	2005 04 07 16 00 00	0.00000	rel
306	GPS9	2005 04 07 18 00 00	0.00000	rel
307	GPS9	2005 04 07 20 00 00	0.00000	rel
308	GPS9	2005 04 07 22 00 00	0.00000	rel
309	GPS9	2005 04 08 00 00 00	0.00000	rel
310	GPS9	2005 04 08 02 00 00	0.00000	rel
311	GPS9	2005 04 08 04 00 00	0.00000	rel

312	GPS9	2005 04 08 06 00 00	0.00000	rel
313	GPS9	2005 04 08 08 00 00	0.00000	rel
314	GPS9	2005 04 08 10 00 00	0.00000	rel
315	GPS9	2005 04 08 12 00 00	0.00000	rel
316	GPS9	2005 04 08 14 00 00	0.00000	rel
317	GPS9	2005 04 08 16 00 00	0.00000	rel
318	GPS9	2005 04 08 18 00 00	0.00000	rel
319	GPS9	2005 04 08 20 00 00	0.00000	rel
320	GPS9	2005 04 08 22 00 00	0.00000	rel
321	GPS9	2005 04 09 00 00 00	0.00000	rel
322	GPS9	2005 04 09 02 00 00	0.00000	rel
323	GPS9	2005 04 09 04 00 00	0.00000	rel
324	GPS9	2005 04 09 06 00 00	0.00000	rel
325	GPS9	2005 04 09 08 00 00	0.00000	rel
326	GPS9	2005 04 09 10 00 00	0.00000	rel
327	GPS9	2005 04 09 12 00 00	0.00000	rel
328	GPS9	2005 04 09 14 00 00	0.00000	rel
329	GP13	2005 04 06 06 00 00	0.00000	abs
330	GP13	2005 04 06 08 00 00	0.00000	rel
331	GP13	2005 04 06 10 00 00	0.00000	rel
332	GP13	2005 04 06 12 00 00	0.00000	rel
333	GP13	2005 04 06 14 00 00	0.00000	rel
334	GP13	2005 04 06 16 00 00	0.00000	rel
335	GP13	2005 04 06 18 00 00	0.00000	rel
336	GP13	2005 04 06 20 00 00	0.00000	rel
337	GP13	2005 04 06 22 00 00	0.00000	rel
338	GP13	2005 04 07 00 00 00	0.00000	rel
339	GP13	2005 04 07 02 00 00	0.00000	rel
340	GP13	2005 04 07 04 00 00	0.00000	rel
341	GP13	2005 04 07 06 00 00	0.00000	rel
342	GP13	2005 04 07 08 00 00	0.00000	rel
343	GP13	2005 04 07 10 00 00	0.00000	rel
344	GP13	2005 04 07 12 00 00	0.00000	rel
345	GP13	2005 04 07 14 00 00	0.00000	rel
346	GP13	2005 04 07 16 00 00	0.00000	rel
347	GP13	2005 04 07 18 00 00	0.00000	rel
348	GP13	2005 04 07 20 00 00	0.00000	rel
349	GP13	2005 04 07 22 00 00	0.00000	rel
350	GP13	2005 04 08 00 00 00	0.00000	rel
351	GP13	2005 04 08 02 00 00	0.00000	rel
352	GP13	2005 04 08 04 00 00	0.00000	rel
353	GP13	2005 04 08 06 00 00	0.00000	rel
354	GP13	2005 04 08 08 00 00	0.00000	rel
355	GP13	2005 04 08 10 00 00	0.00000	rel
356	GP13	2005 04 08 12 00 00	0.00000	rel
357	GP13	2005 04 08 14 00 00	0.00000	rel
358	GP13	2005 04 08 16 00 00	0.00000	rel
359	GP13	2005 04 08 18 00 00	0.00000	rel
360	GP13	2005 04 08 20 00 00	0.00000	rel
361	GP13	2005 04 08 22 00 00	0.00000	rel
362	GP13	2005 04 09 00 00 00	0.00000	rel
363	GP13	2005 04 09 02 00 00	0.00000	rel
364	GP13	2005 04 09 04 00 00	0.00000	rel

365	GP13	2005 04 09 06 00 00	0.00000	rel
366	GP13	2005 04 09 08 00 00	0.00000	rel
367	GP13	2005 04 09 10 00 00	0.00000	rel
368	GP13	2005 04 09 12 00 00	0.00000	rel
369	GP13	2005 04 09 14 00 00	0.00000	rel

IONOSPHERE MODELS: §{P}/OLKI05K\ATM\OLKI05K.ION

 TYPE OF IONOSPHERE MODELS : LOCAL
 RADIUS OF THE EARTH : 6378.14 KM

MODEL	DEG. OF DEVELOP.			VALIDITY		ORIGIN OF DEVELOPMENT			HEIGHT (KM)	NORMAIZATION FACTORS		
	TIME	LAT.	MIXED	START	END	LOCAL TIME	LAT. (D)	LONG. (D)		TIME (H)	LAT. (D)	ELE. CONT.
1	2	1	2	2005 4 5 23.0	2005 4 6 7.0	2005 4 6 3.0	61.23	21.47	450	2.00	6.00	0.10D+18
2	2	1	2	2005 4 6 5.0	2005 4 6 13.0	2005 4 6 9.0	61.23	21.47	450	2.00	6.00	0.10D+18
3	2	1	2	2005 4 6 11.0	2005 4 6 19.0	2005 4 6 15.0	61.23	21.47	450	2.00	6.00	0.10D+18
4	2	1	2	2005 4 6 17.0	2005 4 7 1.0	2005 4 6 21.0	61.23	21.47	450	2.00	6.00	0.10D+18
5	2	1	2	2005 4 6 23.0	2005 4 7 7.0	2005 4 7 3.0	61.23	21.47	450	2.00	6.00	0.10D+18
6	2	1	2	2005 4 7 5.0	2005 4 7 13.0	2005 4 7 9.0	61.23	21.47	450	2.00	6.00	0.10D+18
7	2	1	2	2005 4 7 11.0	2005 4 7 19.0	2005 4 7 15.0	61.23	21.47	450	2.00	6.00	0.10D+18
8	2	1	2	2005 4 7 17.0	2005 4 8 1.0	2005 4 7 21.0	61.23	21.47	450	2.00	6.00	0.10D+18
9	2	1	2	2005 4 7 23.0	2005 4 8 7.0	2005 4 8 3.0	61.23	21.47	450	2.00	6.00	0.10D+18
10	2	1	2	2005 4 8 5.0	2005 4 8 13.0	2005 4 8 9.0	61.23	21.47	450	2.00	6.00	0.10D+18
11	2	1	2	2005 4 8 11.0	2005 4 8 19.0	2005 4 8 15.0	61.23	21.47	450	2.00	6.00	0.10D+18
12	2	1	2	2005 4 8 17.0	2005 4 9 1.0	2005 4 8 21.0	61.23	21.47	450	2.00	6.00	0.10D+18
13	2	1	2	2005 4 8 23.0	2005 4 9 7.0	2005 4 9 3.0	61.23	21.47	450	2.00	6.00	0.10D+18
14	2	1	2	2005 4 9 5.0	2005 4 9 13.0	2005 4 9 9.0	61.23	21.47	450	2.00	6.00	0.10D+18
15	2	1	2	2005 4 9 11.0	2005 4 9 19.0	2005 4 9 15.0	61.23	21.47	450	2.00	6.00	0.10D+18

MODEL	TERM	POL. DEGREE IN		COEFFICIENT	SIGMA
		TIME	LATIT.		
1	1	0	0	0.452466E+00	0.511308E-02
	2	1	0	0.170997E+00	0.115462E-02
	3	2	0	0.842621E-01	0.105540E-02
	4	0	1	0.696852E-01	0.166274E-02
	5	1	1	-0.929507E-01	0.138369E-02
2	1	0	0	0.165773E+01	0.412383E-02
	2	1	0	0.261076E+00	0.106145E-02
	3	2	0	-0.142050E+00	0.915133E-03
	4	0	1	-0.123494E+00	0.149635E-02
	5	1	1	-0.164699E-01	0.151742E-02
3	1	0	0	0.119060E+01	0.490405E-02
	2	1	0	-0.140215E+00	0.131792E-02
	3	2	0	0.200146E-01	0.112966E-02
	4	0	1	-0.161264E+00	0.170012E-02

	5	1	1	-0.921487E-01	0.175262E-02
4	1	0	0	0.284148E+00	0.113253E-01
	2	1	0	-0.167150E+00	0.309033E-02
	3	2	0	0.125971E+00	0.254299E-02
	4	0	1	-0.210293E+00	0.444049E-02
	5	1	1	0.124002E+00	0.478386E-02
5	1	0	0	0.495046E+00	0.552598E-02
	2	1	0	0.181300E+00	0.124148E-02
	3	2	0	0.119285E+00	0.114922E-02
	4	0	1	0.151856E-01	0.179359E-02
	5	1	1	-0.632436E-01	0.149048E-02
6	1	0	0	0.157127E+01	0.596966E-02
	2	1	0	0.229591E+00	0.151540E-02
	3	2	0	-0.145395E+00	0.132515E-02
	4	0	1	-0.210191E+00	0.215808E-02
	5	1	1	0.265832E-02	0.217919E-02
7	1	0	0	0.129290E+01	0.485711E-02
	2	1	0	-0.700043E-01	0.131270E-02
	3	2	0	-0.356235E-01	0.110723E-02
	4	0	1	-0.137158E+00	0.168487E-02
	5	1	1	-0.690903E-01	0.175618E-02
8	1	0	0	0.645537E+00	0.379167E-02
	2	1	0	-0.249297E+00	0.103264E-02
	3	2	0	0.593993E-01	0.855391E-03
	4	0	1	-0.100961E+00	0.147163E-02
	5	1	1	-0.329297E-02	0.160933E-02
9	1	0	0	0.543467E+00	0.454851E-02
	2	1	0	0.207683E+00	0.102011E-02
	3	2	0	0.116372E+00	0.957254E-03
	4	0	1	-0.112359E-01	0.145787E-02
	5	1	1	-0.394272E-01	0.120977E-02
10	1	0	0	0.145300E+01	0.304299E-02
	2	1	0	0.176147E+00	0.777725E-03
	3	2	0	-0.851950E-01	0.677615E-03
	4	0	1	-0.161363E+00	0.108924E-02
	5	1	1	-0.172655E-01	0.112187E-02
11	1	0	0	0.119607E+01	0.324018E-02
	2	1	0	-0.884465E-01	0.883107E-03
	3	2	0	0.231224E-01	0.730189E-03
	4	0	1	-0.161813E+00	0.112535E-02
	5	1	1	-0.127875E-01	0.118448E-02
12	1	0	0	0.756801E+00	0.359746E-02
	2	1	0	-0.244079E+00	0.969538E-03
	3	2	0	0.345333E-01	0.809820E-03

	4	0	1	-0.116869E+00	0.138843E-02
	5	1	1	-0.318231E-01	0.151452E-02
13	1	0	0	0.541542E+00	0.456439E-02
	2	1	0	0.247831E+00	0.102049E-02
	3	2	0	0.147248E+00	0.966278E-03
	4	0	1	-0.772428E-01	0.145959E-02
	5	1	1	-0.163473E-01	0.120755E-02
14	1	0	0	0.146501E+01	0.338122E-02
	2	1	0	0.107447E+00	0.854589E-03
	3	2	0	-0.643017E-01	0.755331E-03
	4	0	1	-0.214899E+00	0.120538E-02
	5	1	1	0.501095E-02	0.124918E-02
15	1	0	0	0.166437E+01	0.323941E-02
	2	1	0	-0.756463E-01	0.885177E-03
	3	2	0	-0.836848E-01	0.737083E-03
	4	0	1	-0.962708E-01	0.112697E-02
	5	1	1	-0.159794E-01	0.121584E-02

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8. POLE COORDINATES AND TIME INFORMATION

A PRIORI POLE AND TIME INFORMATION FROM THE POLE FILE:

DATUM	TIME	X-POLE (") EP-CPO (")	Y-POLE (") PS-CPO (")	UT1-UTC (S)	GPS-UTC (S)	RMS XP (") RMS EP (")	RMS YP (") RMS PS (")	RMS DT (S)
05-04-06	00:00:00	-0.03490 0.00000	0.24637 0.00000	-0.576057	13.	0.00000 0.00000	0.00000 0.00000	0.000000
05-04-07	00:00:00	-0.03553 0.00000	0.24783 0.00000	-0.577232	13.	0.00000 0.00000	0.00000 0.00000	0.000000
05-04-08	00:00:00	-0.03662 0.00000	0.24998 0.00000	-0.578523	13.	0.00000 0.00000	0.00000 0.00000	0.000000
05-04-09	00:00:00	-0.03843 0.00000	0.25215 0.00000	-0.579769	13.	0.00000 0.00000	0.00000 0.00000	0.000000
05-04-10	00:00:00	-0.04059 0.00000	0.25379 0.00000	-0.580836	13.	0.00000 0.00000	0.00000 0.00000	0.000000

NUTATION MODEL: IAU2000
SUBDAILY POLE MODEL: IERS2000

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12. TEST OUTPUT

MIN. AND MAX. ELEVATION/NADIR ANGLES AND MAX. SYNCHRONIZATION ERRORS:

SESS	FILE	STATION NAME 1	STATION NAME 2	MIN/MAX ELEV.	MIN/MAX NADIR	SYNCH. ERR. (NS)
0980	1	GPS1	GPS2	20.0 83.2	1.6 13.2	0.0
0990	2	GPS1	GPS2	20.0 79.9	2.4 13.2	0.0
0980	3	GPS1	GPS3	20.0 83.2	1.6 13.2	0.0
0990	4	GPS1	GPS3	20.0 79.9	2.4 13.2	0.0
0960	5	GPS1	GPS4	20.0 83.2	1.6 13.2	0.0
0970	6	GPS1	GPS4	20.0 79.9	2.4 13.2	0.0
0960	7	GPS1	GPS5	20.0 83.2	1.6 13.2	0.0
0970	8	GPS1	GPS5	20.0 79.9	2.4 13.1	0.0
0980	9	GPS1	GPS5	20.0 83.2	1.6 13.2	0.0
0990	10	GPS1	GPS5	20.0 79.9	2.4 13.1	0.0
0960	11	GPS1	GPS6	20.0 83.2	1.6 13.2	0.0
0970	12	GPS1	GPS6	20.0 79.9	2.4 13.2	0.0
0980	13	GPS1	GPS6	20.0 83.2	1.6 13.2	0.0
0990	14	GPS1	GPS6	20.0 79.9	2.4 13.2	0.0
0960	15	GPS1	GPS7	20.0 83.2	1.6 13.2	0.0
0970	16	GPS1	GPS7	20.0 79.9	2.4 13.2	0.0
0960	17	GPS1	GPS8	20.0 83.2	1.6 13.2	0.0
0970	18	GPS1	GPS8	20.0 79.9	2.4 13.2	0.0
0980	19	GPS1	GPS8	20.0 83.2	1.6 13.2	0.0
0990	20	GPS1	GPS8	20.0 79.9	2.4 13.2	0.0
0960	21	GPS6	GPS9	20.0 83.2	1.6 13.2	0.0
0970	22	GPS6	GPS9	20.0 79.9	2.4 13.2	0.0
0980	23	GPS6	GPS9	20.0 83.2	1.6 13.2	0.0
0990	24	GPS6	GPS9	20.0 79.9	2.4 13.2	0.0
0960	25	GPS6	GP13	20.0 83.2	1.6 13.2	0.0
0970	26	GPS6	GP13	20.0 79.9	2.4 13.2	0.0
0980	27	GPS6	GP13	20.0 83.2	1.6 13.2	0.0
0990	28	GPS6	GP13	20.0 79.9	2.4 13.2	0.0

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13. RESULTS (PART 1)

NUMBER OF PARAMETERS (PART 1):

PARAMETER TYPE	#PARAMETERS	#PRE-ELIMINATED	#SET-UP	#NO-OBS	#REF	#SINGULAR
STATION COORDINATES	30	0	30	0	0	0
AMBIGUITIES	29	29 (BEFORE INV)	966	937	0	2
SITE-SPECIFIC TROPOSPHERE PARAMETERS	369	0	369	0	0	154
TOTAL NUMBER OF PARAMETERS	428	29	1365	937	0	156

NUMBER OF OBSERVATIONS (PART 1):

TYPE	FREQUENCY	FILE	#OBSERVATIONS
PHASE	L1	ALL	236764
PHASE	L2	ALL	236764
TOTAL NUMBER OF OBSERVATIONS			473528

A POSTERIORI SIGMA OF UNIT WEIGHT (PART 1):

A POSTERIORI SIGMA OF UNIT WEIGHT : 0.0017 M (SIGMA OF ONE-WAY L1 PHASE OBSERVABLE AT ZENITH)

DEGREE OF FREEDOM (DOF) : 473256

CHI**2/DOF : 2.95

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STATION COORDINATES: \${P}/OLKI05K\STA\TOLKI05K.CRD

NUM	STATION NAME	PARAMETER	A PRIORI VALUE	NEW VALUE	NEW- A PRIORI	RMS ERROR	3-D ELLIPSOID	2-D ELLIPSE
1	GPS1	X	2863210.1067	2863210.1067	0.0000	0.0008		
		Y	1126271.4390	1126271.4390	0.0000	0.0003		
		Z	5568267.2990	5568267.2991	0.0001	0.0015		

		HEIGHT	30.5520	30.5521	0.0001	0.0017	0.0017	0.0		
		LATITUDE	61 14 22.754183	61 14 22.754183	0.0000	0.0002	0.0002	90.0	0.0002	90.0
		LONGITUDE	21 28 21.633926	21 28 21.633926	0.0000	0.0002	0.0002	0.0	0.0002	
2	GPS2	X	2863312.4876	2863312.4894	0.0018	0.0008				
		Y	1127586.4513	1127586.4502	-0.0011	0.0004				
		Z	5567953.2561	5567953.2591	0.0030	0.0015				
		HEIGHT	32.8443	32.8475	0.0032	0.0018	0.0018	0.0		
		LATITUDE	61 14 1.535088	61 14 1.535097	0.0003	0.0002	0.0002	89.1	0.0002	89.1
		LONGITUDE	21 29 41.145601	21 29 41.145490	-0.0017	0.0002	0.0002	0.0	0.0002	
3	GPS3	X	2862323.4428	2862323.4454	0.0026	0.0008				
		Y	1126533.7706	1126533.7713	0.0007	0.0004				
		Z	5568664.0772	5568664.0789	0.0017	0.0015				
		HEIGHT	27.6613	27.6641	0.0027	0.0018	0.0018	0.0		
		LATITUDE	61 14 49.568852	61 14 49.568802	-0.0015	0.0002	0.0002	89.3	0.0002	89.3
		LONGITUDE	21 28 59.767954	21 28 59.767932	-0.0003	0.0002	0.0002	0.0	0.0002	
4	GPS4	X	2862758.9415	2862758.9457	0.0042	0.0008				
		Y	1125923.2376	1125923.2377	0.0001	0.0004				
		Z	5568566.0154	5568566.0222	0.0068	0.0015				
		HEIGHT	29.1133	29.1211	0.0079	0.0018	0.0018	0.0		
		LATITUDE	61 14 42.897724	61 14 42.897718	-0.0002	0.0002	0.0002	89.3	0.0002	89.3
		LONGITUDE	21 28 10.980705	21 28 10.980610	-0.0014	0.0002	0.0002	0.0	0.0002	
5	GPS5	X	2864192.3764	2864192.3704	-0.0060	0.0008				
		Y	1126421.6871	1126421.6856	-0.0015	0.0004				
		Z	5567725.8796	5567725.8667	-0.0129	0.0015				
		HEIGHT	22.2982	22.2839	-0.0143	0.0017	0.0017	0.0		
		LATITUDE	61 13 46.892454	61 13 46.892426	-0.0009	0.0002	0.0002	89.8	0.0002	89.8
		LONGITUDE	21 28 6.906786	21 28 6.906842	0.0008	0.0002	0.0002	0.0	0.0002	
6	GPS6	X	2863910.3892	2863910.3930	0.0038	0.0008				
		Y	1125229.5963	1125229.5970	0.0007	0.0004				
		Z	5568112.5408	5568112.5493	0.0085	0.0015				
		HEIGHT	25.0654	25.0747	0.0093	0.0017	0.0017	0.0		
		LATITUDE	61 14 12.686451	61 14 12.686476	0.0008	0.0002	0.0002	89.4	0.0002	89.4
		LONGITUDE	21 26 59.459035	21 26 59.458988	-0.0007	0.0002	0.0002	0.0	0.0002	
7	GPS7	X	2863465.8530	2863465.8547	0.0017	0.0008				
		Y	1124819.7828	1124819.7821	-0.0007	0.0004				
		Z	5568430.2557	5568430.2604	0.0047	0.0015				
		HEIGHT	32.4126	32.4173	0.0047	0.0018	0.0018	0.0		
		LATITUDE	61 14 33.586772	61 14 33.586807	0.0011	0.0002	0.0002	89.5	0.0002	89.5
		LONGITUDE	21 26 44.784815	21 26 44.784727	-0.0013	0.0002	0.0002	0.0	0.0002	
8	GPS8	X	2863019.7046	2863019.7083	0.0037	0.0008				

	Y	1124739.5538	1124739.5535	-0.0003	0.0004					
	Z	5568666.6848	5568666.6922	0.0074	0.0015					
	HEIGHT	25.8084	25.8165	0.0080	0.0017	0.0017	0.0			
	LATITUDE	61 14 49.853077	61 14 49.853098	0.0007	0.0002	0.0002	89.3	0.0002	89.3	
	LONGITUDE	21 26 50.715669	21 26 50.715561	-0.0016	0.0002	0.0002	0.0	0.0002		
9	GPS9									
	X	2863742.0387	2863742.0395	0.0008	0.0008					
	Y	1123996.6145	1123996.6142	-0.0003	0.0004					
	Z	5568453.4720	5568453.4780	0.0060	0.0015					
	HEIGHT	31.7025	31.7080	0.0055	0.0017	0.0017	0.0			
	LATITUDE	61 14 35.187574	61 14 35.187649	0.0023	0.0002	0.0002	89.5	0.0002	89.5	
	LONGITUDE	21 25 46.644762	21 25 46.644723	-0.0006	0.0002	0.0002	0.0	0.0002		
10	GP13									
	X	2864309.0028	2864309.0086	0.0058	0.0008					
	Y	1124134.0361	1124134.0385	0.0024	0.0004					
	Z	5568134.1930	5568134.1980	0.0050	0.0015					
	HEIGHT	29.8962	29.9036	0.0074	0.0017	0.0017	0.0			
	LATITUDE	61 14 13.855835	61 14 13.855735	-0.0031	0.0002	0.0002	89.4	0.0002	89.4	
	LONGITUDE	21 25 41.334054	21 25 41.334065	0.0002	0.0002	0.0002	0.0	0.0002		

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SITE-SPECIFIC TROPOSPHERE PARAMETERS: (NOT SAVED)

REQU.	STATION NAME	CORRECTIONS (M)			RMS ERRORS (M)			ZENITH VECTOR (")			ERROR ELLIPSE (M)			
		NORTH	EAST	ZENITH	NORTH	EAST	ZENITH	ANGLE	RMS	RATIO	AZI	MAX RMS	MIN RMS	AZI
1	GPS2			0.00000			0.00000							
2	GPS2			0.00000			0.00000							
3	GPS2			0.00000			0.00000							
4	GPS2			0.00000			0.00000							
5	GPS2			0.00000			0.00000							
6	GPS2			0.00000			0.00000							
7	GPS2			0.00000			0.00000							
8	GPS2			0.00000			0.00000							
9	GPS2			0.00000			0.00000							
10	GPS2			0.00000			0.00000							
11	GPS2			0.00000			0.00000							
12	GPS2			0.00000			0.00000							
13	GPS2			0.00000			0.00000							
14	GPS2			0.00000			0.00000							
15	GPS2			0.00000			0.00000							
16	GPS2			0.00000			0.00000							
17	GPS2			0.00000			0.00000							

18	GPS2	0.00000	0.00000
19	GPS2	0.00000	0.00000
20	GPS2	0.00000	0.00000
21	GPS2	0.00000	0.00000
22	GPS2	0.00000	0.00000
23	GPS2	0.00000	0.00000
24	GPS2	0.00000	0.00000
25	GPS2	0.00050	0.00056
26	GPS2	-0.00154	0.00026
27	GPS2	-0.00124	0.00031
28	GPS2	-0.00037	0.00025
29	GPS2	-0.00380	0.00027
30	GPS2	0.00133	0.00027
31	GPS2	-0.00148	0.00025
32	GPS2	-0.00064	0.00027
33	GPS2	-0.00209	0.00024
34	GPS2	-0.00057	0.00024
35	GPS2	-0.00139	0.00024
36	GPS2	-0.00113	0.00029
37	GPS2	-0.00072	0.00028
38	GPS2	-0.00184	0.00025
39	GPS2	-0.00195	0.00036
40	GPS2	0.00084	0.00085
41	GPS2	0.00000	0.00000
42	GPS3	0.00000	0.00000
43	GPS3	0.00000	0.00000
44	GPS3	0.00000	0.00000
45	GPS3	0.00000	0.00000
46	GPS3	0.00000	0.00000
47	GPS3	0.00000	0.00000
48	GPS3	0.00000	0.00000
49	GPS3	0.00000	0.00000
50	GPS3	0.00000	0.00000
51	GPS3	0.00000	0.00000
52	GPS3	0.00000	0.00000
53	GPS3	0.00000	0.00000
54	GPS3	0.00000	0.00000
55	GPS3	0.00000	0.00000
56	GPS3	0.00000	0.00000
57	GPS3	0.00000	0.00000
58	GPS3	0.00000	0.00000
59	GPS3	0.00000	0.00000
60	GPS3	0.00000	0.00000
61	GPS3	0.00000	0.00000
62	GPS3	0.00000	0.00000
63	GPS3	0.00000	0.00000
64	GPS3	0.00000	0.00000
65	GPS3	0.00000	0.00000
66	GPS3	-0.00158	0.00095
67	GPS3	-0.00216	0.00027
68	GPS3	-0.00173	0.00031
69	GPS3	-0.00195	0.00025
70	GPS3	-0.00302	0.00026

71	GPS3	-0.00166	0.00027
72	GPS3	-0.00255	0.00025
73	GPS3	-0.00225	0.00027
74	GPS3	-0.00162	0.00024
75	GPS3	-0.00207	0.00024
76	GPS3	-0.00154	0.00024
77	GPS3	-0.00176	0.00029
78	GPS3	-0.00102	0.00028
79	GPS3	-0.00159	0.00024
80	GPS3	-0.00229	0.00034
81	GPS3	-0.00132	0.00045
82	GPS3	0.00000	0.00000
83	GPS4	-0.00040	0.00075
84	GPS4	-0.00359	0.00028
85	GPS4	-0.00147	0.00031
86	GPS4	-0.00249	0.00025
87	GPS4	-0.00411	0.00027
88	GPS4	-0.00224	0.00028
89	GPS4	-0.00282	0.00025
90	GPS4	-0.00316	0.00028
91	GPS4	-0.00304	0.00025
92	GPS4	-0.00223	0.00024
93	GPS4	-0.00187	0.00025
94	GPS4	-0.00281	0.00028
95	GPS4	-0.00304	0.00028
96	GPS4	-0.00330	0.00026
97	GPS4	-0.00147	0.00035
98	GPS4	-0.00543	0.00063
99	GPS4	0.00000	0.00000
100	GPS4	0.00000	0.00000
101	GPS4	0.00000	0.00000
102	GPS4	0.00000	0.00000
103	GPS4	0.00000	0.00000
104	GPS4	0.00000	0.00000
105	GPS4	0.00000	0.00000
106	GPS4	0.00000	0.00000
107	GPS4	0.00000	0.00000
108	GPS4	0.00000	0.00000
109	GPS4	0.00000	0.00000
110	GPS4	0.00000	0.00000
111	GPS4	0.00000	0.00000
112	GPS4	0.00000	0.00000
113	GPS4	0.00000	0.00000
114	GPS4	0.00000	0.00000
115	GPS4	0.00000	0.00000
116	GPS4	0.00000	0.00000
117	GPS4	0.00000	0.00000
118	GPS4	0.00000	0.00000
119	GPS4	0.00000	0.00000
120	GPS4	0.00000	0.00000
121	GPS4	0.00000	0.00000
122	GPS4	0.00000	0.00000
123	GPS4	0.00000	0.00000

124	GPS5	0.00000	0.00000
125	GPS5	0.00000	0.00000
126	GPS5	0.00806	0.00067
127	GPS5	0.00131	0.00026
128	GPS5	0.00084	0.00025
129	GPS5	0.00372	0.00027
130	GPS5	0.00340	0.00024
131	GPS5	0.00629	0.00026
132	GPS5	0.00517	0.00023
133	GPS5	0.00049	0.00023
134	GPS5	0.00366	0.00023
135	GPS5	0.00094	0.00027
136	GPS5	0.00213	0.00026
137	GPS5	0.00397	0.00025
138	GPS5	0.00216	0.00033
139	GPS5	0.00160	0.00042
140	GPS5	0.00000	0.00000
141	GPS5	0.00000	0.00000
142	GPS5	0.00000	0.00000
143	GPS5	0.00000	0.00000
144	GPS5	0.00000	0.00000
145	GPS5	0.00000	0.00000
146	GPS5	0.00000	0.00000
147	GPS5	0.00000	0.00000
148	GPS5	0.00000	0.00000
149	GPS5	0.00406	0.00046
150	GPS5	0.00199	0.00033
151	GPS5	0.00249	0.00024
152	GPS5	0.00041	0.00025
153	GPS5	0.00445	0.00027
154	GPS5	0.00420	0.00024
155	GPS5	0.00582	0.00026
156	GPS5	0.00232	0.00023
157	GPS5	0.00217	0.00023
158	GPS5	0.00380	0.00023
159	GPS5	0.00066	0.00028
160	GPS5	0.00384	0.00027
161	GPS5	-0.00404	0.00027
162	GPS5	0.02849	0.00059
163	GPS5	0.00000	0.00000
164	GPS5	0.00000	0.00000
165	GPS6	0.00000	0.00000
166	GPS6	-0.00686	0.00203
167	GPS6	-0.00162	0.00038
168	GPS6	-0.00268	0.00025
169	GPS6	-0.00413	0.00025
170	GPS6	-0.00263	0.00026
171	GPS6	-0.00298	0.00023
172	GPS6	-0.00255	0.00026
173	GPS6	-0.00137	0.00023
174	GPS6	-0.00344	0.00023
175	GPS6	-0.00236	0.00023
176	GPS6	-0.00292	0.00027

177	GPS6	-0.00291	0.00026
178	GPS6	-0.00176	0.00025
179	GPS6	-0.00396	0.00036
180	GPS6	0.00000	0.00000
181	GPS6	0.00000	0.00000
182	GPS6	0.00000	0.00000
183	GPS6	0.00000	0.00000
184	GPS6	0.00000	0.00000
185	GPS6	0.00000	0.00000
186	GPS6	0.00000	0.00000
187	GPS6	0.00000	0.00000
188	GPS6	0.00000	0.00000
189	GPS6	0.00000	0.00000
190	GPS6	-0.00376	0.00032
191	GPS6	-0.00269	0.00031
192	GPS6	-0.00204	0.00024
193	GPS6	-0.00413	0.00025
194	GPS6	-0.00205	0.00026
195	GPS6	-0.00272	0.00024
196	GPS6	-0.00186	0.00026
197	GPS6	-0.00245	0.00023
198	GPS6	-0.00317	0.00023
199	GPS6	-0.00156	0.00023
200	GPS6	-0.00249	0.00027
201	GPS6	-0.00359	0.00027
202	GPS6	-0.00289	0.00023
203	GPS6	-0.00276	0.00030
204	GPS6	-0.00212	0.00027
205	GPS6	-0.00648	0.00113
206	GPS7	0.03766	0.01530
207	GPS7	-0.00336	0.00031
208	GPS7	-0.00110	0.00032
209	GPS7	-0.00173	0.00025
210	GPS7	-0.00363	0.00027
211	GPS7	-0.00118	0.00028
212	GPS7	-0.00206	0.00025
213	GPS7	-0.00302	0.00028
214	GPS7	-0.00193	0.00025
215	GPS7	-0.00191	0.00025
216	GPS7	-0.00117	0.00025
217	GPS7	-0.00227	0.00028
218	GPS7	-0.00243	0.00028
219	GPS7	-0.00102	0.00026
220	GPS7	-0.00327	0.00037
221	GPS7	0.00973	0.00250
222	GPS7	0.00000	0.00000
223	GPS7	0.00000	0.00000
224	GPS7	0.00000	0.00000
225	GPS7	0.00000	0.00000
226	GPS7	0.00000	0.00000
227	GPS7	0.00000	0.00000
228	GPS7	0.00000	0.00000
229	GPS7	0.00000	0.00000

230	GPS7	0.00000	0.00000
231	GPS7	0.00000	0.00000
232	GPS7	0.00000	0.00000
233	GPS7	0.00000	0.00000
234	GPS7	0.00000	0.00000
235	GPS7	0.00000	0.00000
236	GPS7	0.00000	0.00000
237	GPS7	0.00000	0.00000
238	GPS7	0.00000	0.00000
239	GPS7	0.00000	0.00000
240	GPS7	0.00000	0.00000
241	GPS7	0.00000	0.00000
242	GPS7	0.00000	0.00000
243	GPS7	0.00000	0.00000
244	GPS7	0.00000	0.00000
245	GPS7	0.00000	0.00000
246	GPS7	0.00000	0.00000
247	GPS8	-0.00165	0.00160
248	GPS8	-0.00425	0.00029
249	GPS8	-0.00088	0.00030
250	GPS8	-0.00354	0.00024
251	GPS8	-0.00458	0.00025
252	GPS8	-0.00220	0.00026
253	GPS8	-0.00301	0.00023
254	GPS8	-0.00441	0.00026
255	GPS8	-0.00326	0.00023
256	GPS8	-0.00234	0.00023
257	GPS8	-0.00206	0.00023
258	GPS8	-0.00223	0.00027
259	GPS8	-0.00281	0.00026
260	GPS8	-0.00276	0.00024
261	GPS8	-0.00036	0.00035
262	GPS8	-0.00937	0.00098
263	GPS8	0.00000	0.00000
264	GPS8	0.00000	0.00000
265	GPS8	0.00000	0.00000
266	GPS8	0.00000	0.00000
267	GPS8	0.00000	0.00000
268	GPS8	0.00000	0.00000
269	GPS8	0.00000	0.00000
270	GPS8	0.00000	0.00000
271	GPS8	-0.00253	0.00375
272	GPS8	-0.00393	0.00027
273	GPS8	-0.00212	0.00030
274	GPS8	-0.00307	0.00024
275	GPS8	-0.00386	0.00025
276	GPS8	-0.00317	0.00026
277	GPS8	-0.00321	0.00024
278	GPS8	-0.00285	0.00026
279	GPS8	-0.00169	0.00023
280	GPS8	-0.00436	0.00023
281	GPS8	-0.00169	0.00023
282	GPS8	-0.00199	0.00027

283	GPS8	-0.00262	0.00027
284	GPS8	-0.00222	0.00023
285	GPS8	-0.00233	0.00030
286	GPS8	-0.00312	0.00030
287	GPS8	-0.01716	0.01421
288	GPS9	0.00000	0.00000
289	GPS9	-0.01958	0.00203
290	GPS9	0.00150	0.00039
291	GPS9	-0.00187	0.00025
292	GPS9	-0.00376	0.00025
293	GPS9	-0.00047	0.00026
294	GPS9	-0.00139	0.00023
295	GPS9	-0.00354	0.00026
296	GPS9	-0.00088	0.00023
297	GPS9	-0.00214	0.00023
298	GPS9	-0.00068	0.00023
299	GPS9	-0.00133	0.00027
300	GPS9	-0.00208	0.00026
301	GPS9	-0.00070	0.00025
302	GPS9	-0.00284	0.00036
303	GPS9	0.00000	0.00000
304	GPS9	0.00000	0.00000
305	GPS9	0.00000	0.00000
306	GPS9	0.00000	0.00000
307	GPS9	0.00000	0.00000
308	GPS9	0.00000	0.00000
309	GPS9	0.00000	0.00000
310	GPS9	0.00000	0.00000
311	GPS9	0.00000	0.00000
312	GPS9	0.00000	0.00000
313	GPS9	-0.00438	0.00032
314	GPS9	-0.00091	0.00031
315	GPS9	-0.00121	0.00024
316	GPS9	-0.00335	0.00025
317	GPS9	-0.00116	0.00026
318	GPS9	-0.00153	0.00024
319	GPS9	-0.00143	0.00026
320	GPS9	-0.00063	0.00023
321	GPS9	-0.00328	0.00023
322	GPS9	0.00053	0.00023
323	GPS9	-0.00089	0.00027
324	GPS9	-0.00276	0.00027
325	GPS9	-0.00196	0.00023
326	GPS9	-0.00100	0.00030
327	GPS9	-0.00243	0.00028
328	GPS9	0.00165	0.00182
329	GP13	0.00000	0.00000
330	GP13	-0.00783	0.00203
331	GP13	-0.00169	0.00039
332	GP13	-0.00230	0.00025
333	GP13	-0.00351	0.00025
334	GP13	-0.00213	0.00026
335	GP13	-0.00229	0.00023

	H	0.4	1.8	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	B	0.0	0.1	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.0
3	L	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	H	0.4	0.4	1.8	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	B	0.0	0.1	0.1	0.2	0.1	0.0	0.1	0.0	0.0	0.0
4	L	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
	H	0.4	0.4	0.4	1.8	0.4	0.4	0.4	0.4	0.4	0.4
	B	0.0	0.1	0.0	0.1	0.2	0.0	0.1	0.0	0.0	0.0
5	L	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
	H	0.3	0.4	0.4	0.4	1.7	0.3	0.4	0.3	0.3	0.3
	B	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0
6	L	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
	H	0.3	0.4	0.4	0.4	0.3	1.7	0.4	0.3	0.3	0.3
	B	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.0	0.1	0.1
7	L	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
	H	0.4	0.4	0.4	0.4	0.4	0.4	1.8	0.4	0.4	0.4
	B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
8	L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
	H	0.3	0.4	0.4	0.4	0.3	0.3	0.4	1.7	0.3	0.3
	B	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0
9	L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
	H	0.3	0.4	0.4	0.4	0.3	0.3	0.4	0.3	1.7	0.3
	B	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2
10	L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
	H	0.3	0.4	0.4	0.4	0.3	0.3	0.4	0.3	0.3	1.7

1\${P}/OLKI05K
OLKI05K

PROGRAM GPSEST 05-JUL-05 14:58
BERNESE GPS SOFTWARE VERSION 5.0

SLOPE DISTANCES AND RMS ERRORS IN M (PART 1):

NUM		2 N	3 N	4 N	5 N	6 N	7 N	8 N	9 N
1	O	1355.8621	1006.1927	643.4483	1131.6197	1264.8248	1482.9925	1594.5013	2343.5952
	N	1355.8605	1006.1912	643.4485	1131.6205	1264.8253	1482.9940	1594.5030	2343.5962
	RMS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	O		1609.8487	1856.9241	1477.3558	2436.7239	2811.6728	2949.4962	3649.8847
	N		1609.8465	1856.9236	1477.3539	2436.7230	2811.6728	2949.4963	3649.8843

	RMS	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
3	O		756.3239	2094.2040	2126.8432	2073.0479	1924.5782	2914.4348
N	N		756.3246	2094.2029	2126.8422	2073.0483	1924.5795	2914.4344
	RMS		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	O			1734.6515	1418.6646	1317.4851	1216.2397	2165.8769
N	N			1734.6521	1418.6634	1317.4847	1216.2401	2165.8758
	RMS			0.0001	0.0000	0.0000	0.0000	0.0000
5	O				1284.5638	1894.7505	2256.0687	2571.6088
N	N				1284.5661	1894.7534	2256.0713	2571.6119
	RMS				0.0000	0.0000	0.0000	0.0000
6	O					683.0097	1157.8153	1290.2791
N	N					683.0102	1157.8153	1290.2798
	RMS					0.0000	0.0000	0.0000
7	O						511.2571	868.5756
N	N						511.2566	868.5749
	RMS						0.0000	0.0000
8	O							1057.9154
N	N							1057.9138
	RMS							0.0000
9	O							
N	N							
	RMS							

