XA0300386 IAEA-CN-80/5P

USE OF Cs-137 FOR THE CALIBRATION OF THE CIRCULATION MODEL OF LITHUANIAN COASTAL WATERS

L. DAVULIENE, G. TRINKUNAS, V. REMEIKIS, L. VALKUNAS
Institute of Physics, Vilnius, Lithuania

S. DICK
Bundesamt für Seeschiffahrt und Hydrographie, Hamburg, Germany

It is well established that radioactive contamination of waters and sediments in the Lithuanian coastal area of the Baltic Sea is distributed unevenly [1]. To describe the distribution of the radionuclides in waters of the Lithuanian coastal area of the Baltic Sea, the model based on the operational circulation model of the Bundesamt für Seeschffahrt und Hydrographie (BSH) for the North and Baltic seas [2, 3] was developed. The area under consideration contains both the Lithuanian coast of the Baltic Sea as well as the Curonian Gulf of the fresh water. The interplay between the salt and fresh water flows via the Kaipeda strait has impact on the distribution of radionuclides. For instance, Cs-137 is a typical radionuclide demonstrating this effect. It is experimentally well established that this radionuclide in the salt water is mainly in the dissolved form (about 90%) and just its minor part is concentrated in the suspended matter (about 10%). In fresh water the dissolved/suspended matter ratio for Cs-137 is totally opposite. Therefore, Cs-137 can be considered as the tracer following the fresh and salt water mixing. With samples of the radionuclide concentration in the sea area under consideration at hand, Cs-137 is used to normalize the tracer concentration simulated by the developed circulation model.

The model was based on the grade of 1 nautic mile (nm), while the boundary conditions were taken from the more extended BSH model on the 6 nm grade. In order to understand the sensitivity of this local model to the initial conditions, the artificial conditions taken from the more general and coarse model were used. It has been obtained that the effect of the initial conditions is lost within 2-3 weeks. This result is independent of the coarse grain of the grade as calculations carried out on 1 nm and 0.5 nm grades show.

The model was adopted for the PC Pentium III, and calculations of the salinity distribution depending on the meteorological conditions were carried out. Real-time calculations have been performed for the period of 99.04.01-99.06.01 matching the time of radioactivity measurements at HELCOM stations. It was obtained, for instance, that depending on the wind direction, some local spots of uneven salinity in the sea could be formed. This can qualitatively explain the abrupt increase in the Cs-137 concentration as it was observed experimentally.

In addition, the possible inflow of the pollution from the Nemunas river was also considered. It has been obtained that independently of the meteorological conditions the main pathway of the pollution is directed to the Klaipeda strait and afterwards to the Baltic Sea, while the southern part of the Curonian Gulf is almost not influenced by the pollution inflow (see Fig. 1). This result is also qualitatively supported by experimental observations. Further development of this model has to be focused on studies of i) more detailed model calibration in the Klaipeda strait, ii) shallow water effects in the Curonian Gulf, and iii) comparison with the experimental data.

