Danish Meteorological Institute

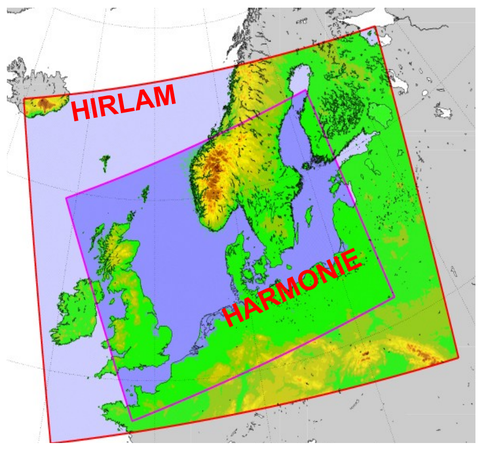
NWP News 2017 @ DMI

COMEPS & Sub-km Harmonie-AROME

Xiaohua Yang, DMI

COntinuous Meso-scale EPS (COMEPS)
(X. Yang, H. Feddersen, K. Sattler, B. H. Sass)

DMI operationalised in 2017 COMEPS, a 2.5 km grid, 24 members, continuously refreshing probabilistic forecasting system with many novice features.

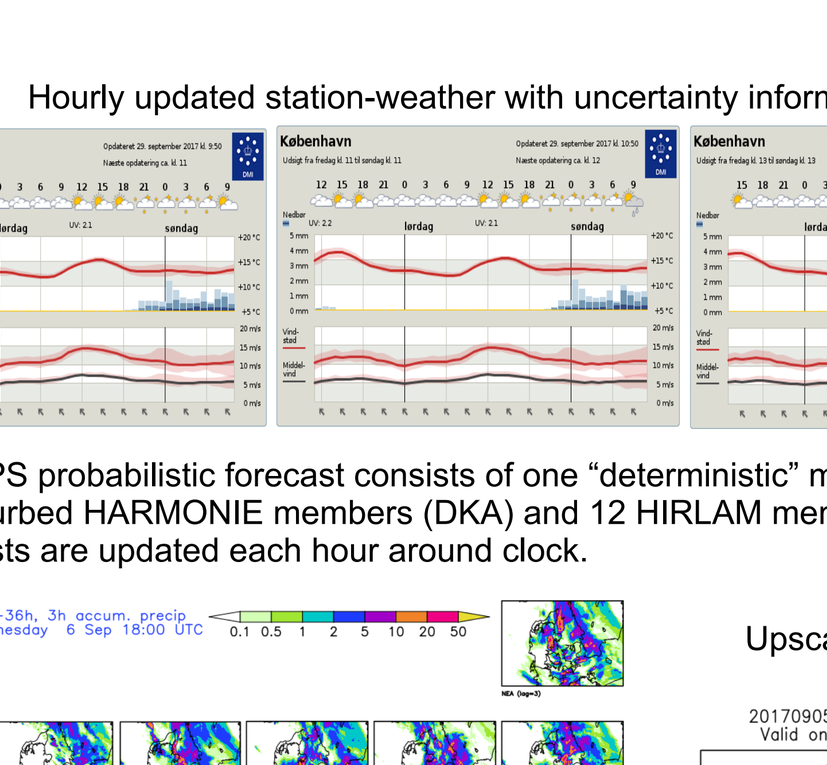


COMEPS features

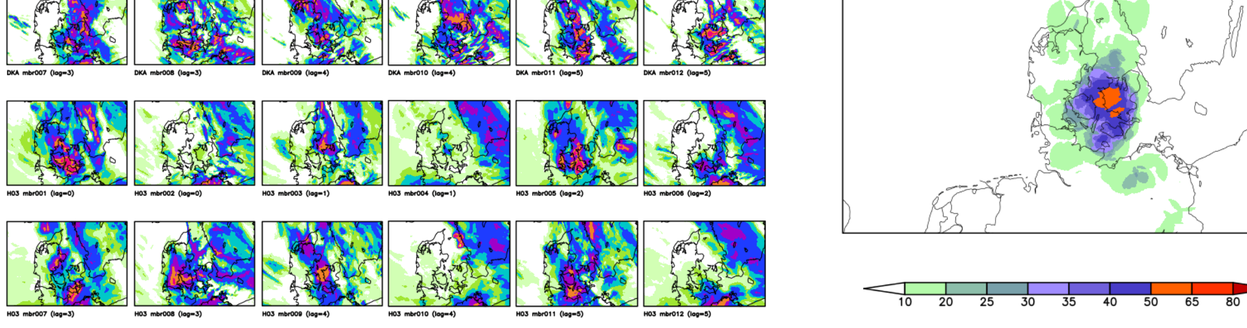
- Multi-model, time-lagged EDA
  - Analysis each hour on partially overlapped 3h time window
  - Perturbed obs by varying data stream
  - Multiphysics
- Perturbed forecasts (+57h) with 4 members each hour
- Multi-physics/stochastic physics for perturbed forecasts
- SLAF using deterministic ECMWF HRES
- 51h probabilistic forecast assembled each hour by time lagging using perturbed forecasts in the past 6 hours

6-member, multi-model, time lagged EDA

For initial condition perturbation, COMEPS applies an EDA along temporal space. For both HARMONIE and HIRLAM models, 3 sets of control analyses, with basetime on consecutively shifted hour, are run using a 3-hour observation window. The 3-h cycling has been selected here with a view to avoid moisture spinup. Use of such consecutive 3-h observation window enables a RUC-like hourly refresh of analyses, so that latest observation is assimilated. A partially overlapped observation data window between consecutive analysis suites also enables use of more observations.