1\${P}/OLKI05K
OLKI05K

PROGRAM GPSEST 05-JUL-05 14:58
BERNESE GPS SOFTWARE VERSION 5.0

SLOPE DISTANCES AND RMS ERRORS IN M (PART 1): CONTINUATION

NUM		10 N
1	O	2407.0274
N	N	2407.0276
	RMS	0.0000
2	O	3597.9093
N	N	3597.9071
	RMS	0.0000
3	O	3159.4226
N	N	3159.4227

		RMS		0.0000	
	4	O		2406.3255	
	N	N		2406.3252	
		RMS		0.0000	
	5	O		2326.7292	
	N	N		2326.7291	
		RMS		0.0000	
	6	O		1166.0248	
	N	N		1166.0238	
		RMS		0.0000	
	7	O		1126.4117	
	N	N		1126.4127	
		RMS		0.0000	
	8	O		1520.6870	
	N	N		1520.6886	
		RMS		0.0000	
	9	O		665.0354	
	N	N		665.0407	
		RMS		0.0000	

Appendix III. Results of the second measurements at Olkiluoto in 2005.

```

=====
Program : GPSEST                               Bernese GPS Software Version 5.0
Purpose : Parameter estimation
Campaign: ${P}/OLKI05S                         Default session: 2830 year 2005
Date    : 21-Dec-2005 14:04                   User name      : ja
=====

```

OLKI05S

```

1${P}/OLKI05S                                PROGRAM GPSEST  21-DEC-05 14:04
OLKI05S                                       BERNESE GPS SOFTWARE VERSION 5.0
-----

```

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```

```

1${P}/OLKI05S PROGRAM GPSEST 21-DEC-05 14:04
OLKI05S BERNESE GPS SOFTWARE VERSION 5.0

```

#### INPUT AND OUTPUT FILENAMES

```

Session table : ${P}/OLKI05S\STA\SESSIONS.SES

```

```

General constants : ${X}/GEN\CONST.
Geodetic datum : ${X}/GEN\DATUM.
Station information : ${P}/OLKI05S\STA\OLKI05S.STA
Earth rotation parameters : ${P}/OLKI05S\ORB\C04_2005.ERP
Subdaily pole model : ${X}/GEN\IERS2000.SUB
Nutation model : ${X}/GEN\IAU2000.NUT
Satellite information : ${X}/GEN\SATELLIT.
Receiver information : ${X}/GEN\RECEIVER.
Satellite problems : ${X}/GEN\SAT_2005.CRX
Phase center eccentricities : ${X}/GEN\PHAS_IGS.REL
SINEX general input file : ${X}/GEN\SINEX.
IONEX control file : ${X}/GEN\IONEX.
Difference GPS-UTC : ---
A priori station coordinates: ${P}/OLKI05S\STA\OLKI.CRD
GNSS standard orbits : ${P}/OLKI05S\ORB\OLKI05S.STD
GNSS orbit partials : ---
Ionosphere models : ${P}/OLKI05S\ATM\OLKI05S.ION
Troposphere estimates : ---
Station sigma factors : ---
Station eccentricities : ---
Ocean loading tables : ---
GNSS clock corrections : ---
Differential code biases : ---
Receiver antenna orientation: ---
Kinematic coordinates : ---
Kinematic velocities : ---
Standard orbit(s) : ---
Orbit partials : ---
Attitude data : ---
Precise orbit(s) : ---
LEO orbital elements : ---
Station coordinates : ${P}/OLKI05S\STA\TOLKI05S.CRD
GNSS orbital elements : ---
Troposphere estimates : ---
Troposphere SINEX : ---
Ionosphere models : ---
IONEX : ---
Residuals : ---
Coordinate covariance matrix: ---
Full covariance matrix : ---
Normal equations : ---
Bernese ERP file : ---
IERS ERP file : ---
GNSS clock corrections : ---
Clock RINEX : ---
Kinematic coordinates : ---
Differential code biases : ---
Phase center variations (gri: ---
Phase center variations (har: ---
Scratch file : ${U}/WORK\GPSEST.SCR
Scratch files : ${U}/WORK\GPSEST.SC1
Program output : ${P}/OLKI05S\OUT\GPSEST.L46
Error message : ${U}/WORK\ERROR.MSG

```

1\${P}/OLKI05S  
OLKI05S

PROGRAM GPSEST 21-DEC-05 14:04  
BERNESE GPS SOFTWARE VERSION 5.0

1. CAMPAIGNS

| CAMPAIGN NAME     | NUM STATION NAME | NUM STATION NAME | NUM STATION NAME | NUM STATION NAME | NUM STATION NAME |
|-------------------|------------------|------------------|------------------|------------------|------------------|
| 1 \${P}/OLKI05S : | 1 GPS1           | 2 GPS2           | 3 GPS3           | 4 GPS4           | 5 GPS5           |
|                   | 6 GPS6           | 7 GPS7           | 8 GPS8           | 9 GPS9           | 10 GP13          |

2. OBSERVATION FILES

\${P}/OLKI05S

MAIN CHARACTERISTICS:

| FILE | OBSERVATION FILE HEADER        | OBSERVATION FILE               | SESS | RECEIVER 1     | RECEIVER 2     |
|------|--------------------------------|--------------------------------|------|----------------|----------------|
| 1    | \${P}/OLKI05S/OBS/01022820.PSH | \${P}/OLKI05S/OBS/01022820.PSO | 2820 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 2    | \${P}/OLKI05S/OBS/01022830.PSH | \${P}/OLKI05S/OBS/01022830.PSO | 2830 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 3    | \${P}/OLKI05S/OBS/01032820.PSH | \${P}/OLKI05S/OBS/01032820.PSO | 2820 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 4    | \${P}/OLKI05S/OBS/01032830.PSH | \${P}/OLKI05S/OBS/01032830.PSO | 2830 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 5    | \${P}/OLKI05S/OBS/01042800.PSH | \${P}/OLKI05S/OBS/01042800.PSO | 2800 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 6    | \${P}/OLKI05S/OBS/01042810.PSH | \${P}/OLKI05S/OBS/01042810.PSO | 2810 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 7    | \${P}/OLKI05S/OBS/01052800.PSH | \${P}/OLKI05S/OBS/01052800.PSO | 2800 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 8    | \${P}/OLKI05S/OBS/01052810.PSH | \${P}/OLKI05S/OBS/01052810.PSO | 2810 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 9    | \${P}/OLKI05S/OBS/01052820.PSH | \${P}/OLKI05S/OBS/01052820.PSO | 2820 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 10   | \${P}/OLKI05S/OBS/01052830.PSH | \${P}/OLKI05S/OBS/01052830.PSO | 2830 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 11   | \${P}/OLKI05S/OBS/01062800.PSH | \${P}/OLKI05S/OBS/01062800.PSO | 2800 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 12   | \${P}/OLKI05S/OBS/01062810.PSH | \${P}/OLKI05S/OBS/01062810.PSO | 2810 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 13   | \${P}/OLKI05S/OBS/01062820.PSH | \${P}/OLKI05S/OBS/01062820.PSO | 2820 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 14   | \${P}/OLKI05S/OBS/01062830.PSH | \${P}/OLKI05S/OBS/01062830.PSO | 2830 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 15   | \${P}/OLKI05S/OBS/01072800.PSH | \${P}/OLKI05S/OBS/01072800.PSO | 2800 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 16   | \${P}/OLKI05S/OBS/01072810.PSH | \${P}/OLKI05S/OBS/01072810.PSO | 2810 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 17   | \${P}/OLKI05S/OBS/01082800.PSH | \${P}/OLKI05S/OBS/01082800.PSO | 2800 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 18   | \${P}/OLKI05S/OBS/01082810.PSH | \${P}/OLKI05S/OBS/01082810.PSO | 2810 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 19   | \${P}/OLKI05S/OBS/01082820.PSH | \${P}/OLKI05S/OBS/01082820.PSO | 2820 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 20   | \${P}/OLKI05S/OBS/01082830.PSH | \${P}/OLKI05S/OBS/01082830.PSO | 2830 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |

|    |                                |                                |      |                |                |
|----|--------------------------------|--------------------------------|------|----------------|----------------|
| 21 | \$(P)/OLKI05S/OBS/06092800.PSH | \$(P)/OLKI05S/OBS/06092800.PSO | 2800 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 22 | \$(P)/OLKI05S/OBS/06092820.PSH | \$(P)/OLKI05S/OBS/06092820.PSO | 2820 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 23 | \$(P)/OLKI05S/OBS/06092830.PSH | \$(P)/OLKI05S/OBS/06092830.PSO | 2830 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 24 | \$(P)/OLKI05S/OBS/06132800.PSH | \$(P)/OLKI05S/OBS/06132800.PSO | 2800 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 25 | \$(P)/OLKI05S/OBS/06132810.PSH | \$(P)/OLKI05S/OBS/06132810.PSO | 2810 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 26 | \$(P)/OLKI05S/OBS/06132820.PSH | \$(P)/OLKI05S/OBS/06132820.PSO | 2820 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 27 | \$(P)/OLKI05S/OBS/06132830.PSH | \$(P)/OLKI05S/OBS/06132830.PSO | 2830 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |

| FILE | TYP | FREQ. | STATION 1 | STATION 2 | SESS | FIRST   | OBSERV.TIME | #EPO | DT | #EF | #CLK | ARC | #SAT | AMB. I.+S. |    |      | #CLUSTERS |    |    |    | RM |   |
|------|-----|-------|-----------|-----------|------|---------|-------------|------|----|-----|------|-----|------|------------|----|------|-----------|----|----|----|----|---|
|      |     |       |           |           |      |         |             |      |    |     |      |     |      | W          | 12 | #AMB | L1        | L2 | L5 |    |    |   |
| 1    | P   | L1,L2 | GPS1      | GPS2      | 2820 | 5-10-09 | 8:04:00     | 1912 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 54 | 20 | 20 | 54 | 0 |
| 2    | P   | L1,L2 | GPS1      | GPS2      | 2830 | 5-10-10 | 0:00:30     | 1421 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 34 | 11 | 11 | 34 | 0 |
| 3    | P   | L1,L2 | GPS1      | GPS3      | 2820 | 5-10-09 | 7:38:30     | 1963 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 53 | 19 | 19 | 53 | 0 |
| 4    | P   | L1,L2 | GPS1      | GPS3      | 2830 | 5-10-10 | 0:00:30     | 1465 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 44 | 19 | 19 | 44 | 0 |
| 5    | P   | L1,L2 | GPS1      | GPS4      | 2800 | 5-10-07 | 8:11:30     | 1897 | 30 | 0   | E    | E   | 1    | 27         | N  | Y    | Y         | 61 | 29 | 29 | 61 | 0 |
| 6    | P   | L1,L2 | GPS1      | GPS4      | 2810 | 5-10-08 | 0:00:30     | 1465 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 45 | 19 | 19 | 45 | 0 |
| 7    | P   | L1,L2 | GPS1      | GPS5      | 2800 | 5-10-07 | 7:37:00     | 1966 | 30 | 0   | E    | E   | 1    | 27         | N  | Y    | Y         | 55 | 21 | 21 | 55 | 0 |
| 8    | P   | L1,L2 | GPS1      | GPS5      | 2810 | 5-10-08 | 0:00:30     | 1234 | 30 | 0   | E    | E   | 1    | 27         | N  | Y    | Y         | 34 | 12 | 12 | 34 | 0 |
| 9    | P   | L1,L2 | GPS1      | GPS5      | 2820 | 5-10-09 | 8:31:00     | 1858 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 49 | 13 | 13 | 49 | 0 |
| 10   | P   | L1,L2 | GPS1      | GPS5      | 2830 | 5-10-10 | 0:00:30     | 1355 | 30 | 0   | E    | E   | 1    | 27         | N  | Y    | Y         | 35 | 12 | 12 | 35 | 0 |
| 11   | P   | L1,L2 | GPS1      | GPS6      | 2800 | 5-10-07 | 9:59:00     | 1682 | 30 | 0   | E    | E   | 1    | 27         | N  | Y    | Y         | 48 | 19 | 19 | 48 | 0 |
| 12   | P   | L1,L2 | GPS1      | GPS6      | 2810 | 5-10-08 | 0:00:30     | 1317 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 39 | 16 | 16 | 39 | 0 |
| 13   | P   | L1,L2 | GPS1      | GPS6      | 2820 | 5-10-09 | 9:14:00     | 1772 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 51 | 20 | 20 | 51 | 0 |
| 14   | P   | L1,L2 | GPS1      | GPS6      | 2830 | 5-10-10 | 0:00:30     | 1166 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 34 | 14 | 14 | 34 | 0 |
| 15   | P   | L1,L2 | GPS1      | GPS7      | 2800 | 5-10-07 | 9:48:30     | 1703 | 30 | 0   | E    | E   | 1    | 27         | N  | Y    | Y         | 48 | 19 | 19 | 48 | 0 |
| 16   | P   | L1,L2 | GPS1      | GPS7      | 2810 | 5-10-08 | 0:00:30     | 1396 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 41 | 17 | 17 | 41 | 0 |
| 17   | P   | L1,L2 | GPS1      | GPS8      | 2800 | 5-10-07 | 8:38:30     | 1843 | 30 | 0   | E    | E   | 1    | 27         | N  | Y    | Y         | 61 | 26 | 26 | 61 | 0 |
| 18   | P   | L1,L2 | GPS1      | GPS8      | 2810 | 5-10-08 | 0:00:30     | 1433 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 48 | 21 | 21 | 48 | 0 |
| 19   | P   | L1,L2 | GPS1      | GPS8      | 2820 | 5-10-09 | 9:01:00     | 1798 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 62 | 26 | 26 | 62 | 0 |
| 20   | P   | L1,L2 | GPS1      | GPS8      | 2830 | 5-10-10 | 0:00:30     | 1095 | 30 | 0   | E    | E   | 1    | 27         | N  | Y    | Y         | 33 | 13 | 13 | 33 | 0 |
| 21   | P   | L1,L2 | GPS6      | GPS9      | 2800 | 5-10-07 | 9:59:00     | 1455 | 30 | 0   | E    | E   | 1    | 27         | N  | Y    | Y         | 40 | 14 | 14 | 40 | 0 |
| 22   | P   | L1,L2 | GPS6      | GPS9      | 2820 | 5-10-09 | 9:39:00     | 1722 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 47 | 16 | 16 | 47 | 0 |
| 23   | P   | L1,L2 | GPS6      | GPS9      | 2830 | 5-10-10 | 0:00:30     | 932  | 30 | 0   | E    | E   | 1    | 25         | N  | Y    | Y         | 28 | 11 | 11 | 28 | 0 |
| 24   | P   | L1,L2 | GPS6      | GP13      | 2800 | 5-10-07 | 9:59:00     | 1682 | 30 | 0   | E    | E   | 1    | 27         | N  | Y    | Y         | 42 | 14 | 14 | 42 | 0 |
| 25   | P   | L1,L2 | GPS6      | GP13      | 2810 | 5-10-08 | 0:00:30     | 1317 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 38 | 15 | 15 | 38 | 0 |
| 26   | P   | L1,L2 | GPS6      | GP13      | 2820 | 5-10-09 | 9:24:30     | 1751 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 49 | 18 | 18 | 49 | 0 |
| 27   | P   | L1,L2 | GPS6      | GP13      | 2830 | 5-10-10 | 0:00:30     | 1166 | 30 | 0   | E    | E   | 1    | 28         | N  | Y    | Y         | 34 | 14 | 14 | 34 | 0 |

## SATELLITES:

-----

FILE #SAT SATELLITES

|   |    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
|---|----|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| 1 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |
| 2 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |
| 3 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |
| 4 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |
| 5 | 27 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |    |  |
| 6 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |

|    |    |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 7  | 27 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |    |
| 8  | 27 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |    |
| 9  | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 10 | 27 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |    |
| 11 | 27 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |    |
| 12 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 13 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 14 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 15 | 27 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |    |
| 16 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 17 | 27 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |    |
| 18 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 19 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 20 | 27 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |    |
| 21 | 27 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |    |
| 22 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 23 | 25 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 10 | 11 | 13 | 14 | 16 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |    |    |    |
| 24 | 27 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 |    |
| 25 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 26 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 27 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |

## OBSERVATION SELECTION:

-----

SAMPLING RATE : 30 SEC  
 ELEVATION CUT-OFF ANGLE : 20 DEGREES  
 SATELLITE SYSTEM : GPS  
 SPECIAL DATA SELECTION : NO

1\${P}/OLKI05S  
 OLKI05S

PROGRAM GPSEST 21-DEC-05 14:04  
 BERNESE GPS SOFTWARE VERSION 5.0

## 3. GENERAL OPTIONS

-----

TIDAL CORRECTION OF STATION COORDINATES : IERS CONVENTIONS 2000

## A PRIORI SIGMA OF UNIT WEIGHT:

-----

A PRIORI SIGMA OF UNIT WEIGHT : 0.001 M (SIGMA OF ONE-WAY L1 PHASE OBSERVABLE AT ZENITH)

MODEL FOR ELEVATION-DEPENDENT WEIGHTING : 1/COS(Z)

## CORRELATIONS AND SESSIONS:

-----

STRATEGY : CORRELATIONS CORRECTLY MODELLED  
 TIME INTERVAL : 0.10000 SEC (TO IDENTIFY EPOCH)

SESS #FILE FILE NUMBERS

```

2820 7 1 3 9 13 19 22 26
2830 7 2 4 10 14 20 23 27
2800 7 5 7 11 15 17 21 24
2810 6 6 8 12 16 18 25
```

AMBIGUITY RESOLUTION STRATEGY:

-----  
 AMBIGUITIES PRE-ELIMINATED EVERY 30 SECONDS

SYNCHRONIZATION ERRORS:

-----  
 STRATEGY : SYNCHRONIZATION ERRORS NOT APPLIED

#### 4. STATIONS

Local geodetic datum:

\$(X)/GEN/DATUM.

| Datum name | Ell. param./ Scale                                        | Shifts to WGS-84                                | Rotations to WGS-84                                               |
|------------|-----------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------|
| WGS - 84   | A = 6378137.000 m<br>1/F= 298.2572236<br>SC = 0.00000D+00 | DX = 0.0000 m<br>DY = 0.0000 m<br>DZ = 0.0000 m | RX = 0.00000 arcsec<br>RY = 0.00000 arcsec<br>RZ = 0.00000 arcsec |

A priori station coordinates:

\$(P)/OLKI05S\STA\OLKI.CRD

A priori station coordinates  
WGS-84

A priori station coordinates  
Ellipsoidal in local geodetic datum

| num | Station name | obs e/f/h | X (m)        | Y (m)        | Z (m)        | Latitude        | Longitude       | Height (m) |
|-----|--------------|-----------|--------------|--------------|--------------|-----------------|-----------------|------------|
| 1   | GPS1         | Y ESTIM   | 2863210.1067 | 1126271.4390 | 5568267.2990 | 61 14 22.754183 | 21 28 21.633926 | 30.5520    |
| 2   | GPS2         | Y ESTIM   | 2863312.4876 | 1127586.4513 | 5567953.2561 | 61 14 1.535088  | 21 29 41.145601 | 32.8443    |
| 3   | GPS3         | Y ESTIM   | 2862323.4428 | 1126533.7706 | 5568664.0772 | 61 14 49.568852 | 21 28 59.767954 | 27.6613    |
| 4   | GPS4         | Y ESTIM   | 2862758.9415 | 1125923.2376 | 5568566.0154 | 61 14 42.897724 | 21 28 10.980705 | 29.1133    |
| 5   | GPS5         | Y ESTIM   | 2864192.3764 | 1126421.6871 | 5567725.8796 | 61 13 46.892454 | 21 28 6.906786  | 22.2982    |
| 6   | GPS6         | Y ESTIM   | 2863910.3892 | 1125229.5963 | 5568112.5408 | 61 14 12.686451 | 21 26 59.459035 | 25.0654    |
| 7   | GPS7         | Y ESTIM   | 2863465.8530 | 1124819.7828 | 5568430.2557 | 61 14 33.586772 | 21 26 44.784815 | 32.4126    |
| 8   | GPS8         | Y ESTIM   | 2863019.7046 | 1124739.5538 | 5568666.6848 | 61 14 49.853077 | 21 26 50.715669 | 25.8084    |
| 9   | GPS9         | Y ESTIM   | 2863742.0387 | 1123996.6145 | 5568453.4720 | 61 14 35.187574 | 21 25 46.644762 | 31.7025    |

10 GP13                    Y ESTIM    2864309.0028    1124134.0361    5568134.1930    61 14 13.855835    21 25 41.334054    29.8962

A priori sigma:

Station coordinates a priori sigma  
in local geodetic datum

| num | Station name | N (m)   | E (m)   | U (m)   |
|-----|--------------|---------|---------|---------|
| 1   | GPS1         | 0.00001 | 0.00001 | 0.00001 |

1\${P}/OLKI05S  
OLKI05S

PROGRAM GPSEST    21-DEC-05 14:04  
BERNESE GPS SOFTWARE VERSION 5.0

5. SATELLITE ORBITS

ARC CHARACTERISTICS:

| ARC | START OF ARC      | END OF ARC        | SOURCE     | #SAT | SATELLITES |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
|-----|-------------------|-------------------|------------|------|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| 1   | 05-10-07 00:00:00 | 05-10-11 00:00:00 | PR2005.283 | 30   | 1          | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |  |
|     |                   |                   |            |      | 20         | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |    |    |    |    |    |    |  |

OSCULATING ELEMENTS:

\${P}/OLKI05S\ORB\OLKI05S.STD

REFERENCE SYSTEM: J2000.0  
REFERENCE EPOCH : 53650.3173611 MJD (2005 10 7 7 37 0.00)

| SAT | S.MAJ.AXIS | ECCENTRIC. | INCLINAT. | NODE        | PERIGEE     | M. ANOMALY  | PER.PASS.TIME |
|-----|------------|------------|-----------|-------------|-------------|-------------|---------------|
| 1   | 26558293.0 | 0.00595631 | 56.491565 | 34.224091   | -99.374121  | 5.384128    | 53650.3099050 |
| 2   | 26560901.3 | 0.00903327 | 54.566718 | -87.776439  | -249.501314 | 87.214346   | 53650.1965667 |
| 3   | 26558658.9 | 0.00731474 | 53.107897 | -152.738073 | 35.117118   | 38.473773   | 53650.2640806 |
| 4   | 26560225.0 | 0.00717401 | 54.542436 | -86.636463  | 3.417001    | -131.939960 | 53650.5000948 |
| 5   | 26559453.0 | 0.00669799 | 53.709087 | 147.700026  | 58.022095   | -154.265870 | 53650.5310064 |
| 6   | 26562313.0 | 0.00620834 | 53.538019 | -149.486370 | 252.141766  | -82.705858  | 53650.4319203 |
| 7   | 26560639.1 | 0.01333049 | 53.626708 | -151.027630 | -101.672871 | 41.329230   | 53650.2601198 |
| 8   | 26559199.1 | 0.00961339 | 55.593803 | 94.449451   | 147.893088  | -77.482769  | 53650.4246667 |
| 9   | 26560914.7 | 0.01731703 | 54.873105 | 90.086582   | 68.430667   | -99.333182  | 53650.4549406 |
| 10  | 26560589.2 | 0.00657509 | 55.931117 | -26.609077  | 20.459179   | 108.092161  | 53650.1676529 |
| 11  | 26561731.3 | 0.00465554 | 51.532338 | -95.386620  | 13.381867   | -43.196193  | 53650.3771919 |





-----  
 Mapping function used for delay estimation: 1/cos(zenith-distance)  
 Troposphere gradient estimation : No

| Par | Station name | Reference epoch     | sig_n (m) | sig_e (m) | sig_u (m) | abs/rel |
|-----|--------------|---------------------|-----------|-----------|-----------|---------|
| 1   | GPS2         | 2005 10 07 06 00 00 |           |           | 0.00000   | abs     |
| 2   | GPS2         | 2005 10 07 08 00 00 |           |           | 0.00000   | rel     |
| 3   | GPS2         | 2005 10 07 10 00 00 |           |           | 0.00000   | rel     |
| 4   | GPS2         | 2005 10 07 12 00 00 |           |           | 0.00000   | rel     |
| 5   | GPS2         | 2005 10 07 14 00 00 |           |           | 0.00000   | rel     |
| 6   | GPS2         | 2005 10 07 16 00 00 |           |           | 0.00000   | rel     |
| 7   | GPS2         | 2005 10 07 18 00 00 |           |           | 0.00000   | rel     |
| 8   | GPS2         | 2005 10 07 20 00 00 |           |           | 0.00000   | rel     |
| 9   | GPS2         | 2005 10 07 22 00 00 |           |           | 0.00000   | rel     |
| 10  | GPS2         | 2005 10 08 00 00 00 |           |           | 0.00000   | rel     |
| 11  | GPS2         | 2005 10 08 02 00 00 |           |           | 0.00000   | rel     |
| 12  | GPS2         | 2005 10 08 04 00 00 |           |           | 0.00000   | rel     |
| 13  | GPS2         | 2005 10 08 06 00 00 |           |           | 0.00000   | rel     |
| 14  | GPS2         | 2005 10 08 08 00 00 |           |           | 0.00000   | rel     |
| 15  | GPS2         | 2005 10 08 10 00 00 |           |           | 0.00000   | rel     |
| 16  | GPS2         | 2005 10 08 12 00 00 |           |           | 0.00000   | rel     |
| 17  | GPS2         | 2005 10 08 14 00 00 |           |           | 0.00000   | rel     |
| 18  | GPS2         | 2005 10 08 16 00 00 |           |           | 0.00000   | rel     |
| 19  | GPS2         | 2005 10 08 18 00 00 |           |           | 0.00000   | rel     |
| 20  | GPS2         | 2005 10 08 20 00 00 |           |           | 0.00000   | rel     |
| 21  | GPS2         | 2005 10 08 22 00 00 |           |           | 0.00000   | rel     |
| 22  | GPS2         | 2005 10 09 00 00 00 |           |           | 0.00000   | rel     |
| 23  | GPS2         | 2005 10 09 02 00 00 |           |           | 0.00000   | rel     |
| 24  | GPS2         | 2005 10 09 04 00 00 |           |           | 0.00000   | rel     |
| 25  | GPS2         | 2005 10 09 06 00 00 |           |           | 0.00000   | rel     |
| 26  | GPS2         | 2005 10 09 08 00 00 |           |           | 0.00000   | rel     |
| 27  | GPS2         | 2005 10 09 10 00 00 |           |           | 0.00000   | rel     |
| 28  | GPS2         | 2005 10 09 12 00 00 |           |           | 0.00000   | rel     |
| 29  | GPS2         | 2005 10 09 14 00 00 |           |           | 0.00000   | rel     |
| 30  | GPS2         | 2005 10 09 16 00 00 |           |           | 0.00000   | rel     |
| 31  | GPS2         | 2005 10 09 18 00 00 |           |           | 0.00000   | rel     |
| 32  | GPS2         | 2005 10 09 20 00 00 |           |           | 0.00000   | rel     |
| 33  | GPS2         | 2005 10 09 22 00 00 |           |           | 0.00000   | rel     |
| 34  | GPS2         | 2005 10 10 00 00 00 |           |           | 0.00000   | rel     |
| 35  | GPS2         | 2005 10 10 02 00 00 |           |           | 0.00000   | rel     |
| 36  | GPS2         | 2005 10 10 04 00 00 |           |           | 0.00000   | rel     |
| 37  | GPS2         | 2005 10 10 06 00 00 |           |           | 0.00000   | rel     |
| 38  | GPS2         | 2005 10 10 08 00 00 |           |           | 0.00000   | rel     |
| 39  | GPS2         | 2005 10 10 10 00 00 |           |           | 0.00000   | rel     |
| 40  | GPS2         | 2005 10 10 12 00 00 |           |           | 0.00000   | rel     |
| 41  | GPS2         | 2005 10 10 14 00 00 |           |           | 0.00000   | rel     |
| 42  | GPS3         | 2005 10 07 06 00 00 |           |           | 0.00000   | abs     |
| 43  | GPS3         | 2005 10 07 08 00 00 |           |           | 0.00000   | rel     |
| 44  | GPS3         | 2005 10 07 10 00 00 |           |           | 0.00000   | rel     |
| 45  | GPS3         | 2005 10 07 12 00 00 |           |           | 0.00000   | rel     |

|    |      |                     |         |     |
|----|------|---------------------|---------|-----|
| 46 | GPS3 | 2005 10 07 14 00 00 | 0.00000 | rel |
| 47 | GPS3 | 2005 10 07 16 00 00 | 0.00000 | rel |
| 48 | GPS3 | 2005 10 07 18 00 00 | 0.00000 | rel |
| 49 | GPS3 | 2005 10 07 20 00 00 | 0.00000 | rel |
| 50 | GPS3 | 2005 10 07 22 00 00 | 0.00000 | rel |
| 51 | GPS3 | 2005 10 08 00 00 00 | 0.00000 | rel |
| 52 | GPS3 | 2005 10 08 02 00 00 | 0.00000 | rel |
| 53 | GPS3 | 2005 10 08 04 00 00 | 0.00000 | rel |
| 54 | GPS3 | 2005 10 08 06 00 00 | 0.00000 | rel |
| 55 | GPS3 | 2005 10 08 08 00 00 | 0.00000 | rel |
| 56 | GPS3 | 2005 10 08 10 00 00 | 0.00000 | rel |
| 57 | GPS3 | 2005 10 08 12 00 00 | 0.00000 | rel |
| 58 | GPS3 | 2005 10 08 14 00 00 | 0.00000 | rel |
| 59 | GPS3 | 2005 10 08 16 00 00 | 0.00000 | rel |
| 60 | GPS3 | 2005 10 08 18 00 00 | 0.00000 | rel |
| 61 | GPS3 | 2005 10 08 20 00 00 | 0.00000 | rel |
| 62 | GPS3 | 2005 10 08 22 00 00 | 0.00000 | rel |
| 63 | GPS3 | 2005 10 09 00 00 00 | 0.00000 | rel |
| 64 | GPS3 | 2005 10 09 02 00 00 | 0.00000 | rel |
| 65 | GPS3 | 2005 10 09 04 00 00 | 0.00000 | rel |
| 66 | GPS3 | 2005 10 09 06 00 00 | 0.00000 | rel |
| 67 | GPS3 | 2005 10 09 08 00 00 | 0.00000 | rel |
| 68 | GPS3 | 2005 10 09 10 00 00 | 0.00000 | rel |
| 69 | GPS3 | 2005 10 09 12 00 00 | 0.00000 | rel |
| 70 | GPS3 | 2005 10 09 14 00 00 | 0.00000 | rel |
| 71 | GPS3 | 2005 10 09 16 00 00 | 0.00000 | rel |
| 72 | GPS3 | 2005 10 09 18 00 00 | 0.00000 | rel |
| 73 | GPS3 | 2005 10 09 20 00 00 | 0.00000 | rel |
| 74 | GPS3 | 2005 10 09 22 00 00 | 0.00000 | rel |
| 75 | GPS3 | 2005 10 10 00 00 00 | 0.00000 | rel |
| 76 | GPS3 | 2005 10 10 02 00 00 | 0.00000 | rel |
| 77 | GPS3 | 2005 10 10 04 00 00 | 0.00000 | rel |
| 78 | GPS3 | 2005 10 10 06 00 00 | 0.00000 | rel |
| 79 | GPS3 | 2005 10 10 08 00 00 | 0.00000 | rel |
| 80 | GPS3 | 2005 10 10 10 00 00 | 0.00000 | rel |
| 81 | GPS3 | 2005 10 10 12 00 00 | 0.00000 | rel |
| 82 | GPS3 | 2005 10 10 14 00 00 | 0.00000 | rel |
| 83 | GPS4 | 2005 10 07 06 00 00 | 0.00000 | abs |
| 84 | GPS4 | 2005 10 07 08 00 00 | 0.00000 | rel |
| 85 | GPS4 | 2005 10 07 10 00 00 | 0.00000 | rel |
| 86 | GPS4 | 2005 10 07 12 00 00 | 0.00000 | rel |
| 87 | GPS4 | 2005 10 07 14 00 00 | 0.00000 | rel |
| 88 | GPS4 | 2005 10 07 16 00 00 | 0.00000 | rel |
| 89 | GPS4 | 2005 10 07 18 00 00 | 0.00000 | rel |
| 90 | GPS4 | 2005 10 07 20 00 00 | 0.00000 | rel |
| 91 | GPS4 | 2005 10 07 22 00 00 | 0.00000 | rel |
| 92 | GPS4 | 2005 10 08 00 00 00 | 0.00000 | rel |
| 93 | GPS4 | 2005 10 08 02 00 00 | 0.00000 | rel |
| 94 | GPS4 | 2005 10 08 04 00 00 | 0.00000 | rel |
| 95 | GPS4 | 2005 10 08 06 00 00 | 0.00000 | rel |
| 96 | GPS4 | 2005 10 08 08 00 00 | 0.00000 | rel |
| 97 | GPS4 | 2005 10 08 10 00 00 | 0.00000 | rel |
| 98 | GPS4 | 2005 10 08 12 00 00 | 0.00000 | rel |

|     |      |                     |         |     |
|-----|------|---------------------|---------|-----|
| 99  | GPS4 | 2005 10 08 14 00 00 | 0.00000 | rel |
| 100 | GPS4 | 2005 10 08 16 00 00 | 0.00000 | rel |
| 101 | GPS4 | 2005 10 08 18 00 00 | 0.00000 | rel |
| 102 | GPS4 | 2005 10 08 20 00 00 | 0.00000 | rel |
| 103 | GPS4 | 2005 10 08 22 00 00 | 0.00000 | rel |
| 104 | GPS4 | 2005 10 09 00 00 00 | 0.00000 | rel |
| 105 | GPS4 | 2005 10 09 02 00 00 | 0.00000 | rel |
| 106 | GPS4 | 2005 10 09 04 00 00 | 0.00000 | rel |
| 107 | GPS4 | 2005 10 09 06 00 00 | 0.00000 | rel |
| 108 | GPS4 | 2005 10 09 08 00 00 | 0.00000 | rel |
| 109 | GPS4 | 2005 10 09 10 00 00 | 0.00000 | rel |
| 110 | GPS4 | 2005 10 09 12 00 00 | 0.00000 | rel |
| 111 | GPS4 | 2005 10 09 14 00 00 | 0.00000 | rel |
| 112 | GPS4 | 2005 10 09 16 00 00 | 0.00000 | rel |
| 113 | GPS4 | 2005 10 09 18 00 00 | 0.00000 | rel |
| 114 | GPS4 | 2005 10 09 20 00 00 | 0.00000 | rel |
| 115 | GPS4 | 2005 10 09 22 00 00 | 0.00000 | rel |
| 116 | GPS4 | 2005 10 10 00 00 00 | 0.00000 | rel |
| 117 | GPS4 | 2005 10 10 02 00 00 | 0.00000 | rel |
| 118 | GPS4 | 2005 10 10 04 00 00 | 0.00000 | rel |
| 119 | GPS4 | 2005 10 10 06 00 00 | 0.00000 | rel |
| 120 | GPS4 | 2005 10 10 08 00 00 | 0.00000 | rel |
| 121 | GPS4 | 2005 10 10 10 00 00 | 0.00000 | rel |
| 122 | GPS4 | 2005 10 10 12 00 00 | 0.00000 | rel |
| 123 | GPS4 | 2005 10 10 14 00 00 | 0.00000 | rel |
| 124 | GPS5 | 2005 10 07 06 00 00 | 0.00000 | abs |
| 125 | GPS5 | 2005 10 07 08 00 00 | 0.00000 | rel |
| 126 | GPS5 | 2005 10 07 10 00 00 | 0.00000 | rel |
| 127 | GPS5 | 2005 10 07 12 00 00 | 0.00000 | rel |
| 128 | GPS5 | 2005 10 07 14 00 00 | 0.00000 | rel |
| 129 | GPS5 | 2005 10 07 16 00 00 | 0.00000 | rel |
| 130 | GPS5 | 2005 10 07 18 00 00 | 0.00000 | rel |
| 131 | GPS5 | 2005 10 07 20 00 00 | 0.00000 | rel |
| 132 | GPS5 | 2005 10 07 22 00 00 | 0.00000 | rel |
| 133 | GPS5 | 2005 10 08 00 00 00 | 0.00000 | rel |
| 134 | GPS5 | 2005 10 08 02 00 00 | 0.00000 | rel |
| 135 | GPS5 | 2005 10 08 04 00 00 | 0.00000 | rel |
| 136 | GPS5 | 2005 10 08 06 00 00 | 0.00000 | rel |
| 137 | GPS5 | 2005 10 08 08 00 00 | 0.00000 | rel |
| 138 | GPS5 | 2005 10 08 10 00 00 | 0.00000 | rel |
| 139 | GPS5 | 2005 10 08 12 00 00 | 0.00000 | rel |
| 140 | GPS5 | 2005 10 08 14 00 00 | 0.00000 | rel |
| 141 | GPS5 | 2005 10 08 16 00 00 | 0.00000 | rel |
| 142 | GPS5 | 2005 10 08 18 00 00 | 0.00000 | rel |
| 143 | GPS5 | 2005 10 08 20 00 00 | 0.00000 | rel |
| 144 | GPS5 | 2005 10 08 22 00 00 | 0.00000 | rel |
| 145 | GPS5 | 2005 10 09 00 00 00 | 0.00000 | rel |
| 146 | GPS5 | 2005 10 09 02 00 00 | 0.00000 | rel |
| 147 | GPS5 | 2005 10 09 04 00 00 | 0.00000 | rel |
| 148 | GPS5 | 2005 10 09 06 00 00 | 0.00000 | rel |
| 149 | GPS5 | 2005 10 09 08 00 00 | 0.00000 | rel |
| 150 | GPS5 | 2005 10 09 10 00 00 | 0.00000 | rel |
| 151 | GPS5 | 2005 10 09 12 00 00 | 0.00000 | rel |

|     |      |                     |         |     |
|-----|------|---------------------|---------|-----|
| 152 | GPS5 | 2005 10 09 14 00 00 | 0.00000 | rel |
| 153 | GPS5 | 2005 10 09 16 00 00 | 0.00000 | rel |
| 154 | GPS5 | 2005 10 09 18 00 00 | 0.00000 | rel |
| 155 | GPS5 | 2005 10 09 20 00 00 | 0.00000 | rel |
| 156 | GPS5 | 2005 10 09 22 00 00 | 0.00000 | rel |
| 157 | GPS5 | 2005 10 10 00 00 00 | 0.00000 | rel |
| 158 | GPS5 | 2005 10 10 02 00 00 | 0.00000 | rel |
| 159 | GPS5 | 2005 10 10 04 00 00 | 0.00000 | rel |
| 160 | GPS5 | 2005 10 10 06 00 00 | 0.00000 | rel |
| 161 | GPS5 | 2005 10 10 08 00 00 | 0.00000 | rel |
| 162 | GPS5 | 2005 10 10 10 00 00 | 0.00000 | rel |
| 163 | GPS5 | 2005 10 10 12 00 00 | 0.00000 | rel |
| 164 | GPS5 | 2005 10 10 14 00 00 | 0.00000 | rel |
| 165 | GPS6 | 2005 10 07 06 00 00 | 0.00000 | abs |
| 166 | GPS6 | 2005 10 07 08 00 00 | 0.00000 | rel |
| 167 | GPS6 | 2005 10 07 10 00 00 | 0.00000 | rel |
| 168 | GPS6 | 2005 10 07 12 00 00 | 0.00000 | rel |
| 169 | GPS6 | 2005 10 07 14 00 00 | 0.00000 | rel |
| 170 | GPS6 | 2005 10 07 16 00 00 | 0.00000 | rel |
| 171 | GPS6 | 2005 10 07 18 00 00 | 0.00000 | rel |
| 172 | GPS6 | 2005 10 07 20 00 00 | 0.00000 | rel |
| 173 | GPS6 | 2005 10 07 22 00 00 | 0.00000 | rel |
| 174 | GPS6 | 2005 10 08 00 00 00 | 0.00000 | rel |
| 175 | GPS6 | 2005 10 08 02 00 00 | 0.00000 | rel |
| 176 | GPS6 | 2005 10 08 04 00 00 | 0.00000 | rel |
| 177 | GPS6 | 2005 10 08 06 00 00 | 0.00000 | rel |
| 178 | GPS6 | 2005 10 08 08 00 00 | 0.00000 | rel |
| 179 | GPS6 | 2005 10 08 10 00 00 | 0.00000 | rel |
| 180 | GPS6 | 2005 10 08 12 00 00 | 0.00000 | rel |
| 181 | GPS6 | 2005 10 08 14 00 00 | 0.00000 | rel |
| 182 | GPS6 | 2005 10 08 16 00 00 | 0.00000 | rel |
| 183 | GPS6 | 2005 10 08 18 00 00 | 0.00000 | rel |
| 184 | GPS6 | 2005 10 08 20 00 00 | 0.00000 | rel |
| 185 | GPS6 | 2005 10 08 22 00 00 | 0.00000 | rel |
| 186 | GPS6 | 2005 10 09 00 00 00 | 0.00000 | rel |
| 187 | GPS6 | 2005 10 09 02 00 00 | 0.00000 | rel |
| 188 | GPS6 | 2005 10 09 04 00 00 | 0.00000 | rel |
| 189 | GPS6 | 2005 10 09 06 00 00 | 0.00000 | rel |
| 190 | GPS6 | 2005 10 09 08 00 00 | 0.00000 | rel |
| 191 | GPS6 | 2005 10 09 10 00 00 | 0.00000 | rel |
| 192 | GPS6 | 2005 10 09 12 00 00 | 0.00000 | rel |
| 193 | GPS6 | 2005 10 09 14 00 00 | 0.00000 | rel |
| 194 | GPS6 | 2005 10 09 16 00 00 | 0.00000 | rel |
| 195 | GPS6 | 2005 10 09 18 00 00 | 0.00000 | rel |
| 196 | GPS6 | 2005 10 09 20 00 00 | 0.00000 | rel |
| 197 | GPS6 | 2005 10 09 22 00 00 | 0.00000 | rel |
| 198 | GPS6 | 2005 10 10 00 00 00 | 0.00000 | rel |
| 199 | GPS6 | 2005 10 10 02 00 00 | 0.00000 | rel |
| 200 | GPS6 | 2005 10 10 04 00 00 | 0.00000 | rel |
| 201 | GPS6 | 2005 10 10 06 00 00 | 0.00000 | rel |
| 202 | GPS6 | 2005 10 10 08 00 00 | 0.00000 | rel |
| 203 | GPS6 | 2005 10 10 10 00 00 | 0.00000 | rel |
| 204 | GPS6 | 2005 10 10 12 00 00 | 0.00000 | rel |

