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METEOROLOGISKA INSTITUTET
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Verification of seasonal marine ensemble forecasts

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Hydrodynamics of the Sea

Marine Research

Finnish Meteorological Institute





Ensemble ocean forecasts in FMI

- **Biogeochemical model Baleco**
 - MITgcm
 - Coupled biochemical model
- **Monthly and seasonal forecasts**
 - 1 and 6 month time spans
- **First ensembles produced in May 2008**
- **Pre-operational production of monthly forecasts in July 2009**
 - Frequency 1 forecast / week



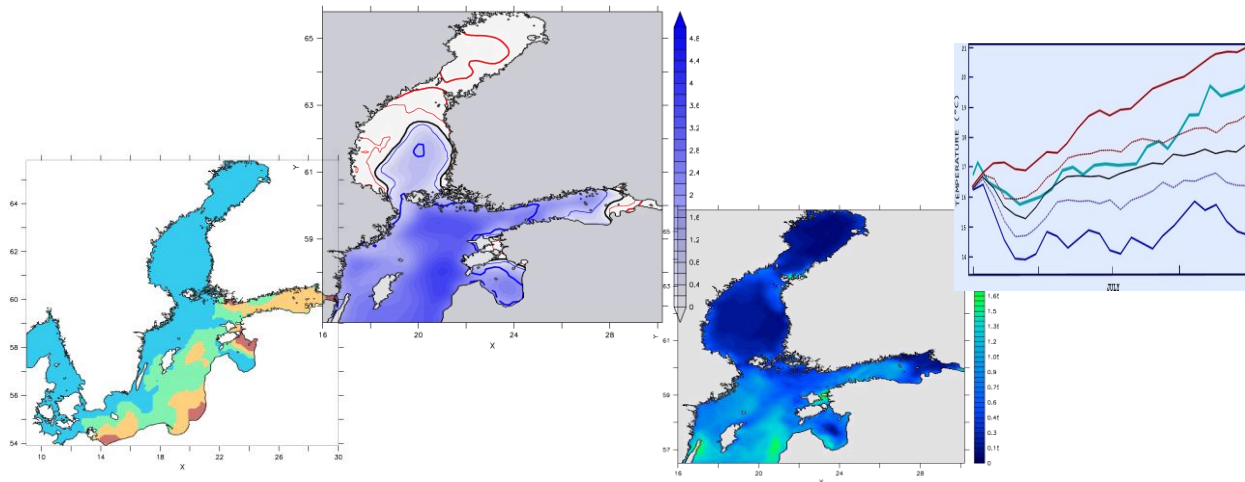
Potential Applications for Ensemble Forecasts

- Ice service
- HAB forecasts
- Environmental policymaking
- Environmental risk analysis
- Recreational uses

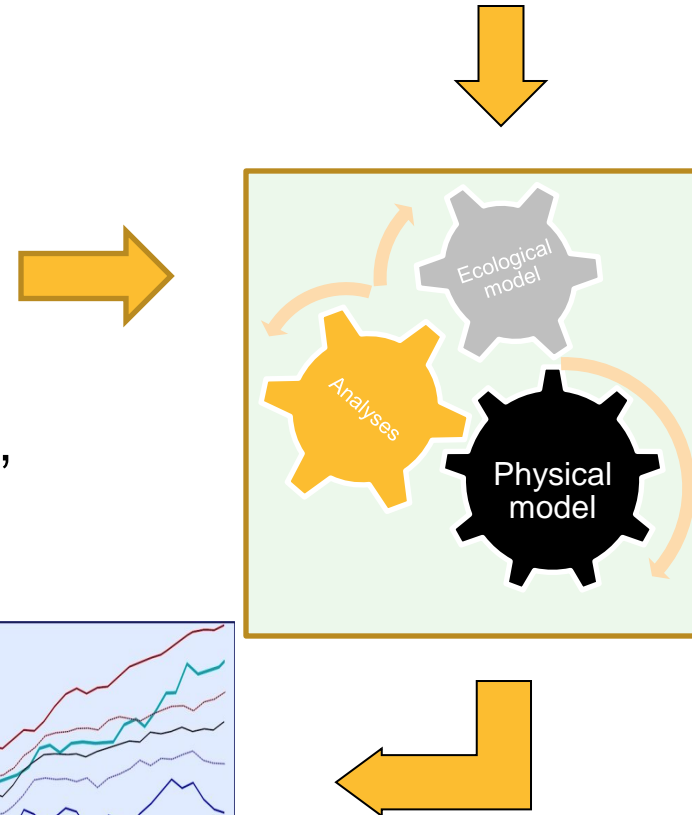


Ensemble construction

- **Forcing ECMWF weather parameters, 50+1 members**
 - 10 metre winds, 2 metre temperature, 2 metre dew point temperature, surface solar radiation, surface thermal radiation