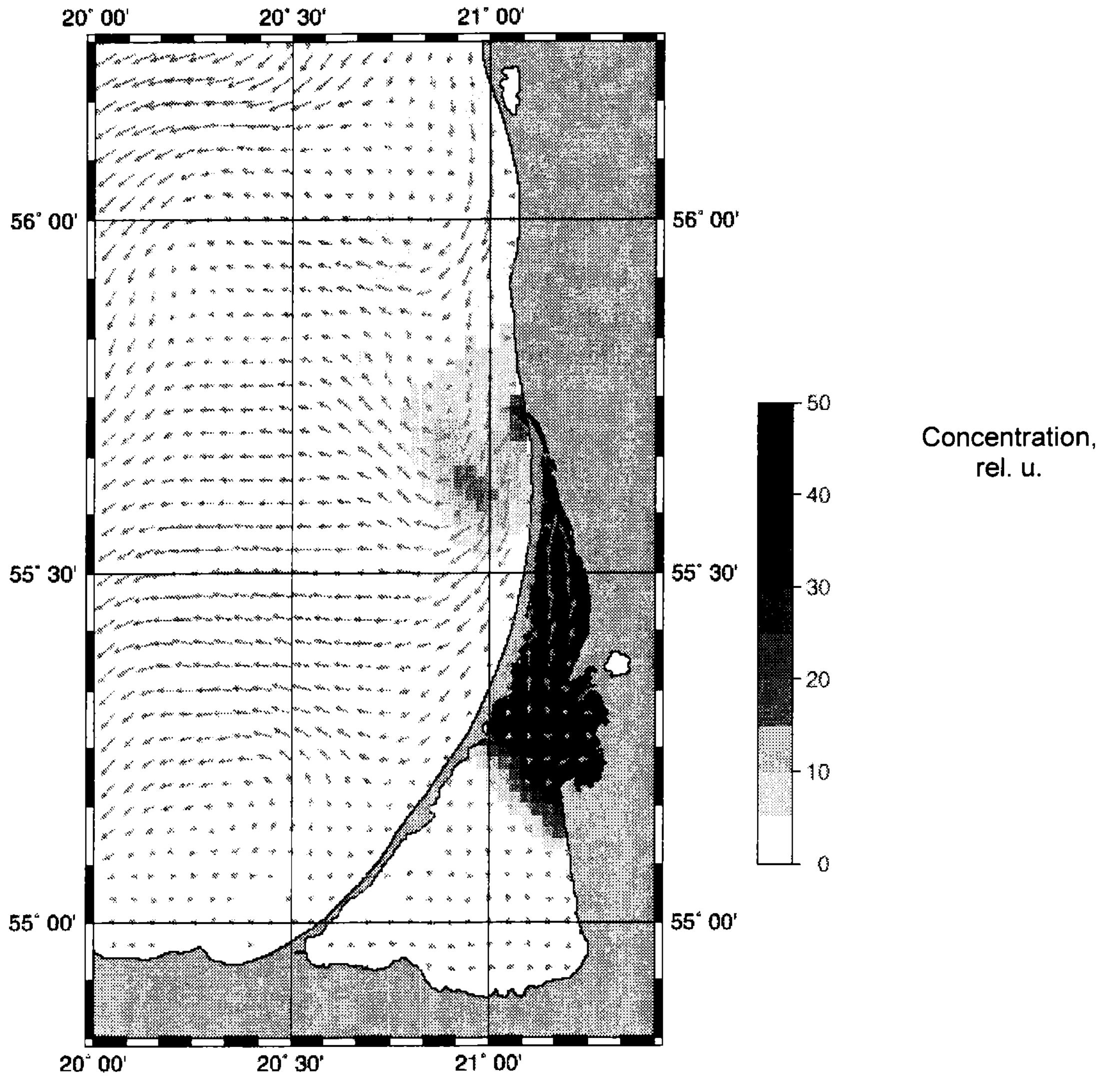

FIG. 1. Uneven tracer concentration distribution on 99.05.13, 12:00 UTC; wind SO 5 m/s. Simulation started on 99.04.01 with the inflow of the pollution from the Nemunas river. Arrows indicate flow directions; the arrow length scales with the flow rate.

REFERENCES

[1] TARASIUK, N., SPIRKAUSKAITE, N. Radioactive contamination of the coastal zone of the Baltic Sea of Lithuania, Atmospheric Physics **18** (1994) 85-89.

[2] KLEINE, E. Das operationelle Modell des BSH für Nordsee und Ostsee – Konzeption und Übersicht, Unveröffentl. Manuscript (1994) 126 pp.

[3] DICK, S. SCHOENFELD, W. Water Transport and Mixing in the North Frisian Wadden Sea – Results of Numerical Investigations, German J. Hydrography **48** (1996) 27-48.