|     |      |                     |         |     |
|-----|------|---------------------|---------|-----|
| 205 | GPS6 | 2005 10 10 14 00 00 | 0.00000 | rel |
| 206 | GPS7 | 2005 10 07 06 00 00 | 0.00000 | abs |
| 207 | GPS7 | 2005 10 07 08 00 00 | 0.00000 | rel |
| 208 | GPS7 | 2005 10 07 10 00 00 | 0.00000 | rel |
| 209 | GPS7 | 2005 10 07 12 00 00 | 0.00000 | rel |
| 210 | GPS7 | 2005 10 07 14 00 00 | 0.00000 | rel |
| 211 | GPS7 | 2005 10 07 16 00 00 | 0.00000 | rel |
| 212 | GPS7 | 2005 10 07 18 00 00 | 0.00000 | rel |
| 213 | GPS7 | 2005 10 07 20 00 00 | 0.00000 | rel |
| 214 | GPS7 | 2005 10 07 22 00 00 | 0.00000 | rel |
| 215 | GPS7 | 2005 10 08 00 00 00 | 0.00000 | rel |
| 216 | GPS7 | 2005 10 08 02 00 00 | 0.00000 | rel |
| 217 | GPS7 | 2005 10 08 04 00 00 | 0.00000 | rel |
| 218 | GPS7 | 2005 10 08 06 00 00 | 0.00000 | rel |
| 219 | GPS7 | 2005 10 08 08 00 00 | 0.00000 | rel |
| 220 | GPS7 | 2005 10 08 10 00 00 | 0.00000 | rel |
| 221 | GPS7 | 2005 10 08 12 00 00 | 0.00000 | rel |
| 222 | GPS7 | 2005 10 08 14 00 00 | 0.00000 | rel |
| 223 | GPS7 | 2005 10 08 16 00 00 | 0.00000 | rel |
| 224 | GPS7 | 2005 10 08 18 00 00 | 0.00000 | rel |
| 225 | GPS7 | 2005 10 08 20 00 00 | 0.00000 | rel |
| 226 | GPS7 | 2005 10 08 22 00 00 | 0.00000 | rel |
| 227 | GPS7 | 2005 10 09 00 00 00 | 0.00000 | rel |
| 228 | GPS7 | 2005 10 09 02 00 00 | 0.00000 | rel |
| 229 | GPS7 | 2005 10 09 04 00 00 | 0.00000 | rel |
| 230 | GPS7 | 2005 10 09 06 00 00 | 0.00000 | rel |
| 231 | GPS7 | 2005 10 09 08 00 00 | 0.00000 | rel |
| 232 | GPS7 | 2005 10 09 10 00 00 | 0.00000 | rel |
| 233 | GPS7 | 2005 10 09 12 00 00 | 0.00000 | rel |
| 234 | GPS7 | 2005 10 09 14 00 00 | 0.00000 | rel |
| 235 | GPS7 | 2005 10 09 16 00 00 | 0.00000 | rel |
| 236 | GPS7 | 2005 10 09 18 00 00 | 0.00000 | rel |
| 237 | GPS7 | 2005 10 09 20 00 00 | 0.00000 | rel |
| 238 | GPS7 | 2005 10 09 22 00 00 | 0.00000 | rel |
| 239 | GPS7 | 2005 10 10 00 00 00 | 0.00000 | rel |
| 240 | GPS7 | 2005 10 10 02 00 00 | 0.00000 | rel |
| 241 | GPS7 | 2005 10 10 04 00 00 | 0.00000 | rel |
| 242 | GPS7 | 2005 10 10 06 00 00 | 0.00000 | rel |
| 243 | GPS7 | 2005 10 10 08 00 00 | 0.00000 | rel |
| 244 | GPS7 | 2005 10 10 10 00 00 | 0.00000 | rel |
| 245 | GPS7 | 2005 10 10 12 00 00 | 0.00000 | rel |
| 246 | GPS7 | 2005 10 10 14 00 00 | 0.00000 | rel |
| 247 | GPS8 | 2005 10 07 06 00 00 | 0.00000 | abs |
| 248 | GPS8 | 2005 10 07 08 00 00 | 0.00000 | rel |
| 249 | GPS8 | 2005 10 07 10 00 00 | 0.00000 | rel |
| 250 | GPS8 | 2005 10 07 12 00 00 | 0.00000 | rel |
| 251 | GPS8 | 2005 10 07 14 00 00 | 0.00000 | rel |
| 252 | GPS8 | 2005 10 07 16 00 00 | 0.00000 | rel |
| 253 | GPS8 | 2005 10 07 18 00 00 | 0.00000 | rel |
| 254 | GPS8 | 2005 10 07 20 00 00 | 0.00000 | rel |
| 255 | GPS8 | 2005 10 07 22 00 00 | 0.00000 | rel |
| 256 | GPS8 | 2005 10 08 00 00 00 | 0.00000 | rel |
| 257 | GPS8 | 2005 10 08 02 00 00 | 0.00000 | rel |

|     |      |                     |         |     |
|-----|------|---------------------|---------|-----|
| 258 | GPS8 | 2005 10 08 04 00 00 | 0.00000 | rel |
| 259 | GPS8 | 2005 10 08 06 00 00 | 0.00000 | rel |
| 260 | GPS8 | 2005 10 08 08 00 00 | 0.00000 | rel |
| 261 | GPS8 | 2005 10 08 10 00 00 | 0.00000 | rel |
| 262 | GPS8 | 2005 10 08 12 00 00 | 0.00000 | rel |
| 263 | GPS8 | 2005 10 08 14 00 00 | 0.00000 | rel |
| 264 | GPS8 | 2005 10 08 16 00 00 | 0.00000 | rel |
| 265 | GPS8 | 2005 10 08 18 00 00 | 0.00000 | rel |
| 266 | GPS8 | 2005 10 08 20 00 00 | 0.00000 | rel |
| 267 | GPS8 | 2005 10 08 22 00 00 | 0.00000 | rel |
| 268 | GPS8 | 2005 10 09 00 00 00 | 0.00000 | rel |
| 269 | GPS8 | 2005 10 09 02 00 00 | 0.00000 | rel |
| 270 | GPS8 | 2005 10 09 04 00 00 | 0.00000 | rel |
| 271 | GPS8 | 2005 10 09 06 00 00 | 0.00000 | rel |
| 272 | GPS8 | 2005 10 09 08 00 00 | 0.00000 | rel |
| 273 | GPS8 | 2005 10 09 10 00 00 | 0.00000 | rel |
| 274 | GPS8 | 2005 10 09 12 00 00 | 0.00000 | rel |
| 275 | GPS8 | 2005 10 09 14 00 00 | 0.00000 | rel |
| 276 | GPS8 | 2005 10 09 16 00 00 | 0.00000 | rel |
| 277 | GPS8 | 2005 10 09 18 00 00 | 0.00000 | rel |
| 278 | GPS8 | 2005 10 09 20 00 00 | 0.00000 | rel |
| 279 | GPS8 | 2005 10 09 22 00 00 | 0.00000 | rel |
| 280 | GPS8 | 2005 10 10 00 00 00 | 0.00000 | rel |
| 281 | GPS8 | 2005 10 10 02 00 00 | 0.00000 | rel |
| 282 | GPS8 | 2005 10 10 04 00 00 | 0.00000 | rel |
| 283 | GPS8 | 2005 10 10 06 00 00 | 0.00000 | rel |
| 284 | GPS8 | 2005 10 10 08 00 00 | 0.00000 | rel |
| 285 | GPS8 | 2005 10 10 10 00 00 | 0.00000 | rel |
| 286 | GPS8 | 2005 10 10 12 00 00 | 0.00000 | rel |
| 287 | GPS8 | 2005 10 10 14 00 00 | 0.00000 | rel |
| 288 | GPS9 | 2005 10 07 06 00 00 | 0.00000 | abs |
| 289 | GPS9 | 2005 10 07 08 00 00 | 0.00000 | rel |
| 290 | GPS9 | 2005 10 07 10 00 00 | 0.00000 | rel |
| 291 | GPS9 | 2005 10 07 12 00 00 | 0.00000 | rel |
| 292 | GPS9 | 2005 10 07 14 00 00 | 0.00000 | rel |
| 293 | GPS9 | 2005 10 07 16 00 00 | 0.00000 | rel |
| 294 | GPS9 | 2005 10 07 18 00 00 | 0.00000 | rel |
| 295 | GPS9 | 2005 10 07 20 00 00 | 0.00000 | rel |
| 296 | GPS9 | 2005 10 07 22 00 00 | 0.00000 | rel |
| 297 | GPS9 | 2005 10 08 00 00 00 | 0.00000 | rel |
| 298 | GPS9 | 2005 10 08 02 00 00 | 0.00000 | rel |
| 299 | GPS9 | 2005 10 08 04 00 00 | 0.00000 | rel |
| 300 | GPS9 | 2005 10 08 06 00 00 | 0.00000 | rel |
| 301 | GPS9 | 2005 10 08 08 00 00 | 0.00000 | rel |
| 302 | GPS9 | 2005 10 08 10 00 00 | 0.00000 | rel |
| 303 | GPS9 | 2005 10 08 12 00 00 | 0.00000 | rel |
| 304 | GPS9 | 2005 10 08 14 00 00 | 0.00000 | rel |
| 305 | GPS9 | 2005 10 08 16 00 00 | 0.00000 | rel |
| 306 | GPS9 | 2005 10 08 18 00 00 | 0.00000 | rel |
| 307 | GPS9 | 2005 10 08 20 00 00 | 0.00000 | rel |
| 308 | GPS9 | 2005 10 08 22 00 00 | 0.00000 | rel |
| 309 | GPS9 | 2005 10 09 00 00 00 | 0.00000 | rel |
| 310 | GPS9 | 2005 10 09 02 00 00 | 0.00000 | rel |

|     |      |                     |         |     |
|-----|------|---------------------|---------|-----|
| 311 | GPS9 | 2005 10 09 04 00 00 | 0.00000 | rel |
| 312 | GPS9 | 2005 10 09 06 00 00 | 0.00000 | rel |
| 313 | GPS9 | 2005 10 09 08 00 00 | 0.00000 | rel |
| 314 | GPS9 | 2005 10 09 10 00 00 | 0.00000 | rel |
| 315 | GPS9 | 2005 10 09 12 00 00 | 0.00000 | rel |
| 316 | GPS9 | 2005 10 09 14 00 00 | 0.00000 | rel |
| 317 | GPS9 | 2005 10 09 16 00 00 | 0.00000 | rel |
| 318 | GPS9 | 2005 10 09 18 00 00 | 0.00000 | rel |
| 319 | GPS9 | 2005 10 09 20 00 00 | 0.00000 | rel |
| 320 | GPS9 | 2005 10 09 22 00 00 | 0.00000 | rel |
| 321 | GPS9 | 2005 10 10 00 00 00 | 0.00000 | rel |
| 322 | GPS9 | 2005 10 10 02 00 00 | 0.00000 | rel |
| 323 | GPS9 | 2005 10 10 04 00 00 | 0.00000 | rel |
| 324 | GPS9 | 2005 10 10 06 00 00 | 0.00000 | rel |
| 325 | GPS9 | 2005 10 10 08 00 00 | 0.00000 | rel |
| 326 | GPS9 | 2005 10 10 10 00 00 | 0.00000 | rel |
| 327 | GPS9 | 2005 10 10 12 00 00 | 0.00000 | rel |
| 328 | GPS9 | 2005 10 10 14 00 00 | 0.00000 | rel |
| 329 | GP13 | 2005 10 07 06 00 00 | 0.00000 | abs |
| 330 | GP13 | 2005 10 07 08 00 00 | 0.00000 | rel |
| 331 | GP13 | 2005 10 07 10 00 00 | 0.00000 | rel |
| 332 | GP13 | 2005 10 07 12 00 00 | 0.00000 | rel |
| 333 | GP13 | 2005 10 07 14 00 00 | 0.00000 | rel |
| 334 | GP13 | 2005 10 07 16 00 00 | 0.00000 | rel |
| 335 | GP13 | 2005 10 07 18 00 00 | 0.00000 | rel |
| 336 | GP13 | 2005 10 07 20 00 00 | 0.00000 | rel |
| 337 | GP13 | 2005 10 07 22 00 00 | 0.00000 | rel |
| 338 | GP13 | 2005 10 08 00 00 00 | 0.00000 | rel |
| 339 | GP13 | 2005 10 08 02 00 00 | 0.00000 | rel |
| 340 | GP13 | 2005 10 08 04 00 00 | 0.00000 | rel |
| 341 | GP13 | 2005 10 08 06 00 00 | 0.00000 | rel |
| 342 | GP13 | 2005 10 08 08 00 00 | 0.00000 | rel |
| 343 | GP13 | 2005 10 08 10 00 00 | 0.00000 | rel |
| 344 | GP13 | 2005 10 08 12 00 00 | 0.00000 | rel |
| 345 | GP13 | 2005 10 08 14 00 00 | 0.00000 | rel |
| 346 | GP13 | 2005 10 08 16 00 00 | 0.00000 | rel |
| 347 | GP13 | 2005 10 08 18 00 00 | 0.00000 | rel |
| 348 | GP13 | 2005 10 08 20 00 00 | 0.00000 | rel |
| 349 | GP13 | 2005 10 08 22 00 00 | 0.00000 | rel |
| 350 | GP13 | 2005 10 09 00 00 00 | 0.00000 | rel |
| 351 | GP13 | 2005 10 09 02 00 00 | 0.00000 | rel |
| 352 | GP13 | 2005 10 09 04 00 00 | 0.00000 | rel |
| 353 | GP13 | 2005 10 09 06 00 00 | 0.00000 | rel |
| 354 | GP13 | 2005 10 09 08 00 00 | 0.00000 | rel |
| 355 | GP13 | 2005 10 09 10 00 00 | 0.00000 | rel |
| 356 | GP13 | 2005 10 09 12 00 00 | 0.00000 | rel |
| 357 | GP13 | 2005 10 09 14 00 00 | 0.00000 | rel |
| 358 | GP13 | 2005 10 09 16 00 00 | 0.00000 | rel |
| 359 | GP13 | 2005 10 09 18 00 00 | 0.00000 | rel |
| 360 | GP13 | 2005 10 09 20 00 00 | 0.00000 | rel |
| 361 | GP13 | 2005 10 09 22 00 00 | 0.00000 | rel |
| 362 | GP13 | 2005 10 10 00 00 00 | 0.00000 | rel |
| 363 | GP13 | 2005 10 10 02 00 00 | 0.00000 | rel |



|     |      |                     |         |     |
|-----|------|---------------------|---------|-----|
| 364 | GP13 | 2005 10 10 04 00 00 | 0.00000 | rel |
| 365 | GP13 | 2005 10 10 06 00 00 | 0.00000 | rel |
| 366 | GP13 | 2005 10 10 08 00 00 | 0.00000 | rel |
| 367 | GP13 | 2005 10 10 10 00 00 | 0.00000 | rel |
| 368 | GP13 | 2005 10 10 12 00 00 | 0.00000 | rel |
| 369 | GP13 | 2005 10 10 14 00 00 | 0.00000 | rel |

IONOSPHERE MODELS:                                \${P}/OLKI05S\ATM\OLKI05S.ION

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TYPE OF IONOSPHERE MODELS : LOCAL  
RADIUS OF THE EARTH : 6378.14 KM

| MODEL | DEG. OF DEVELOP. |      |       | VALIDITY        |                 | ORIGIN OF DEVELOPMENT |          |           | HEIGHT<br>(KM) | NORMAIZATION FACTORS |          |           |
|-------|------------------|------|-------|-----------------|-----------------|-----------------------|----------|-----------|----------------|----------------------|----------|-----------|
|       | TIME             | LAT. | MIXED | START           | END             | LOCAL TIME            | LAT. (D) | LONG. (D) |                | TIME (H)             | LAT. (D) | ELE.CONT. |
| 2     | 2                | 1    | 2     | 2005 10 7 5.0   | 2005 10 7 13.0  | 2005 10 7 9.0         | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 3     | 2                | 1    | 2     | 2005 10 7 11.0  | 2005 10 7 19.0  | 2005 10 7 15.0        | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 4     | 2                | 1    | 2     | 2005 10 7 17.0  | 2005 10 8 1.0   | 2005 10 7 21.0        | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 5     | 2                | 1    | 2     | 2005 10 7 23.0  | 2005 10 8 7.0   | 2005 10 8 3.0         | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 6     | 2                | 1    | 2     | 2005 10 8 5.0   | 2005 10 8 13.0  | 2005 10 8 9.0         | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 7     | 2                | 1    | 2     | 2005 10 8 11.0  | 2005 10 8 19.0  | 2005 10 8 15.0        | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 8     | 2                | 1    | 2     | 2005 10 8 17.0  | 2005 10 9 1.0   | 2005 10 8 21.0        | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 9     | 2                | 1    | 2     | 2005 10 8 23.0  | 2005 10 9 7.0   | 2005 10 9 3.0         | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 10    | 2                | 1    | 2     | 2005 10 9 5.0   | 2005 10 9 13.0  | 2005 10 9 9.0         | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 11    | 2                | 1    | 2     | 2005 10 9 11.0  | 2005 10 9 19.0  | 2005 10 9 15.0        | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 12    | 2                | 1    | 2     | 2005 10 9 17.0  | 2005 10 10 1.0  | 2005 10 9 21.0        | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 13    | 2                | 1    | 2     | 2005 10 9 23.0  | 2005 10 10 7.0  | 2005 10 10 3.0        | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 14    | 2                | 1    | 2     | 2005 10 10 5.0  | 2005 10 10 13.0 | 2005 10 10 9.0        | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |
| 15    | 2                | 1    | 2     | 2005 10 10 11.0 | 2005 10 10 19.0 | 2005 10 10 15.0       | 61.23    | 21.47     | 450            | 2.00                 | 6.00     | 0.10D+18  |

| MODEL | TERM | POL. DEGREE IN |        | COEFFICIENT   | SIGMA        |
|-------|------|----------------|--------|---------------|--------------|
|       |      | TIME           | LATIT. |               |              |
| 2     | 1    | 0              | 0      | 0.112180E+01  | 0.419220E-02 |
|       | 2    | 1              | 0      | 0.149742E+00  | 0.115647E-02 |
|       | 3    | 2              | 0      | -0.637677E-01 | 0.100648E-02 |
|       | 4    | 0              | 1      | -0.161279E+00 | 0.160475E-02 |
|       | 5    | 1              | 1      | -0.249790E-01 | 0.181337E-02 |
| 3     | 1    | 0              | 0      | 0.137059E+01  | 0.599469E-02 |
|       | 2    | 1              | 0      | -0.139149E+00 | 0.148713E-02 |
|       | 3    | 2              | 0      | -0.138979E+00 | 0.140757E-02 |
|       | 4    | 0              | 1      | -0.110932E+00 | 0.195212E-02 |
|       | 5    | 1              | 1      | -0.475761E-01 | 0.175236E-02 |
| 4     | 1    | 0              | 0      | 0.501109E+00  | 0.119856E-01 |
|       | 2    | 1              | 0      | 0.729986E-01  | 0.290487E-02 |
|       | 3    | 2              | 0      | 0.918989E-01  | 0.251761E-02 |
|       | 4    | 0              | 1      | -0.959778E-01 | 0.449534E-02 |

|    |   |   |   |               |              |
|----|---|---|---|---------------|--------------|
|    | 5 | 1 | 1 | 0.150815E+00  | 0.499682E-02 |
| 5  | 1 | 0 | 0 | 0.583916E+00  | 0.115694E-01 |
|    | 2 | 1 | 0 | -0.888838E-02 | 0.325656E-02 |
|    | 3 | 2 | 0 | 0.693218E-01  | 0.268651E-02 |
|    | 4 | 0 | 1 | 0.127968E+00  | 0.416298E-02 |
|    | 5 | 1 | 1 | -0.297192E-01 | 0.463688E-02 |
| 6  | 1 | 0 | 0 | 0.136853E+01  | 0.669435E-02 |
|    | 2 | 1 | 0 | 0.940086E-01  | 0.163186E-02 |
|    | 3 | 2 | 0 | -0.164148E+00 | 0.149399E-02 |
|    | 4 | 0 | 1 | -0.192318E+00 | 0.252301E-02 |
|    | 5 | 1 | 1 | 0.868545E-02  | 0.273855E-02 |
| 7  | 1 | 0 | 0 | 0.919211E+00  | 0.450449E-02 |
|    | 2 | 1 | 0 | -0.113465E+00 | 0.113617E-02 |
|    | 3 | 2 | 0 | -0.789023E-01 | 0.106692E-02 |
|    | 4 | 0 | 1 | -0.219792E+00 | 0.147880E-02 |
|    | 5 | 1 | 1 | -0.872012E-01 | 0.135016E-02 |
| 8  | 1 | 0 | 0 | 0.275497E+00  | 0.835119E-02 |
|    | 2 | 1 | 0 | -0.203151E-01 | 0.204453E-02 |
|    | 3 | 2 | 0 | 0.387755E-01  | 0.177602E-02 |
|    | 4 | 0 | 1 | -0.214853E+00 | 0.309506E-02 |
|    | 5 | 1 | 1 | 0.578436E-01  | 0.350896E-02 |
| 9  | 1 | 0 | 0 | 0.436499E+00  | 0.494048E-02 |
|    | 2 | 1 | 0 | 0.659104E-01  | 0.124751E-02 |
|    | 3 | 2 | 0 | 0.561990E-01  | 0.106518E-02 |
|    | 4 | 0 | 1 | -0.646296E-01 | 0.171673E-02 |
|    | 5 | 1 | 1 | -0.563746E-02 | 0.173082E-02 |
| 10 | 1 | 0 | 0 | 0.932276E+00  | 0.304447E-02 |
|    | 2 | 1 | 0 | 0.159865E+00  | 0.741338E-03 |
|    | 3 | 2 | 0 | -0.240756E-01 | 0.688491E-03 |
|    | 4 | 0 | 1 | -0.133690E+00 | 0.114338E-02 |
|    | 5 | 1 | 1 | -0.173639E-01 | 0.124865E-02 |
| 11 | 1 | 0 | 0 | 0.105313E+01  | 0.394672E-02 |
|    | 2 | 1 | 0 | -0.145114E+00 | 0.101093E-02 |
|    | 3 | 2 | 0 | -0.511534E-01 | 0.941210E-03 |
|    | 4 | 0 | 1 | -0.162984E+00 | 0.130199E-02 |
|    | 5 | 1 | 1 | -0.264088E-01 | 0.120009E-02 |
| 12 | 1 | 0 | 0 | 0.289508E+00  | 0.815344E-02 |
|    | 2 | 1 | 0 | -0.325394E-01 | 0.200244E-02 |
|    | 3 | 2 | 0 | 0.416185E-01  | 0.174317E-02 |
|    | 4 | 0 | 1 | -0.205691E+00 | 0.299588E-02 |
|    | 5 | 1 | 1 | 0.208905E-01  | 0.335892E-02 |
| 13 | 1 | 0 | 0 | 0.427965E+00  | 0.587731E-02 |
|    | 2 | 1 | 0 | 0.582015E-01  | 0.148874E-02 |
|    | 3 | 2 | 0 | 0.831949E-01  | 0.126428E-02 |

|    |   |   |   |               |              |
|----|---|---|---|---------------|--------------|
|    | 4 | 0 | 1 | -0.920522E-01 | 0.204129E-02 |
|    | 5 | 1 | 1 | 0.940273E-02  | 0.205801E-02 |
| 14 | 1 | 0 | 0 | 0.132926E+01  | 0.460493E-02 |
|    | 2 | 1 | 0 | 0.205049E+00  | 0.110824E-02 |
|    | 3 | 2 | 0 | -0.134045E+00 | 0.104667E-02 |
|    | 4 | 0 | 1 | -0.119086E+00 | 0.176406E-02 |
|    | 5 | 1 | 1 | 0.390818E-02  | 0.190623E-02 |
| 15 | 1 | 0 | 0 | 0.112769E+01  | 0.443186E-02 |
|    | 2 | 1 | 0 | -0.129343E+00 | 0.114825E-02 |
|    | 3 | 2 | 0 | 0.282572E-02  | 0.106075E-02 |
|    | 4 | 0 | 1 | -0.148493E+00 | 0.146947E-02 |
|    | 5 | 1 | 1 | -0.312067E-01 | 0.136772E-02 |

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8. POLE COORDINATES AND TIME INFORMATION

A PRIORI POLE AND TIME INFORMATION FROM THE POLE FILE:

| DATUM    | TIME     | X-POLE (")<br>EP-CPO (") | Y-POLE (")<br>PS-CPO (") | UT1-UTC (S) | GPS-UTC (S) | RMS XP (")<br>RMS EP (") | RMS YP (")<br>RMS PS (") | RMS DT (S) |
|----------|----------|--------------------------|--------------------------|-------------|-------------|--------------------------|--------------------------|------------|
| 05-10-07 | 00:00:00 | 0.06335<br>0.00000       | 0.41543<br>0.00000       | -0.611694   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-10-08 | 00:00:00 | 0.06405<br>0.00000       | 0.41549<br>0.00000       | -0.611988   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-10-09 | 00:00:00 | 0.06462<br>0.00000       | 0.41491<br>0.00000       | -0.612026   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-10-10 | 00:00:00 | 0.06515<br>0.00000       | 0.41418<br>0.00000       | -0.612031   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-10-11 | 00:00:00 | 0.06533<br>0.00000       | 0.41338<br>0.00000       | -0.612057   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |

NUTATION MODEL: IAU2000  
SUBDAILY POLE MODEL: IERS2000

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## 12. TEST OUTPUT

-----  
 MIN. AND MAX. ELEVATION/NADIR ANGLES AND MAX. SYNCHRONIZATION ERRORS:  
 -----

| SESS | FILE | STATION NAME 1 | STATION NAME 2 | MIN/MAX ELEV. | MIN/MAX NADIR | SYNCH. ERR. (NS) |
|------|------|----------------|----------------|---------------|---------------|------------------|
| 2820 | 1    | GPS1           | GPS2           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2830 | 2    | GPS1           | GPS2           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 2820 | 3    | GPS1           | GPS3           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2830 | 4    | GPS1           | GPS3           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 2800 | 5    | GPS1           | GPS4           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2810 | 6    | GPS1           | GPS4           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 2800 | 7    | GPS1           | GPS5           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2810 | 8    | GPS1           | GPS5           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 2820 | 9    | GPS1           | GPS5           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2830 | 10   | GPS1           | GPS5           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 2800 | 11   | GPS1           | GPS6           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2810 | 12   | GPS1           | GPS6           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 2820 | 13   | GPS1           | GPS6           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2830 | 14   | GPS1           | GPS6           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 2800 | 15   | GPS1           | GPS7           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2810 | 16   | GPS1           | GPS7           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 2800 | 17   | GPS1           | GPS8           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2810 | 18   | GPS1           | GPS8           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 2820 | 19   | GPS1           | GPS8           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2830 | 20   | GPS1           | GPS8           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 2800 | 21   | GPS6           | GPS9           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2820 | 22   | GPS6           | GPS9           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2830 | 23   | GPS6           | GPS9           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 2800 | 24   | GPS6           | GP13           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2810 | 25   | GPS6           | GP13           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 2820 | 26   | GPS6           | GP13           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 2830 | 27   | GPS6           | GP13           | 20.0 83.5     | 1.5 13.2      | 0.0              |

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## 13. RESULTS (PART 1)

-----  
 NUMBER OF PARAMETERS (PART 1):  
 -----

| PARAMETER TYPE      | #PARAMETERS | #PRE-ELIMINATED | #SET-UP | #NO-OBS | #REF | #SINGULAR |
|---------------------|-------------|-----------------|---------|---------|------|-----------|
| STATION COORDINATES | 30          | 0               | 30      | 0       | 0    | 0         |

|                                      |     |    |              |     |     |   |     |
|--------------------------------------|-----|----|--------------|-----|-----|---|-----|
| AMBIGUITIES                          | 24  | 24 | (BEFORE INV) | 936 | 912 | 0 | 0   |
| SITE-SPECIFIC TROPOSPHERE PARAMETERS | 369 | 0  |              | 369 | 0   | 0 | 166 |

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|                            |     |    |  |      |     |   |     |
|----------------------------|-----|----|--|------|-----|---|-----|
| TOTAL NUMBER OF PARAMETERS | 423 | 24 |  | 1335 | 912 | 0 | 166 |
|----------------------------|-----|----|--|------|-----|---|-----|

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NUMBER OF OBSERVATIONS (PART 1):

| TYPE  | FREQUENCY | FILE | #OBSERVATIONS |
|-------|-----------|------|---------------|
| PHASE | L1        | ALL  | 213205        |
| PHASE | L2        | ALL  | 213205        |

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|                              |        |
|------------------------------|--------|
| TOTAL NUMBER OF OBSERVATIONS | 426410 |
|------------------------------|--------|

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A POSTERIORI SIGMA OF UNIT WEIGHT (PART 1):

A POSTERIORI SIGMA OF UNIT WEIGHT : 0.0022 M (SIGMA OF ONE-WAY L1 PHASE OBSERVABLE AT ZENITH)

DEGREE OF FREEDOM (DOF) : 426153

CHI\*\*2/DOF : 4.91

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STATION COORDINATES:                   \${P}/OLKI05S\STA\TOLKI05S.CRD

| NUM | STATION NAME | PARAMETER       | A PRIORI VALUE  | NEW VALUE       | NEW- A PRIORI | RMS ERROR | 3-D ELLIPSOID | 2-D ELLIPSE |
|-----|--------------|-----------------|-----------------|-----------------|---------------|-----------|---------------|-------------|
| 1   | GPS1         | X               | 2863210.1067    | 2863210.1067    | 0.0000        | 0.0000    |               |             |
|     |              | Y               | 1126271.4390    | 1126271.4390    | 0.0000        | 0.0000    |               |             |
|     |              | Z               | 5568267.2990    | 5568267.2990    | 0.0000        | 0.0000    |               |             |
|     |              | HEIGHT          | 30.5520         | 30.5520         | 0.0000        | 0.0000    | 0.0000        | 0.0         |
|     |              | LATITUDE        | 61 14 22.754183 | 61 14 22.754183 | 0.0000        | 0.0000    | 0.0000        | 90.0        |
|     | LONGITUDE    | 21 28 21.633926 | 21 28 21.633926 | 0.0000          | 0.0000        | 0.0000    | 0.0           |             |
| 2   | GPS2         | X               | 2863312.4876    | 2863312.4891    | 0.0015        | 0.0002    |               |             |
|     |              | Y               | 1127586.4513    | 1127586.4508    | -0.0005       | 0.0001    |               |             |
|     |              | Z               | 5567953.2561    | 5567953.2574    | 0.0013        | 0.0004    |               |             |

|   |      |           |                 |                 |         |        |        |      |        |      |
|---|------|-----------|-----------------|-----------------|---------|--------|--------|------|--------|------|
|   |      | HEIGHT    | 32.8443         | 32.8460         | 0.0017  | 0.0005 | 0.0005 | 0.6  |        |      |
|   |      | LATITUDE  | 61 14 1.535088  | 61 14 1.535074  | -0.0004 | 0.0001 | 0.0000 | 90.2 | 0.0000 | 90.0 |
|   |      | LONGITUDE | 21 29 41.145601 | 21 29 41.145535 | -0.0010 | 0.0000 | 0.0001 | -0.1 | 0.0001 |      |
| 3 | GPS3 | X         | 2862323.4428    | 2862323.4455    | 0.0027  | 0.0002 |        |      |        |      |
|   |      | Y         | 1126533.7706    | 1126533.7722    | 0.0016  | 0.0001 |        |      |        |      |
|   |      | Z         | 5568664.0772    | 5568664.0792    | 0.0020  | 0.0004 |        |      |        |      |
|   |      | HEIGHT    | 27.6613         | 27.6646         | 0.0033  | 0.0005 | 0.0005 | 0.6  |        |      |
|   |      | LATITUDE  | 61 14 49.568852 | 61 14 49.568796 | -0.0017 | 0.0001 | 0.0000 | 90.0 | 0.0000 | 89.9 |
|   |      | LONGITUDE | 21 28 59.767954 | 21 28 59.767988 | 0.0005  | 0.0000 | 0.0001 | -0.1 | 0.0001 |      |
| 4 | GPS4 | X         | 2862758.9415    | 2862758.9467    | 0.0052  | 0.0002 |        |      |        |      |
|   |      | Y         | 1125923.2376    | 1125923.2379    | 0.0003  | 0.0001 |        |      |        |      |
|   |      | Z         | 5568566.0154    | 5568566.0234    | 0.0080  | 0.0004 |        |      |        |      |
|   |      | HEIGHT    | 29.1133         | 29.1227         | 0.0094  | 0.0005 | 0.0005 | 0.5  |        |      |
|   |      | LATITUDE  | 61 14 42.897724 | 61 14 42.897708 | -0.0005 | 0.0001 | 0.0000 | 90.1 | 0.0000 | 90.0 |
|   |      | LONGITUDE | 21 28 10.980705 | 21 28 10.980594 | -0.0017 | 0.0000 | 0.0001 | -0.1 | 0.0001 |      |
| 5 | GPS5 | X         | 2864192.3764    | 2864192.3692    | -0.0072 | 0.0002 |        |      |        |      |
|   |      | Y         | 1126421.6871    | 1126421.6845    | -0.0026 | 0.0001 |        |      |        |      |
|   |      | Z         | 5567725.8796    | 5567725.8597    | -0.0199 | 0.0003 |        |      |        |      |
|   |      | HEIGHT    | 22.2982         | 22.2771         | -0.0211 | 0.0004 | 0.0004 | 0.5  |        |      |
|   |      | LATITUDE  | 61 13 46.892454 | 61 13 46.892361 | -0.0029 | 0.0001 | 0.0000 | 90.2 | 0.0000 | 90.1 |
|   |      | LONGITUDE | 21 28 6.906786  | 21 28 6.906801  | 0.0002  | 0.0000 | 0.0001 | -0.1 | 0.0001 |      |
| 6 | GPS6 | X         | 2863910.3892    | 2863910.3950    | 0.0058  | 0.0002 |        |      |        |      |
|   |      | Y         | 1125229.5963    | 1125229.5981    | 0.0018  | 0.0001 |        |      |        |      |
|   |      | Z         | 5568112.5408    | 5568112.5511    | 0.0103  | 0.0003 |        |      |        |      |
|   |      | HEIGHT    | 25.0654         | 25.0774         | 0.0119  | 0.0004 | 0.0004 | 0.5  |        |      |
|   |      | LATITUDE  | 61 14 12.686451 | 61 14 12.686441 | -0.0003 | 0.0001 | 0.0000 | 89.9 | 0.0000 | 89.9 |
|   |      | LONGITUDE | 21 26 59.459035 | 21 26 59.459006 | -0.0004 | 0.0000 | 0.0001 | 0.0  | 0.0001 |      |
| 7 | GPS7 | X         | 2863465.8530    | 2863465.8559    | 0.0029  | 0.0002 |        |      |        |      |
|   |      | Y         | 1124819.7828    | 1124819.7830    | 0.0002  | 0.0001 |        |      |        |      |
|   |      | Z         | 5568430.2557    | 5568430.2624    | 0.0067  | 0.0004 |        |      |        |      |
|   |      | HEIGHT    | 32.4126         | 32.4198         | 0.0072  | 0.0005 | 0.0005 | 0.5  |        |      |
|   |      | LATITUDE  | 61 14 33.586772 | 61 14 33.586797 | 0.0008  | 0.0001 | 0.0000 | 90.4 | 0.0000 | 90.3 |
|   |      | LONGITUDE | 21 26 44.784815 | 21 26 44.784753 | -0.0009 | 0.0000 | 0.0001 | -0.1 | 0.0001 |      |
| 8 | GPS8 | X         | 2863019.7046    | 2863019.7083    | 0.0037  | 0.0002 |        |      |        |      |
|   |      | Y         | 1124739.5538    | 1124739.5538    | 0.0000  | 0.0001 |        |      |        |      |
|   |      | Z         | 5568666.6848    | 5568666.6923    | 0.0075  | 0.0003 |        |      |        |      |
|   |      | HEIGHT    | 25.8084         | 25.8167         | 0.0083  | 0.0004 | 0.0004 | 0.5  |        |      |
|   |      | LATITUDE  | 61 14 49.853077 | 61 14 49.853096 | 0.0006  | 0.0001 | 0.0000 | 89.9 | 0.0000 | 89.8 |
|   |      | LONGITUDE | 21 26 50.715669 | 21 26 50.715582 | -0.0013 | 0.0000 | 0.0001 | -0.1 | 0.0001 |      |

|    |      |           |                 |                 |         |        |        |      |        |      |  |
|----|------|-----------|-----------------|-----------------|---------|--------|--------|------|--------|------|--|
| 9  | GPS9 | X         | 2863742.0387    | 2863742.0411    | 0.0024  | 0.0002 |        |      |        |      |  |
|    |      | Y         | 1123996.6145    | 1123996.6143    | -0.0002 | 0.0001 |        |      |        |      |  |
|    |      | Z         | 5568453.4720    | 5568453.4796    | 0.0076  | 0.0004 |        |      |        |      |  |
|    |      | HEIGHT    | 31.7025         | 31.7101         | 0.0077  | 0.0004 | 0.0004 | 0.5  |        |      |  |
|    |      | LATITUDE  | 61 14 35.187574 | 61 14 35.187631 | 0.0018  | 0.0001 | 0.0000 | 89.9 | 0.0000 | 89.9 |  |
|    |      | LONGITUDE | 21 25 46.644762 | 21 25 46.644692 | -0.0010 | 0.0000 | 0.0001 | -0.1 | 0.0001 |      |  |
| 10 | GP13 | X         | 2864309.0028    | 2864309.0100    | 0.0072  | 0.0002 |        |      |        |      |  |
|    |      | Y         | 1124134.0361    | 1124134.0390    | 0.0029  | 0.0001 |        |      |        |      |  |
|    |      | Z         | 5568134.1930    | 5568134.1990    | 0.0060  | 0.0003 |        |      |        |      |  |
|    |      | HEIGHT    | 29.8962         | 29.9052         | 0.0090  | 0.0004 | 0.0004 | 0.5  |        |      |  |
|    |      | LATITUDE  | 61 14 13.855835 | 61 14 13.855708 | -0.0039 | 0.0001 | 0.0000 | 89.8 | 0.0000 | 89.8 |  |
|    |      | LONGITUDE | 21 25 41.334054 | 21 25 41.334057 | 0.0000  | 0.0000 | 0.0001 | 0.0  | 0.0001 |      |  |

