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Calibration of MEPS ensemble forecasts in MetCoOp

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MetCoOp

- MetCoOp (*Meteorological Co-operation on Operational NWP*) Is a cooperation between Swedish Meteorological and Hydrological Institute SMHI , MET Norway, the Finnish Meteorological Institute FMI and Estonia Environment Agency ESTEA.
- The primary goal of the collaboration is to provide a state-of-the-art operational short- and very short-range numerical weather prediction (NWP) system → “MEPS” & ”MetCoOp nowcast”
- The core of the MEPS model is based on the convection-permitting Applications of Research to Operations at Mesoscale (AROME) model developed by Météo-France
- Closer collaboration between the institutes in other areas of common interest



Probabilistic forecasts

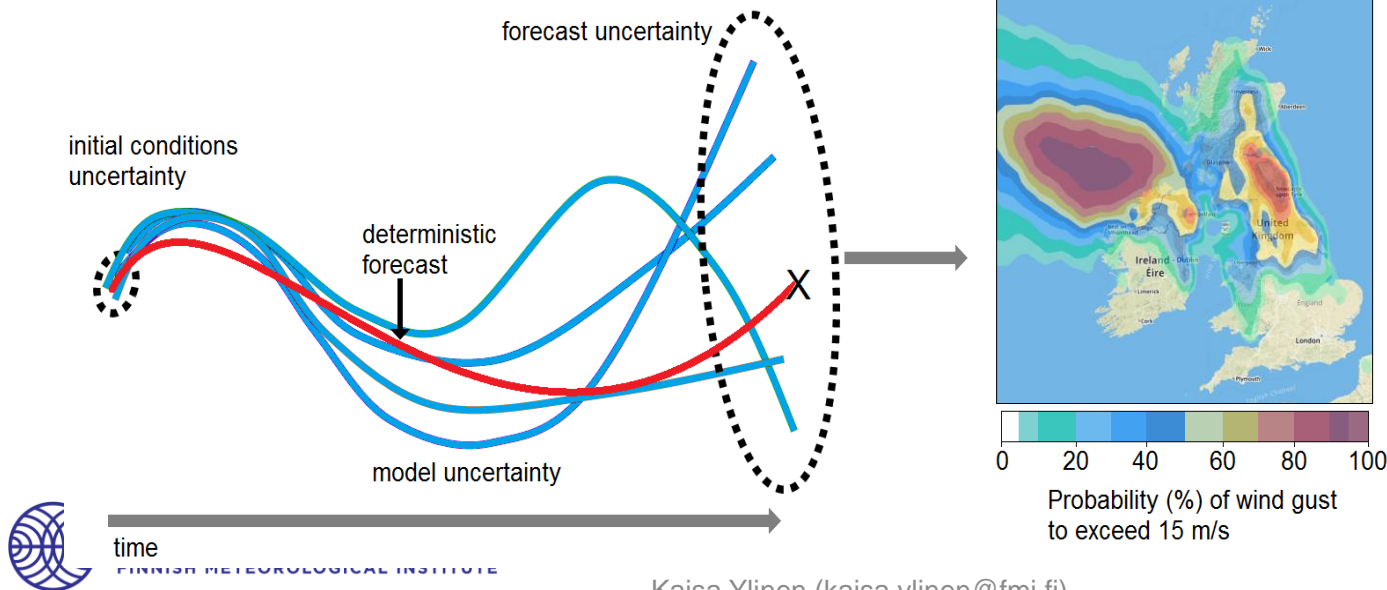
Why?

- Forecasts inherently uncertain

- Initial conditions
- Model approximations

+ chaotic nature of the atmosphere

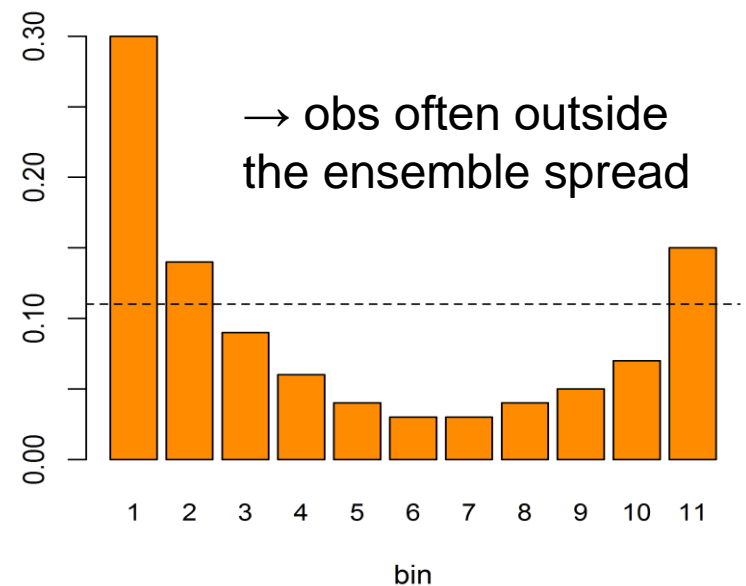
How?