Nutrient forcing



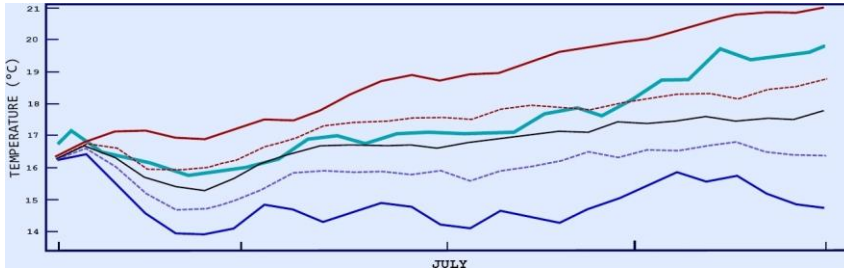


Diagnostical Methods for Ensembles

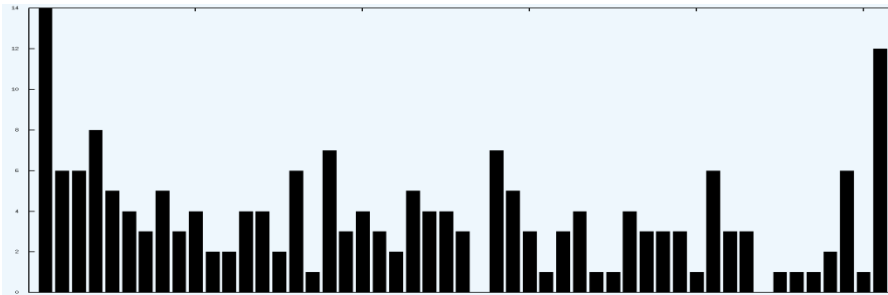
- **Ensemble forecasts: many forecast values, one obs.**
- **Methods**
 - Rank histograms
 - Average spread compared to observations
 - Continuous Rank Probability Score
 - Defaults to mean average errors in deterministic forecasts
 - "Eye balling"
 - Work in Progress: Method for upwelling phenomena



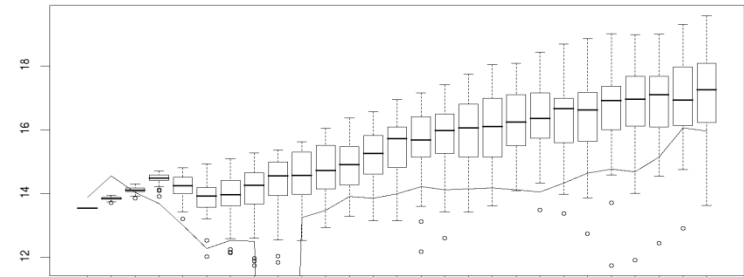
Illustrations of diagnostics



Observation and ensemble characteristics, July 2008



Rank histogram for June-September 2008



Observation and boxplot, June 2008



Observations

- **Wave buoys**

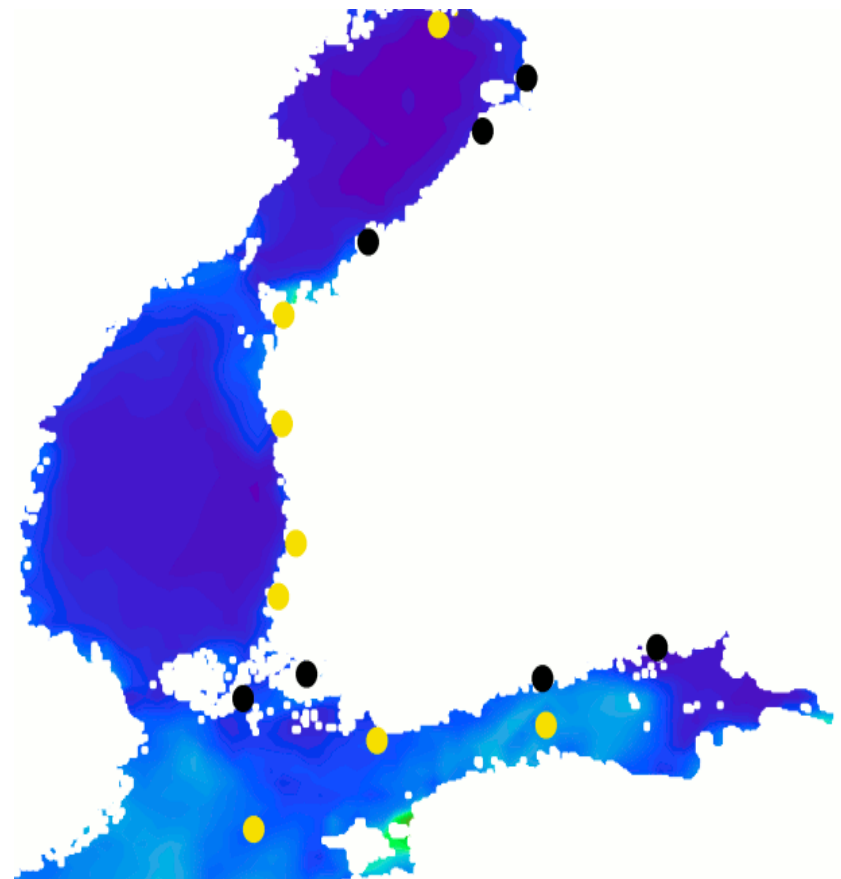
- 2 buoys: Northern Baltic Proper, Helsinki
- Temperature

- **Mareographs**

- Data from 6 mareographs: Kemi, Vaasa, Mäntyluoto, Kaskinen, Rauma, Hanko
- Temperature

- **Alg@line**

- Ferrybox measurements (Travemünde-Helsinki)
- Blue-green algae biomass



Data measurement points



Challenges

- Sufficient computational capacity
- Adequacy of forcing points
- Limited observations
 - Availability of good initial fields for biochemical ensembles
- Verification methods for ensembles
- Communicating the statistical nature to users