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SITE-SPECIFIC TROPOSPHERE PARAMETERS: (NOT SAVED)

| REQU. | STATION NAME | CORRECTIONS (M) |      |         | RMS ERRORS (M) |      |         | ZENITH VECTOR (") |     |       |     | ERROR ELLIPSE (M) |         |     |
|-------|--------------|-----------------|------|---------|----------------|------|---------|-------------------|-----|-------|-----|-------------------|---------|-----|
|       |              | NORTH           | EAST | ZENITH  | NORTH          | EAST | ZENITH  | ANGLE             | RMS | RATIO | AZI | MAX RMS           | MIN RMS | AZI |
| 1     | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 2     | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 3     | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 4     | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 5     | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 6     | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 7     | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 8     | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 9     | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 10    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 11    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 12    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 13    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 14    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 15    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 16    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 17    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 18    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 19    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 20    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 21    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 22    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 23    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 24    | GPS2         |                 |      | 0.00000 |                |      | 0.00000 |                   |     |       |     |                   |         |     |

|    |      |          |         |
|----|------|----------|---------|
| 25 | GPS2 | 0.00000  | 0.00000 |
| 26 | GPS2 | -0.00006 | 0.00044 |
| 27 | GPS2 | -0.00127 | 0.00034 |
| 28 | GPS2 | 0.00005  | 0.00034 |
| 29 | GPS2 | -0.00078 | 0.00031 |
| 30 | GPS2 | 0.00033  | 0.00037 |
| 31 | GPS2 | -0.00169 | 0.00036 |
| 32 | GPS2 | -0.00034 | 0.00030 |
| 33 | GPS2 | 0.00163  | 0.00033 |
| 34 | GPS2 | -0.00043 | 0.00034 |
| 35 | GPS2 | -0.00264 | 0.00033 |
| 36 | GPS2 | 0.00084  | 0.00033 |
| 37 | GPS2 | -0.00143 | 0.00035 |
| 38 | GPS2 | 0.00009  | 0.00034 |
| 39 | GPS2 | -0.00299 | 0.00034 |
| 40 | GPS2 | 0.00119  | 0.00049 |
| 41 | GPS2 | 0.00000  | 0.00000 |
| 42 | GPS3 | 0.00000  | 0.00000 |
| 43 | GPS3 | 0.00000  | 0.00000 |
| 44 | GPS3 | 0.00000  | 0.00000 |
| 45 | GPS3 | 0.00000  | 0.00000 |
| 46 | GPS3 | 0.00000  | 0.00000 |
| 47 | GPS3 | 0.00000  | 0.00000 |
| 48 | GPS3 | 0.00000  | 0.00000 |
| 49 | GPS3 | 0.00000  | 0.00000 |
| 50 | GPS3 | 0.00000  | 0.00000 |
| 51 | GPS3 | 0.00000  | 0.00000 |
| 52 | GPS3 | 0.00000  | 0.00000 |
| 53 | GPS3 | 0.00000  | 0.00000 |
| 54 | GPS3 | 0.00000  | 0.00000 |
| 55 | GPS3 | 0.00000  | 0.00000 |
| 56 | GPS3 | 0.00000  | 0.00000 |
| 57 | GPS3 | 0.00000  | 0.00000 |
| 58 | GPS3 | 0.00000  | 0.00000 |
| 59 | GPS3 | 0.00000  | 0.00000 |
| 60 | GPS3 | 0.00000  | 0.00000 |
| 61 | GPS3 | 0.00000  | 0.00000 |
| 62 | GPS3 | 0.00000  | 0.00000 |
| 63 | GPS3 | 0.00000  | 0.00000 |
| 64 | GPS3 | 0.00000  | 0.00000 |
| 65 | GPS3 | 0.00000  | 0.00000 |
| 66 | GPS3 | -0.00087 | 0.00646 |
| 67 | GPS3 | -0.00224 | 0.00041 |
| 68 | GPS3 | -0.00213 | 0.00033 |
| 69 | GPS3 | -0.00304 | 0.00034 |
| 70 | GPS3 | -0.00185 | 0.00031 |
| 71 | GPS3 | -0.00190 | 0.00037 |
| 72 | GPS3 | -0.00251 | 0.00036 |
| 73 | GPS3 | -0.00261 | 0.00030 |
| 74 | GPS3 | -0.00360 | 0.00033 |
| 75 | GPS3 | -0.00369 | 0.00034 |
| 76 | GPS3 | -0.00289 | 0.00033 |
| 77 | GPS3 | -0.00192 | 0.00033 |



|     |      |          |         |
|-----|------|----------|---------|
| 78  | GPS3 | -0.00315 | 0.00035 |
| 79  | GPS3 | -0.00188 | 0.00034 |
| 80  | GPS3 | -0.00272 | 0.00033 |
| 81  | GPS3 | -0.00304 | 0.00044 |
| 82  | GPS3 | -0.00093 | 0.01131 |
| 83  | GPS4 | 0.00000  | 0.00000 |
| 84  | GPS4 | -0.00241 | 0.00050 |
| 85  | GPS4 | -0.00247 | 0.00035 |
| 86  | GPS4 | -0.00354 | 0.00034 |
| 87  | GPS4 | -0.00304 | 0.00031 |
| 88  | GPS4 | -0.00363 | 0.00038 |
| 89  | GPS4 | -0.00390 | 0.00037 |
| 90  | GPS4 | -0.00550 | 0.00033 |
| 91  | GPS4 | 0.00053  | 0.00034 |
| 92  | GPS4 | -0.00273 | 0.00034 |
| 93  | GPS4 | -0.00468 | 0.00033 |
| 94  | GPS4 | -0.00144 | 0.00034 |
| 95  | GPS4 | -0.00417 | 0.00034 |
| 96  | GPS4 | -0.00294 | 0.00035 |
| 97  | GPS4 | -0.00246 | 0.00033 |
| 98  | GPS4 | -0.00406 | 0.00044 |
| 99  | GPS4 | -0.01128 | 0.01292 |
| 100 | GPS4 | 0.00000  | 0.00000 |
| 101 | GPS4 | 0.00000  | 0.00000 |
| 102 | GPS4 | 0.00000  | 0.00000 |
| 103 | GPS4 | 0.00000  | 0.00000 |
| 104 | GPS4 | 0.00000  | 0.00000 |
| 105 | GPS4 | 0.00000  | 0.00000 |
| 106 | GPS4 | 0.00000  | 0.00000 |
| 107 | GPS4 | 0.00000  | 0.00000 |
| 108 | GPS4 | 0.00000  | 0.00000 |
| 109 | GPS4 | 0.00000  | 0.00000 |
| 110 | GPS4 | 0.00000  | 0.00000 |
| 111 | GPS4 | 0.00000  | 0.00000 |
| 112 | GPS4 | 0.00000  | 0.00000 |
| 113 | GPS4 | 0.00000  | 0.00000 |
| 114 | GPS4 | 0.00000  | 0.00000 |
| 115 | GPS4 | 0.00000  | 0.00000 |
| 116 | GPS4 | 0.00000  | 0.00000 |
| 117 | GPS4 | 0.00000  | 0.00000 |
| 118 | GPS4 | 0.00000  | 0.00000 |
| 119 | GPS4 | 0.00000  | 0.00000 |
| 120 | GPS4 | 0.00000  | 0.00000 |
| 121 | GPS4 | 0.00000  | 0.00000 |
| 122 | GPS4 | 0.00000  | 0.00000 |
| 123 | GPS4 | 0.00000  | 0.00000 |
| 124 | GPS5 | -0.02516 | 0.00975 |
| 125 | GPS5 | 0.01125  | 0.00044 |
| 126 | GPS5 | 0.00431  | 0.00033 |
| 127 | GPS5 | 0.00708  | 0.00032 |
| 128 | GPS5 | 0.00686  | 0.00029 |
| 129 | GPS5 | 0.00628  | 0.00035 |
| 130 | GPS5 | 0.00519  | 0.00035 |

|     |      |          |         |
|-----|------|----------|---------|
| 131 | GPS5 | 0.01176  | 0.00031 |
| 132 | GPS5 | 0.00055  | 0.00032 |
| 133 | GPS5 | 0.00372  | 0.00033 |
| 134 | GPS5 | 0.00520  | 0.00031 |
| 135 | GPS5 | 0.00816  | 0.00032 |
| 136 | GPS5 | 0.00748  | 0.00032 |
| 137 | GPS5 | 0.00895  | 0.00034 |
| 138 | GPS5 | 0.00469  | 0.00036 |
| 139 | GPS5 | 0.09221  | 0.00618 |
| 140 | GPS5 | 0.00000  | 0.00000 |
| 141 | GPS5 | 0.00000  | 0.00000 |
| 142 | GPS5 | 0.00000  | 0.00000 |
| 143 | GPS5 | 0.00000  | 0.00000 |
| 144 | GPS5 | 0.00000  | 0.00000 |
| 145 | GPS5 | 0.00000  | 0.00000 |
| 146 | GPS5 | 0.00000  | 0.00000 |
| 147 | GPS5 | 0.00000  | 0.00000 |
| 148 | GPS5 | 0.00000  | 0.00000 |
| 149 | GPS5 | 0.00620  | 0.00053 |
| 150 | GPS5 | 0.00414  | 0.00033 |
| 151 | GPS5 | 0.00786  | 0.00032 |
| 152 | GPS5 | 0.00559  | 0.00029 |
| 153 | GPS5 | 0.00622  | 0.00035 |
| 154 | GPS5 | 0.00482  | 0.00035 |
| 155 | GPS5 | 0.01161  | 0.00028 |
| 156 | GPS5 | 0.00805  | 0.00031 |
| 157 | GPS5 | 0.00524  | 0.00033 |
| 158 | GPS5 | 0.00557  | 0.00031 |
| 159 | GPS5 | 0.00945  | 0.00031 |
| 160 | GPS5 | 0.00709  | 0.00033 |
| 161 | GPS5 | 0.00931  | 0.00033 |
| 162 | GPS5 | 0.00578  | 0.00033 |
| 163 | GPS5 | -0.00078 | 0.00069 |
| 164 | GPS5 | 0.00000  | 0.00000 |
| 165 | GPS6 | 0.00000  | 0.00000 |
| 166 | GPS6 | 0.46950  | 0.43112 |
| 167 | GPS6 | -0.00294 | 0.00040 |
| 168 | GPS6 | -0.00412 | 0.00033 |
| 169 | GPS6 | -0.00311 | 0.00029 |
| 170 | GPS6 | -0.00273 | 0.00035 |
| 171 | GPS6 | -0.00307 | 0.00035 |
| 172 | GPS6 | -0.00254 | 0.00031 |
| 173 | GPS6 | -0.00524 | 0.00032 |
| 174 | GPS6 | -0.00341 | 0.00033 |
| 175 | GPS6 | -0.00524 | 0.00031 |
| 176 | GPS6 | -0.00194 | 0.00031 |
| 177 | GPS6 | -0.00345 | 0.00032 |
| 178 | GPS6 | -0.00308 | 0.00033 |
| 179 | GPS6 | -0.00239 | 0.00034 |
| 180 | GPS6 | -0.00301 | 0.00116 |
| 181 | GPS6 | 0.00000  | 0.00000 |
| 182 | GPS6 | 0.00000  | 0.00000 |
| 183 | GPS6 | 0.00000  | 0.00000 |

|     |      |          |         |
|-----|------|----------|---------|
| 184 | GPS6 | 0.00000  | 0.00000 |
| 185 | GPS6 | 0.00000  | 0.00000 |
| 186 | GPS6 | 0.00000  | 0.00000 |
| 187 | GPS6 | 0.00000  | 0.00000 |
| 188 | GPS6 | 0.00000  | 0.00000 |
| 189 | GPS6 | 0.00000  | 0.00000 |
| 190 | GPS6 | -0.00537 | 0.00171 |
| 191 | GPS6 | -0.00333 | 0.00035 |
| 192 | GPS6 | -0.00397 | 0.00032 |
| 193 | GPS6 | -0.00323 | 0.00029 |
| 194 | GPS6 | -0.00378 | 0.00035 |
| 195 | GPS6 | -0.00187 | 0.00035 |
| 196 | GPS6 | -0.00281 | 0.00028 |
| 197 | GPS6 | -0.00464 | 0.00031 |
| 198 | GPS6 | -0.00346 | 0.00033 |
| 199 | GPS6 | -0.00423 | 0.00031 |
| 200 | GPS6 | -0.00225 | 0.00031 |
| 201 | GPS6 | -0.00315 | 0.00034 |
| 202 | GPS6 | -0.00325 | 0.00034 |
| 203 | GPS6 | -0.00061 | 0.00049 |
| 204 | GPS6 | 0.00000  | 0.00000 |
| 205 | GPS6 | 0.00000  | 0.00000 |
| 206 | GPS7 | 0.00000  | 0.00000 |
| 207 | GPS7 | 0.00530  | 0.01273 |
| 208 | GPS7 | -0.00223 | 0.00039 |
| 209 | GPS7 | -0.00387 | 0.00035 |
| 210 | GPS7 | -0.00266 | 0.00032 |
| 211 | GPS7 | -0.00199 | 0.00038 |
| 212 | GPS7 | -0.00291 | 0.00037 |
| 213 | GPS7 | -0.00358 | 0.00033 |
| 214 | GPS7 | -0.00124 | 0.00034 |
| 215 | GPS7 | -0.00200 | 0.00034 |
| 216 | GPS7 | -0.00517 | 0.00034 |
| 217 | GPS7 | -0.00067 | 0.00034 |
| 218 | GPS7 | -0.00344 | 0.00035 |
| 219 | GPS7 | -0.00246 | 0.00035 |
| 220 | GPS7 | -0.00196 | 0.00034 |
| 221 | GPS7 | -0.00527 | 0.00048 |
| 222 | GPS7 | 0.00000  | 0.00000 |
| 223 | GPS7 | 0.00000  | 0.00000 |
| 224 | GPS7 | 0.00000  | 0.00000 |
| 225 | GPS7 | 0.00000  | 0.00000 |
| 226 | GPS7 | 0.00000  | 0.00000 |
| 227 | GPS7 | 0.00000  | 0.00000 |
| 228 | GPS7 | 0.00000  | 0.00000 |
| 229 | GPS7 | 0.00000  | 0.00000 |
| 230 | GPS7 | 0.00000  | 0.00000 |
| 231 | GPS7 | 0.00000  | 0.00000 |
| 232 | GPS7 | 0.00000  | 0.00000 |
| 233 | GPS7 | 0.00000  | 0.00000 |
| 234 | GPS7 | 0.00000  | 0.00000 |
| 235 | GPS7 | 0.00000  | 0.00000 |
| 236 | GPS7 | 0.00000  | 0.00000 |

|     |      |          |         |
|-----|------|----------|---------|
| 237 | GPS7 | 0.00000  | 0.00000 |
| 238 | GPS7 | 0.00000  | 0.00000 |
| 239 | GPS7 | 0.00000  | 0.00000 |
| 240 | GPS7 | 0.00000  | 0.00000 |
| 241 | GPS7 | 0.00000  | 0.00000 |
| 242 | GPS7 | 0.00000  | 0.00000 |
| 243 | GPS7 | 0.00000  | 0.00000 |
| 244 | GPS7 | 0.00000  | 0.00000 |
| 245 | GPS7 | 0.00000  | 0.00000 |
| 246 | GPS7 | 0.00000  | 0.00000 |
| 247 | GPS8 | 0.00000  | 0.00000 |
| 248 | GPS8 | 0.00036  | 0.00065 |
| 249 | GPS8 | -0.00275 | 0.00034 |
| 250 | GPS8 | -0.00412 | 0.00033 |
| 251 | GPS8 | -0.00371 | 0.00029 |
| 252 | GPS8 | -0.00034 | 0.00035 |
| 253 | GPS8 | -0.00356 | 0.00035 |
| 254 | GPS8 | -0.00463 | 0.00031 |
| 255 | GPS8 | 0.00478  | 0.00032 |
| 256 | GPS8 | -0.00258 | 0.00034 |
| 257 | GPS8 | -0.00457 | 0.00031 |
| 258 | GPS8 | -0.00050 | 0.00032 |
| 259 | GPS8 | -0.00369 | 0.00032 |
| 260 | GPS8 | -0.00213 | 0.00033 |
| 261 | GPS8 | -0.00293 | 0.00032 |
| 262 | GPS8 | -0.00509 | 0.00044 |
| 263 | GPS8 | 0.00000  | 0.00000 |
| 264 | GPS8 | 0.00000  | 0.00000 |
| 265 | GPS8 | 0.00000  | 0.00000 |
| 266 | GPS8 | 0.00000  | 0.00000 |
| 267 | GPS8 | 0.00000  | 0.00000 |
| 268 | GPS8 | 0.00000  | 0.00000 |
| 269 | GPS8 | 0.00000  | 0.00000 |
| 270 | GPS8 | 0.00000  | 0.00000 |
| 271 | GPS8 | 0.00000  | 0.00000 |
| 272 | GPS8 | -0.00368 | 0.00120 |
| 273 | GPS8 | -0.00403 | 0.00034 |
| 274 | GPS8 | -0.00436 | 0.00032 |
| 275 | GPS8 | -0.00320 | 0.00029 |
| 276 | GPS8 | -0.00230 | 0.00035 |
| 277 | GPS8 | -0.00147 | 0.00035 |
| 278 | GPS8 | -0.00233 | 0.00028 |
| 279 | GPS8 | -0.00562 | 0.00031 |
| 280 | GPS8 | -0.00542 | 0.00033 |
| 281 | GPS8 | -0.00461 | 0.00031 |
| 282 | GPS8 | -0.00283 | 0.00031 |
| 283 | GPS8 | -0.00331 | 0.00034 |
| 284 | GPS8 | -0.00314 | 0.00036 |
| 285 | GPS8 | -0.00016 | 0.00080 |
| 286 | GPS8 | 0.00000  | 0.00000 |
| 287 | GPS8 | 0.00000  | 0.00000 |
| 288 | GPS9 | 0.00000  | 0.00000 |
| 289 | GPS9 | -0.97454 | 0.43138 |

|     |      |          |         |
|-----|------|----------|---------|
| 290 | GPS9 | 0.00010  | 0.00040 |
| 291 | GPS9 | -0.00329 | 0.00033 |
| 292 | GPS9 | -0.00331 | 0.00030 |
| 293 | GPS9 | 0.00208  | 0.00037 |
| 294 | GPS9 | -0.00384 | 0.00036 |
| 295 | GPS9 | -0.00315 | 0.00032 |
| 296 | GPS9 | -0.00125 | 0.00046 |
| 297 | GPS9 | 0.18685  | 0.02098 |
| 298 | GPS9 | 0.00000  | 0.00000 |
| 299 | GPS9 | 0.00000  | 0.00000 |
| 300 | GPS9 | 0.00000  | 0.00000 |
| 301 | GPS9 | 0.00000  | 0.00000 |
| 302 | GPS9 | 0.00000  | 0.00000 |
| 303 | GPS9 | 0.00000  | 0.00000 |
| 304 | GPS9 | 0.00000  | 0.00000 |
| 305 | GPS9 | 0.00000  | 0.00000 |
| 306 | GPS9 | 0.00000  | 0.00000 |
| 307 | GPS9 | 0.00000  | 0.00000 |
| 308 | GPS9 | 0.00000  | 0.00000 |
| 309 | GPS9 | 0.00000  | 0.00000 |
| 310 | GPS9 | 0.00000  | 0.00000 |
| 311 | GPS9 | 0.00000  | 0.00000 |
| 312 | GPS9 | 0.00000  | 0.00000 |
| 313 | GPS9 | 0.01542  | 0.00442 |
| 314 | GPS9 | -0.00270 | 0.00037 |
| 315 | GPS9 | -0.00340 | 0.00033 |
| 316 | GPS9 | -0.00312 | 0.00030 |
| 317 | GPS9 | -0.00053 | 0.00036 |
| 318 | GPS9 | -0.00067 | 0.00036 |
| 319 | GPS9 | -0.00247 | 0.00029 |
| 320 | GPS9 | -0.00514 | 0.00032 |
| 321 | GPS9 | -0.00398 | 0.00033 |
| 322 | GPS9 | -0.00382 | 0.00032 |
| 323 | GPS9 | -0.00010 | 0.00032 |
| 324 | GPS9 | -0.00187 | 0.00035 |
| 325 | GPS9 | -0.00195 | 0.00046 |
| 326 | GPS9 | 0.00000  | 0.00000 |
| 327 | GPS9 | 0.00000  | 0.00000 |
| 328 | GPS9 | 0.00000  | 0.00000 |
| 329 | GP13 | 0.00000  | 0.00000 |
| 330 | GP13 | -1.09385 | 0.43193 |
| 331 | GP13 | -0.00173 | 0.00042 |
| 332 | GP13 | -0.00447 | 0.00034 |
| 333 | GP13 | -0.00250 | 0.00029 |
| 334 | GP13 | -0.00172 | 0.00036 |
| 335 | GP13 | -0.00234 | 0.00035 |
| 336 | GP13 | -0.00244 | 0.00031 |
| 337 | GP13 | -0.00495 | 0.00032 |
| 338 | GP13 | -0.00202 | 0.00033 |
| 339 | GP13 | -0.00423 | 0.00031 |
| 340 | GP13 | -0.00155 | 0.00031 |
| 341 | GP13 | -0.00302 | 0.00032 |
| 342 | GP13 | -0.00261 | 0.00033 |



|    |   |     |     |     |     |     |     |     |     |     |     |
|----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 4  | L | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
|    | H | 0.5 | 0.6 | 0.6 | 0.5 | 0.5 | 0.5 | 0.6 | 0.5 | 0.5 | 0.5 |
|    | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 5  | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
|    | H | 0.4 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.5 | 0.4 | 0.4 | 0.4 |
|    | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 6  | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
|    | H | 0.4 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.5 | 0.4 | 0.4 | 0.4 |
|    | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 7  | L | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
|    | H | 0.5 | 0.6 | 0.6 | 0.6 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
|    | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 8  | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
|    | H | 0.4 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.5 | 0.4 | 0.4 | 0.4 |
|    | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 9  | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
|    | H | 0.4 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.5 | 0.4 | 0.4 | 0.4 |
|    | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| 10 | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
|    | H | 0.4 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.5 | 0.4 | 0.4 | 0.4 |

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PROGRAM GPSEST 21-DEC-05 14:04  
BERNESE GPS SOFTWARE VERSION 5.0

SLOPE DISTANCES AND RMS ERRORS IN M (PART 1):

| NUM |     | 2 N       | 3 N       | 4 N       | 5 N       | 6 N       | 7 N       | 8 N       | 9 N       |
|-----|-----|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1   | O   | 1355.8621 | 1006.1927 | 643.4483  | 1131.6197 | 1264.8248 | 1482.9925 | 1594.5013 | 2343.5952 |
|     | N   | 1355.8615 | 1006.1915 | 643.4482  | 1131.6227 | 1264.8253 | 1482.9936 | 1594.5027 | 2343.5966 |
|     | RMS | 0.0000    | 0.0001    | 0.0001    | 0.0001    | 0.0000    | 0.0000    | 0.0000    | 0.0000    |
| 2   | O   |           | 1609.8487 | 1856.9241 | 1477.3558 | 2436.7239 | 2811.6728 | 2949.4962 | 3649.8847 |
|     | N   |           | 1609.8469 | 1856.9245 | 1477.3555 | 2436.7233 | 2811.6732 | 2949.4970 | 3649.8854 |
|     | RMS |           | 0.0001    | 0.0001    | 0.0000    | 0.0000    | 0.0001    | 0.0000    | 0.0000    |
| 3   | O   |           |           | 756.3239  | 2094.2040 | 2126.8432 | 2073.0479 | 1924.5782 | 2914.4348 |
|     | N   |           |           | 756.3256  | 2094.2052 | 2126.8432 | 2073.0487 | 1924.5800 | 2914.4358 |
|     | RMS |           |           | 0.0001    | 0.0001    | 0.0000    | 0.0001    | 0.0000    | 0.0000    |
| 4   | O   |           |           |           | 1734.6515 | 1418.6646 | 1317.4851 | 1216.2397 | 2165.8769 |

|  |   |  |     |  |           |           |           |           |           |
|--|---|--|-----|--|-----------|-----------|-----------|-----------|-----------|
|  | N |  | N   |  | 1734.6539 | 1418.6636 | 1317.4841 | 1216.2396 | 2165.8760 |
|  |   |  | RMS |  | 0.0001    | 0.0001    | 0.0000    | 0.0000    | 0.0000    |
|  | 5 |  | O   |  |           | 1284.5638 | 1894.7505 | 2256.0687 | 2571.6088 |
|  | N |  | N   |  |           | 1284.5660 | 1894.7541 | 2256.0725 | 2571.6127 |
|  |   |  | RMS |  |           | 0.0000    | 0.0001    | 0.0000    | 0.0000    |
|  | 6 |  | O   |  |           |           | 683.0097  | 1157.8153 | 1290.2791 |
|  | N |  | N   |  |           |           | 683.0109  | 1157.8163 | 1290.2807 |
|  |   |  | RMS |  |           |           | 0.0001    | 0.0001    | 0.0000    |
|  | 7 |  | O   |  |           |           |           | 511.2571  | 868.5756  |
|  | N |  | N   |  |           |           |           | 511.2568  | 868.5758  |
|  |   |  | RMS |  |           |           |           | 0.0001    | 0.0000    |
|  | 8 |  | O   |  |           |           |           |           | 1057.9154 |
|  | N |  | N   |  |           |           |           |           | 1057.9147 |
|  |   |  | RMS |  |           |           |           |           | 0.0000    |
|  | 9 |  | O   |  |           |           |           |           |           |
|  | N |  | N   |  |           |           |           |           |           |
|  |   |  | RMS |  |           |           |           |           |           |

1\${P}/OLKI05S  
OLKI05S

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SLOPE DISTANCES AND RMS ERRORS IN M (PART 1): CONTINUATION

| NUM |     | 10 N      |
|-----|-----|-----------|
| 1   | O   | 2407.0274 |
| N   | N   | 2407.0278 |
|     | RMS | 0.0000    |
| 2   | O   | 3597.9093 |
| N   | N   | 3597.9079 |
|     | RMS | 0.0000    |
| 3   | O   | 3159.4226 |
| N   | N   | 3159.4239 |
|     | RMS | 0.0000    |
| 4   | O   | 2406.3255 |
| N   | N   | 2406.3253 |
|     | RMS | 0.0000    |
| 5   | O   | 2326.7292 |



|  |   |  |     |  |           |  |
|--|---|--|-----|--|-----------|--|
|  | N |  | N   |  | 2326.7291 |  |
|  |   |  | RMS |  | 0.0000    |  |
|  |   |  |     |  |           |  |
|  | 6 |  | O   |  | 1166.0248 |  |
|  | N |  | N   |  | 1166.0242 |  |
|  |   |  | RMS |  | 0.0000    |  |
|  |   |  |     |  |           |  |
|  | 7 |  | O   |  | 1126.4117 |  |
|  | N |  | N   |  | 1126.4134 |  |
|  |   |  | RMS |  | 0.0001    |  |
|  |   |  |     |  |           |  |
|  | 8 |  | O   |  | 1520.6870 |  |
|  | N |  | N   |  | 1520.6895 |  |
|  |   |  | RMS |  | 0.0000    |  |
|  |   |  |     |  |           |  |
|  | 9 |  | O   |  | 665.0354  |  |
|  | N |  | N   |  | 665.0409  |  |
|  |   |  | RMS |  | 0.0001    |  |

-----

## Appendix IV. Results of the first measurements of GPS11 and GPS12 stations at Oikiluoto in 2005.

```

=====
Program : GPSEST Bernese GPS Software Version 5.0
Purpose : Parameter estimation
Campaign: ${P}/OL05KU Default session: 1010 year 2005
Date : 07-Mar-2006 14:03 User name : ja
=====

```

OL05KU

```

1${P}/OL05KU PROGRAM GPSEST 07-MAR-06 14:03
OL05KU BERNESE GPS SOFTWARE VERSION 5.0

```

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  11. PARAMETER CHARACTERIZATION LIST
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  13. RESULTS (PART 1)
  14. RESULTS (PART 2)

```

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```

### INPUT AND OUTPUT FILENAMES

-----

```

Session table : ${P}/OL05KU\STA\SESSIONS.SES

```

```

General constants : ${X}/GEN\CONST.
Geodetic datum : ${X}/GEN\DATUM.
Station information : ${P}/OL05KU\STA\OL05KU.STA
Earth rotation parameters : ${P}/OL05KU\ORB\C04_2005.ERP
Subdaily pole model : ${X}/GEN\IERS2000.SUB
Nutation model : ${X}/GEN\IAU2000.NUT
Satellite information : ${X}/GEN\SATELLIT.
Receiver information : ${X}/GEN\RECEIVER.
Satellite problems : ${X}/GEN\SAT_2005.CRX
Phase center eccentricities : ${X}/GEN\PHAS_IGS.REL
SINEX general input file : ${X}/GEN\SINEX.
IONEX control file : ${X}/GEN\IONEX.
Difference GPS-UTC : ---
A priori station coordinates: ${P}/OL05KU\STA\OLKIU.CRD
GNSS standard orbits : ${P}/OL05KU\ORB\OL05KU.STD
GNSS orbit partials : ---
Ionosphere models : ---
Troposphere estimates : ---
Station sigma factors : ---
Station eccentricities : ---
Ocean loading tables : ---
GNSS clock corrections : ---
Differential code biases : ---
Receiver antenna orientation: ---
Kinematic coordinates : ---
Kinematic velocities : ---
Standard orbit(s) : ---
Orbit partials : ---
Attitude data : ---
Precise orbit(s) : ---
LEO orbital elements : ---
Station coordinates : ${P}/OL05KU\STA\TOL05KU.CRD
GNSS orbital elements : ---
Troposphere estimates : ---
Troposphere SINEX : ---
Ionosphere models : ---
IONEX : ---
Residuals : ---
Coordinate covariance matrix: ---
Full covariance matrix : ---
Normal equations : ---
Bernese ERP file : ---
IERS ERP file : ---
GNSS clock corrections : ---
Clock RINEX : ---
Kinematic coordinates : ---
Differential code biases : ---
Phase center variations (gri: ---
Phase center variations (har: ---
Scratch file : ${U}/WORK\GPSEST.SCR
Scratch files : ${U}/WORK\GPSEST.SC1
Program output : ${P}/OL05KU\OUT\GPSEST.L08
Error message : ${U}/WORK\ERROR.MSG

```

1\${P}/OL05KU  
OL05KU

PROGRAM GPSEST 07-MAR-06 14:03  
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1. CAMPAIGNS

| CAMPAIGN NAME | NUM | STATION NAME | NUM  | STATION NAME | NUM  | STATION NAME | NUM | STATION NAME | NUM | STATION NAME |
|---------------|-----|--------------|------|--------------|------|--------------|-----|--------------|-----|--------------|
| -----         |     |              |      |              |      |              |     |              |     |              |
| \${P}/OL05KU  | :   | 1            | GPS1 | 2            | GP11 |              |     |              |     |              |

2. OBSERVATION FILES

-----  
\${P}/OL05KU  
-----

MAIN CHARACTERISTICS:

| FILE  | OBSERVATION FILE HEADER       | OBSERVATION FILE              | SESS | RECEIVER 1     | RECEIVER 2    |
|-------|-------------------------------|-------------------------------|------|----------------|---------------|
| ----- |                               |                               |      |                |               |
| 1     | \${P}/OL05KU\OBS\01110990.PSH | \${P}/OL05KU\OBS\01110990.PSO | 0990 | ASHTECH Z-XII3 | ASHTECH Z-XII |
| 2     | \${P}/OL05KU\OBS\01111000.PSH | \${P}/OL05KU\OBS\01111000.PSO | 1000 | ASHTECH Z-XII3 | ASHTECH Z-XII |
| 3     | \${P}/OL05KU\OBS\01111010.PSH | \${P}/OL05KU\OBS\01111010.PSO | 1010 | ASHTECH Z-XII3 | ASHTECH Z-XII |

| FILE  | TYP | FREQ. | STATION 1 | STATION 2 | SESS | FIRST   | OBSERV.TIME | #EPO | DT | #EF | #CLK | ARC | #SAT | AMB.I.+S. |    |      | #CLUSTERS |    |    |    |    |   |
|-------|-----|-------|-----------|-----------|------|---------|-------------|------|----|-----|------|-----|------|-----------|----|------|-----------|----|----|----|----|---|
|       |     |       |           |           |      |         |             |      |    |     |      |     |      | W         | 12 | #AMB | L1        | L2 | L5 | RM |    |   |
| ----- |     |       |           |           |      |         |             |      |    |     |      |     |      |           |    |      |           |    |    |    |    |   |
| 1     | P   | L3    | GPS1      | GP11      | 0990 | 5-04-09 | 15:28:30    | 1023 | 30 | 0   | E    | E   | 1    | 24        | N  | Y    | Y         | 25 | 7  | 7  | 25 | 0 |
| 2     | P   | L3    | GPS1      | GP11      | 1000 | 5-04-10 | 0:00:30     | 2879 | 30 | 0   | E    | E   | 1    | 28        | N  | Y    | Y         | 74 | 26 | 26 | 74 | 0 |
| 3     | P   | L3    | GPS1      | GP11      | 1010 | 5-04-11 | 0:00:30     | 1635 | 30 | 0   | E    | E   | 1    | 28        | N  | Y    | Y         | 47 | 18 | 18 | 47 | 0 |

SATELLITES:

| FILE  | #SAT | SATELLITES |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |
|-------|------|------------|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|--|
| ----- |      |            |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |
| 1     | 24   | 2          | 3 | 4 | 5 | 6 | 8 | 9 | 10 | 11 | 13 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 26 | 27 | 28 | 29 | 31 |    |    |    |    |  |  |  |  |
| 2     | 28   | 1          | 2 | 3 | 4 | 5 | 6 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |  |  |  |  |

3 28 1 2 3 4 5 6 8 9 10 11 13 14 15 16 18 19 20 21 22 23 24 25 26 27 28 29 30 31

## OBSERVATION SELECTION:

-----  
 SAMPLING RATE : 30 SEC  
 ELEVATION CUT-OFF ANGLE : 20 DEGREES  
 SATELLITE SYSTEM : GPS  
 SPECIAL DATA SELECTION : NO

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 BERNESE GPS SOFTWARE VERSION 5.0

## 3. GENERAL OPTIONS

-----  
 TIDAL CORRECTION OF STATION COORDINATES : IERS CONVENTIONS 2000

## A PRIORI SIGMA OF UNIT WEIGHT:

-----  
 A PRIORI SIGMA OF UNIT WEIGHT : 0.001 M (SIGMA OF ONE-WAY L1 PHASE OBSERVABLE AT ZENITH)

MODEL FOR ELEVATION-DEPENDENT WEIGHTING : 1/COS(Z)

## CORRELATIONS AND SESSIONS:

-----  
 STRATEGY : CORRELATIONS WITHIN BASELINE

## AMBIGUITY RESOLUTION STRATEGY:

-----  
 AMBIGUITIES PRE-ELIMINATED EVERY 30 SECONDS

## SYNCHRONIZATION ERRORS:

-----  
 STRATEGY : SYNCHRONIZATION ERRORS NOT APPLIED

## 4. STATIONS

-----  
 Local geodetic datum: \${X}/GEN\DATUM.

```

Datum name Ell. param./ Scale Shifts to WGS-84 Rotations to WGS-84

WGS - 84 A = 6378137.000 m DX = 0.0000 m RX = 0.00000 arcsec
 1/F= 298.2572236 DY = 0.0000 m RY = 0.00000 arcsec
 SC = 0.00000D+00 DZ = 0.0000 m RZ = 0.00000 arcsec

```

A priori station coordinates:           \${P}/OL05KU\STA\OLKIU.CRD

```

 A priori station coordinates A priori station coordinates
 WGS-84 Ellipsoidal in local geodetic datum

num Station name obs e/f/h X (m) Y (m) Z (m) Latitude Longitude Height (m)

 1 GPS1 Y ESTIM 2863210.2855 1126271.3627 5568267.2028 61 14 22.748766 21 28 21.624778 30.5343
 2 GP11 Y ESTIM 2859164.4451 1133699.2391 5568849.3287 61 15 1.096558 21 37 44.500394 43.1905

```

A priori sigma:

```

 Station coordinates a priori sigma
 in local geodetic datum

num Station name N (m) E (m) U (m)

 1 GPS1 0.00001 0.00001 0.00001

```

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5. SATELLITE ORBITS

ARC CHARACTERISTICS:

```

ARC START OF ARC END OF ARC SOURCE #SAT SATELLITES

 1 05-04-09 00:00:00 05-04-12 00:00:00 PR2005.101 29
 1 2 3 4 5 6 7 8 9 10 11 13 14 15 16 18 19 20
 21 22 23 24 25 26 27 28 29 30 31

```

OSCULATING ELEMENTS:

\${P}/OL05KU\ORB\OL05KU.STD

REFERENCE SYSTEM: J2000.0

REFERENCE EPOCH : 53469.6447917 MJD (2005 4 9 15 28 30.00)

| SAT | S.MAJ.AXIS | ECCENTRIC. | INCLINAT. | NODE        | PERIGEE     | M. ANOMALY  | PER.PASS.TIME |
|-----|------------|------------|-----------|-------------|-------------|-------------|---------------|
| 1   | 26559437.4 | 0.00594059 | 56.375246 | 41.268871   | 265.586121  | -135.782759 | 53469.8328392 |
| 2   | 26559591.3 | 0.00957743 | 54.699438 | -80.439963  | 103.458771  | -44.354370  | 53469.7062192 |
| 3   | 26560054.1 | 0.00673649 | 53.134786 | -145.255602 | 34.890537   | -98.912824  | 53469.7817823 |
| 4   | 26558059.0 | 0.00701396 | 54.678710 | -79.294303  | 2.088431    | 92.890864   | 53469.5161558 |
| 5   | 26559197.7 | 0.00596863 | 53.681776 | 155.081085  | 53.594619   | 78.862240   | 53469.5355757 |
| 6   | 26559767.4 | 0.00631965 | 53.563007 | -142.078328 | -110.786267 | 148.269334  | 53469.4394475 |
| 7   | 26562498.1 | 0.01311349 | 53.656790 | -143.640639 | 256.356947  | -87.075618  | 53469.7654048 |
| 8   | 26560244.2 | 0.00917722 | 55.468217 | 101.604983  | -214.618729 | 153.534349  | 53469.4321500 |
| 9   | 26561740.2 | 0.01653589 | 54.738548 | 97.396892   | -294.996596 | 128.326910  | 53469.4670467 |
| 10  | 26561528.7 | 0.00662971 | 56.034940 | -19.473948  | 19.353639   | -23.997664  | 53469.6780303 |
| 11  | 26561724.8 | 0.00405873 | 51.663067 | -87.516091  | 13.845383   | -179.385368 | 53469.8932572 |
| 13  | 26561912.4 | 0.00256135 | 56.616910 | 40.358810   | 52.150139   | -20.821450  | 53469.6736316 |
| 14  | 26562371.4 | 0.00173827 | 56.292582 | 39.730934   | 256.427680  | -89.729310  | 53469.7690797 |
| 15  | 26557844.1 | 0.00908528 | 55.083154 | -76.163944  | -224.068754 | 146.968827  | 53469.4412707 |
| 16  | 26562709.8 | 0.00278619 | 55.108690 | 159.686029  | -65.638531  | 74.400652   | 53469.5417341 |
| 18  | 26559427.0 | 0.00566829 | 55.110138 | -17.874466  | -161.635266 | 59.144506   | 53469.5628816 |
| 19  | 26558450.2 | 0.00312012 | 54.970505 | -137.321631 | -97.873634  | 6.298531    | 53469.6360692 |
| 20  | 26560121.6 | 0.00256296 | 55.094535 | -20.887061  | 79.473386   | 42.479039   | 53469.5859595 |
| 21  | 26560418.0 | 0.00967382 | 54.313515 | -77.988934  | -180.412669 | 140.844630  | 53469.4497231 |
| 22  | 26560322.9 | 0.00479884 | 54.964990 | -17.353917  | -85.199301  | -44.490042  | 53469.7064097 |
| 23  | 26559676.2 | 0.00376866 | 55.268918 | 39.368119   | 128.301522  | -69.303927  | 53469.7407730 |
| 24  | 26559512.4 | 0.00866094 | 55.268332 | -77.589526  | 292.791996  | -160.860242 | 53469.8675703 |
| 25  | 26558745.2 | 0.01211479 | 54.348694 | 94.422871   | -84.656743  | 174.692202  | 53469.4028673 |
| 26  | 26557185.7 | 0.01632525 | 56.515408 | 40.465941   | 38.697815   | -129.525885 | 53469.8241512 |
| 27  | 26560557.9 | 0.01907391 | 54.608873 | 96.134390   | -117.367010 | 82.143425   | 53469.5310228 |
| 28  | 26559507.6 | 0.01001165 | 54.992931 | 160.269223  | -133.564008 | 8.428847    | 53469.6331184 |
| 29  | 26557856.3 | 0.00873900 | 56.335728 | 38.550643   | -65.928490  | -8.539306   | 53469.6566168 |
| 30  | 26559289.5 | 0.00792639 | 54.070347 | 157.578848  | 72.557046   | 26.460907   | 53469.6081459 |
| 31  | 26561784.9 | 0.01212769 | 53.626758 | -143.709035 | -296.826263 | 122.901085  | 53469.4745616 |

SATELLITE PROBLEMS:

| SAT | PROBLEM TYPE   | ACTION       | FROM              | TO                |
|-----|----------------|--------------|-------------------|-------------------|
| 118 | BAD PHASE+CODE | OBS. REMOVED | 05-04-07 00:00:00 | 05-05-04 23:59:59 |

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6. ATMOSPHERE





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8. POLE COORDINATES AND TIME INFORMATION

A PRIORI POLE AND TIME INFORMATION FROM THE POLE FILE:

| DATUM    | TIME     | X-POLE (")<br>EP-CPO (") | Y-POLE (")<br>PS-CPO (") | UT1-UTC (S) | GPS-UTC (S) | RMS XP (")<br>RMS EP (") | RMS YP (")<br>RMS PS (") | RMS DT (S) |
|----------|----------|--------------------------|--------------------------|-------------|-------------|--------------------------|--------------------------|------------|
| 05-04-09 | 00:00:00 | -0.03843<br>0.00000      | 0.25215<br>0.00000       | -0.579769   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-04-10 | 00:00:00 | -0.04059<br>0.00000      | 0.25379<br>0.00000       | -0.580836   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-04-11 | 00:00:00 | -0.04252<br>0.00000      | 0.25514<br>0.00000       | -0.581604   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-04-12 | 00:00:00 | -0.04414<br>0.00000      | 0.25667<br>0.00000       | -0.582070   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |

NUTATION MODEL: IAU2000  
SUBDAILY POLE MODEL: IERS2000

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12. TEST OUTPUT

MIN. AND MAX. ELEVATION/NADIR ANGLES AND MAX. SYNCHRONIZATION ERRORS:

| SESS | FILE | STATION NAME 1 | STATION NAME 2 | MIN/MAX ELEV. | MIN/MAX NADIR | SYNCH. ERR. (NS) |
|------|------|----------------|----------------|---------------|---------------|------------------|
| 0001 | 1    | GPS1           | GP11           | 20.0 83.2     | 1.6 13.2      | 0.0              |
| 0002 | 2    | GPS1           | GP11           | 20.0 83.2     | 1.6 13.2      | 0.0              |
| 0003 | 3    | GPS1           | GP11           | 20.0 79.9     | 2.4 13.2      | 0.0              |

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## 13. RESULTS (PART 1)

## NUMBER OF PARAMETERS (PART 1):

| PARAMETER TYPE                       | #PARAMETERS | #PRE-ELIMINATED | #SET-UP | #NO-OBS | #REF | #SINGULAR |
|--------------------------------------|-------------|-----------------|---------|---------|------|-----------|
| STATION COORDINATES                  | 6           | 0               | 6       | 0       | 0    | 0         |
| AMBIGUITIES                          | 5           | 5 (BEFORE INV)  | 51      | 46      | 0    | 2         |
| SITE-SPECIFIC TROPOSPHERE PARAMETERS | 25          | 0               | 25      | 0       | 0    | 0         |
| TOTAL NUMBER OF PARAMETERS           | 36          | 5               | 82      | 46      | 0    | 2         |

## NUMBER OF OBSERVATIONS (PART 1):

| TYPE                         | FREQUENCY | FILE | #OBSERVATIONS |
|------------------------------|-----------|------|---------------|
| PHASE                        | L3        | ALL  | 27853         |
| TOTAL NUMBER OF OBSERVATIONS |           |      | 27853         |

## A POSTERIORI SIGMA OF UNIT WEIGHT (PART 1):

A POSTERIORI SIGMA OF UNIT WEIGHT : 0.0009 M (SIGMA OF ONE-WAY L1 PHASE OBSERVABLE AT ZENITH)

DEGREE OF FREEDOM (DOF) : 27819

CHI\*\*2/DOF : 0.81

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## STATION COORDINATES: \${P}/OL05KU\STA\TOL05KU.CRD

| NUM | STATION NAME | PARAMETER | A PRIORI VALUE | NEW VALUE    | NEW- A PRIORI | RMS ERROR | 3-D ELLIPSOID | 2-D ELLIPSE |
|-----|--------------|-----------|----------------|--------------|---------------|-----------|---------------|-------------|
| 1   | GPS1         | X         | 2863210.2855   | 2863210.2855 | 0.0000        | 0.0000    |               |             |
|     |              | Y         | 1126271.3627   | 1126271.3627 | 0.0000        | 0.0000    |               |             |

|   |           |                 |                 |         |        |        |      |        |      |  |
|---|-----------|-----------------|-----------------|---------|--------|--------|------|--------|------|--|
|   | Z         | 5568267.2028    | 5568267.2028    | 0.0000  | 0.0000 |        |      |        |      |  |
|   | HEIGHT    | 30.5343         | 30.5343         | 0.0000  | 0.0000 | 0.0000 | 0.0  |        |      |  |
|   | LATITUDE  | 61 14 22.748766 | 61 14 22.748766 | 0.0000  | 0.0000 | 0.0000 | 90.0 | 0.0000 | 90.0 |  |
|   | LONGITUDE | 21 28 21.624778 | 21 28 21.624778 | 0.0000  | 0.0000 | 0.0000 | 0.0  | 0.0000 |      |  |
| 2 | GP11      |                 |                 |         |        |        |      |        |      |  |
|   | X         | 2859164.4451    | 2859164.4558    | 0.0107  | 0.0003 |        |      |        |      |  |
|   | Y         | 1133699.2391    | 1133699.2423    | 0.0032  | 0.0001 |        |      |        |      |  |
|   | Z         | 5568849.3287    | 5568849.3505    | 0.0218  | 0.0006 |        |      |        |      |  |
|   | HEIGHT    | 43.1905         | 43.2150         | 0.0244  | 0.0007 | 0.0007 | 0.6  |        |      |  |
|   | LATITUDE  | 61 15 1.096558  | 61 15 1.096582  | 0.0007  | 0.0001 | 0.0001 | 89.9 | 0.0001 | 90.1 |  |
|   | LONGITUDE | 21 37 44.500394 | 21 37 44.500328 | -0.0010 | 0.0001 | 0.0001 | -0.2 | 0.0001 |      |  |

1\$(P)/OL05KU  
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PROGRAM GPSEST 07-MAR-06 14:03  
BERNESE GPS SOFTWARE VERSION 5.0

-----  
SITE-SPECIFIC TROPOSPHERE PARAMETERS: (NOT SAVED)  
-----

| REQU. | STATION NAME | CORRECTIONS (M) |      |          | RMS ERRORS (M) |      |         | ZENITH VECTOR (") |     |       |     | ERROR ELLIPSE (M) |         |     |
|-------|--------------|-----------------|------|----------|----------------|------|---------|-------------------|-----|-------|-----|-------------------|---------|-----|
|       |              | NORTH           | EAST | ZENITH   | NORTH          | EAST | ZENITH  | ANGLE             | RMS | RATIO | AZI | MAX RMS           | MIN RMS | AZI |
| 1     | GP11         |                 |      | -0.03953 |                |      | 0.01111 |                   |     |       |     |                   |         |     |
| 2     | GP11         |                 |      | -0.00535 |                |      | 0.00070 |                   |     |       |     |                   |         |     |
| 3     | GP11         |                 |      | -0.01005 |                |      | 0.00055 |                   |     |       |     |                   |         |     |
| 4     | GP11         |                 |      | -0.00683 |                |      | 0.00058 |                   |     |       |     |                   |         |     |
| 5     | GP11         |                 |      | -0.00979 |                |      | 0.00052 |                   |     |       |     |                   |         |     |
| 6     | GP11         |                 |      | -0.00761 |                |      | 0.00053 |                   |     |       |     |                   |         |     |
| 7     | GP11         |                 |      | -0.00895 |                |      | 0.00051 |                   |     |       |     |                   |         |     |
| 8     | GP11         |                 |      | -0.00651 |                |      | 0.00063 |                   |     |       |     |                   |         |     |
| 9     | GP11         |                 |      | -0.00943 |                |      | 0.00061 |                   |     |       |     |                   |         |     |
| 10    | GP11         |                 |      | -0.00773 |                |      | 0.00051 |                   |     |       |     |                   |         |     |
| 11    | GP11         |                 |      | -0.00683 |                |      | 0.00070 |                   |     |       |     |                   |         |     |
| 12    | GP11         |                 |      | -0.00672 |                |      | 0.00099 |                   |     |       |     |                   |         |     |
| 13    | GP11         |                 |      | -0.01163 |                |      | 0.00057 |                   |     |       |     |                   |         |     |
| 14    | GP11         |                 |      | -0.00757 |                |      | 0.00057 |                   |     |       |     |                   |         |     |
| 15    | GP11         |                 |      | -0.00866 |                |      | 0.00054 |                   |     |       |     |                   |         |     |
| 16    | GP11         |                 |      | -0.00594 |                |      | 0.00058 |                   |     |       |     |                   |         |     |
| 17    | GP11         |                 |      | -0.00873 |                |      | 0.00052 |                   |     |       |     |                   |         |     |
| 18    | GP11         |                 |      | -0.00731 |                |      | 0.00052 |                   |     |       |     |                   |         |     |
| 19    | GP11         |                 |      | -0.00938 |                |      | 0.00051 |                   |     |       |     |                   |         |     |
| 20    | GP11         |                 |      | -0.00863 |                |      | 0.00063 |                   |     |       |     |                   |         |     |
| 21    | GP11         |                 |      | -0.00960 |                |      | 0.00061 |                   |     |       |     |                   |         |     |
| 22    | GP11         |                 |      | -0.00675 |                |      | 0.00050 |                   |     |       |     |                   |         |     |
| 23    | GP11         |                 |      | -0.00956 |                |      | 0.00064 |                   |     |       |     |                   |         |     |
| 24    | GP11         |                 |      | -0.00536 |                |      | 0.00057 |                   |     |       |     |                   |         |     |
| 25    | GP11         |                 |      | -0.01126 |                |      | 0.00107 |                   |     |       |     |                   |         |     |

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PROGRAM GPSEST 07-MAR-06 14:03  
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RMS ERRORS OF ELLIP. COORDINATES AND COORDINATE DIFFER. IN MM (PART 1):

| NUM |   | 1   | 2   |
|-----|---|-----|-----|
| 1   | B | 0.0 | 0.1 |
|     | L | 0.0 | 0.1 |
|     | H | 0.0 | 0.7 |
| 2   | B | 0.1 | 0.1 |
|     | L | 0.1 | 0.1 |
|     | H | 0.7 | 0.7 |

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PROGRAM GPSEST 07-MAR-06 14:03  
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SLOPE DISTANCES AND RMS ERRORS IN M (PART 1):

| NUM |     | 2 N       |
|-----|-----|-----------|
| 1   | O   | 8478.2689 |
| N   | N   | 8478.2680 |
|     | RMS | 0.0001    |



```

General constants : ${X}/GEN\CONST.
Geodetic datum : ${X}/GEN\DATUM.
Station information : ${P}/OL05SU\STA\OL05SU.STA
Earth rotation parameters : ${P}/OL05SU\ORB\C04_2005.ERP
Subdaily pole model : ${X}/GEN\IERS2000.SUB
Nutation model : ${X}/GEN\IAU2000.NUT
Satellite information : ${X}/GEN\SATELLIT.
Receiver information : ${X}/GEN\RECEIVER.
Satellite problems : ${X}/GEN\SAT_2005.CRX
Phase center eccentricities : ${X}/GEN\PHAS_IGS.REL
SINEX general input file : ${X}/GEN\SINEX.
IONEX control file : ${X}/GEN\IONEX.
Difference GPS-UTC : ---
A priori station coordinates: ${P}/OL05SU\STA\OLKIU.CRD
GNSS standard orbits : ${P}/OL05SU\ORB\OL05SU.STD
GNSS orbit partials : ---
Ionosphere models : ---
Troposphere estimates : ---
Station sigma factors : ---
Station eccentricities : ---
Ocean loading tables : ---
GNSS clock corrections : ---
Differential code biases : ---
Receiver antenna orientation: ---
Kinematic coordinates : ---
Kinematic velocities : ---
Standard orbit(s) : ---
Orbit partials : ---
Attitude data : ---
Precise orbit(s) : ---
LEO orbital elements : ---
Station coordinates : ${P}/OL05SU\STA\TOL05SU.CRD
GNSS orbital elements : ---
Troposphere estimates : ---
Troposphere SINEX : ---
Ionosphere models : ---
IONEX : ---
Residuals : ---
Coordinate covariance matrix: ---
Full covariance matrix : ---
Normal equations : ---
Bernese ERP file : ---
IERS ERP file : ---
GNSS clock corrections : ---
Clock RINEX : ---
Kinematic coordinates : ---
Differential code biases : ---
Phase center variations (gri: ---
Phase center variations (har: ---
Scratch file : ${U}/WORK\GPSEST.SCR
Scratch files : ${U}/WORK\GPSEST.SC1
Program output : ${P}/OL05SU\OUT\GPSEST.L12
Error message : ${U}/WORK\ERROR.MSG

```

1\${P}/OL05SU  
OL05SU

PROGRAM GPSEST 07-MAR-06 12:34  
BERNESE GPS SOFTWARE VERSION 5.0

1. CAMPAIGNS

| CAMPAIGN NAME | NUM | STATION NAME | NUM  | STATION NAME | NUM  | STATION NAME | NUM  | STATION NAME | NUM | STATION NAME |
|---------------|-----|--------------|------|--------------|------|--------------|------|--------------|-----|--------------|
| -----         |     |              |      |              |      |              |      |              |     |              |
| \${P}/OL05SU  | :   | 1            | GPS1 | 2            | GP11 | 3            | GP12 |              |     |              |

2. OBSERVATION FILES

-----  
\${P}/OL05SU  
-----

MAIN CHARACTERISTICS:

| FILE | OBSERVATION FILE HEADER       | OBSERVATION FILE              | SESS | RECEIVER 1     | RECEIVER 2    |
|------|-------------------------------|-------------------------------|------|----------------|---------------|
| 1    | \${P}/OL05SU\OBS\01112770.PSH | \${P}/OL05SU\OBS\01112770.PSO | 2770 | ASHTECH Z-XII3 | ASHTECH UZ-12 |
| 2    | \${P}/OL05SU\OBS\01112780.PSH | \${P}/OL05SU\OBS\01112780.PSO | 2780 | ASHTECH Z-XII3 | ASHTECH UZ-12 |
| 3    | \${P}/OL05SU\OBS\01112790.PSH | \${P}/OL05SU\OBS\01112790.PSO | 2790 | ASHTECH Z-XII3 | ASHTECH UZ-12 |
| 4    | \${P}/OL05SU\OBS\01112800.PSH | \${P}/OL05SU\OBS\01112800.PSO | 2800 | ASHTECH Z-XII3 | ASHTECH UZ-12 |
| 5    | \${P}/OL05SU\OBS\01122770.PSH | \${P}/OL05SU\OBS\01122770.PSO | 2770 | ASHTECH Z-XII3 | ASHTECH UZ-12 |
| 6    | \${P}/OL05SU\OBS\01122780.PSH | \${P}/OL05SU\OBS\01122780.PSO | 2780 | ASHTECH Z-XII3 | ASHTECH UZ-12 |
| 7    | \${P}/OL05SU\OBS\01122790.PSH | \${P}/OL05SU\OBS\01122790.PSO | 2790 | ASHTECH Z-XII3 | ASHTECH UZ-12 |
| 8    | \${P}/OL05SU\OBS\01122800.PSH | \${P}/OL05SU\OBS\01122800.PSO | 2800 | ASHTECH Z-XII3 | ASHTECH UZ-12 |
| 9    | \${P}/OL05SU\OBS\11122770.PSH | \${P}/OL05SU\OBS\11122770.PSO | 2770 | ASHTECH UZ-12  | ASHTECH UZ-12 |
| 10   | \${P}/OL05SU\OBS\11122780.PSH | \${P}/OL05SU\OBS\11122780.PSO | 2780 | ASHTECH UZ-12  | ASHTECH UZ-12 |
| 11   | \${P}/OL05SU\OBS\11122790.PSH | \${P}/OL05SU\OBS\11122790.PSO | 2790 | ASHTECH UZ-12  | ASHTECH UZ-12 |
| 12   | \${P}/OL05SU\OBS\11122800.PSH | \${P}/OL05SU\OBS\11122800.PSO | 2800 | ASHTECH UZ-12  | ASHTECH UZ-12 |

| FILE | TYP | FREQ. | STATION 1 | STATION 2 | SESS | FIRST   | OBSERV.TIME | #EPO | DT | #EF | #CLK | ARC | #SAT | AMB.I.+S. |    |      | #CLUSTERS |    |    |    |    |   |
|------|-----|-------|-----------|-----------|------|---------|-------------|------|----|-----|------|-----|------|-----------|----|------|-----------|----|----|----|----|---|
|      |     |       |           |           |      |         |             |      |    |     |      |     |      | W         | 12 | #AMB | L1        | L2 | L5 | RM |    |   |
| 1    | P   | L3    | GPS1      | GP11      | 2770 | 5-10-04 | 13:58:30    | 1203 | 30 | 0   | E    | E   | 1    | 27        | N  | Y    | Y         | 37 | 15 | 15 | 37 | 0 |
| 2    | P   | L3    | GPS1      | GP11      | 2780 | 5-10-05 | 0:00:30     | 2879 | 30 | 0   | E    | E   | 1    | 28        | N  | Y    | Y         | 73 | 26 | 26 | 73 | 0 |
| 3    | P   | L3    | GPS1      | GP11      | 2790 | 5-10-06 | 0:00:30     | 2879 | 30 | 0   | E    | E   | 1    | 28        | N  | Y    | Y         | 72 | 25 | 25 | 72 | 0 |
| 4    | P   | L3    | GPS1      | GP11      | 2800 | 5-10-07 | 0:00:30     | 548  | 30 | 0   | E    | E   | 1    | 18        | N  | Y    | Y         | 18 | 6  | 6  | 18 | 0 |

|    |   |    |      |      |      |         |          |      |    |   |   |   |   |    |   |   |   |    |    |    |    |   |
|----|---|----|------|------|------|---------|----------|------|----|---|---|---|---|----|---|---|---|----|----|----|----|---|
| 5  | P | L3 | GPS1 | GP12 | 2770 | 5-10-04 | 11:46:30 | 1467 | 30 | 0 | E | E | 1 | 28 | N | Y | Y | 46 | 21 | 21 | 46 | 0 |
| 6  | P | L3 | GPS1 | GP12 | 2780 | 5-10-05 | 0:00:30  | 2879 | 30 | 0 | E | E | 1 | 28 | N | Y | Y | 79 | 32 | 32 | 79 | 0 |
| 7  | P | L3 | GPS1 | GP12 | 2790 | 5-10-06 | 0:00:30  | 2879 | 30 | 0 | E | E | 1 | 28 | N | Y | Y | 74 | 27 | 27 | 74 | 0 |
| 8  | P | L3 | GPS1 | GP12 | 2800 | 5-10-07 | 0:00:30  | 693  | 30 | 0 | E | E | 1 | 22 | N | Y | Y | 24 | 10 | 10 | 24 | 0 |
| 9  | P | L3 | GP11 | GP12 | 2770 | 5-10-04 | 13:58:30 | 1203 | 30 | 0 | E | E | 1 | 28 | N | Y | Y | 32 | 10 | 10 | 32 | 0 |
| 10 | P | L3 | GP11 | GP12 | 2780 | 5-10-05 | 0:00:00  | 2880 | 30 | 0 | E | E | 1 | 28 | N | Y | Y | 67 | 21 | 21 | 67 | 0 |
| 11 | P | L3 | GP11 | GP12 | 2790 | 5-10-06 | 0:00:00  | 2880 | 30 | 0 | E | E | 1 | 28 | N | Y | Y | 68 | 21 | 21 | 68 | 0 |
| 12 | P | L3 | GP11 | GP12 | 2800 | 5-10-07 | 0:00:00  | 549  | 30 | 0 | E | E | 1 | 18 | N | Y | Y | 19 | 6  | 6  | 19 | 0 |

SATELLITES:

-----

FILE #SAT SATELLITES

|    |    |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1  | 27 | 1 | 2 | 3 | 4 | 5 | 6  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |    |
| 2  | 28 | 1 | 2 | 3 | 4 | 5 | 6  | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 3  | 28 | 1 | 2 | 3 | 4 | 5 | 6  | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 4  | 18 | 1 | 2 | 4 | 5 | 7 | 11 | 13 | 14 | 16 | 19 | 20 | 22 | 23 | 24 | 25 | 27 | 28 | 30 |    |    |    |    |    |    |    |    |    |    |
| 5  | 28 | 1 | 2 | 3 | 4 | 5 | 6  | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 6  | 28 | 1 | 2 | 3 | 4 | 5 | 6  | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 7  | 28 | 1 | 2 | 3 | 4 | 5 | 6  | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 8  | 22 | 1 | 2 | 4 | 5 | 6 | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 16 | 19 | 20 | 22 | 23 | 24 | 25 | 27 | 28 | 30 |    |    |    |    |    |    |
| 9  | 28 | 1 | 2 | 3 | 4 | 5 | 6  | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 10 | 28 | 1 | 2 | 3 | 4 | 5 | 6  | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 11 | 28 | 1 | 2 | 3 | 4 | 5 | 6  | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 12 | 18 | 1 | 2 | 4 | 5 | 7 | 11 | 13 | 14 | 16 | 19 | 20 | 22 | 23 | 24 | 25 | 27 | 28 | 30 |    |    |    |    |    |    |    |    |    |    |

OBSERVATION SELECTION:

-----

SAMPLING RATE : 30 SEC  
 ELEVATION CUT-OFF ANGLE : 20 DEGREES  
 SATELLITE SYSTEM : GPS  
 SPECIAL DATA SELECTION : NO

1\${P}/OL05SU  
 OL05SU

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3. GENERAL OPTIONS

-----

TIDAL CORRECTION OF STATION COORDINATES : IERS CONVENTIONS 2000

A PRIORI SIGMA OF UNIT WEIGHT:

-----



A PRIORI SIGMA OF UNIT WEIGHT : 0.001 M (SIGMA OF ONE-WAY L1 PHASE OBSERVABLE AT ZENITH)  
 MODEL FOR ELEVATION-DEPENDENT WEIGHTING : 1/COS(Z)

CORRELATIONS AND SESSIONS:  
 -----

STRATEGY : CORRELATIONS WITHIN BASELINE

AMBIGUITY RESOLUTION STRATEGY:  
 -----

AMBIGUITIES PRE-ELIMINATED EVERY 30 SECONDS

SYNCHRONIZATION ERRORS:  
 -----

STRATEGY : SYNCHRONIZATION ERRORS NOT APPLIED

4. STATIONS  
 -----

Local geodetic datum: \${X}/GEN\DATUM.

| Datum name | Ell. param./ Scale                                        | Shifts to WGS-84                                | Rotations to WGS-84                                               |
|------------|-----------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------|
| WGS - 84   | A = 6378137.000 m<br>1/F= 298.2572236<br>SC = 0.00000D+00 | DX = 0.0000 m<br>DY = 0.0000 m<br>DZ = 0.0000 m | RX = 0.00000 arcsec<br>RY = 0.00000 arcsec<br>RZ = 0.00000 arcsec |

A priori station coordinates: \${P}/OL05SU\STA\OLKIU.CRD

| num | Station name | obs e/f/h | A priori station coordinates<br>WGS-84 |              |              | A priori station coordinates<br>Ellipsoidal in local geodetic datum |                 |         | Height (m) |
|-----|--------------|-----------|----------------------------------------|--------------|--------------|---------------------------------------------------------------------|-----------------|---------|------------|
|     |              |           | X (m)                                  | Y (m)        | Z (m)        | Latitude                                                            | Longitude       |         |            |
| 1   | GPS1         | Y ESTIM   | 2863210.2855                           | 1126271.3627 | 5568267.2028 | 61 14 22.748766                                                     | 21 28 21.624778 | 30.5343 |            |
| 2   | GP11         | Y ESTIM   | 2859164.4451                           | 1133699.2391 | 5568849.3287 | 61 15 1.096558                                                      | 21 37 44.500394 | 43.1905 |            |
| 3   | GP12         | Y ESTIM   | 2861097.0631                           | 1122358.5353 | 5570120.7180 | 61 16 27.780953                                                     | 21 25 9.163734  | 21.8609 |            |

A priori sigma:

| Station coordinates a priori sigma<br>in local geodetic datum |              |       |       |
|---------------------------------------------------------------|--------------|-------|-------|
| num                                                           | Station name | N (m) | U (m) |
|                                                               |              | E (m) |       |

```

1 GPS1 0.00001 0.00001 0.00001

```

1\${P}/OL05SU  
OL05SU

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5. SATELLITE ORBITS  
-----

ARC CHARACTERISTICS:  
-----

| ARC | START OF ARC      | END OF ARC        | SOURCE     | #SAT | SATELLITES |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
|-----|-------------------|-------------------|------------|------|------------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| 1   | 05-10-04 00:00:00 | 05-10-08 00:00:00 | PR2005.280 | 30   | 1          | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |  |

OSCULATING ELEMENTS:                   \${P}/OL05SU\ORB\OL05SU.STD  
-----

REFERENCE SYSTEM: J2000.0  
REFERENCE EPOCH : 53647.4906250 MJD (2005 10 4 11 46 30.00)

| SAT | S.MAJ.AXIS | ECCENTRIC. | INCLINAT. | NODE        | PERIGEE     | M. ANOMALY  | PER.PASS.TIME |
|-----|------------|------------|-----------|-------------|-------------|-------------|---------------|
| 1   | 26561317.2 | 0.00599181 | 56.490536 | 34.330489   | -98.953047  | 123.922798  | 53647.3189843 |
| 2   | 26559795.8 | 0.00902294 | 54.562209 | -87.660314  | 110.318974  | -153.742193 | 53647.7035491 |
| 3   | 26561728.5 | 0.00729221 | 53.112826 | -152.623658 | -324.593438 | 157.102645  | 53647.2730231 |
| 4   | 26562200.0 | 0.00717509 | 54.540658 | -86.519821  | 3.187894    | -12.728094  | 53647.5082551 |
| 5   | 26562323.5 | 0.00669481 | 53.716857 | 147.819311  | 57.568056   | -34.810209  | 53647.5388420 |
| 6   | 26559293.5 | 0.00617787 | 53.537656 | -149.373522 | -107.614476 | 36.032754   | 53647.4407231 |
| 7   | 26560498.7 | 0.01337583 | 53.628959 | -150.911672 | -101.678962 | 160.411490  | 53647.2684554 |
| 8   | 26562097.8 | 0.00963747 | 55.590320 | 94.562068   | -212.300827 | 41.678061   | 53647.4328958 |
| 9   | 26558486.6 | 0.01729982 | 54.864969 | 90.203231   | 68.431028   | 19.588497   | 53647.4634981 |
| 10  | 26559848.7 | 0.00657067 | 55.935086 | -26.492273  | 20.752376   | -133.163638 | 53647.6750496 |
| 11  | 26559368.0 | 0.00461019 | 51.526558 | -95.259308  | 13.465951   | 75.682479   | 53647.3858116 |
| 13  | 26558254.8 | 0.00267326 | 56.728978 | 33.454956   | 65.664704   | -143.291929 | 53647.6890589 |
| 14  | 26558424.8 | 0.00211498 | 56.400973 | 32.777026   | -118.638476 | 174.905993  | 53647.2484090 |
| 15  | 26560063.6 | 0.00914605 | 54.944925 | -83.318751  | -216.433187 | 43.874197   | 53647.4298608 |
| 16  | 26557674.0 | 0.00288931 | 55.128090 | 152.686777  | -56.384614  | -43.472893  | 53647.5508253 |
| 17  | 26476070.5 | 0.00335970 | 55.055079 | -147.814880 | 185.725914  | -167.378357 | 53647.7213392 |
| 18  | 26560850.3 | 0.00664737 | 55.019576 | -25.047110  | 202.857357  | -47.314116  | 53647.5561562 |
| 19  | 26562548.9 | 0.00328743 | 54.941324 | -144.372286 | 274.562928  | -114.490891 | 53647.6492130 |
| 20  | 26561432.9 | 0.00248942 | 54.997220 | -28.063909  | 82.512247   | -67.647003  | 53647.5843209 |
| 21  | 26559980.2 | 0.01038353 | 54.172246 | -85.273678  | -174.329622 | 32.726416   | 53647.4453003 |



|    |      |                     |         |     |
|----|------|---------------------|---------|-----|
| 3  | GP11 | 2005 10 04 14 00 00 | 0.00000 | rel |
| 4  | GP11 | 2005 10 04 16 00 00 | 0.00000 | rel |
| 5  | GP11 | 2005 10 04 18 00 00 | 0.00000 | rel |
| 6  | GP11 | 2005 10 04 20 00 00 | 0.00000 | rel |
| 7  | GP11 | 2005 10 04 22 00 00 | 0.00000 | rel |
| 8  | GP11 | 2005 10 05 00 00 00 | 0.00000 | rel |
| 9  | GP11 | 2005 10 05 02 00 00 | 0.00000 | rel |
| 10 | GP11 | 2005 10 05 04 00 00 | 0.00000 | rel |
| 11 | GP11 | 2005 10 05 06 00 00 | 0.00000 | rel |
| 12 | GP11 | 2005 10 05 08 00 00 | 0.00000 | rel |
| 13 | GP11 | 2005 10 05 10 00 00 | 0.00000 | rel |
| 14 | GP11 | 2005 10 05 12 00 00 | 0.00000 | rel |
| 15 | GP11 | 2005 10 05 14 00 00 | 0.00000 | rel |
| 16 | GP11 | 2005 10 05 16 00 00 | 0.00000 | rel |
| 17 | GP11 | 2005 10 05 18 00 00 | 0.00000 | rel |
| 18 | GP11 | 2005 10 05 20 00 00 | 0.00000 | rel |
| 19 | GP11 | 2005 10 05 22 00 00 | 0.00000 | rel |
| 20 | GP11 | 2005 10 06 00 00 00 | 0.00000 | rel |
| 21 | GP11 | 2005 10 06 02 00 00 | 0.00000 | rel |
| 22 | GP11 | 2005 10 06 04 00 00 | 0.00000 | rel |
| 23 | GP11 | 2005 10 06 06 00 00 | 0.00000 | rel |
| 24 | GP11 | 2005 10 06 08 00 00 | 0.00000 | rel |
| 25 | GP11 | 2005 10 06 10 00 00 | 0.00000 | rel |
| 26 | GP11 | 2005 10 06 12 00 00 | 0.00000 | rel |
| 27 | GP11 | 2005 10 06 14 00 00 | 0.00000 | rel |
| 28 | GP11 | 2005 10 06 16 00 00 | 0.00000 | rel |
| 29 | GP11 | 2005 10 06 18 00 00 | 0.00000 | rel |
| 30 | GP11 | 2005 10 06 20 00 00 | 0.00000 | rel |
| 31 | GP11 | 2005 10 06 22 00 00 | 0.00000 | rel |
| 32 | GP11 | 2005 10 07 00 00 00 | 0.00000 | rel |
| 33 | GP11 | 2005 10 07 02 00 00 | 0.00000 | rel |
| 34 | GP11 | 2005 10 07 04 00 00 | 0.00000 | rel |
| 35 | GP11 | 2005 10 07 06 00 00 | 0.00000 | rel |
| 36 | GP12 | 2005 10 04 10 00 00 | 0.00000 | abs |
| 37 | GP12 | 2005 10 04 12 00 00 | 0.00000 | rel |
| 38 | GP12 | 2005 10 04 14 00 00 | 0.00000 | rel |
| 39 | GP12 | 2005 10 04 16 00 00 | 0.00000 | rel |
| 40 | GP12 | 2005 10 04 18 00 00 | 0.00000 | rel |
| 41 | GP12 | 2005 10 04 20 00 00 | 0.00000 | rel |
| 42 | GP12 | 2005 10 04 22 00 00 | 0.00000 | rel |
| 43 | GP12 | 2005 10 05 00 00 00 | 0.00000 | rel |
| 44 | GP12 | 2005 10 05 02 00 00 | 0.00000 | rel |
| 45 | GP12 | 2005 10 05 04 00 00 | 0.00000 | rel |
| 46 | GP12 | 2005 10 05 06 00 00 | 0.00000 | rel |
| 47 | GP12 | 2005 10 05 08 00 00 | 0.00000 | rel |
| 48 | GP12 | 2005 10 05 10 00 00 | 0.00000 | rel |
| 49 | GP12 | 2005 10 05 12 00 00 | 0.00000 | rel |
| 50 | GP12 | 2005 10 05 14 00 00 | 0.00000 | rel |
| 51 | GP12 | 2005 10 05 16 00 00 | 0.00000 | rel |
| 52 | GP12 | 2005 10 05 18 00 00 | 0.00000 | rel |
| 53 | GP12 | 2005 10 05 20 00 00 | 0.00000 | rel |
| 54 | GP12 | 2005 10 05 22 00 00 | 0.00000 | rel |
| 55 | GP12 | 2005 10 06 00 00 00 | 0.00000 | rel |

|    |      |                     |         |     |
|----|------|---------------------|---------|-----|
| 56 | GP12 | 2005 10 06 02 00 00 | 0.00000 | rel |
| 57 | GP12 | 2005 10 06 04 00 00 | 0.00000 | rel |
| 58 | GP12 | 2005 10 06 06 00 00 | 0.00000 | rel |
| 59 | GP12 | 2005 10 06 08 00 00 | 0.00000 | rel |
| 60 | GP12 | 2005 10 06 10 00 00 | 0.00000 | rel |
| 61 | GP12 | 2005 10 06 12 00 00 | 0.00000 | rel |
| 62 | GP12 | 2005 10 06 14 00 00 | 0.00000 | rel |
| 63 | GP12 | 2005 10 06 16 00 00 | 0.00000 | rel |
| 64 | GP12 | 2005 10 06 18 00 00 | 0.00000 | rel |
| 65 | GP12 | 2005 10 06 20 00 00 | 0.00000 | rel |
| 66 | GP12 | 2005 10 06 22 00 00 | 0.00000 | rel |
| 67 | GP12 | 2005 10 07 00 00 00 | 0.00000 | rel |
| 68 | GP12 | 2005 10 07 02 00 00 | 0.00000 | rel |
| 69 | GP12 | 2005 10 07 04 00 00 | 0.00000 | rel |
| 70 | GP12 | 2005 10 07 06 00 00 | 0.00000 | rel |

## IONOSPHERE MODELS:

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NO IONOSPHERE MODELS APPLIED

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## 8. POLE COORDINATES AND TIME INFORMATION

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A PRIORI POLE AND TIME INFORMATION FROM THE POLE FILE:

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| DATUM    | TIME     | X-POLE (")<br>EP-CPO (") | Y-POLE (")<br>PS-CPO (") | UT1-UTC (S) | GPS-UTC (S) | RMS XP (")<br>RMS EP (") | RMS YP (")<br>RMS PS (") | RMS DT (S) |
|----------|----------|--------------------------|--------------------------|-------------|-------------|--------------------------|--------------------------|------------|
| 05-10-04 | 00:00:00 | 0.05987<br>0.00000       | 0.41550<br>0.00000       | -0.610203   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-10-05 | 00:00:00 | 0.06094<br>0.00000       | 0.41507<br>0.00000       | -0.610864   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-10-06 | 00:00:00 | 0.06220<br>0.00000       | 0.41506<br>0.00000       | -0.611320   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-10-07 | 00:00:00 | 0.06335<br>0.00000       | 0.41543<br>0.00000       | -0.611694   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-10-08 | 00:00:00 | 0.06405<br>0.00000       | 0.41549<br>0.00000       | -0.611988   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |

NUTATION MODEL: IAU2000  
SUBDAILY POLE MODEL: IERS2000

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12. TEST OUTPUT

MIN. AND MAX. ELEVATION/NADIR ANGLES AND MAX. SYNCHRONIZATION ERRORS:

| SESS | FILE | STATION NAME 1 | STATION NAME 2 | MIN/MAX ELEV. | MIN/MAX NADIR | SYNCH. ERR. (NS) |
|------|------|----------------|----------------|---------------|---------------|------------------|
| 0001 | 1    | GPS1           | GP11           | 20.0 79.4     | 2.5 13.2      | 0.0              |
| 0002 | 2    | GPS1           | GP11           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 0003 | 3    | GPS1           | GP11           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 0004 | 4    | GPS1           | GP11           | 20.0 81.5     | 2.0 13.1      | 0.0              |
| 0005 | 5    | GPS1           | GP12           | 20.0 79.8     | 2.4 13.2      | 0.0              |
| 0006 | 6    | GPS1           | GP12           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 0007 | 7    | GPS1           | GP12           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 0008 | 8    | GPS1           | GP12           | 20.0 83.5     | 1.5 13.1      | 0.0              |
| 0009 | 9    | GP11           | GP12           | 20.0 79.4     | 2.5 13.2      | 0.0              |
| 0010 | 10   | GP11           | GP12           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 0011 | 11   | GP11           | GP12           | 20.0 83.5     | 1.5 13.2      | 0.0              |
| 0012 | 12   | GP11           | GP12           | 20.0 81.5     | 2.0 13.1      | 0.0              |

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13. RESULTS (PART 1)

NUMBER OF PARAMETERS (PART 1):

| PARAMETER TYPE                       | #PARAMETERS | #PRE-ELIMINATED | #SET-UP | #NO-OBS | #REF | #SINGULAR |
|--------------------------------------|-------------|-----------------|---------|---------|------|-----------|
| STATION COORDINATES                  | 9           | 0               | 9       | 0       | 0    | 0         |
| AMBIGUITIES                          | 18          | 18 (BEFORE INV) | 220     | 202     | 0    | 7         |
| SITE-SPECIFIC TROPOSPHERE PARAMETERS | 70          | 0               | 70      | 0       | 0    | 2         |
| TOTAL NUMBER OF PARAMETERS           | 97          | 18              | 299     | 202     | 0    | 9         |

NUMBER OF OBSERVATIONS (PART 1):

```

TYPE FREQUENCY FILE #OBSERVATIONS

PHASE L3 ALL 118860

TOTAL NUMBER OF OBSERVATIONS 118860

```

A POSTERIORI SIGMA OF UNIT WEIGHT (PART 1):

```

A POSTERIORI SIGMA OF UNIT WEIGHT : 0.0008 M (SIGMA OF ONE-WAY L1 PHASE OBSERVABLE AT ZENITH)
DEGREE OF FREEDOM (DOF) : 118772
CHI**2/DOF : 0.69

```

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STATION COORDINATES:                   \${P}/OL05SU\STA\TOL05SU.CRD