Problems in ensemble forecast

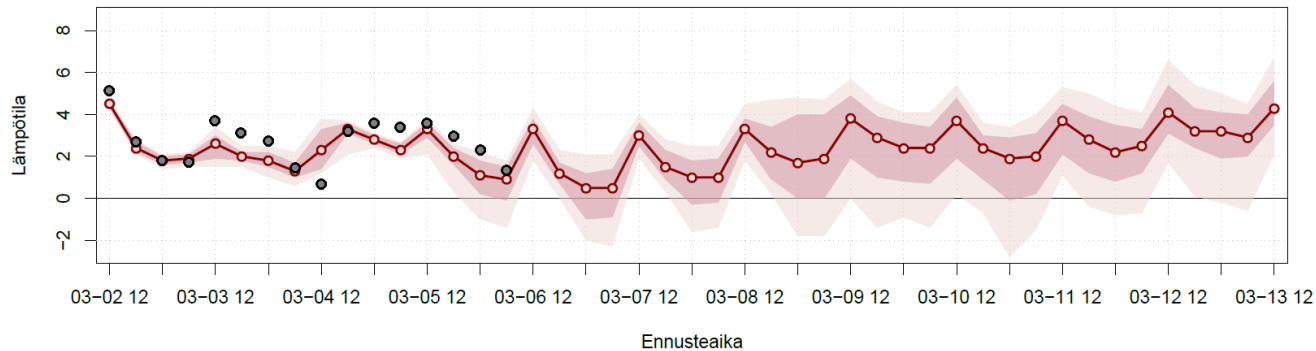
- The ensemble spread should be related to the uncertainty of the forecast and the observed atmospheric state should fall within the predicted ensemble spread.
- Underdispersive
 - Too high forecast confidence compared to measured forecast uncertainty
- Biased
 - Under or overforecasting

