Dependence of seasonal hindcast skill on different mechanisms influencing European summers during the 20th century

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Seasonal Summer Hindcast Skill

- Anomaly Correlation (ACC) between model (MPI-ESM-MR) and reanalysis (ERA-20C)
- no seasonal prediction skill over Europe
European Seasonal Summer Hindcast Skill

- MPI-ESM-MR, fully coupled seasonal prediction system
- 10 independent ensemble members, initialised in May
- 1900-2010
European Seasonal Summer Hindcast Skill

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Why do ensemble members show such a large spread?

- various physical mechanisms influence European summers
- Is skill of model influenced by those mechanisms?

Which mechanisms influence European summers?

- North Atlantic Oscillation (NAO)
- Zonal Pressure Difference (PD)
- Can we identify which mechanism dominates which summer?
  → Cluster analysis
Cluster Analysis

Analyse mechanisms in 1900-2010

- ERA-20C, Z500
Cluster Analysis

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- different patterns in positive and negative phase
Cluster Analysis

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  - identify which mechanism dominates each year
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→ identify which mechanism dominates each year
Cluster Analysis

Is skill of model influenced by mechanisms?

• each ensemble member can be assigned to one mechanisms with pattern matching algorithm

• in each year several mechanisms are predicted, but only one is dominant

→ How would skill be influenced if we select ensemble members for dominant mechanism?
Ensemble Selection
Ensemble Selection

- selection of ensemble members based on known dominant mechanism
Ensemble Selection

- selection of ensemble members based on known dominant mechanism
- new ensemble mean over selected members
- higher variability
Seasonal Summer Hindcast Skill

**Ensemble Mean**
July-August (JA)
500hPa geopotential height (Z500)

**Ensemble Selection**
July-August (JA)
500hPa geopotential height (Z500)
Reliability

- comparison of probability of forecast to actually observed frequency
- $Z_{500}$ over Europe

→ improved reliability

→ improved distribution of forecasts
Summary

• we apply cluster analysis to ERA-20C
• identify which mechanisms dominate European summer climate in individual years by analysing
  • North Atlantic Oscillation +/-
  • Zonal Pressure Difference +/-

• model is able to represent these mechanisms
• if known mechanism is considered in hindcast analysis, hindcast skill is improved

→ predictors for mechanisms needed to use method in real forecast set up