```

NUM STATION NAME PARAMETER A PRIORI VALUE NEW VALUE NEW- A PRIORI RMS ERROR 3-D ELLIPSOID 2-D ELLIPSE

1 GPS1 X 2863210.2855 2863210.2855 0.0000 0.0000
 Y 1126271.3627 1126271.3627 0.0000 0.0000
 Z 5568267.2028 5568267.2028 0.0000 0.0000
 HEIGHT 30.5343 30.5343 0.0000 0.0000 0.0000 0.0
 LATITUDE 61 14 22.748766 61 14 22.748766 0.0000 0.0000 0.0000 90.0 0.0000 90.0
 LONGITUDE 21 28 21.624778 21 28 21.624778 0.0000 0.0000 0.0000 0.0 0.0000
2 GP11 X 2859164.4451 2859164.4575 0.0124 0.0002
 Y 1133699.2391 1133699.2418 0.0027 0.0001
 Z 5568849.3287 5568849.3523 0.0236 0.0004
 HEIGHT 43.1905 43.2172 0.0267 0.0005 0.0005 0.5
 LATITUDE 61 15 1.096558 61 15 1.096569 0.0003 0.0001 0.0000 89.4 0.0000 89.4
 LONGITUDE 21 37 44.500394 21 37 44.500252 -0.0021 0.0000 0.0001 0.0 0.0001
3 GP12 X 2861097.0631 2861097.0783 0.0152 0.0002
 Y 1122358.5353 1122358.5401 0.0048 0.0001
 Z 5570120.7180 5570120.7450 0.0270 0.0004
 HEIGHT 21.8609 21.8922 0.0313 0.0004 0.0004 0.5

```





|    |      |          |         |
|----|------|----------|---------|
| 38 | GP12 | -0.01265 | 0.00041 |
| 39 | GP12 | -0.01366 | 0.00048 |
| 40 | GP12 | -0.01444 | 0.00043 |
| 41 | GP12 | -0.01258 | 0.00035 |
| 42 | GP12 | -0.01215 | 0.00044 |
| 43 | GP12 | -0.01386 | 0.00043 |
| 44 | GP12 | -0.01557 | 0.00039 |
| 45 | GP12 | -0.01038 | 0.00040 |
| 46 | GP12 | -0.01364 | 0.00039 |
| 47 | GP12 | -0.01254 | 0.00042 |
| 48 | GP12 | -0.01255 | 0.00039 |
| 49 | GP12 | -0.01477 | 0.00041 |
| 50 | GP12 | -0.01512 | 0.00036 |
| 51 | GP12 | -0.01251 | 0.00045 |
| 52 | GP12 | -0.01716 | 0.00043 |
| 53 | GP12 | -0.01391 | 0.00035 |
| 54 | GP12 | -0.01335 | 0.00043 |
| 55 | GP12 | -0.01501 | 0.00042 |
| 56 | GP12 | -0.01332 | 0.00039 |
| 57 | GP12 | -0.01118 | 0.00040 |
| 58 | GP12 | -0.01364 | 0.00040 |
| 59 | GP12 | -0.01095 | 0.00042 |
| 60 | GP12 | -0.01168 | 0.00039 |
| 61 | GP12 | -0.01247 | 0.00040 |
| 62 | GP12 | -0.01073 | 0.00036 |
| 63 | GP12 | -0.01089 | 0.00045 |
| 64 | GP12 | -0.01454 | 0.00044 |
| 65 | GP12 | -0.01305 | 0.00035 |
| 66 | GP12 | -0.01173 | 0.00042 |
| 67 | GP12 | -0.01394 | 0.00041 |
| 68 | GP12 | -0.01325 | 0.00039 |
| 69 | GP12 | -0.00976 | 0.00042 |
| 70 | GP12 | -0.01106 | 0.00074 |

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-----  
RMS ERRORS OF ELLIP. COORDINATES AND COORDINATE DIFFER. IN MM (PART 1):  
-----

| NUM |       | 1   | 2   | 3   |
|-----|-------|-----|-----|-----|
|     | B     | 0.0 | 0.1 | 0.1 |
|     | 1   L | 0.0 | 0.0 | 0.0 |
|     | H     | 0.0 | 0.5 | 0.4 |
|     |       |     |     |     |
|     | B     | 0.1 | 0.1 | 0.1 |
|     | 2   L | 0.0 | 0.0 | 0.0 |
|     | H     | 0.5 | 0.5 | 0.5 |

|   |   |     |     |     |
|---|---|-----|-----|-----|
|   | B | 0.1 | 0.1 | 0.1 |
| 3 | L | 0.0 | 0.0 | 0.0 |
|   | H | 0.4 | 0.5 | 0.4 |

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SLOPE DISTANCES AND RMS ERRORS IN M (PART 1):

| NUM |     | 2 N       | 3 N        |
|-----|-----|-----------|------------|
| 1   | O   | 8478.2689 | 4817.8258  |
|     | N   | 8478.2669 | 4817.8256  |
|     | RMS | 0.0000    | 0.0001     |
| 2   | O   |           | 11574.2389 |
|     | N   |           | 11574.2376 |
|     | RMS |           | 0.0000     |

**Appendix VIa. Results of 14 measurements at Kivetty. Deviations of the vector lengths from their mean in millimeters. Unscaled observations.**

| Vector    | Mean length<br>[mm] | Time [a] |      |      |      |      |      |      |      |      |      |      |      |      |      | RMS  |
|-----------|---------------------|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|           |                     | 96.3     | 96.8 | 97.3 | 97.8 | 98.3 | 98.8 | 99.3 | 99.8 | 1.3  | 1.8  | 2.8  | 3.8  | 4.8  | 5.8  |      |
| GPS1-GPS2 | 659084.0            | -1.0     | 0.1  | 0.7  | -0.6 | -0.4 | -0.6 | -0.6 | 0.1  | 0.2  | 0.3  | 1.0  | 0.5  | 0.5  | -0.1 | ±0.5 |
| GPS1-GPS3 | 1613486.0           | 0.2      | 0.1  | 0.9  | -0.6 | 0.1  | -0.4 | 0.6  | -1.0 | 0.0  | -0.1 | -0.1 | 0.3  | -0.1 | 0.2  | 0.5  |
| GPS1-GPS4 | 1591096.4           | 0.1      | 0.0  | 0.5  | -0.8 | 0.1  | -0.1 | 0.1  | 0.9  | -0.6 | 0.0  | -0.9 | 0.5  | -0.2 | 0.7  | 0.5  |
| GPS1-GPS5 | 672046.9            | 0.5      | 0.3  | 0.3  | 0.7  | -0.4 | 0.2  | -0.4 | -0.1 | -0.2 | 0.2  | -1.1 | 0.2  | -0.8 | 0.2  | 0.5  |
| GPS1-GPS6 | 1180588.1           | -0.6     | -0.4 | 0.0  | -0.4 | -1.0 | 0.0  | 0.1  | 0.3  | 0.3  | -0.5 | 0.5  | 0.4  | 0.6  | 0.9  | 0.5  |
| GPS1-GPS7 | 735563.3            | -1.1     | -1.1 | 0.7  | -0.2 | 0.7  | -0.3 | -0.1 | 0.2  | 0.3  | 0.8  | -0.7 | 0.4  | 0.1  | -0.1 | 0.6  |
| GPS2-GPS3 | 955938.8            | 1.1      | -0.1 | 0.2  | -0.2 | 0.5  | 0.2  | 1.3  | -1.0 | -0.2 | -0.3 | -0.9 | -0.3 | -0.4 | 0.2  | 0.6  |
| GPS2-GPS4 | 1198884.1           | -0.4     | -0.9 | 0.0  | -1.5 | 0.4  | 0.8  | 0.5  | 1.3  | -0.9 | 0.4  | -0.8 | 0.6  | -0.3 | 0.3  | 0.8  |
| GPS2-GPS5 | 1167283.9           | -0.9     | 0.2  | 1.2  | 0.2  | -0.6 | -0.1 | -0.7 | 0.4  | 0.0  | 0.5  | 0.2  | 0.7  | -0.2 | -0.3 | 0.6  |
| GPS2-GPS6 | 1829810.3           | -1.5     | -0.2 | 0.8  | -0.8 | -1.2 | -0.6 | -0.5 | 0.3  | 0.3  | -0.1 | 1.2  | 1.1  | 0.7  | 0.6  | 0.8  |
| GPS2-GPS7 | 901317.6            | -0.7     | 0.1  | 0.6  | -0.3 | 0.7  | -0.4 | -0.4 | -0.8 | 0.5  | 0.7  | -1.0 | 0.5  | 0.0  | 0.8  | 0.6  |
| GPS3-GPS4 | 1102331.6           | 0.1      | -0.3 | 0.7  | -0.7 | 0.3  | 0.8  | -0.4 | -2.9 | -0.3 | 1.7  | -1.0 | 0.8  | 0.0  | 1.7  | 1.1  |
| GPS3-GPS5 | 2031115.4           | 0.3      | 0.3  | 1.6  | 0.4  | -0.3 | -0.3 | 0.1  | -1.9 | 0.0  | 0.3  | -0.9 | 0.2  | -0.5 | 0.2  | 0.8  |
| GPS3-GPS6 | 2770064.6           | -0.2     | -0.2 | 1.1  | -0.8 | -0.6 | -0.5 | 0.7  | -1.4 | 0.2  | -0.3 | 0.3  | 0.6  | 0.3  | 1.0  | 0.7  |
| GPS3-GPS7 | 1693397.8           | -0.4     | -0.1 | 0.3  | -1.6 | 1.0  | 0.0  | 1.0  | -0.4 | 0.2  | -0.1 | -0.8 | 0.3  | -0.3 | 0.3  | 0.7  |
| GPS4-GPS5 | 1608741.9           | -0.2     | 0.3  | 1.2  | 0.3  | -0.3 | -0.5 | 0.0  | 1.0  | -0.3 | -0.3 | -0.7 | -0.1 | -0.2 | -0.2 | 0.5  |
| GPS4-GPS6 | 2462388.5           | -0.3     | -0.1 | 0.7  | -0.5 | -0.5 | -0.7 | 0.2  | 1.4  | -0.4 | -0.7 | 0.0  | 0.4  | 0.3  | 0.1  | 0.6  |
| GPS4-GPS7 | 2089326.3           | -0.9     | -0.8 | 0.7  | -1.5 | 1.1  | 0.3  | 0.2  | 0.7  | -0.3 | 1.0  | -2.0 | 1.0  | -0.2 | 1.1  | 1.0  |
| GPS5-GPS6 | 854744.9            | -0.1     | -0.5 | -0.6 | -0.9 | -0.5 | -0.1 | 0.2  | 0.5  | -0.1 | -1.0 | 0.7  | 0.6  | 0.8  | 0.4  | 0.6  |
| GPS5-GPS7 | 1379384.7           | -0.3     | -0.7 | 1.1  | 0.6  | 0.1  | -0.2 | -0.3 | 0.3  | -0.1 | 0.9  | -1.9 | 0.8  | -0.7 | 0.2  | 0.8  |
| GPS6-GPS7 | 1604962.4           | -1.1     | -1.3 | 0.9  | 0.0  | -1.2 | -0.5 | 0.0  | 0.6  | 0.3  | 0.2  | -0.4 | 0.8  | 0.3  | 1.1  | 0.8  |
| Mean:     |                     | -0.4     | -0.3 | 0.7  | -0.4 | -0.1 | -0.1 | 0.1  | -0.1 | -0.1 | 0.2  | -0.4 | 0.5  | 0.0  | 0.5  |      |
| St.dev.:  |                     | ±0.6     | 0.5  | 0.5  | 0.7  | 0.7  | 0.4  | 0.5  | 1.1  | 0.3  | 0.6  | 0.9  | 0.3  | 0.4  | 0.5  |      |
| RMS:      |                     | ±0.7     | 0.5  | 0.8  | 0.8  | 0.7  | 0.4  | 0.5  | 1.1  | 0.3  | 0.6  | 1.0  | 0.6  | 0.4  | 0.7  | ±0.7 |

**Appendix VIb. Results of 14 measurements at Kivetty. Deviations of the vector lengths from their mean in millimeters. Scaled observations.**

| Vector    | Mean length<br>[mm] | Time [a] |      |      |      |      |      |      |      |      |      |      |      |      |      | RMS  |
|-----------|---------------------|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|           |                     | 96.3     | 96.8 | 97.3 | 97.8 | 98.3 | 98.8 | 99.3 | 99.8 | 1.3  | 1.8  | 2.8  | 3.8  | 4.8  | 5.8  |      |
| GPS1-GPS2 | 659084.0            | 0.8      | 0.2  | 0.4  | -0.4 | -0.4 | -0.5 | -0.6 | 0.1  | 0.2  | 0.2  | 1.2  | 0.3  | 0.5  | -0.3 | ±0.5 |
| GPS1-GPS3 | 1613486.2           | 0.6      | 0.4  | 0.2  | -0.1 | 0.2  | -0.3 | 0.6  | -0.9 | 0.0  | -0.4 | 0.4  | -0.3 | -0.1 | -0.3 | 0.4  |
| GPS1-GPS4 | 1591096.6           | 0.5      | 0.3  | -0.2 | -0.3 | 0.2  | 0.0  | 0.1  | 1.0  | -0.6 | -0.3 | -0.4 | -0.1 | -0.2 | 0.2  | 0.4  |
| GPS1-GPS5 | 672047.0            | 0.7      | 0.4  | 0.0  | 0.9  | -0.4 | 0.3  | -0.4 | -0.1 | -0.2 | 0.1  | -0.9 | -0.1 | -0.8 | 0.0  | 0.5  |
| GPS1-GPS6 | 1180588.3           | -0.3     | -0.2 | -0.5 | 0.0  | -0.9 | 0.1  | 0.1  | 0.4  | 0.3  | -0.7 | 0.9  | 0.0  | 0.6  | 0.5  | 0.5  |
| GPS1-GPS7 | 735563.4            | -0.9     | -1.0 | 0.4  | 0.0  | 0.7  | -0.2 | -0.1 | 0.3  | 0.3  | 0.7  | -0.5 | 0.1  | 0.1  | -0.3 | 0.5  |
| GPS2-GPS3 | 955938.9            | 1.4      | 0.1  | -0.2 | 0.1  | 0.5  | 0.3  | 1.3  | -0.9 | -0.2 | -0.5 | -0.6 | -0.7 | -0.4 | -0.1 | 0.7  |
| GPS2-GPS4 | 1198884.2           | -0.1     | -0.7 | -0.6 | -1.1 | 0.5  | 0.9  | 0.5  | 1.4  | -0.9 | 0.2  | -0.4 | 0.1  | -0.3 | -0.1 | 0.7  |
| GPS2-GPS5 | 1167284.0           | -0.6     | 0.4  | 0.7  | 0.5  | -0.5 | 0.0  | -0.7 | 0.5  | 0.0  | 0.3  | 0.6  | 0.3  | -0.2 | -0.7 | 0.5  |
| GPS2-GPS6 | 1829810.6           | -1.0     | 0.2  | 0.0  | -0.3 | -1.1 | -0.4 | -0.5 | 0.4  | 0.3  | -0.4 | 1.8  | 0.4  | 0.7  | 0.0  | 0.7  |
| GPS2-GPS7 | 901317.7            | -0.5     | 0.3  | 0.2  | 0.0  | 0.7  | -0.3 | -0.4 | -0.7 | 0.5  | 0.5  | -0.7 | 0.2  | 0.0  | 0.5  | 0.5  |
| GPS3-GPS4 | 1102331.8           | 0.4      | -0.1 | 0.2  | -0.4 | 0.4  | 0.9  | -0.4 | -2.8 | -0.3 | 1.5  | -0.6 | 0.4  | 0.0  | 1.3  | 1.0  |
| GPS3-GPS5 | 2031115.7           | 0.9      | 0.7  | 0.7  | 1.0  | -0.2 | -0.1 | 0.1  | -1.8 | 0.1  | -0.1 | -0.2 | -0.6 | -0.5 | -0.5 | 0.7  |
| GPS3-GPS6 | 2770065.0           | 0.6      | 0.4  | -0.2 | 0.0  | -0.5 | -0.3 | 0.7  | -1.2 | 0.3  | -0.8 | 1.2  | -0.5 | 0.3  | 0.1  | 0.6  |
| GPS3-GPS7 | 1693398.0           | 0.2      | 0.3  | -0.5 | -1.1 | 1.2  | 0.2  | 1.1  | -0.3 | 0.3  | -0.4 | -0.2 | -0.3 | -0.3 | -0.3 | 0.6  |
| GPS4-GPS5 | 1608742.1           | 0.2      | 0.6  | 0.5  | 0.8  | -0.2 | -0.4 | 0.0  | 1.1  | -0.3 | -0.6 | -0.2 | -0.7 | -0.2 | -0.7 | 0.6  |
| GPS4-GPS6 | 2462388.8           | 0.4      | 0.4  | -0.4 | 0.2  | -0.4 | -0.5 | 0.2  | 1.6  | -0.3 | -1.1 | 0.8  | -0.5 | 0.3  | -0.7 | 0.7  |
| GPS4-GPS7 | 2089326.6           | -0.3     | -0.4 | -0.3 | -0.9 | 1.2  | 0.5  | 0.2  | 0.8  | -0.2 | 0.6  | -1.3 | 0.2  | -0.2 | 0.4  | 0.7  |
| GPS5-GPS6 | 854745.1            | 0.1      | -0.3 | -1.0 | -0.6 | -0.5 | 0.0  | 0.2  | 0.6  | -0.1 | -1.1 | 1.0  | 0.3  | 0.8  | 0.1  | 0.6  |
| GPS5-GPS7 | 1379384.9           | 0.1      | -0.4 | 0.5  | 1.0  | 0.2  | -0.1 | -0.3 | 0.4  | -0.1 | 0.7  | -1.4 | 0.3  | -0.7 | -0.2 | 0.6  |
| GPS6-GPS7 | 1604962.6           | -0.7     | -1.0 | 0.2  | 0.5  | -1.1 | -0.4 | 0.0  | 0.7  | 0.3  | -0.1 | 0.1  | 0.2  | 0.3  | 0.6  | 0.6  |
| Mean:     |                     | 0.0      | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.1  | 0.0  | 0.0  | -0.1 | 0.0  | -0.1 | 0.0  | 0.0  |      |
| St.dev.:  |                     | ±0.7     | 0.5  | 0.5  | 0.6  | 0.7  | 0.4  | 0.5  | 1.1  | 0.3  | 0.7  | 0.9  | 0.4  | 0.4  | 0.5  |      |
| RMS:      |                     | ±0.6     | 0.5  | 0.4  | 0.6  | 0.7  | 0.4  | 0.5  | 1.1  | 0.3  | 0.6  | 0.9  | 0.4  | 0.4  | 0.5  | ±0.6 |

## Appendix VII. Results of the measurements at Kivetty in 2005.

```

=====
Program : GPSEST Bernese GPS Software Version 5.0
Purpose : Parameter estimation
Campaign: ${P}/KIVE05S Default session: 2610 year 2005
Date : 18-Jan-2006 16:40 User name : ja
=====

```

KIVE05S

```

1${P}/KIVE05S PROGRAM GPSEST 18-JAN-06 16:40
KIVE05S BERNESE GPS SOFTWARE VERSION 5.0

```

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```

1${P}/KIVE05S PROGRAM GPSEST 18-JAN-06 16:40
KIVE05S BERNESE GPS SOFTWARE VERSION 5.0

```

### INPUT AND OUTPUT FILENAMES

-----

```

Session table : ${P}/KIVE05S\STA\SESSIONS.SES

```

```

General constants : ${X}/GEN\CONST.
Geodetic datum : ${X}/GEN\DATUM.
Station information : ${P}/KIVE05S\STA\KIVE05S.STA
Earth rotation parameters : ${P}/KIVE05S\ORB\C04_2005.ERP
Subdaily pole model : ${X}/GEN\IERS2000.SUB
Nutation model : ${X}/GEN\IAU2000.NUT
Satellite information : ${X}/GEN\SATELLIT.
Receiver information : ${X}/GEN\RECEIVER.
Satellite problems : ${X}/GEN\SAT_2005.CRX
Phase center eccentricities : ${X}/GEN\PHAS_IGS.REL
SINEX general input file : ${X}/GEN\SINEX.
IONEX control file : ${X}/GEN\IONEX.
Difference GPS-UTC : ---
A priori station coordinates: ${P}/KIVE05S\STA\KIVE.CRD
GNSS standard orbits : ${P}/KIVE05S\ORB\KIVE05S.STD
GNSS orbit partials : ---
Ionosphere models : ${P}/KIVE05S\ATM\KIVE05S.ION
Troposphere estimates : ---
Station sigma factors : ---
Station eccentricities : ---
Ocean loading tables : ---
GNSS clock corrections : ---
Differential code biases : ---
Receiver antenna orientation: ---
Kinematic coordinates : ---
Kinematic velocities : ---
Standard orbit(s) : ---
Orbit partials : ---
Attitude data : ---
Precise orbit(s) : ---
LEO orbital elements : ---
Station coordinates : ${P}/KIVE05S\STA\TKIVE05S.CRD
GNSS orbital elements : ---
Troposphere estimates : ---
Troposphere SINEX : ---
Ionosphere models : ---
IONEX : ---
Residuals : ---
Coordinate covariance matrix: ---
Full covariance matrix : ---
Normal equations : ---
Bernese ERP file : ---
IERS ERP file : ---
GNSS clock corrections : ---
Clock RINEX : ---
Kinematic coordinates : ---
Differential code biases : ---
Phase center variations (gri: ---
Phase center variations (har: ---
Scratch file : ${U}/WORK\GPSEST.SCR
Scratch files : ${U}/WORK\GPSEST.SC1
Program output : ${P}/KIVE05S\OUT\GPSEST.L12
Error message : ${U}/WORK\ERROR.MSG

```

1\${P}/KIVE05S  
KIVE05S

PROGRAM GPSEST 18-JAN-06 16:40  
BERNESE GPS SOFTWARE VERSION 5.0

1. CAMPAIGNS

| CAMPAIGN NAME | NUM | STATION NAME | NUM    | STATION NAME | NUM    | STATION NAME | NUM | STATION NAME | NUM | STATION NAME |
|---------------|-----|--------------|--------|--------------|--------|--------------|-----|--------------|-----|--------------|
| \${P}/KIVE05S | :   | 1 GPS1       | 2 GPS2 | 5 GPS5       | 6 GPS6 | 7 GPS7       |     |              |     |              |
|               |     | 3 GPS3       | 4 GPS4 |              |        |              |     |              |     |              |

2. OBSERVATION FILES

\${P}/KIVE05S

MAIN CHARACTERISTICS:

| FILE | OBSERVATION FILE HEADER        | OBSERVATION FILE               | SESS | RECEIVER 1     | RECEIVER 2     |
|------|--------------------------------|--------------------------------|------|----------------|----------------|
| 1    | \${P}/KIVE05S/OBS/01022600.PSH | \${P}/KIVE05S/OBS/01022600.PSO | 2600 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 2    | \${P}/KIVE05S/OBS/01022610.PSH | \${P}/KIVE05S/OBS/01022610.PSO | 2610 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 3    | \${P}/KIVE05S/OBS/01052600.PSH | \${P}/KIVE05S/OBS/01052600.PSO | 2600 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 4    | \${P}/KIVE05S/OBS/01052610.PSH | \${P}/KIVE05S/OBS/01052610.PSO | 2610 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 5    | \${P}/KIVE05S/OBS/01062600.PSH | \${P}/KIVE05S/OBS/01062600.PSO | 2600 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 6    | \${P}/KIVE05S/OBS/01062610.PSH | \${P}/KIVE05S/OBS/01062610.PSO | 2610 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 7    | \${P}/KIVE05S/OBS/01072600.PSH | \${P}/KIVE05S/OBS/01072600.PSO | 2600 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 8    | \${P}/KIVE05S/OBS/01072610.PSH | \${P}/KIVE05S/OBS/01072610.PSO | 2610 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 9    | \${P}/KIVE05S/OBS/02032600.PSH | \${P}/KIVE05S/OBS/02032600.PSO | 2600 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 10   | \${P}/KIVE05S/OBS/02032610.PSH | \${P}/KIVE05S/OBS/02032610.PSO | 2610 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 11   | \${P}/KIVE05S/OBS/02042600.PSH | \${P}/KIVE05S/OBS/02042600.PSO | 2600 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 12   | \${P}/KIVE05S/OBS/02042610.PSH | \${P}/KIVE05S/OBS/02042610.PSO | 2610 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |

| FILE | TYP | FREQ. | STATION 1 | STATION 2 | SESS | FIRST   | OBSERV.TIME | #EPO | DT | #EF | #CLK | ARC | #SAT | AMB.I.+S. |    |      | #CLUSTERS |    |    |    |    |   |
|------|-----|-------|-----------|-----------|------|---------|-------------|------|----|-----|------|-----|------|-----------|----|------|-----------|----|----|----|----|---|
|      |     |       |           |           |      |         |             |      |    |     |      |     |      | W         | 12 | #AMB | L1        | L2 | L5 | RM |    |   |
| 1    | P   | L1,L2 | GPS1      | GPS2      | 2600 | 5-09-17 | 8:58:30     | 1803 | 30 | 0   | E    | E   | 1    | 28        | N  | Y    | Y         | 50 | 17 | 17 | 50 | 0 |
| 2    | P   | L1,L2 | GPS1      | GPS2      | 2610 | 5-09-18 | 0:00:30     | 1438 | 30 | 0   | E    | E   | 1    | 28        | N  | Y    | Y         | 43 | 16 | 16 | 43 | 0 |
| 3    | P   | L1,L2 | GPS1      | GPS5      | 2600 | 5-09-17 | 10:35:00    | 1610 | 30 | 0   | E    | E   | 1    | 28        | N  | Y    | Y         | 52 | 22 | 22 | 52 | 0 |

|    |   |       |      |      |      |         |          |      |    |   |   |   |   |    |   |   |   |    |    |    |    |   |
|----|---|-------|------|------|------|---------|----------|------|----|---|---|---|---|----|---|---|---|----|----|----|----|---|
| 4  | P | L1,L2 | GPS1 | GPS5 | 2610 | 5-09-18 | 0:00:30  | 1399 | 30 | 0 | E | E | 1 | 28 | N | Y | Y | 41 | 15 | 15 | 41 | 0 |
| 5  | P | L1,L2 | GPS1 | GPS6 | 2600 | 5-09-17 | 10:20:30 | 1639 | 30 | 0 | E | E | 1 | 28 | N | Y | Y | 48 | 14 | 14 | 48 | 0 |
| 6  | P | L1,L2 | GPS1 | GPS6 | 2610 | 5-09-18 | 0:00:30  | 1379 | 30 | 0 | E | E | 1 | 27 | N | Y | Y | 37 | 10 | 10 | 37 | 0 |
| 7  | P | L1,L2 | GPS1 | GPS7 | 2600 | 5-09-17 | 10:02:30 | 1675 | 30 | 0 | E | E | 1 | 28 | N | Y | Y | 44 | 12 | 12 | 44 | 0 |
| 8  | P | L1,L2 | GPS1 | GPS7 | 2610 | 5-09-18 | 0:00:30  | 1345 | 30 | 0 | E | E | 1 | 27 | N | Y | Y | 33 | 8  | 8  | 33 | 0 |
| 9  | P | L1,L2 | GPS2 | GPS3 | 2600 | 5-09-17 | 9:26:00  | 1748 | 30 | 0 | E | E | 1 | 28 | N | Y | Y | 59 | 27 | 27 | 59 | 0 |
| 10 | P | L1,L2 | GPS2 | GPS3 | 2610 | 5-09-18 | 0:00:30  | 1269 | 30 | 0 | E | E | 1 | 28 | N | Y | Y | 40 | 16 | 15 | 40 | 0 |
| 11 | P | L1,L2 | GPS2 | GPS4 | 2600 | 5-09-17 | 9:44:30  | 1711 | 30 | 0 | E | E | 1 | 28 | N | Y | Y | 47 | 15 | 15 | 47 | 0 |
| 12 | P | L1,L2 | GPS2 | GPS4 | 2610 | 5-09-18 | 0:00:30  | 1296 | 30 | 0 | E | E | 1 | 27 | N | Y | Y | 37 | 13 | 13 | 37 | 0 |

## SATELLITES:

-----

FILE #SAT SATELLITES

-----

|    |    |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|----|----|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1  | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 2  | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 3  | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 4  | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 5  | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 6  | 27 | 1 | 2 | 3 | 4 | 5 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |    |
| 7  | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 8  | 27 | 1 | 2 | 3 | 4 | 5 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |    |
| 9  | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 10 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 11 | 28 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 12 | 27 | 1 | 2 | 3 | 4 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |    |

## OBSERVATION SELECTION:

-----

SAMPLING RATE : 30 SEC  
ELEVATION CUT-OFF ANGLE : 20 DEGREES  
SATELLITE SYSTEM : GPS  
SPECIAL DATA SELECTION : NO

1\${P}/KIVE05S  
KIVE05S

PROGRAM GPSEST 18-JAN-06 16:40  
BERNESE GPS SOFTWARE VERSION 5.0

-----

## 3. GENERAL OPTIONS

-----

TIDAL CORRECTION OF STATION COORDINATES : IERS CONVENTIONS 2000

A PRIORI SIGMA OF UNIT WEIGHT:

-----



A PRIORI SIGMA OF UNIT WEIGHT : 0.001 M (SIGMA OF ONE-WAY L1 PHASE OBSERVABLE AT ZENITH)  
 MODEL FOR ELEVATION-DEPENDENT WEIGHTING : 1/COS(Z)

CORRELATIONS AND SESSIONS:  
 -----

STRATEGY : CORRELATIONS CORRECTLY MODELLED  
 TIME INTERVAL : 0.10000 SEC (TO IDENTIFY EPOCH)

SESS #FILE FILE NUMBERS  
 -----

2600 6 1 3 5 7 9 11  
 2610 6 2 4 6 8 10 12

AMBIGUITY RESOLUTION STRATEGY:  
 -----

AMBIGUITIES PRE-ELIMINATED EVERY 30 SECONDS

SYNCHRONIZATION ERRORS:  
 -----

STRATEGY : SYNCHRONIZATION ERRORS NOT APPLIED

4. STATIONS  
 -----

Local geodetic datum: \${X}/GEN\DATUM.

| Datum name | Ell. param./ Scale                                        | Shifts to WGS-84                                | Rotations to WGS-84                                               |
|------------|-----------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------|
| WGS - 84   | A = 6378137.000 m<br>1/F= 298.2572236<br>SC = 0.00000D+00 | DX = 0.0000 m<br>DY = 0.0000 m<br>DZ = 0.0000 m | RX = 0.00000 arcsec<br>RY = 0.00000 arcsec<br>RZ = 0.00000 arcsec |

A priori station coordinates: \${P}/KIVE05S\STA\KIVE.CRD

A priori station coordinates WGS-84                      A priori station coordinates  
 Ellipsoidal in local geodetic datum

| num | Station name | obs e/f/h | X (m)        | Y (m)        | Z (m)        | Latitude        | Longitude       | Height (m) |
|-----|--------------|-----------|--------------|--------------|--------------|-----------------|-----------------|------------|
| 1   | GPS1         | Y ESTIM   | 2632277.3097 | 1266957.3328 | 5651027.6130 | 62 49 11.541281 | 25 42 8.131873  | 216.2605   |
| 2   | GPS2         | Y ESTIM   | 2632668.6713 | 1266433.2178 | 5650946.8226 | 62 49 6.746291  | 25 41 22.804861 | 201.6768   |
| 5   | GPS5         | Y ESTIM   | 2631669.9819 | 1266914.5590 | 5651312.1649 | 62 49 31.995017 | 25 42 24.011125 | 210.9794   |

|   |      |   |       |              |              |              |                 |                 |          |
|---|------|---|-------|--------------|--------------|--------------|-----------------|-----------------|----------|
| 6 | GPS6 | Y | ESTIM | 2631400.1527 | 1267721.3486 | 5651229.2666 | 62 49 27.699096 | 25 43 23.611374 | 186.0792 |
| 7 | GPS7 | Y | ESTIM | 2632837.9413 | 1267275.0647 | 5650672.9413 | 62 48 47.835455 | 25 42 11.178073 | 194.4937 |
| 3 | GPS3 | Y | ESTIM | 2633182.4577 | 1265629.9428 | 5650879.0389 | 62 49 2.443920  | 25 40 15.973856 | 193.8849 |
| 4 | GPS4 | Y | ESTIM | 2632226.4697 | 1265406.6777 | 5651380.4111 | 62 49 37.375281 | 25 40 31.010505 | 202.1775 |

A priori sigma:

Station coordinates a priori sigma  
in local geodetic datum

| num | Station name | N (m)   | E (m)   | U (m)   |
|-----|--------------|---------|---------|---------|
| 1   | GPS1         | 0.00001 | 0.00001 | 0.00001 |

1\${P}/KIVE05S  
KIVE05S

PROGRAM GPSEST 18-JAN-06 16:40  
BERNESE GPS SOFTWARE VERSION 5.0

5. SATELLITE ORBITS

ARC CHARACTERISTICS:

| ARC | START OF ARC      | END OF ARC        | SOURCE     | #SAT | SATELLITES |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
|-----|-------------------|-------------------|------------|------|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| 1   | 05-09-17 00:00:00 | 05-09-19 00:00:00 | PR2005.261 | 29   | 1          | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 |  |
|     |                   |                   |            |      | 21         | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |    |    |    |    |    |    |    |  |

OSCULATING ELEMENTS:                   \${P}/KIVE05S\ORB\KIVE05S.STD

REFERENCE SYSTEM: J2000.0  
REFERENCE EPOCH : 53630.3739583 MJD (2005 9 17 8 58 30.00)

| SAT | S.MAJ.AXIS | ECCENTRIC. | INCLINAT. | NODE        | PERIGEE     | M. ANOMALY  | PER.PASS.TIME |
|-----|------------|------------|-----------|-------------|-------------|-------------|---------------|
| 1   | 26558282.5 | 0.00588205 | 56.464722 | 34.990489   | -98.843746  | 4.691869    | 53630.3674609 |
| 2   | 26560975.0 | 0.00905290 | 54.570111 | -86.946255  | -249.881747 | 86.781991   | 53630.2537622 |
| 3   | 26558634.5 | 0.00718238 | 53.098026 | -151.916669 | 34.686849   | 38.450582   | 53630.3207100 |
| 4   | 26560355.5 | 0.00709779 | 54.546805 | -85.805381  | 3.059053    | -131.571331 | 53630.5561829 |
| 5   | 26559393.6 | 0.00662313 | 53.730826 | 148.519428  | 57.433893   | -153.379041 | 53630.5863747 |
| 6   | 26562447.8 | 0.00627207 | 53.525809 | -148.672809 | 251.747953  | -82.262573  | 53630.4879044 |
| 7   | 26560686.4 | 0.01337982 | 53.615602 | -150.216487 | -101.839064 | 42.116805   | 53630.3156260 |
| 8   | 26559423.8 | 0.00956410 | 55.581921 | 95.255522   | 147.361957  | -76.954380  | 53630.4805335 |



|    |      |                     |         |     |
|----|------|---------------------|---------|-----|
| 3  | GPS2 | 2005 09 17 12 00 00 | 0.00000 | rel |
| 4  | GPS2 | 2005 09 17 14 00 00 | 0.00000 | rel |
| 5  | GPS2 | 2005 09 17 16 00 00 | 0.00000 | rel |
| 6  | GPS2 | 2005 09 17 18 00 00 | 0.00000 | rel |
| 7  | GPS2 | 2005 09 17 20 00 00 | 0.00000 | rel |
| 8  | GPS2 | 2005 09 17 22 00 00 | 0.00000 | rel |
| 9  | GPS2 | 2005 09 18 00 00 00 | 0.00000 | rel |
| 10 | GPS2 | 2005 09 18 02 00 00 | 0.00000 | rel |
| 11 | GPS2 | 2005 09 18 04 00 00 | 0.00000 | rel |
| 12 | GPS2 | 2005 09 18 06 00 00 | 0.00000 | rel |
| 13 | GPS2 | 2005 09 18 08 00 00 | 0.00000 | rel |
| 14 | GPS2 | 2005 09 18 10 00 00 | 0.00000 | rel |
| 15 | GPS2 | 2005 09 18 12 00 00 | 0.00000 | rel |
| 16 | GPS5 | 2005 09 17 08 00 00 | 0.00000 | abs |
| 17 | GPS5 | 2005 09 17 10 00 00 | 0.00000 | rel |
| 18 | GPS5 | 2005 09 17 12 00 00 | 0.00000 | rel |
| 19 | GPS5 | 2005 09 17 14 00 00 | 0.00000 | rel |
| 20 | GPS5 | 2005 09 17 16 00 00 | 0.00000 | rel |
| 21 | GPS5 | 2005 09 17 18 00 00 | 0.00000 | rel |
| 22 | GPS5 | 2005 09 17 20 00 00 | 0.00000 | rel |
| 23 | GPS5 | 2005 09 17 22 00 00 | 0.00000 | rel |
| 24 | GPS5 | 2005 09 18 00 00 00 | 0.00000 | rel |
| 25 | GPS5 | 2005 09 18 02 00 00 | 0.00000 | rel |
| 26 | GPS5 | 2005 09 18 04 00 00 | 0.00000 | rel |
| 27 | GPS5 | 2005 09 18 06 00 00 | 0.00000 | rel |
| 28 | GPS5 | 2005 09 18 08 00 00 | 0.00000 | rel |
| 29 | GPS5 | 2005 09 18 10 00 00 | 0.00000 | rel |
| 30 | GPS5 | 2005 09 18 12 00 00 | 0.00000 | rel |
| 31 | GPS6 | 2005 09 17 08 00 00 | 0.00000 | abs |
| 32 | GPS6 | 2005 09 17 10 00 00 | 0.00000 | rel |
| 33 | GPS6 | 2005 09 17 12 00 00 | 0.00000 | rel |
| 34 | GPS6 | 2005 09 17 14 00 00 | 0.00000 | rel |
| 35 | GPS6 | 2005 09 17 16 00 00 | 0.00000 | rel |
| 36 | GPS6 | 2005 09 17 18 00 00 | 0.00000 | rel |
| 37 | GPS6 | 2005 09 17 20 00 00 | 0.00000 | rel |
| 38 | GPS6 | 2005 09 17 22 00 00 | 0.00000 | rel |
| 39 | GPS6 | 2005 09 18 00 00 00 | 0.00000 | rel |
| 40 | GPS6 | 2005 09 18 02 00 00 | 0.00000 | rel |
| 41 | GPS6 | 2005 09 18 04 00 00 | 0.00000 | rel |
| 42 | GPS6 | 2005 09 18 06 00 00 | 0.00000 | rel |
| 43 | GPS6 | 2005 09 18 08 00 00 | 0.00000 | rel |
| 44 | GPS6 | 2005 09 18 10 00 00 | 0.00000 | rel |
| 45 | GPS6 | 2005 09 18 12 00 00 | 0.00000 | rel |
| 46 | GPS7 | 2005 09 17 08 00 00 | 0.00000 | abs |
| 47 | GPS7 | 2005 09 17 10 00 00 | 0.00000 | rel |
| 48 | GPS7 | 2005 09 17 12 00 00 | 0.00000 | rel |
| 49 | GPS7 | 2005 09 17 14 00 00 | 0.00000 | rel |
| 50 | GPS7 | 2005 09 17 16 00 00 | 0.00000 | rel |
| 51 | GPS7 | 2005 09 17 18 00 00 | 0.00000 | rel |
| 52 | GPS7 | 2005 09 17 20 00 00 | 0.00000 | rel |
| 53 | GPS7 | 2005 09 17 22 00 00 | 0.00000 | rel |
| 54 | GPS7 | 2005 09 18 00 00 00 | 0.00000 | rel |
| 55 | GPS7 | 2005 09 18 02 00 00 | 0.00000 | rel |



| MODEL | TERM | POL. TIME | DEGREE LATIT. | IN | COEFFICIENT   | SIGMA        |
|-------|------|-----------|---------------|----|---------------|--------------|
| 2     | 1    | 0         | 0             |    | 0.115402E+01  | 0.269996E-02 |
|       | 2    | 1         | 0             |    | 0.117565E+00  | 0.720246E-03 |
|       | 3    | 2         | 0             |    | -0.538670E-01 | 0.587808E-03 |
|       | 4    | 0         | 1             |    | -0.944348E-01 | 0.108423E-02 |
|       | 5    | 1         | 1             |    | -0.273392E-01 | 0.101801E-02 |
| 3     | 1    | 0         | 0             |    | 0.111057E+01  | 0.975368E-02 |
|       | 2    | 1         | 0             |    | -0.174607E+00 | 0.253280E-02 |
|       | 3    | 2         | 0             |    | -0.920208E-01 | 0.224496E-02 |
|       | 4    | 0         | 1             |    | -0.225634E+00 | 0.344014E-02 |
|       | 5    | 1         | 1             |    | -0.667780E-01 | 0.301309E-02 |
| 4     | 1    | 0         | 0             |    | 0.380276E+00  | 0.713678E-02 |
|       | 2    | 1         | 0             |    | -0.455253E-01 | 0.160539E-02 |
|       | 3    | 2         | 0             |    | 0.412665E-01  | 0.132575E-02 |
|       | 4    | 0         | 1             |    | -0.155551E+00 | 0.257584E-02 |
|       | 5    | 1         | 1             |    | 0.161541E+00  | 0.231455E-02 |
| 5     | 1    | 0         | 0             |    | 0.321465E+00  | 0.405192E-02 |
|       | 2    | 1         | 0             |    | 0.193869E+00  | 0.104357E-02 |
|       | 3    | 2         | 0             |    | 0.110517E+00  | 0.957395E-03 |
|       | 4    | 0         | 1             |    | -0.587298E-01 | 0.136541E-02 |
|       | 5    | 1         | 1             |    | -0.541921E-02 | 0.133906E-02 |
| 6     | 1    | 0         | 0             |    | 0.123291E+01  | 0.343540E-02 |
|       | 2    | 1         | 0             |    | 0.942508E-01  | 0.911754E-03 |
|       | 3    | 2         | 0             |    | -0.759713E-01 | 0.749927E-03 |
|       | 4    | 0         | 1             |    | -0.270675E-01 | 0.137550E-02 |
|       | 5    | 1         | 1             |    | -0.121604E-02 | 0.130209E-02 |
| 7     | 1    | 0         | 0             |    | 0.845316E+00  | 0.376911E-02 |
|       | 2    | 1         | 0             |    | -0.123691E+00 | 0.970877E-03 |
|       | 3    | 2         | 0             |    | -0.471698E-01 | 0.865229E-03 |
|       | 4    | 0         | 1             |    | -0.135770E+00 | 0.132362E-02 |
|       | 5    | 1         | 1             |    | -0.684146E-01 | 0.116264E-02 |

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8. POLE COORDINATES AND TIME INFORMATION