→ Unreliable probabilistic forecasts

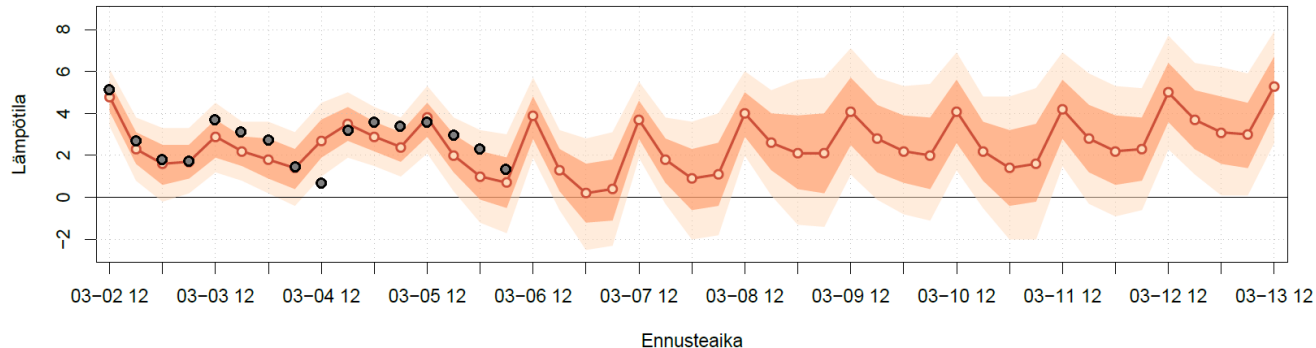


Problems in ensemble forecast

Helsinki 2020-03-02 00:00:00 ECMWF Parviennuste



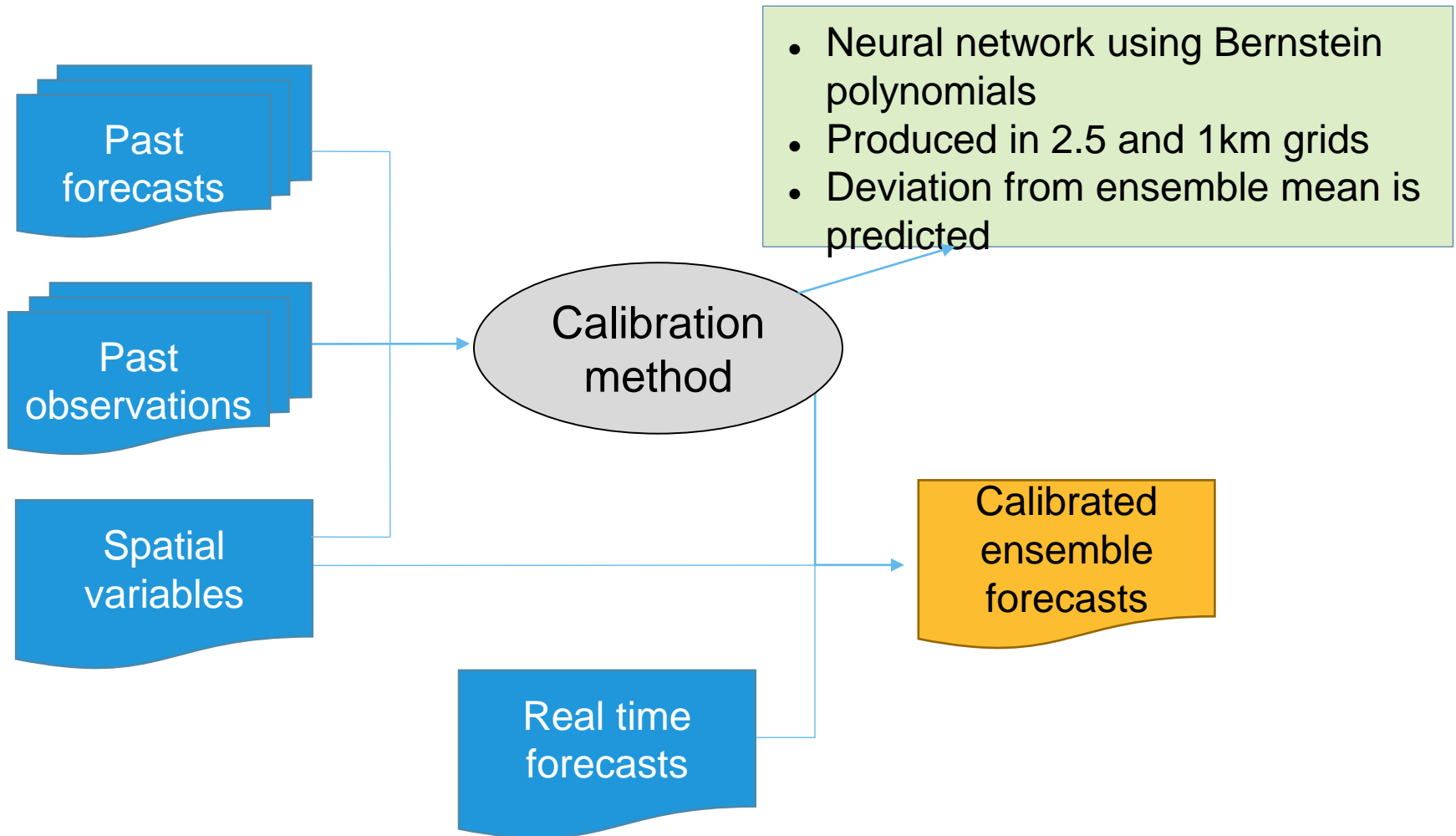
Helsinki 2020-03-02 00:00:00 ECMWF Parviennuste kalibroitu



- Example of overconfident ensemble forecast (top) compared with calibrated forecast (bottom) where in calibrated one the spread represents the true observed values (grey dots) a lot better



Statistical calibration





MEPS calibration

- The ensemble forecasts tend to have the same systematic biases as the deterministic forecasts
 - With calibration the skill of the ensemble can be improved
- MetCoOp has postprocessing subgroup where MEPS calibration has been developed in collaboration

Objectives

- Generate well-calibrated probabilistic forecasts
- Focus on basic (observable) variables
 - temperature 2m, wind speed 10m, gust 10m, precipitation, ...
 - train the calibration model against synop/station observations
 - no gridded analyses are used currently
- Make predictions at any point (any grid)