Hourly updated station-weather with uncertainty information



COMEPS probabilistic forecast consists of one “deterministic” member (top right), 12 perturbed HARMONIE members (DKA) and 12 HIRLAM members (H03). Forecasts are updated each hour around clock.

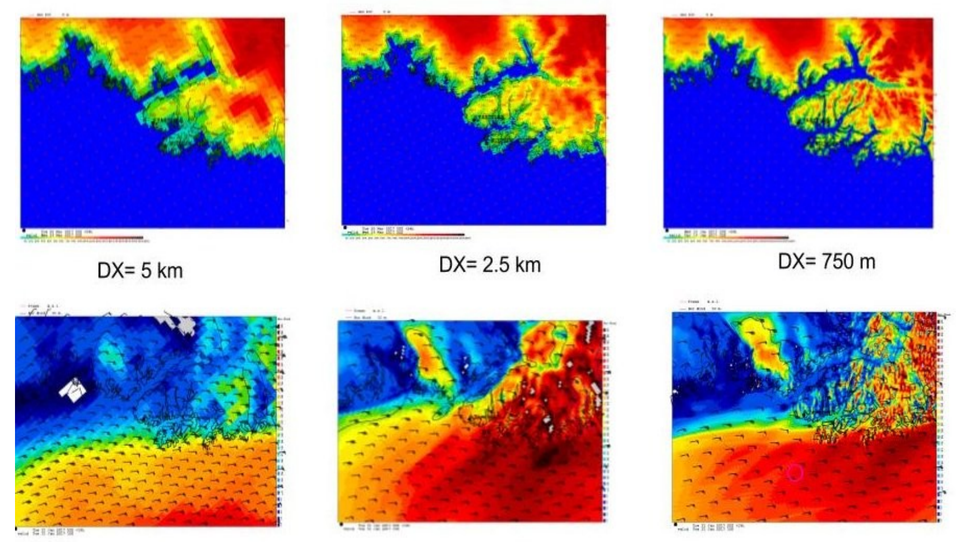
Upscaled probability map.

Upgrade 2018

COMEPS will be upgraded in 2018, following an upgrade of DMI's supercomputer, to new model versions with enlarged domain and increased ensemble members. Deterministic model and HIRLAM components will be phased out. Surface perturbation and use of IFS-ENS as LBC will be explored.

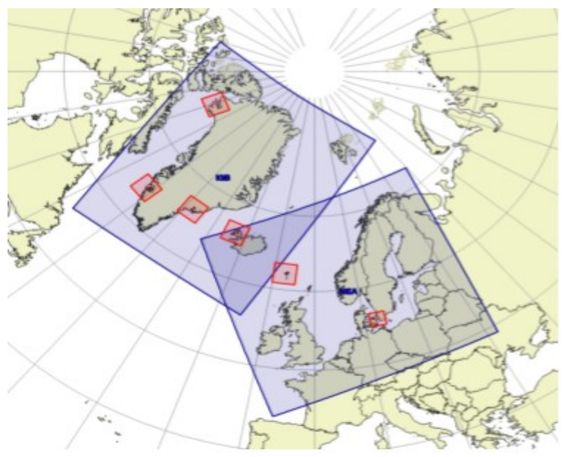
Sub-km Modelling with Harmonie-AROME

Coastal Greenland/Faroe Islands feature complex orography with small scales, resulting in complex flow patterns, sometimes with extremes such as storms and abrupt temperature changes. From operational experiences at DMI, while HARMONIE@2.5 km in general has performed well for weather forecast for these area, wind forecasts suffer systematic errors for some coastal stations. Grid resolution appears to be crucial for such situations.



Orography representation for area near Tasiilaq, a coastal city in East Greenland, with model and simulated wind for Jan 31 2017, 18 UTC.

“Harmonie-lite”, sub-km downscaling



In order to better predict severe weather for regions with complex orography, a set of real time Harmonie suites have been set up for real-time run at DMI since spring 2017, with a 400x400x65 mesh and 750 m grid for selected regions in Greenland, Iceland and Faroe Islands. These are downscaling runs from operational 2.5 km Harmonie model, running 4 times a day with 24h forecast, providing users with supplementry detailes about surface parameters. The sub-km suites are configured on cubic grid, using a timestep of 30s to allow stable and efficient execution. HARMONITE-lite has been found to be of good value for end users. An on-demand setup is in testing.

Nowcasting for small scale, convective systems

Recent years have seen increasingly more high impact convective weather with small scales in Denmark. Alone in Copenhagen metropolitan regions, cloudburst/flashflood weather in summer are becoming more common, some with very small scales which are difficult to simulate unless sub-km grid is used.

A Harmonie-based sub-km grid nowcasting system has recently been setup aiming at frequent launch, rapid delivery with assimilation of high freqeuncy, high resolution remote sensing data. In order to avoid spin-up and to secure larger amount of observation data, a COMEPS-type EDA type cycling will be explored, probably also combined with nudging of radar rain and NWC cloud info at start.