A PRIORI POLE AND TIME INFORMATION FROM THE POLE FILE:

| DATUM    | TIME     | X-POLE (")<br>EP-CPO (") | Y-POLE (")<br>PS-CPO (") | UT1-UTC (S) | GPS-UTC (S) | RMS XP (")<br>RMS EP (") | RMS YP (")<br>RMS PS (") | RMS DT (S) |
|----------|----------|--------------------------|--------------------------|-------------|-------------|--------------------------|--------------------------|------------|
| 05-09-17 | 00:00:00 | 0.05197<br>0.00000       | 0.42124<br>0.00000       | -0.602076   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-09-18 | 00:00:00 | 0.05255<br>0.00000       | 0.42156<br>0.00000       | -0.603291   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-09-19 | 00:00:00 | 0.05268<br>0.00000       | 0.42149<br>0.00000       | -0.604579   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |

NUTATION MODEL: IAU2000  
SUBDAILY POLE MODEL: IERS2000

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12. TEST OUTPUT  
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MIN. AND MAX. ELEVATION/NADIR ANGLES AND MAX. SYNCHRONIZATION ERRORS:  
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| SESS | FILE | STATION NAME 1 | STATION NAME 2 | MIN/MAX ELEV. | MIN/MAX NADIR | SYNCH. ERR. (NS) |
|------|------|----------------|----------------|---------------|---------------|------------------|
| 2600 | 1    | GPS1           | GPS2           | 20.0 78.1     | 2.8 13.2      | 0.0              |
| 2610 | 2    | GPS1           | GPS2           | 20.0 81.9     | 1.9 13.2      | 0.0              |
| 2600 | 3    | GPS1           | GPS5           | 20.0 77.8     | 2.9 13.2      | 0.0              |
| 2610 | 4    | GPS1           | GPS5           | 20.0 81.9     | 1.9 13.2      | 0.0              |
| 2600 | 5    | GPS1           | GPS6           | 20.0 77.8     | 2.9 13.2      | 0.0              |
| 2610 | 6    | GPS1           | GPS6           | 20.0 81.9     | 1.9 13.1      | 0.0              |
| 2600 | 7    | GPS1           | GPS7           | 20.0 77.8     | 2.9 13.2      | 0.0              |
| 2610 | 8    | GPS1           | GPS7           | 20.0 81.9     | 1.9 13.2      | 0.0              |
| 2600 | 9    | GPS2           | GPS3           | 20.0 77.8     | 2.9 13.2      | 0.0              |
| 2610 | 10   | GPS2           | GPS3           | 20.0 81.9     | 1.9 13.2      | 0.0              |
| 2600 | 11   | GPS2           | GPS4           | 20.0 77.8     | 2.9 13.2      | 0.0              |
| 2610 | 12   | GPS2           | GPS4           | 20.0 81.9     | 1.9 13.2      | 0.0              |

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13. RESULTS (PART 1)  
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## NUMBER OF PARAMETERS (PART 1):

| PARAMETER TYPE                       | #PARAMETERS | #PRE-ELIMINATED | #SET-UP | #NO-OBS | #REF | #SINGULAR |
|--------------------------------------|-------------|-----------------|---------|---------|------|-----------|
| STATION COORDINATES                  | 21          | 0               | 21      | 0       | 0    | 0         |
| AMBIGUITIES                          | 13          | 13 (BEFORE INV) | 369     | 356     | 0    | 1         |
| SITE-SPECIFIC TROPOSPHERE PARAMETERS | 90          | 0               | 90      | 0       | 0    | 3         |
| TOTAL NUMBER OF PARAMETERS           | 124         | 13              | 480     | 356     | 0    | 4         |

## NUMBER OF OBSERVATIONS (PART 1):

| TYPE                         | FREQUENCY | FILE | #OBSERVATIONS |
|------------------------------|-----------|------|---------------|
| PHASE                        | L1        | ALL  | 95183         |
| PHASE                        | L2        | ALL  | 95183         |
| TOTAL NUMBER OF OBSERVATIONS |           |      | 190366        |

## A POSTERIORI SIGMA OF UNIT WEIGHT (PART 1):

A POSTERIORI SIGMA OF UNIT WEIGHT : 0.0022 M (SIGMA OF ONE-WAY L1 PHASE OBSERVABLE AT ZENITH)

DEGREE OF FREEDOM (DOF) : 190246

CHI\*\*2/DOF : 4.84

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## STATION COORDINATES: \${P}/KIVE05S\STA\TKIVE05S.CRD

| NUM | STATION NAME | PARAMETER | A PRIORI VALUE | NEW VALUE    | NEW- A PRIORI | RMS ERROR | 3-D ELLIPSOID | 2-D ELLIPSE |
|-----|--------------|-----------|----------------|--------------|---------------|-----------|---------------|-------------|
| 1   | GPS1         | X         | 2632277.3097   | 2632277.3097 | 0.0000        | 0.0000    |               |             |
|     |              | Y         | 1266957.3328   | 1266957.3328 | 0.0000        | 0.0000    |               |             |
|     |              | Z         | 5651027.6130   | 5651027.6130 | 0.0000        | 0.0000    |               |             |



|   |      |           |                 |                 |         |        |        |      |        |      |
|---|------|-----------|-----------------|-----------------|---------|--------|--------|------|--------|------|
|   |      | HEIGHT    | 216.2605        | 216.2605        | 0.0000  | 0.0000 | 0.0000 | 0.0  |        |      |
|   |      | LATITUDE  | 62 49 11.541281 | 62 49 11.541281 | 0.0000  | 0.0000 | 0.0000 | 90.0 | 0.0000 | 90.0 |
|   |      | LONGITUDE | 25 42 8.131873  | 25 42 8.131873  | 0.0000  | 0.0000 | 0.0000 | 0.0  | 0.0000 |      |
| 2 | GPS2 | X         | 2632668.6713    | 2632668.6740    | 0.0027  | 0.0002 |        |      |        |      |
|   |      | Y         | 1266433.2178    | 1266433.2149    | -0.0029 | 0.0001 |        |      |        |      |
|   |      | Z         | 5650946.8226    | 5650946.8259    | 0.0033  | 0.0005 |        |      |        |      |
|   |      | HEIGHT    | 201.6768        | 201.6802        | 0.0034  | 0.0006 | 0.0006 | 0.6  |        |      |
|   |      | LATITUDE  | 62 49 6.746291  | 62 49 6.746307  | 0.0005  | 0.0001 | 0.0001 | 90.1 | 0.0001 | 90.2 |
|   |      | LONGITUDE | 25 41 22.804861 | 25 41 22.804593 | -0.0038 | 0.0001 | 0.0001 | -0.2 | 0.0001 |      |
| 5 | GPS5 | X         | 2631669.9819    | 2631669.9808    | -0.0011 | 0.0002 |        |      |        |      |
|   |      | Y         | 1266914.5590    | 1266914.5584    | -0.0006 | 0.0001 |        |      |        |      |
|   |      | Z         | 5651312.1649    | 5651312.1633    | -0.0016 | 0.0005 |        |      |        |      |
|   |      | HEIGHT    | 210.9794        | 210.9774        | -0.0020 | 0.0006 | 0.0006 | 0.5  |        |      |
|   |      | LATITUDE  | 62 49 31.995017 | 62 49 31.995031 | 0.0004  | 0.0001 | 0.0001 | 89.8 | 0.0001 | 89.9 |
|   |      | LONGITUDE | 25 42 24.011125 | 25 42 24.011123 | 0.0000  | 0.0001 | 0.0001 | -0.1 | 0.0001 |      |
| 6 | GPS6 | X         | 2631400.1527    | 2631400.1451    | -0.0076 | 0.0002 |        |      |        |      |
|   |      | Y         | 1267721.3486    | 1267721.3454    | -0.0032 | 0.0001 |        |      |        |      |
|   |      | Z         | 5651229.2666    | 5651229.2534    | -0.0132 | 0.0005 |        |      |        |      |
|   |      | HEIGHT    | 186.0792        | 186.0637        | -0.0155 | 0.0006 | 0.0006 | 0.5  |        |      |
|   |      | LATITUDE  | 62 49 27.699096 | 62 49 27.699138 | 0.0013  | 0.0001 | 0.0001 | 89.9 | 0.0001 | 90.0 |
|   |      | LONGITUDE | 25 43 23.611374 | 25 43 23.611405 | 0.0004  | 0.0001 | 0.0001 | -0.1 | 0.0001 |      |
| 7 | GPS7 | X         | 2632837.9413    | 2632837.9447    | 0.0034  | 0.0002 |        |      |        |      |
|   |      | Y         | 1267275.0647    | 1267275.0656    | 0.0009  | 0.0001 |        |      |        |      |
|   |      | Z         | 5650672.9413    | 5650672.9470    | 0.0057  | 0.0005 |        |      |        |      |
|   |      | HEIGHT    | 194.4937        | 194.5003        | 0.0066  | 0.0006 | 0.0006 | 0.5  |        |      |
|   |      | LATITUDE  | 62 48 47.835455 | 62 48 47.835438 | -0.0005 | 0.0001 | 0.0001 | 89.9 | 0.0001 | 90.0 |
|   |      | LONGITUDE | 25 42 11.178073 | 25 42 11.178022 | -0.0007 | 0.0001 | 0.0001 | -0.1 | 0.0001 |      |
| 3 | GPS3 | X         | 2633182.4577    | 2633182.4621    | 0.0044  | 0.0002 |        |      |        |      |
|   |      | Y         | 1265629.9428    | 1265629.9427    | -0.0001 | 0.0001 |        |      |        |      |
|   |      | Z         | 5650879.0389    | 5650879.0434    | 0.0045  | 0.0005 |        |      |        |      |
|   |      | HEIGHT    | 193.8849        | 193.8907        | 0.0058  | 0.0006 | 0.0006 | 0.5  |        |      |
|   |      | LATITUDE  | 62 49 2.443920  | 62 49 2.443874  | -0.0014 | 0.0001 | 0.0001 | 90.0 | 0.0001 | 90.1 |
|   |      | LONGITUDE | 25 40 15.973856 | 25 40 15.973716 | -0.0020 | 0.0001 | 0.0001 | -0.2 | 0.0001 |      |
| 4 | GPS4 | X         | 2632226.4697    | 2632226.4701    | 0.0004  | 0.0002 |        |      |        |      |
|   |      | Y         | 1265406.6777    | 1265406.6756    | -0.0021 | 0.0001 |        |      |        |      |
|   |      | Z         | 5651380.4111    | 5651380.4123    | 0.0012  | 0.0005 |        |      |        |      |
|   |      | HEIGHT    | 202.1775        | 202.1783        | 0.0008  | 0.0006 | 0.0006 | 0.5  |        |      |
|   |      | LATITUDE  | 62 49 37.375281 | 62 49 37.375313 | 0.0010  | 0.0001 | 0.0001 | 90.0 | 0.0001 | 90.1 |
|   |      | LONGITUDE | 25 40 31.010505 | 25 40 31.010359 | -0.0021 | 0.0001 | 0.0001 | -0.1 | 0.0001 |      |

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SITE-SPECIFIC TROPOSPHERE PARAMETERS: (NOT SAVED)  
-----

| REQU. | STATION NAME | CORRECTIONS (M) |      |          | RMS ERRORS (M) |      |         | ZENITH VECTOR (") |     |       |     | ERROR ELLIPSE (M) |         |     |
|-------|--------------|-----------------|------|----------|----------------|------|---------|-------------------|-----|-------|-----|-------------------|---------|-----|
|       |              | NORTH           | EAST | ZENITH   | NORTH          | EAST | ZENITH  | ANGLE             | RMS | RATIO | AZI | MAX RMS           | MIN RMS | AZI |
| 1     | GPS2         |                 |      | 0.00491  |                |      | 0.00101 |                   |     |       |     |                   |         |     |
| 2     | GPS2         |                 |      | 0.00162  |                |      | 0.00039 |                   |     |       |     |                   |         |     |
| 3     | GPS2         |                 |      | 0.00526  |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 4     | GPS2         |                 |      | 0.00058  |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 5     | GPS2         |                 |      | 0.00402  |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 6     | GPS2         |                 |      | 0.00440  |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 7     | GPS2         |                 |      | 0.00087  |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 8     | GPS2         |                 |      | 0.00393  |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 9     | GPS2         |                 |      | 0.00596  |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 10    | GPS2         |                 |      | 0.00390  |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 11    | GPS2         |                 |      | 0.00643  |                |      | 0.00037 |                   |     |       |     |                   |         |     |
| 12    | GPS2         |                 |      | 0.00176  |                |      | 0.00035 |                   |     |       |     |                   |         |     |
| 13    | GPS2         |                 |      | 0.00387  |                |      | 0.00039 |                   |     |       |     |                   |         |     |
| 14    | GPS2         |                 |      | 0.00171  |                |      | 0.00035 |                   |     |       |     |                   |         |     |
| 15    | GPS2         |                 |      | 0.00657  |                |      | 0.00045 |                   |     |       |     |                   |         |     |
| 16    | GPS5         |                 |      | 0.00000  |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 17    | GPS5         |                 |      | 0.00300  |                |      | 0.00064 |                   |     |       |     |                   |         |     |
| 18    | GPS5         |                 |      | -0.00055 |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 19    | GPS5         |                 |      | 0.00194  |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 20    | GPS5         |                 |      | -0.00076 |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 21    | GPS5         |                 |      | -0.00036 |                |      | 0.00037 |                   |     |       |     |                   |         |     |
| 22    | GPS5         |                 |      | -0.00038 |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 23    | GPS5         |                 |      | 0.00292  |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 24    | GPS5         |                 |      | 0.00063  |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 25    | GPS5         |                 |      | 0.00167  |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 26    | GPS5         |                 |      | 0.00206  |                |      | 0.00037 |                   |     |       |     |                   |         |     |
| 27    | GPS5         |                 |      | 0.00097  |                |      | 0.00035 |                   |     |       |     |                   |         |     |
| 28    | GPS5         |                 |      | 0.00091  |                |      | 0.00039 |                   |     |       |     |                   |         |     |
| 29    | GPS5         |                 |      | 0.00156  |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 30    | GPS5         |                 |      | -0.00055 |                |      | 0.00052 |                   |     |       |     |                   |         |     |
| 31    | GPS6         |                 |      | 0.00000  |                |      | 0.00000 |                   |     |       |     |                   |         |     |
| 32    | GPS6         |                 |      | 0.00584  |                |      | 0.00052 |                   |     |       |     |                   |         |     |
| 33    | GPS6         |                 |      | 0.00705  |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 34    | GPS6         |                 |      | 0.00632  |                |      | 0.00037 |                   |     |       |     |                   |         |     |
| 35    | GPS6         |                 |      | 0.00923  |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 36    | GPS6         |                 |      | 0.00544  |                |      | 0.00037 |                   |     |       |     |                   |         |     |
| 37    | GPS6         |                 |      | 0.00841  |                |      | 0.00037 |                   |     |       |     |                   |         |     |
| 38    | GPS6         |                 |      | 0.00551  |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 39    | GPS6         |                 |      | 0.00812  |                |      | 0.00035 |                   |     |       |     |                   |         |     |
| 40    | GPS6         |                 |      | 0.01083  |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 41    | GPS6         |                 |      | 0.00641  |                |      | 0.00039 |                   |     |       |     |                   |         |     |

|    |      |          |         |
|----|------|----------|---------|
| 42 | GPS6 | 0.00794  | 0.00036 |
| 43 | GPS6 | 0.00689  | 0.00039 |
| 44 | GPS6 | 0.00738  | 0.00037 |
| 45 | GPS6 | 0.00771  | 0.00059 |
| 46 | GPS7 | 0.00000  | 0.00000 |
| 47 | GPS7 | -0.00314 | 0.00042 |
| 48 | GPS7 | 0.00013  | 0.00035 |
| 49 | GPS7 | -0.00868 | 0.00035 |
| 50 | GPS7 | -0.00119 | 0.00034 |
| 51 | GPS7 | -0.00112 | 0.00037 |
| 52 | GPS7 | -0.00184 | 0.00036 |
| 53 | GPS7 | -0.00245 | 0.00034 |
| 54 | GPS7 | -0.00134 | 0.00034 |
| 55 | GPS7 | -0.00260 | 0.00036 |
| 56 | GPS7 | -0.00106 | 0.00037 |
| 57 | GPS7 | -0.00306 | 0.00035 |
| 58 | GPS7 | -0.00305 | 0.00039 |
| 59 | GPS7 | -0.00237 | 0.00037 |
| 60 | GPS7 | -0.00005 | 0.00088 |
| 61 | GPS3 | 0.00804  | 0.00266 |
| 62 | GPS3 | -0.00199 | 0.00040 |
| 63 | GPS3 | 0.00160  | 0.00035 |
| 64 | GPS3 | -0.00131 | 0.00036 |
| 65 | GPS3 | 0.00120  | 0.00034 |
| 66 | GPS3 | 0.00146  | 0.00037 |
| 67 | GPS3 | -0.00052 | 0.00036 |
| 68 | GPS3 | 0.00045  | 0.00034 |
| 69 | GPS3 | 0.00099  | 0.00034 |
| 70 | GPS3 | -0.00057 | 0.00037 |
| 71 | GPS3 | 0.00086  | 0.00038 |
| 72 | GPS3 | -0.00089 | 0.00035 |
| 73 | GPS3 | 0.00073  | 0.00039 |
| 74 | GPS3 | -0.00014 | 0.00039 |
| 75 | GPS3 | 0.01397  | 0.00186 |
| 76 | GPS4 | 0.00911  | 0.00782 |
| 77 | GPS4 | 0.00291  | 0.00041 |
| 78 | GPS4 | 0.00292  | 0.00035 |
| 79 | GPS4 | 0.00250  | 0.00036 |
| 80 | GPS4 | 0.00278  | 0.00034 |
| 81 | GPS4 | 0.00109  | 0.00037 |
| 82 | GPS4 | 0.00072  | 0.00036 |
| 83 | GPS4 | 0.00448  | 0.00034 |
| 84 | GPS4 | 0.00455  | 0.00034 |
| 85 | GPS4 | 0.00139  | 0.00037 |
| 86 | GPS4 | 0.00799  | 0.00038 |
| 87 | GPS4 | 0.00210  | 0.00035 |
| 88 | GPS4 | 0.00306  | 0.00039 |
| 89 | GPS4 | 0.00168  | 0.00039 |
| 90 | GPS4 | 0.00330  | 0.00131 |

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KIVE05S

PROGRAM GPSEST 18-JAN-06 16:40  
BERNESE GPS SOFTWARE VERSION 5.0

-----  
 RMS ERRORS OF ELLIPSS. COORDINATES AND COORDINATE DIFFER. IN MM (PART 1):  
 -----

| NUM |   | 1   | 2   | 5   | 6   | 7   | 3   | 4   |
|-----|---|-----|-----|-----|-----|-----|-----|-----|
| 1   | B | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
|     | H | 0.0 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| 2   | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
|     | H | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| 5   | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
|     | H | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| 6   | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 |
|     | H | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| 7   | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
|     | H | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| 3   | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 |
|     | H | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| 4   | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
|     | H | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |

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PROGRAM GPSEST 18-JAN-06 16:40  
 BERNESE GPS SOFTWARE VERSION 5.0

-----  
 SLOPE DISTANCES AND RMS ERRORS IN M (PART 1):  
 -----

| NUM |     | 2 N      | 5 N      | 6 N       | 7 N      | 3 N       | 4 N       |
|-----|-----|----------|----------|-----------|----------|-----------|-----------|
| 1   | O   | 659.0808 | 672.0465 | 1180.5883 | 735.5633 | 1613.4842 | 1591.0947 |
| N   | N   | 659.0843 | 672.0469 | 1180.5896 | 735.5636 | 1613.4864 | 1591.0970 |
|     | RMS | 0.0000   | 0.0001   | 0.0001    | 0.0001   | 0.0000    | 0.0001    |

|   |     |           |           |           |           |           |
|---|-----|-----------|-----------|-----------|-----------|-----------|
| 2 | O   | 1167.2810 | 1829.8074 | 901.3154  | 955.9403  | 1198.8852 |
| N | N   | 1167.2837 | 1829.8118 | 901.3184  | 955.9387  | 1198.8846 |
|   | RMS | 0.0001    | 0.0001    | 0.0001    | 0.0000    | 0.0001    |
| 5 | O   |           | 854.7452  | 1379.3840 | 2031.1130 | 1608.7393 |
| N | N   |           | 854.7459  | 1379.3850 | 2031.1155 | 1608.7414 |
|   | RMS |           | 0.0001    | 0.0001    | 0.0001    | 0.0000    |
| 6 | O   |           |           | 1604.9621 | 2770.0630 | 2462.3862 |
| N | N   |           |           | 1604.9643 | 2770.0661 | 2462.3888 |
|   | RMS |           |           | 0.0001    | 0.0001    | 0.0000    |
| 7 | O   |           |           |           | 1693.3971 | 2089.3255 |
| N | N   |           |           |           | 1693.3981 | 2089.3275 |
|   | RMS |           |           |           | 0.0001    | 0.0001    |
| 3 | O   |           |           |           |           | 1102.3314 |
| N | N   |           |           |           |           | 1102.3337 |
|   | RMS |           |           |           |           | 0.0001    |

---

**Appendix VIIIa. Results of 14 measurements at Romuvaara. Deviations of the vector lengths from their mean in millimeters. Unscaled observations.**

| Vector    | Mean length<br>[mm] | Time [a] |      |      |      |      |      |      |      |      |      |     |      |      |      | RMS  |
|-----------|---------------------|----------|------|------|------|------|------|------|------|------|------|-----|------|------|------|------|
|           |                     | 96.3     | 96.8 | 97.3 | 97.8 | 98.3 | 98.8 | 99.3 | 99.8 | 1.3  | 1.8  | 2.8 | 3.8  | 4.8  | 5.8  |      |
| GPS1-GPS2 | 1176417.6           | -0.7     | -1.0 | 1.4  | -1.4 | -0.4 | -0.3 | -0.1 | 1.3  | 0.8  | 0.3  | 2.6 | -0.5 | -0.4 | -1.4 | ±1.1 |
| GPS1-GPS3 | 541205.2            | 1.0      | -0.7 | 0.5  | -0.5 | 0.2  | -0.5 | 0.4  | 0.0  | 0.5  | -0.4 | 1.4 | -0.8 | -0.3 | -0.7 | 0.7  |
| GPS1-GPS4 | 731895.9            | -3.0     | 0.0  | -0.9 | 0.2  | -2.3 | 0.4  | 0.0  | 0.8  | 1.0  | 1.4  | 1.5 | 0.5  | 0.8  | 0.2  | 1.3  |
| GPS1-GPS5 | 614734.4            | 0.8      | -0.2 | 0.2  | -0.6 | 0.0  | -0.5 | 0.2  | -0.3 | 0.1  | 0.4  | 0.3 | 0.1  | -0.1 | -0.1 | 0.4  |
| GPS1-GPS6 | 678196.5            | -0.1     | 1.0  | 0.1  | 0.3  | -0.4 | -0.4 | -1.2 | 0.7  | -0.7 | -0.1 | 1.6 | 0.0  | -0.2 | -1.2 | 0.8  |
| GPS1-GPS7 | 1222388.6           | -0.6     | 0.9  | -0.2 | -0.1 | -0.9 | -1.0 | -0.4 | 1.0  | -0.3 | 0.2  | 1.8 | 0.1  | 0.3  | -0.9 | 0.7  |
| GPS2-GPS3 | 783976.1            | -1.5     | -0.3 | 0.8  | -1.2 | 0.0  | -0.3 | 0.0  | 1.1  | 0.3  | 0.5  | 0.9 | 0.6  | -0.2 | -0.7 | 0.7  |
| GPS2-GPS4 | 692374.6            | -1.8     | -0.3 | 1.6  | 0.1  | -1.6 | -1.2 | -0.5 | 0.8  | 0.2  | 0.2  | 2.4 | 0.2  | 0.2  | -0.6 | 1.1  |
| GPS2-GPS5 | 1397223.2           | -0.5     | -0.2 | 0.1  | -1.7 | -0.7 | -0.9 | -0.1 | 1.7  | 0.4  | 0.9  | 2.0 | 0.1  | 0.1  | -0.8 | 1.0  |
| GPS2-GPS6 | 1686681.9           | -0.5     | -0.5 | 2.1  | -1.3 | -0.8 | -0.7 | -0.8 | 1.8  | 0.7  | -0.1 | 4.6 | -0.6 | -0.8 | -2.6 | 1.7  |
| GPS2-GPS7 | 1940414.0           | -1.2     | -0.5 | 1.8  | -1.2 | -1.5 | -0.9 | -0.6 | 1.6  | 0.9  | -0.4 | 5.2 | -0.6 | -0.6 | -2.4 | 1.8  |
| GPS3-GPS4 | 717506.4            | -3.9     | 0.4  | -0.8 | 0.6  | -2.6 | -1.0 | 0.0  | 0.5  | 0.8  | 1.2  | 1.3 | 1.2  | 1.1  | 0.7  | 1.5  |
| GPS3-GPS5 | 616536.0            | 1.0      | 0.1  | -0.7 | -0.6 | -0.9 | -0.6 | -0.2 | 0.6  | 0.1  | 0.5  | 1.1 | -0.6 | 0.4  | -0.2 | 0.6  |
| GPS3-GPS6 | 1204805.3           | 0.9      | 0.3  | 0.6  | -0.3 | -0.1 | -1.0 | -0.7 | 0.7  | 0.1  | -0.6 | 2.9 | -0.8 | -0.6 | -2.0 | 1.1  |
| GPS3-GPS7 | 1679302.2           | 0.2      | 0.3  | 0.5  | -0.6 | -0.5 | -1.5 | 0.1  | 0.9  | 0.5  | -0.4 | 3.1 | -0.5 | -0.2 | -1.5 | 1.1  |
| GPS4-GPS5 | 1225010.6           | -3.2     | 0.4  | -1.5 | 0.0  | -3.3 | -0.8 | -0.2 | 0.7  | 0.7  | 2.0  | 1.6 | 1.0  | 1.3  | 0.7  | 1.6  |
| GPS4-GPS6 | 1045309.6           | -0.4     | -0.2 | 0.1  | -0.9 | -0.7 | 0.4  | -0.3 | 1.0  | 1.0  | 0.3  | 2.7 | -0.4 | -0.5 | -1.6 | 1.0  |
| GPS4-GPS7 | 1248362.9           | 0.8      | -0.2 | 0.2  | -1.3 | 0.2  | 0.3  | 0.0  | 0.9  | 0.7  | -0.6 | 2.8 | -0.7 | -0.8 | -1.7 | 1.1  |
| GPS5-GPS6 | 1188022.5           | 0.7      | 0.8  | 0.4  | 0.3  | 0.0  | -0.4 | -0.9 | 0.0  | -0.5 | 0.3  | 1.5 | -0.1 | -0.4 | -1.2 | 0.7  |
| GPS5-GPS7 | 1795940.0           | 0.5      | 0.6  | 0.3  | -0.4 | -0.6 | -1.3 | -0.1 | 0.3  | -0.1 | 0.5  | 1.7 | 0.0  | 0.0  | -0.9 | 0.7  |
| GPS6-GPS7 | 636487.7            | -0.1     | -0.2 | 0.1  | -0.7 | -0.4 | -1.0 | 0.8  | 0.3  | 0.5  | 0.3  | 0.3 | -0.1 | 0.2  | 0.1  | 0.5  |
| Mean:     |                     | -0.6     | 0.0  | 0.3  | -0.5 | -0.8 | -0.6 | -0.2 | 0.8  | 0.4  | 0.3  | 2.1 | -0.1 | 0.0  | -0.9 |      |
| St.dev.:  |                     | ±1.4     | 0.5  | 0.9  | 0.7  | 0.9  | 0.5  | 0.5  | 0.6  | 0.5  | 0.7  | 1.2 | 0.6  | 0.6  | 0.9  |      |
| RMS:      |                     | ±1.5     | 0.5  | 0.9  | 0.9  | 1.2  | 0.8  | 0.5  | 0.9  | 0.6  | 0.7  | 2.4 | 0.6  | 0.6  | 1.3  | ±1.1 |

**Appendix VIIIb. Results of 14 measurements at Romuvaara. Deviations of the vector lengths from their mean in millimeters. Scaled observations.**

| Vector    | Mean length<br>[mm] | Time [a] |      |      |      |      |      |      |      |      |      |      |      |      |      | RMS  |
|-----------|---------------------|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|           |                     | 96.3     | 96.8 | 97.3 | 97.8 | 98.3 | 98.8 | 99.3 | 99.8 | 1.3  | 1.8  | 2.8  | 3.8  | 4.8  | 5.8  |      |
| GPS1-GPS2 | 1176417.9           | 0.0      | -1.0 | 1.1  | -0.8 | 0.6  | 0.4  | 0.1  | 0.5  | 0.4  | -0.1 | 0.4  | -0.4 | -0.4 | -0.5 | ±0.6 |
| GPS1-GPS3 | 541205.7            | 1.3      | -0.7 | 0.4  | -0.2 | 0.7  | -0.2 | 0.5  | -0.4 | 0.3  | -0.6 | 0.4  | -0.8 | -0.3 | -0.3 | 0.6  |
| GPS1-GPS4 | 731896.0            | -2.6     | 0.0  | -1.1 | 0.6  | -1.7 | 0.9  | 0.1  | 0.3  | 0.7  | 1.1  | 0.1  | 0.5  | 0.8  | 0.7  | 1.0  |
| GPS1-GPS5 | 614734.6            | 1.2      | -0.2 | 0.1  | -0.3 | 0.5  | -0.1 | 0.3  | -0.7 | -0.1 | 0.2  | -0.8 | 0.1  | -0.1 | 0.4  | 0.5  |
| GPS1-GPS6 | 678196.6            | 0.4      | 1.1  | -0.1 | 0.7  | 0.3  | 0.1  | -1.1 | 0.3  | -0.9 | -0.3 | 0.4  | 0.1  | -0.2 | -0.7 | 0.6  |
| GPS1-GPS7 | 1222388.9           | 0.1      | 0.8  | -0.5 | 0.5  | 0.2  | -0.2 | -0.2 | 0.0  | -0.7 | -0.3 | -0.6 | 0.1  | 0.2  | 0.0  | 0.4  |
| GPS2-GPS3 | 783976.3            | -1.0     | -0.3 | 0.6  | -0.8 | 0.7  | 0.2  | 0.1  | 0.6  | 0.0  | 0.2  | -0.6 | 0.6  | -0.2 | -0.1 | 0.5  |
| GPS2-GPS4 | 692374.8            | -1.4     | -0.3 | 1.4  | 0.4  | -1.0 | -0.8 | -0.4 | 0.3  | -0.1 | 0.0  | 1.1  | 0.2  | 0.2  | -0.1 | 0.7  |
| GPS2-GPS5 | 1397223.5           | 0.3      | -0.2 | -0.2 | -1.0 | 0.5  | 0.0  | 0.1  | 0.7  | -0.1 | 0.4  | -0.6 | 0.2  | 0.1  | 0.2  | 0.4  |
| GPS2-GPS6 | 1686682.3           | 0.5      | -0.5 | 1.7  | -0.5 | 0.7  | 0.4  | -0.5 | 0.6  | 0.1  | -0.7 | 1.5  | -0.5 | -0.8 | -1.4 | 0.9  |
| GPS2-GPS7 | 1940414.5           | 0.0      | -0.5 | 1.3  | -0.3 | 0.2  | 0.3  | -0.3 | 0.2  | 0.2  | -1.1 | 1.6  | -0.5 | -0.7 | -1.0 | 0.8  |
| GPS3-GPS4 | 717506.5            | -3.5     | 0.5  | -1.0 | 1.0  | -2.0 | -0.5 | 0.2  | 0.1  | 0.6  | 1.0  | 0.1  | 1.3  | 1.2  | 1.3  | 1.3  |
| GPS3-GPS5 | 616536.2            | 1.3      | 0.0  | -0.8 | -0.3 | -0.4 | -0.2 | -0.1 | 0.1  | -0.2 | 0.2  | -0.1 | -0.6 | 0.3  | 0.3  | 0.5  |
| GPS3-GPS6 | 1204805.6           | 1.6      | 0.3  | 0.3  | 0.3  | 0.9  | -0.2 | -0.5 | -0.1 | -0.3 | -1.0 | 0.7  | -0.7 | -0.6 | -1.1 | 0.7  |
| GPS3-GPS7 | 1679302.6           | 1.2      | 0.3  | 0.1  | 0.2  | 0.9  | -0.4 | 0.4  | -0.3 | -0.1 | -1.0 | 0.0  | -0.4 | -0.2 | -0.3 | 0.5  |
| GPS4-GPS5 | 1225010.9           | -2.5     | 0.4  | -1.8 | 0.6  | -2.2 | 0.0  | 0.0  | -0.2 | 0.3  | 1.6  | -0.7 | 1.1  | 1.3  | 1.6  | 1.3  |
| GPS4-GPS6 | 1045309.9           | 0.2      | -0.2 | -0.2 | -0.4 | 0.2  | 1.1  | -0.1 | 0.3  | 0.6  | -0.1 | 0.8  | -0.3 | -0.5 | -0.8 | 0.5  |
| GPS4-GPS7 | 1248363.2           | 1.6      | -0.3 | -0.2 | -0.8 | 1.3  | 1.1  | 0.2  | -0.1 | 0.2  | -1.1 | 0.5  | -0.7 | -0.9 | -0.9 | 0.8  |
| GPS5-GPS6 | 1188022.8           | 1.4      | 0.8  | 0.1  | 0.9  | 1.0  | 0.3  | -0.7 | -0.8 | -0.9 | -0.1 | -0.7 | 0.0  | -0.4 | -0.3 | 0.7  |
| GPS5-GPS7 | 1795940.4           | 1.6      | 0.6  | -0.1 | 0.5  | 0.9  | -0.2 | 0.2  | -1.0 | -0.8 | -0.1 | -1.6 | 0.1  | -0.1 | 0.4  | 0.8  |
| GPS6-GPS7 | 636487.8            | 0.3      | -0.2 | -0.1 | -0.4 | 0.1  | -0.6 | 0.9  | -0.1 | 0.3  | 0.1  | -0.9 | -0.1 | 0.2  | 0.6  | 0.5  |
| Mean:     |                     | 0.1      | 0.0  | 0.1  | 0.0  | 0.1  | 0.1  | 0.0  | 0.0  | 0.0  | -0.1 | 0.0  | 0.0  | -0.1 | -0.1 |      |
| St.dev.:  |                     | ±1.5     | 0.5  | 0.9  | 0.6  | 1.0  | 0.5  | 0.4  | 0.5  | 0.5  | 0.7  | 0.8  | 0.6  | 0.6  | 0.8  |      |
| RMS:      |                     | ±1.4     | 0.5  | 0.8  | 0.6  | 1.0  | 0.5  | 0.4  | 0.5  | 0.5  | 0.7  | 0.8  | 0.6  | 0.6  | 0.8  | ±0.7 |

## Appendix IX. Results of the measurements at Romuvaara in 2005.

```

=====
Program : GPSEST Bernese GPS Software Version 5.0
Purpose : Parameter estimation
Campaign: ${P}/ROMU05S Default session: 2590 year 2005
Date : 18-Jan-2006 13:58 User name : ja
=====

```

ROMU05S

```

1${P}/ROMU05S PROGRAM GPSEST 18-JAN-06 13:58
ROMU05S BERNESE GPS SOFTWARE VERSION 5.0

```

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1${P}/ROMU05S PROGRAM GPSEST 18-JAN-06 13:58
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```

### INPUT AND OUTPUT FILENAMES

-----

```

Session table : ${P}/ROMU05S\STA\SESSIONS.SES

```



```

General constants : ${X}/GEN\CONST.
Geodetic datum : ${X}/GEN\DATUM.
Station information : ${P}/ROMU05S\STA\ROMU.STA
Earth rotation parameters : ${P}/ROMU05S\ORB\C04_2005.ERP
Subdaily pole model : ${X}/GEN\IERS2000.SUB
Nutation model : ${X}/GEN\IAU2000.NUT
Satellite information : ${X}/GEN\SATELLIT.
Receiver information : ${X}/GEN\RECEIVER.
Satellite problems : ${X}/GEN\SAT_2005.CRX
Phase center eccentricities : ${X}/GEN\PHAS_IGS.REL
SINEX general input file : ${X}/GEN\SINEX.
IONEX control file : ${X}/GEN\IONEX.
Difference GPS-UTC : ---
A priori station coordinates: ${P}/ROMU05S\STA\ROMU.CRD
GNSS standard orbits : ${P}/ROMU05S\ORB\ROMU05S.STD
GNSS orbit partials : ---
Ionosphere models : ${P}/ROMU05S\ATM\ROMU05S.ION
Troposphere estimates : ---
Station sigma factors : ---
Station eccentricities : ---
Ocean loading tables : ---
GNSS clock corrections : ---
Differential code biases : ---
Receiver antenna orientation: ---
Kinematic coordinates : ---
Kinematic velocities : ---
Standard orbit(s) : ---
Orbit partials : ---
Attitude data : ---
Precise orbit(s) : ---
LEO orbital elements : ---
Station coordinates : ${P}/ROMU05S\STA\TROMU05S.CRD
GNSS orbital elements : ---
Troposphere estimates : ---
Troposphere SINEX : ---
Ionosphere models : ---
IONEX : ---
Residuals : ---
Coordinate covariance matrix: ---
Full covariance matrix : ---
Normal equations : ---
Bernese ERP file : ---
IERS ERP file : ---
GNSS clock corrections : ---
Clock RINEX : ---
Kinematic coordinates : ---
Differential code biases : ---
Phase center variations (gri: ---
Phase center variations (har: ---
Scratch file : ${U}/WORK\GPSEST.SCR
Scratch files : ${U}/WORK\GPSEST.SC1
Program output : ${P}/ROMU05S\OUT\GPSEST.L12
Error message : ${U}/WORK\ERROR.MSG

```

1\${P}/ROMU05S  
ROMU05S

PROGRAM GPSEST 18-JAN-06 13:58  
BERNESE GPS SOFTWARE VERSION 5.0

1. CAMPAIGNS

| CAMPAIGN NAME | NUM | STATION NAME | NUM | STATION NAME | NUM | STATION NAME | NUM | STATION NAME | NUM | STATION NAME |
|---------------|-----|--------------|-----|--------------|-----|--------------|-----|--------------|-----|--------------|
| \${P}/ROMU05S | 1   | GPS1         | 3   | GPS3         | 4   | GPS4         | 5   | GPS5         | 6   | GPS6         |
|               | 7   | GPS7         | 2   | GPS2         |     |              |     |              |     |              |