MEPS calibration - status

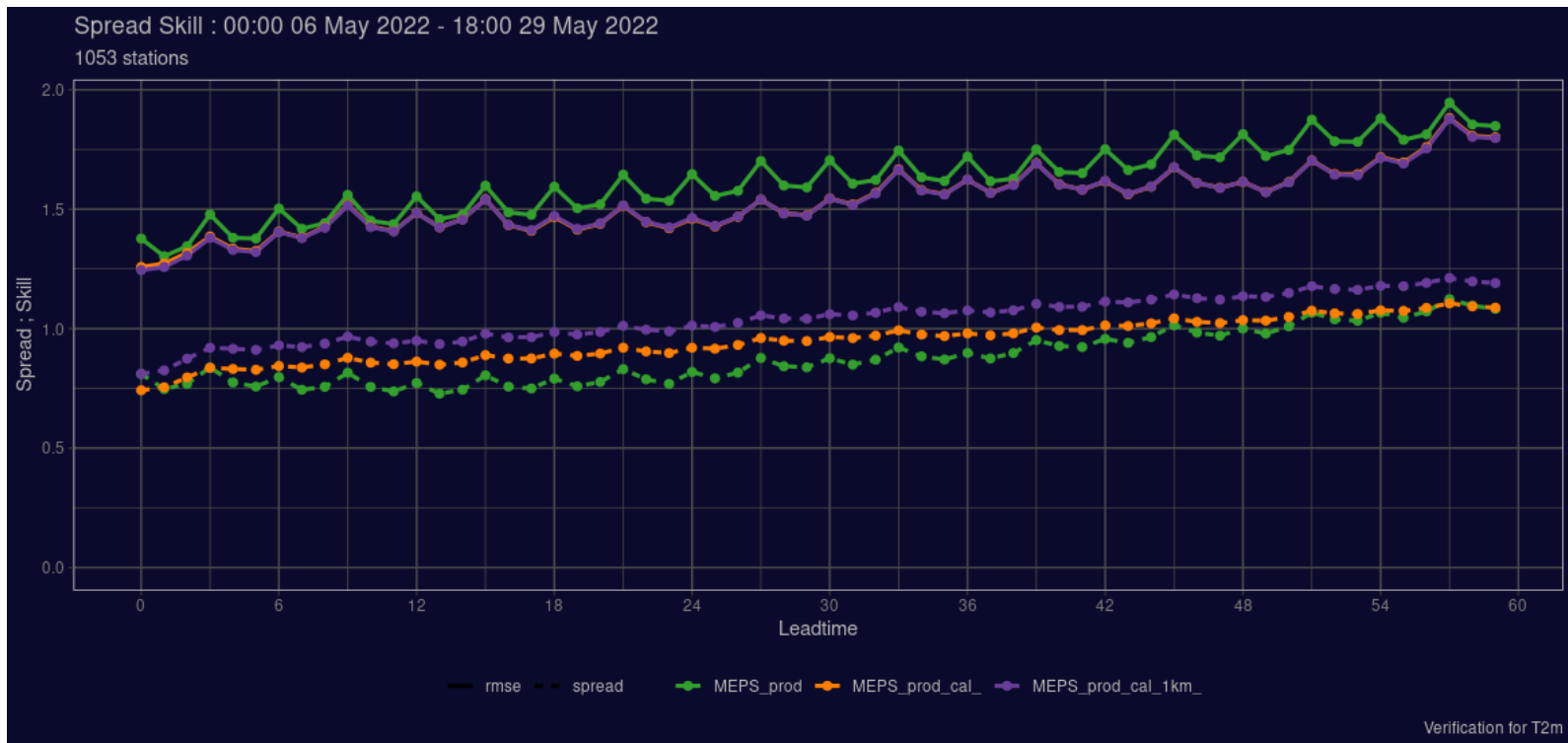
- MEPS T2m calibration pre-op has been produced since 2020
 - Results looked very promising, there's a large improvement in the spread





MEPS calibration - status

- In spring 2021 major upgrade in MEPS model version caused problems for calibration model → results not as good as before





Objectives 2022

- (Pre-)operational calibration of temperature, wind speed and gust
 - new training data (Feb 2021 - March 2022)
 - Calibration also for wind speed and gust
 - new/upgraded source code (Julia programming language)
- All data needed for training should be available on MetCoOp systems
 - forecast grib files on Arcus archive → SQLite HARP tables
 - observations in SQLite tables (available) + quality control
 - Digital elevation model (DEM) and surface type features
 - new Julia code for data preparation (joining data sources)
- Make the data available for forecasters to use

Summer 2022