2. OBSERVATION FILES

\${P}/ROMU05S

MAIN CHARACTERISTICS:

| FILE | OBSERVATION FILE HEADER        | OBSERVATION FILE               | SESS | RECEIVER 1     | RECEIVER 2     |
|------|--------------------------------|--------------------------------|------|----------------|----------------|
| 1    | \${P}/ROMU05S\OBS\01032580.PSH | \${P}/ROMU05S\OBS\01032580.PSO | 2580 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 2    | \${P}/ROMU05S\OBS\01032590.PSH | \${P}/ROMU05S\OBS\01032590.PSO | 2590 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 3    | \${P}/ROMU05S\OBS\01042580.PSH | \${P}/ROMU05S\OBS\01042580.PSO | 2580 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 4    | \${P}/ROMU05S\OBS\01042590.PSH | \${P}/ROMU05S\OBS\01042590.PSO | 2590 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 5    | \${P}/ROMU05S\OBS\01052580.PSH | \${P}/ROMU05S\OBS\01052580.PSO | 2580 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 6    | \${P}/ROMU05S\OBS\01052590.PSH | \${P}/ROMU05S\OBS\01052590.PSO | 2590 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 7    | \${P}/ROMU05S\OBS\01062580.PSH | \${P}/ROMU05S\OBS\01062580.PSO | 2580 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 8    | \${P}/ROMU05S\OBS\01062590.PSH | \${P}/ROMU05S\OBS\01062590.PSO | 2590 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 9    | \${P}/ROMU05S\OBS\01072590.PSH | \${P}/ROMU05S\OBS\01072590.PSO | 2590 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 10   | \${P}/ROMU05S\OBS\03022580.PSH | \${P}/ROMU05S\OBS\03022580.PSO | 2580 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 11   | \${P}/ROMU05S\OBS\03022590.PSH | \${P}/ROMU05S\OBS\03022590.PSO | 2590 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |
| 12   | \${P}/ROMU05S\OBS\06072580.PSH | \${P}/ROMU05S\OBS\06072580.PSO | 2580 | ASHTECH Z-XII3 | ASHTECH Z-XII3 |

| FILE | TYP | FREQ. | STATION 1 | STATION 2 | SESS | FIRST   | OBSERV.TIME | #EPO | DT | #EF | #CLK | ARC | #SAT | AMB.I.+S. |    | #CLUSTERS |    |    |    |    |    |   |
|------|-----|-------|-----------|-----------|------|---------|-------------|------|----|-----|------|-----|------|-----------|----|-----------|----|----|----|----|----|---|
|      |     |       |           |           |      |         |             |      |    |     |      |     |      | W         | 12 | #AMB      | L1 | L2 | L5 | RM |    |   |
| 1    | P   | L1,L2 | GPS1      | GPS3      | 2580 | 5-09-15 | 9:25:00     | 1750 | 30 | 0   | E    | E   | 1    | 27        | N  | Y         | Y  | 55 | 21 | 21 | 55 | 0 |
| 2    | P   | L1,L2 | GPS1      | GPS3      | 2590 | 5-09-16 | 0:00:30     | 1342 | 30 | 0   | E    | E   | 1    | 27        | N  | Y         | Y  | 35 | 10 | 10 | 35 | 0 |
| 3    | P   | L1,L2 | GPS1      | GPS4      | 2580 | 5-09-15 | 9:39:00     | 1722 | 30 | 0   | E    | E   | 1    | 27        | N  | Y         | Y  | 57 | 24 | 24 | 57 | 0 |

|    |   |       |      |      |      |         |          |      |    |   |   |   |   |    |   |   |   |    |    |    |    |   |
|----|---|-------|------|------|------|---------|----------|------|----|---|---|---|---|----|---|---|---|----|----|----|----|---|
| 4  | P | L1,L2 | GPS1 | GPS4 | 2590 | 5-09-16 | 0:00:30  | 1364 | 30 | 0 | E | E | 1 | 27 | N | Y | Y | 35 | 9  | 9  | 35 | 0 |
| 5  | P | L1,L2 | GPS1 | GPS5 | 2580 | 5-09-15 | 8:08:30  | 1903 | 30 | 0 | E | E | 1 | 27 | N | Y | Y | 63 | 28 | 28 | 63 | 0 |
| 6  | P | L1,L2 | GPS1 | GPS5 | 2590 | 5-09-16 | 0:00:30  | 1213 | 30 | 0 | E | E | 1 | 27 | N | Y | Y | 32 | 7  | 7  | 32 | 0 |
| 7  | P | L1,L2 | GPS1 | GPS6 | 2580 | 5-09-15 | 9:51:30  | 1697 | 30 | 0 | E | E | 1 | 27 | N | Y | Y | 59 | 26 | 26 | 59 | 0 |
| 8  | P | L1,L2 | GPS1 | GPS6 | 2590 | 5-09-16 | 0:00:30  | 443  | 30 | 0 | E | E | 1 | 17 | N | Y | Y | 18 | 4  | 4  | 18 | 0 |
| 9  | P | L1,L2 | GPS1 | GPS7 | 2590 | 5-09-16 | 0:00:30  | 1402 | 30 | 0 | E | E | 1 | 27 | N | Y | Y | 36 | 9  | 9  | 36 | 0 |
| 10 | P | L1,L2 | GPS3 | GPS2 | 2580 | 5-09-15 | 9:25:00  | 1750 | 30 | 0 | E | E | 1 | 27 | N | Y | Y | 50 | 15 | 15 | 50 | 0 |
| 11 | P | L1,L2 | GPS3 | GPS2 | 2590 | 5-09-16 | 0:00:30  | 1308 | 30 | 0 | E | E | 1 | 27 | N | Y | Y | 38 | 12 | 12 | 38 | 0 |
| 12 | P | L1,L2 | GPS6 | GPS7 | 2580 | 5-09-15 | 10:01:00 | 1678 | 30 | 0 | E | E | 1 | 27 | N | Y | Y | 54 | 22 | 22 | 54 | 0 |

SATELLITES:

-----

FILE #SAT SATELLITES

| FILE | #SAT | SATELLITES |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |
|------|------|------------|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|
| 1    | 27   | 1          | 2 | 3 | 4 | 6 | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |
| 2    | 27   | 1          | 2 | 3 | 4 | 6 | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |
| 3    | 27   | 1          | 2 | 3 | 4 | 6 | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |
| 4    | 27   | 1          | 2 | 3 | 4 | 6 | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |
| 5    | 27   | 1          | 2 | 3 | 4 | 6 | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |
| 6    | 27   | 1          | 2 | 3 | 4 | 6 | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |
| 7    | 27   | 1          | 2 | 3 | 4 | 6 | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |
| 8    | 17   | 1          | 3 | 4 | 7 | 9 | 11 | 14 | 15 | 18 | 19 | 20 | 22 | 23 | 24 | 25 | 28 | 30 |    |    |    |    |    |    |    |    |    |    |  |  |  |
| 9    | 27   | 1          | 2 | 3 | 4 | 6 | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |
| 10   | 27   | 1          | 2 | 3 | 4 | 6 | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |
| 11   | 27   | 1          | 2 | 3 | 4 | 6 | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |
| 12   | 27   | 1          | 2 | 3 | 4 | 6 | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |  |

OBSERVATION SELECTION:

-----

SAMPLING RATE : 30 SEC  
 ELEVATION CUT-OFF ANGLE : 20 DEGREES  
 SATELLITE SYSTEM : GPS  
 SPECIAL DATA SELECTION : NO

1\${P}/ROMU05S  
 ROMU05S

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3. GENERAL OPTIONS

-----

TIDAL CORRECTION OF STATION COORDINATES : IERS CONVENTIONS 2000

A PRIORI SIGMA OF UNIT WEIGHT:

-----

A PRIORI SIGMA OF UNIT WEIGHT : 0.001 M (SIGMA OF ONE-WAY L1 PHASE OBSERVABLE AT ZENITH)  
 MODEL FOR ELEVATION-DEPENDENT WEIGHTING : 1/COS(Z)

CORRELATIONS AND SESSIONS:  
 -----

STRATEGY : CORRELATIONS CORRECTLY MODELLED  
 TIME INTERVAL : 0.10000 SEC (TO IDENTIFY EPOCH)

SESS #FILE FILE NUMBERS  
 -----

2580 6 1 3 5 7 10 12  
 2590 6 2 4 6 8 9 11

AMBIGUITY RESOLUTION STRATEGY:  
 -----

AMBIGUITIES PRE-ELIMINATED EVERY 30 SECONDS

SYNCHRONIZATION ERRORS:  
 -----

STRATEGY : SYNCHRONIZATION ERRORS NOT APPLIED

4. STATIONS  
 -----

Local geodetic datum: \${X}/GEN\DATUM.

| Datum name | Ell. param./ Scale                                        | Shifts to WGS-84                                | Rotations to WGS-84                                               |
|------------|-----------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------|
| WGS - 84   | A = 6378137.000 m<br>1/F= 298.2572236<br>SC = 0.00000D+00 | DX = 0.0000 m<br>DY = 0.0000 m<br>DZ = 0.0000 m | RX = 0.00000 arcsec<br>RY = 0.00000 arcsec<br>RZ = 0.00000 arcsec |

A priori station coordinates: \${P}/ROMU05S\STA\ROMU.CRD

| A priori station coordinates<br>WGS-84 |              |           | A priori station coordinates<br>Ellipsoidal in local geodetic datum |              |              |                 |                 |            |
|----------------------------------------|--------------|-----------|---------------------------------------------------------------------|--------------|--------------|-----------------|-----------------|------------|
| num                                    | Station name | obs e/f/h | X (m)                                                               | Y (m)        | Z (m)        | Latitude        | Longitude       | Height (m) |
| 1                                      | GPS1         | Y ESTIM   | 2410839.3072                                                        | 1388069.5136 | 5720515.2143 | 64 13 2.630039  | 29 55 54.118509 | 241.6600   |
| 3                                      | GPS3         | Y ESTIM   | 2410512.9957                                                        | 1387690.3887 | 5720721.8220 | 64 13 19.254883 | 29 55 41.827606 | 222.4407   |
| 4                                      | GPS4         | Y ESTIM   | 2410183.6629                                                        | 1388327.7870 | 5720712.9448 | 64 13 18.179839 | 29 56 34.977031 | 228.6607   |

|   |      |   |       |              |              |              |    |    |           |    |    |           |          |
|---|------|---|-------|--------------|--------------|--------------|----|----|-----------|----|----|-----------|----------|
| 5 | GPS5 | Y | ESTIM | 2411065.8443 | 1387498.1880 | 5720528.0899 | 64 | 13 | 5.389555  | 29 | 55 | 9.024823  | 214.6804 |
| 6 | GPS6 | Y | ESTIM | 2411071.3051 | 1388657.9331 | 5720270.4931 | 64 | 12 | 44.808990 | 29 | 56 | 23.339861 | 236.4912 |
| 7 | GPS7 | Y | ESTIM | 2410852.0692 | 1389251.9113 | 5720205.3683 | 64 | 12 | 40.796407 | 29 | 57 | 9.606445  | 224.2017 |
| 2 | GPS2 | Y | ESTIM | 2409792.7492 | 1387832.0097 | 5720997.1485 | 64 | 13 | 39.216043 | 29 | 56 | 17.584812 | 229.6879 |

A priori sigma:

Station coordinates a priori sigma  
in local geodetic datum

| num | Station name | N (m)   | E (m)   | U (m)   |
|-----|--------------|---------|---------|---------|
| 1   | GPS1         | 0.00001 | 0.00001 | 0.00001 |

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5. SATELLITE ORBITS

ARC CHARACTERISTICS:

| ARC | START OF ARC      | END OF ARC        | SOURCE     | #SAT | SATELLITES |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
|-----|-------------------|-------------------|------------|------|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| 1   | 05-09-15 00:00:00 | 05-09-17 00:00:00 | PR2005.259 | 29   | 1          | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 |  |
|     |                   |                   |            |      | 21         | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |    |    |    |    |    |    |    |  |

OSCULATING ELEMENTS:                   \${P}/ROMU05S\ORB\ROMU05S.STD

REFERENCE SYSTEM: J2000.0  
REFERENCE EPOCH : 53628.3392361 MJD (2005 9 15 8 8 30.00)

| SAT | S.MAJ.AXIS | ECCENTRIC. | INCLINAT. | NODE        | PERIGEE     | M. ANOMALY  | PER.PASS.TIME |
|-----|------------|------------|-----------|-------------|-------------|-------------|---------------|
| 1   | 26559356.8 | 0.00593018 | 56.461315 | 35.073676   | -98.541674  | -24.790571  | 53628.3735688 |
| 2   | 26561213.6 | 0.00909023 | 54.575032 | -86.862926  | 110.044041  | 57.603962   | 53628.2594515 |
| 3   | 26560153.0 | 0.00722817 | 53.093176 | -151.829825 | 35.001515   | 8.923212    | 53628.3268777 |
| 4   | 26561847.8 | 0.00704458 | 54.552943 | -85.720984  | 2.840779    | -160.522046 | 53628.5615757 |
| 5   | 26560613.2 | 0.00657143 | 53.731874 | 148.602262  | -303.034720 | 177.980699  | 53628.0927316 |
| 6   | 26561138.3 | 0.00624871 | 53.518823 | -148.588087 | 252.192518  | -111.862065 | 53628.4941704 |
| 7   | 26559699.1 | 0.01333426 | 53.608939 | -150.129799 | -101.798141 | 12.970589   | 53628.3212727 |
| 8   | 26561041.7 | 0.00957061 | 55.586518 | 95.340652   | 146.985475  | -105.730114 | 53628.4856766 |



|    |      |                     |         |     |
|----|------|---------------------|---------|-----|
| 3  | GPS3 | 2005 09 15 12 00 00 | 0.00000 | rel |
| 4  | GPS3 | 2005 09 15 14 00 00 | 0.00000 | rel |
| 5  | GPS3 | 2005 09 15 16 00 00 | 0.00000 | rel |
| 6  | GPS3 | 2005 09 15 18 00 00 | 0.00000 | rel |
| 7  | GPS3 | 2005 09 15 20 00 00 | 0.00000 | rel |
| 8  | GPS3 | 2005 09 15 22 00 00 | 0.00000 | rel |
| 9  | GPS3 | 2005 09 16 00 00 00 | 0.00000 | rel |
| 10 | GPS3 | 2005 09 16 02 00 00 | 0.00000 | rel |
| 11 | GPS3 | 2005 09 16 04 00 00 | 0.00000 | rel |
| 12 | GPS3 | 2005 09 16 06 00 00 | 0.00000 | rel |
| 13 | GPS3 | 2005 09 16 08 00 00 | 0.00000 | rel |
| 14 | GPS3 | 2005 09 16 10 00 00 | 0.00000 | rel |
| 15 | GPS3 | 2005 09 16 12 00 00 | 0.00000 | rel |
| 16 | GPS4 | 2005 09 15 08 00 00 | 0.00000 | abs |
| 17 | GPS4 | 2005 09 15 10 00 00 | 0.00000 | rel |
| 18 | GPS4 | 2005 09 15 12 00 00 | 0.00000 | rel |
| 19 | GPS4 | 2005 09 15 14 00 00 | 0.00000 | rel |
| 20 | GPS4 | 2005 09 15 16 00 00 | 0.00000 | rel |
| 21 | GPS4 | 2005 09 15 18 00 00 | 0.00000 | rel |
| 22 | GPS4 | 2005 09 15 20 00 00 | 0.00000 | rel |
| 23 | GPS4 | 2005 09 15 22 00 00 | 0.00000 | rel |
| 24 | GPS4 | 2005 09 16 00 00 00 | 0.00000 | rel |
| 25 | GPS4 | 2005 09 16 02 00 00 | 0.00000 | rel |
| 26 | GPS4 | 2005 09 16 04 00 00 | 0.00000 | rel |
| 27 | GPS4 | 2005 09 16 06 00 00 | 0.00000 | rel |
| 28 | GPS4 | 2005 09 16 08 00 00 | 0.00000 | rel |
| 29 | GPS4 | 2005 09 16 10 00 00 | 0.00000 | rel |
| 30 | GPS4 | 2005 09 16 12 00 00 | 0.00000 | rel |
| 31 | GPS5 | 2005 09 15 08 00 00 | 0.00000 | abs |
| 32 | GPS5 | 2005 09 15 10 00 00 | 0.00000 | rel |
| 33 | GPS5 | 2005 09 15 12 00 00 | 0.00000 | rel |
| 34 | GPS5 | 2005 09 15 14 00 00 | 0.00000 | rel |
| 35 | GPS5 | 2005 09 15 16 00 00 | 0.00000 | rel |
| 36 | GPS5 | 2005 09 15 18 00 00 | 0.00000 | rel |
| 37 | GPS5 | 2005 09 15 20 00 00 | 0.00000 | rel |
| 38 | GPS5 | 2005 09 15 22 00 00 | 0.00000 | rel |
| 39 | GPS5 | 2005 09 16 00 00 00 | 0.00000 | rel |
| 40 | GPS5 | 2005 09 16 02 00 00 | 0.00000 | rel |
| 41 | GPS5 | 2005 09 16 04 00 00 | 0.00000 | rel |
| 42 | GPS5 | 2005 09 16 06 00 00 | 0.00000 | rel |
| 43 | GPS5 | 2005 09 16 08 00 00 | 0.00000 | rel |
| 44 | GPS5 | 2005 09 16 10 00 00 | 0.00000 | rel |
| 45 | GPS5 | 2005 09 16 12 00 00 | 0.00000 | rel |
| 46 | GPS6 | 2005 09 15 08 00 00 | 0.00000 | abs |
| 47 | GPS6 | 2005 09 15 10 00 00 | 0.00000 | rel |
| 48 | GPS6 | 2005 09 15 12 00 00 | 0.00000 | rel |
| 49 | GPS6 | 2005 09 15 14 00 00 | 0.00000 | rel |
| 50 | GPS6 | 2005 09 15 16 00 00 | 0.00000 | rel |
| 51 | GPS6 | 2005 09 15 18 00 00 | 0.00000 | rel |
| 52 | GPS6 | 2005 09 15 20 00 00 | 0.00000 | rel |
| 53 | GPS6 | 2005 09 15 22 00 00 | 0.00000 | rel |
| 54 | GPS6 | 2005 09 16 00 00 00 | 0.00000 | rel |
| 55 | GPS6 | 2005 09 16 02 00 00 | 0.00000 | rel |





| MODEL | TERM | POL. TIME | DEGREE LATIT. | IN | COEFFICIENT   | SIGMA        |
|-------|------|-----------|---------------|----|---------------|--------------|
| 2     | 1    | 0         | 0             |    | 0.966457E+00  | 0.297262E-02 |
|       | 2    | 1         | 0             |    | 0.873689E-01  | 0.748914E-03 |
|       | 3    | 2         | 0             |    | -0.210447E-01 | 0.587948E-03 |
|       | 4    | 0         | 1             |    | -0.497977E-01 | 0.108524E-02 |
|       | 5    | 1         | 1             |    | -0.353153E-02 | 0.922924E-03 |
| 3     | 1    | 0         | 0             |    | 0.678626E+00  | 0.168477E-01 |
|       | 2    | 1         | 0             |    | -0.196174E+00 | 0.617339E-02 |
|       | 3    | 2         | 0             |    | 0.901607E-01  | 0.332072E-02 |
|       | 4    | 0         | 1             |    | -0.485174E-01 | 0.788698E-02 |
|       | 5    | 1         | 1             |    | 0.825560E-01  | 0.627324E-02 |
| 4     | 1    | 0         | 0             |    | 0.427713E+00  | 0.925441E-02 |
|       | 2    | 1         | 0             |    | -0.125369E+00 | 0.246562E-02 |
|       | 3    | 2         | 0             |    | 0.275873E-02  | 0.146116E-02 |
|       | 4    | 0         | 1             |    | 0.703463E-01  | 0.332318E-02 |
|       | 5    | 1         | 1             |    | -0.462593E-01 | 0.221325E-02 |
| 5     | 1    | 0         | 0             |    | 0.318137E+00  | 0.280539E-02 |
|       | 2    | 1         | 0             |    | 0.164339E+00  | 0.705365E-03 |
|       | 3    | 2         | 0             |    | 0.781584E-01  | 0.636342E-03 |
|       | 4    | 0         | 1             |    | 0.352829E-02  | 0.961739E-03 |
|       | 5    | 1         | 1             |    | -0.331439E-01 | 0.959516E-03 |
| 6     | 1    | 0         | 0             |    | 0.102029E+01  | 0.290591E-02 |
|       | 2    | 1         | 0             |    | 0.376386E-01  | 0.765003E-03 |
|       | 3    | 2         | 0             |    | -0.548631E-01 | 0.613259E-03 |
|       | 4    | 0         | 1             |    | -0.245523E-01 | 0.113216E-02 |
|       | 5    | 1         | 1             |    | -0.302067E-01 | 0.959466E-03 |
| 7     | 1    | 0         | 0             |    | 0.890959E+00  | 0.632478E-02 |
|       | 2    | 1         | 0             |    | -0.165956E+00 | 0.208307E-02 |
|       | 3    | 2         | 0             |    | -0.331760E-01 | 0.182015E-02 |
|       | 4    | 0         | 1             |    | -0.145373E+00 | 0.239960E-02 |
|       | 5    | 1         | 1             |    | -0.171207E-01 | 0.268573E-02 |

1\${P}/ROMU05S  
ROMU05S

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8. POLE COORDINATES AND TIME INFORMATION

A PRIORI POLE AND TIME INFORMATION FROM THE POLE FILE:

| DATUM    | TIME     | X-POLE (")<br>EP-CPO (") | Y-POLE (")<br>PS-CPO (") | UT1-UTC (S) | GPS-UTC (S) | RMS XP (")<br>RMS EP (") | RMS YP (")<br>RMS PS (") | RMS DT (S) |
|----------|----------|--------------------------|--------------------------|-------------|-------------|--------------------------|--------------------------|------------|
| 05-09-15 | 00:00:00 | 0.05026<br>0.00000       | 0.42088<br>0.00000       | -0.600592   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-09-16 | 00:00:00 | 0.05098<br>0.00000       | 0.42111<br>0.00000       | -0.601145   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |
| 05-09-17 | 00:00:00 | 0.05197<br>0.00000       | 0.42124<br>0.00000       | -0.602076   | 13.         | 0.00000<br>0.00000       | 0.00000<br>0.00000       | 0.000000   |

NUTATION MODEL: IAU2000  
SUBDAILY POLE MODEL: IERS2000

1\${P}/ROMU05S  
ROMU05S

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12. TEST OUTPUT

MIN. AND MAX. ELEVATION/NADIR ANGLES AND MAX. SYNCHRONIZATION ERRORS:

| SESS | FILE | STATION NAME 1 | STATION NAME 2 | MIN/MAX ELEV. | MIN/MAX NADIR | SYNCH. ERR. (NS) |
|------|------|----------------|----------------|---------------|---------------|------------------|
| 2580 | 1    | GPS1           | GPS3           | 20.0 77.3     | 3.0 13.2      | 0.0              |
| 2590 | 2    | GPS1           | GPS3           | 20.0 80.2     | 2.3 13.2      | 0.0              |
| 2580 | 3    | GPS1           | GPS4           | 20.0 77.0     | 3.1 13.2      | 0.0              |
| 2590 | 4    | GPS1           | GPS4           | 20.0 80.2     | 2.3 13.2      | 0.0              |
| 2580 | 5    | GPS1           | GPS5           | 20.0 77.3     | 3.0 13.2      | 0.0              |
| 2590 | 6    | GPS1           | GPS5           | 20.0 80.2     | 2.3 13.2      | 0.0              |
| 2580 | 7    | GPS1           | GPS6           | 20.0 76.5     | 3.2 13.2      | 0.0              |
| 2590 | 8    | GPS1           | GPS6           | 20.0 76.1     | 3.3 13.2      | 0.0              |
| 2590 | 9    | GPS1           | GPS7           | 20.0 80.2     | 2.3 13.2      | 0.0              |
| 2580 | 10   | GPS3           | GPS2           | 20.0 77.3     | 3.0 13.2      | 0.0              |
| 2590 | 11   | GPS3           | GPS2           | 20.0 80.1     | 2.3 13.2      | 0.0              |
| 2580 | 12   | GPS6           | GPS7           | 20.0 76.5     | 3.2 13.2      | 0.0              |

1\${P}/ROMU05S  
ROMU05S

PROGRAM GPSEST 18-JAN-06 13:58  
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13. RESULTS (PART 1)

## NUMBER OF PARAMETERS (PART 1):

| PARAMETER TYPE                       | #PARAMETERS | #PRE-ELIMINATED | #SET-UP | #NO-OBS | #REF | #SINGULAR |
|--------------------------------------|-------------|-----------------|---------|---------|------|-----------|
| STATION COORDINATES                  | 21          | 0               | 21      | 0       | 0    | 0         |
| AMBIGUITIES                          | 10          | 10 (BEFORE INV) | 374     | 364     | 0    | 0         |
| SITE-SPECIFIC TROPOSPHERE PARAMETERS | 90          | 0               | 90      | 0       | 0    | 6         |
| TOTAL NUMBER OF PARAMETERS           | 121         | 10              | 485     | 364     | 0    | 6         |

## NUMBER OF OBSERVATIONS (PART 1):

| TYPE                         | FREQUENCY | FILE | #OBSERVATIONS |
|------------------------------|-----------|------|---------------|
| PHASE                        | L1        | ALL  | 89081         |
| PHASE                        | L2        | ALL  | 89081         |
| TOTAL NUMBER OF OBSERVATIONS |           |      | 178162        |

## A POSTERIORI SIGMA OF UNIT WEIGHT (PART 1):

A POSTERIORI SIGMA OF UNIT WEIGHT : 0.0021 M (SIGMA OF ONE-WAY L1 PHASE OBSERVABLE AT ZENITH)

DEGREE OF FREEDOM (DOF) : 178047

CHI\*\*2/DOF : 4.34

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## STATION COORDINATES: \${P}/ROMU05S\STA\tROMU05S.CRD

| NUM | STATION NAME | PARAMETER | A PRIORI VALUE | NEW VALUE    | NEW- A PRIORI | RMS ERROR | 3-D ELLIPSOID | 2-D ELLIPSE |
|-----|--------------|-----------|----------------|--------------|---------------|-----------|---------------|-------------|
| 1   | GPS1         | X         | 2410839.3072   | 2410839.3072 | 0.0000        | 0.0000    |               |             |
|     |              | Y         | 1388069.5136   | 1388069.5136 | 0.0000        | 0.0000    |               |             |
|     |              | Z         | 5720515.2143   | 5720515.2143 | 0.0000        | 0.0000    |               |             |

|   |      |           |                 |                 |         |        |        |      |        |      |
|---|------|-----------|-----------------|-----------------|---------|--------|--------|------|--------|------|
|   |      | HEIGHT    | 241.6600        | 241.6600        | 0.0000  | 0.0000 | 0.0000 | 0.0  |        |      |
|   |      | LATITUDE  | 64 13 2.630039  | 64 13 2.630039  | 0.0000  | 0.0000 | 0.0000 | 90.0 | 0.0000 | 90.0 |
|   |      | LONGITUDE | 29 55 54.118509 | 29 55 54.118509 | 0.0000  | 0.0000 | 0.0000 | 0.0  | 0.0000 |      |
| 3 | GPS3 | X         | 2410512.9957    | 2410512.9961    | 0.0004  | 0.0002 |        |      |        |      |
|   |      | Y         | 1387690.3887    | 1387690.3890    | 0.0003  | 0.0001 |        |      |        |      |
|   |      | Z         | 5720721.8220    | 5720721.8244    | 0.0024  | 0.0005 |        |      |        |      |
|   |      | HEIGHT    | 222.4407        | 222.4431        | 0.0024  | 0.0006 | 0.0006 | 0.4  |        |      |
|   |      | LATITUDE  | 64 13 19.254883 | 64 13 19.254903 | 0.0006  | 0.0001 | 0.0000 | 89.3 | 0.0000 | 89.4 |
|   |      | LONGITUDE | 29 55 41.827606 | 29 55 41.827612 | 0.0001  | 0.0000 | 0.0001 | -0.2 | 0.0001 |      |
| 4 | GPS4 | X         | 2410183.6629    | 2410183.6650    | 0.0021  | 0.0002 |        |      |        |      |
|   |      | Y         | 1388327.7870    | 1388327.7906    | 0.0036  | 0.0001 |        |      |        |      |
|   |      | Z         | 5720712.9448    | 5720712.9510    | 0.0062  | 0.0005 |        |      |        |      |
|   |      | HEIGHT    | 228.6607        | 228.6679        | 0.0072  | 0.0006 | 0.0006 | 0.3  |        |      |
|   |      | LATITUDE  | 64 13 18.179839 | 64 13 18.179822 | -0.0005 | 0.0001 | 0.0000 | 89.1 | 0.0000 | 89.2 |
|   |      | LONGITUDE | 29 56 34.977031 | 29 56 34.977188 | 0.0021  | 0.0000 | 0.0001 | -0.1 | 0.0001 |      |
| 5 | GPS5 | X         | 2411065.8443    | 2411065.8480    | 0.0037  | 0.0002 |        |      |        |      |
|   |      | Y         | 1387498.1880    | 1387498.1891    | 0.0011  | 0.0001 |        |      |        |      |
|   |      | Z         | 5720528.0899    | 5720528.0958    | 0.0059  | 0.0005 |        |      |        |      |
|   |      | HEIGHT    | 214.6804        | 214.6874        | 0.0069  | 0.0005 | 0.0005 | 0.4  |        |      |
|   |      | LATITUDE  | 64 13 5.389555  | 64 13 5.389528  | -0.0008 | 0.0001 | 0.0000 | 89.0 | 0.0000 | 89.2 |
|   |      | LONGITUDE | 29 55 9.024823  | 29 55 9.024754  | -0.0009 | 0.0000 | 0.0001 | -0.3 | 0.0001 |      |
| 6 | GPS6 | X         | 2411071.3051    | 2411071.3076    | 0.0025  | 0.0003 |        |      |        |      |
|   |      | Y         | 1388657.9331    | 1388657.9335    | 0.0004  | 0.0002 |        |      |        |      |
|   |      | Z         | 5720270.4931    | 5720270.4973    | 0.0042  | 0.0006 |        |      |        |      |
|   |      | HEIGHT    | 236.4912        | 236.4960        | 0.0048  | 0.0007 | 0.0007 | 0.4  |        |      |
|   |      | LATITUDE  | 64 12 44.808990 | 64 12 44.808981 | -0.0003 | 0.0001 | 0.0001 | 89.4 | 0.0001 | 89.3 |
|   |      | LONGITUDE | 29 56 23.339861 | 29 56 23.339790 | -0.0009 | 0.0001 | 0.0001 | -0.1 | 0.0001 |      |
| 7 | GPS7 | X         | 2410852.0692    | 2410852.0728    | 0.0036  | 0.0002 |        |      |        |      |
|   |      | Y         | 1389251.9113    | 1389251.9134    | 0.0021  | 0.0001 |        |      |        |      |
|   |      | Z         | 5720205.3683    | 5720205.3756    | 0.0073  | 0.0005 |        |      |        |      |
|   |      | HEIGHT    | 224.2017        | 224.2101        | 0.0084  | 0.0006 | 0.0006 | 0.3  |        |      |
|   |      | LATITUDE  | 64 12 40.796407 | 64 12 40.796386 | -0.0006 | 0.0001 | 0.0000 | 88.8 | 0.0000 | 88.9 |
|   |      | LONGITUDE | 29 57 9.606445  | 29 57 9.606448  | 0.0000  | 0.0000 | 0.0001 | -0.1 | 0.0001 |      |
| 2 | GPS2 | X         | 2409792.7492    | 2409792.7456    | -0.0036 | 0.0002 |        |      |        |      |
|   |      | Y         | 1387832.0097    | 1387832.0094    | -0.0003 | 0.0001 |        |      |        |      |
|   |      | Z         | 5720997.1485    | 5720997.1432    | -0.0053 | 0.0005 |        |      |        |      |
|   |      | HEIGHT    | 229.6879        | 229.6817        | -0.0062 | 0.0006 | 0.0006 | 0.4  |        |      |
|   |      | LATITUDE  | 64 13 39.216043 | 64 13 39.216064 | 0.0006  | 0.0001 | 0.0000 | 89.3 | 0.0000 | 89.4 |
|   |      | LONGITUDE | 29 56 17.584812 | 29 56 17.584925 | 0.0015  | 0.0000 | 0.0001 | -0.2 | 0.0001 |      |

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SITE-SPECIFIC TROPOSPHERE PARAMETERS: (NOT SAVED)  
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| REQU. | STATION NAME | CORRECTIONS (M) |      |          | RMS ERRORS (M) |      |         | ZENITH VECTOR (") |     |       |     | ERROR ELLIPSE (M) |         |     |
|-------|--------------|-----------------|------|----------|----------------|------|---------|-------------------|-----|-------|-----|-------------------|---------|-----|
|       |              | NORTH           | EAST | ZENITH   | NORTH          | EAST | ZENITH  | ANGLE             | RMS | RATIO | AZI | MAX RMS           | MIN RMS | AZI |
| 1     | GPS3         |                 |      | 0.00455  |                |      | 0.00234 |                   |     |       |     |                   |         |     |
| 2     | GPS3         |                 |      | -0.00330 |                |      | 0.00040 |                   |     |       |     |                   |         |     |
| 3     | GPS3         |                 |      | 0.00124  |                |      | 0.00032 |                   |     |       |     |                   |         |     |
| 4     | GPS3         |                 |      | -0.00110 |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 5     | GPS3         |                 |      | -0.00042 |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 6     | GPS3         |                 |      | -0.00152 |                |      | 0.00039 |                   |     |       |     |                   |         |     |
| 7     | GPS3         |                 |      | 0.00061  |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 8     | GPS3         |                 |      | -0.00229 |                |      | 0.00033 |                   |     |       |     |                   |         |     |
| 9     | GPS3         |                 |      | 0.00071  |                |      | 0.00031 |                   |     |       |     |                   |         |     |
| 10    | GPS3         |                 |      | -0.00020 |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 11    | GPS3         |                 |      | -0.00076 |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 12    | GPS3         |                 |      | -0.00120 |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 13    | GPS3         |                 |      | -0.00066 |                |      | 0.00037 |                   |     |       |     |                   |         |     |
| 14    | GPS3         |                 |      | -0.00101 |                |      | 0.00037 |                   |     |       |     |                   |         |     |
| 15    | GPS3         |                 |      | -0.00785 |                |      | 0.00100 |                   |     |       |     |                   |         |     |
| 16    | GPS4         |                 |      | 0.00347  |                |      | 0.00684 |                   |     |       |     |                   |         |     |
| 17    | GPS4         |                 |      | -0.00563 |                |      | 0.00041 |                   |     |       |     |                   |         |     |
| 18    | GPS4         |                 |      | -0.00294 |                |      | 0.00033 |                   |     |       |     |                   |         |     |
| 19    | GPS4         |                 |      | -0.00391 |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 20    | GPS4         |                 |      | -0.00296 |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 21    | GPS4         |                 |      | -0.00451 |                |      | 0.00039 |                   |     |       |     |                   |         |     |
| 22    | GPS4         |                 |      | -0.00292 |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 23    | GPS4         |                 |      | -0.00444 |                |      | 0.00033 |                   |     |       |     |                   |         |     |
| 24    | GPS4         |                 |      | -0.00309 |                |      | 0.00031 |                   |     |       |     |                   |         |     |
| 25    | GPS4         |                 |      | -0.00320 |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 26    | GPS4         |                 |      | -0.00425 |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 27    | GPS4         |                 |      | -0.00445 |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 28    | GPS4         |                 |      | -0.00309 |                |      | 0.00037 |                   |     |       |     |                   |         |     |
| 29    | GPS4         |                 |      | -0.00484 |                |      | 0.00037 |                   |     |       |     |                   |         |     |
| 30    | GPS4         |                 |      | -0.00533 |                |      | 0.00092 |                   |     |       |     |                   |         |     |
| 31    | GPS5         |                 |      | -0.00200 |                |      | 0.00052 |                   |     |       |     |                   |         |     |
| 32    | GPS5         |                 |      | -0.00370 |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 33    | GPS5         |                 |      | -0.00153 |                |      | 0.00032 |                   |     |       |     |                   |         |     |
| 34    | GPS5         |                 |      | -0.00279 |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 35    | GPS5         |                 |      | -0.00164 |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 36    | GPS5         |                 |      | -0.00308 |                |      | 0.00038 |                   |     |       |     |                   |         |     |
| 37    | GPS5         |                 |      | -0.00080 |                |      | 0.00036 |                   |     |       |     |                   |         |     |
| 38    | GPS5         |                 |      | -0.00275 |                |      | 0.00033 |                   |     |       |     |                   |         |     |
| 39    | GPS5         |                 |      | -0.00116 |                |      | 0.00030 |                   |     |       |     |                   |         |     |
| 40    | GPS5         |                 |      | -0.00205 |                |      | 0.00034 |                   |     |       |     |                   |         |     |
| 41    | GPS5         |                 |      | -0.00173 |                |      | 0.00036 |                   |     |       |     |                   |         |     |

|    |      |          |         |
|----|------|----------|---------|
| 42 | GPS5 | -0.00192 | 0.00034 |
| 43 | GPS5 | -0.00260 | 0.00037 |
| 44 | GPS5 | -0.00220 | 0.00039 |
| 45 | GPS5 | -0.07366 | 0.02105 |
| 46 | GPS6 | 0.00000  | 0.00000 |
| 47 | GPS6 | -0.00401 | 0.00045 |
| 48 | GPS6 | -0.00094 | 0.00035 |
| 49 | GPS6 | 0.00204  | 0.00039 |
| 50 | GPS6 | -0.00221 | 0.00036 |
| 51 | GPS6 | -0.00402 | 0.00042 |
| 52 | GPS6 | -0.00256 | 0.00039 |
| 53 | GPS6 | -0.00154 | 0.00037 |
| 54 | GPS6 | -0.00158 | 0.00033 |
| 55 | GPS6 | 0.00169  | 0.00037 |
| 56 | GPS6 | -0.00323 | 0.00046 |
| 57 | GPS6 | 0.00000  | 0.00000 |
| 58 | GPS6 | 0.00000  | 0.00000 |
| 59 | GPS6 | 0.00000  | 0.00000 |
| 60 | GPS6 | 0.00000  | 0.00000 |
| 61 | GPS7 | 0.00000  | 0.00000 |
| 62 | GPS7 | -0.00517 | 0.00042 |
| 63 | GPS7 | -0.00304 | 0.00033 |
| 64 | GPS7 | -0.00267 | 0.00036 |
| 65 | GPS7 | -0.00389 | 0.00034 |
| 66 | GPS7 | -0.00583 | 0.00039 |
| 67 | GPS7 | -0.00575 | 0.00036 |
| 68 | GPS7 | -0.00371 | 0.00033 |
| 69 | GPS7 | -0.00256 | 0.00031 |
| 70 | GPS7 | -0.00233 | 0.00034 |
| 71 | GPS7 | -0.00439 | 0.00036 |
| 72 | GPS7 | -0.00554 | 0.00034 |
| 73 | GPS7 | -0.00205 | 0.00036 |
| 74 | GPS7 | -0.00598 | 0.00036 |
| 75 | GPS7 | 0.00127  | 0.00057 |
| 76 | GPS2 | 0.03586  | 0.00235 |
| 77 | GPS2 | -0.00245 | 0.00040 |
| 78 | GPS2 | 0.01043  | 0.00033 |
| 79 | GPS2 | 0.00127  | 0.00036 |
| 80 | GPS2 | 0.00795  | 0.00034 |
| 81 | GPS2 | 0.00375  | 0.00039 |
| 82 | GPS2 | 0.00827  | 0.00036 |
| 83 | GPS2 | 0.00123  | 0.00033 |
| 84 | GPS2 | 0.00659  | 0.00031 |
| 85 | GPS2 | 0.00352  | 0.00034 |
| 86 | GPS2 | 0.00561  | 0.00036 |
| 87 | GPS2 | 0.00438  | 0.00034 |
| 88 | GPS2 | 0.00761  | 0.00037 |
| 89 | GPS2 | 0.00059  | 0.00037 |
| 90 | GPS2 | -0.00212 | 0.00115 |

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 RMS ERRORS OF ELLIPS. COORDINATES AND COORDINATE DIFFER. IN MM (PART 1):  
 -----

| NUM |   | 1   | 3   | 4   | 5   | 6   | 7   | 2   |
|-----|---|-----|-----|-----|-----|-----|-----|-----|
| 1   | B | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
|     | H | 0.0 | 0.6 | 0.6 | 0.5 | 0.7 | 0.6 | 0.6 |
| 3   | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
|     | H | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.6 | 0.6 |
| 4   | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
|     | H | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.6 | 0.6 |
| 5   | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
|     | H | 0.5 | 0.6 | 0.6 | 0.5 | 0.7 | 0.6 | 0.6 |
| 6   | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | H | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| 7   | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
|     | H | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.6 | 0.6 |
| 2   | B | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
|     | L | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
|     | H | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.6 | 0.6 |

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 SLOPE DISTANCES AND RMS ERRORS IN M (PART 1):  
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| NUM |     | 3 N      | 4 N      | 5 N      | 6 N      | 7 N       | 2 N       |
|-----|-----|----------|----------|----------|----------|-----------|-----------|
| 1   | O   | 541.2039 | 731.8961 | 614.7339 | 678.1954 | 1222.3877 | 1176.4150 |
| N   | N   | 541.2043 | 731.8973 | 614.7344 | 678.1950 | 1222.3880 | 1176.4161 |
|     | RMS | 0.0001   | 0.0001   | 0.0000   | 0.0001   | 0.0001    | 0.0001    |

|   |     |          |           |           |           |           |
|---|-----|----------|-----------|-----------|-----------|-----------|
| 3 | O   | 717.5064 | 616.5345  | 1204.8026 | 1679.2999 | 783.9746  |
| N | N   | 717.5086 | 616.5362  | 1204.8030 | 1679.3007 | 783.9754  |
|   | RMS | 0.0000   | 0.0001    | 0.0001    | 0.0001    | 0.0001    |
| 4 | O   |          | 1225.0101 | 1045.3079 | 1248.3616 | 692.3730  |
| N | N   |          | 1225.0131 | 1045.3081 | 1248.3609 | 692.3743  |
|   | RMS |          | 0.0000    | 0.0001    | 0.0001    | 0.0001    |
| 5 | O   |          |           | 1188.0213 | 1795.9383 | 1397.2201 |
| N | N   |          |           | 1188.0210 | 1795.9391 | 1397.2227 |
|   | RMS |          |           | 0.0001    | 0.0001    | 0.0001    |
| 6 | O   |          |           |           | 636.4870  | 1686.6780 |
| N | N   |          |           |           | 636.4880  | 1686.6789 |
|   | RMS |          |           |           | 0.0001    | 0.0001    |
| 7 | O   |          |           |           |           | 1940.4111 |
| N | N   |          |           |           |           | 1940.4117 |
|   | RMS |          |           |           |           | 0.0001    |

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