COntinuous **M**esoscale **E**nsemble **P**rediction **S**ystem *version 2*

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Basic model configuration

- COMEPS v2 is based on HarmonEPS.
- One half of the members run 1-day forecasts on a big domain (NEA, 1200 x 1080 x 65 grid points); the other half run 2-day forecasts on a small domain (DKA, 800 x 600 x 65 grid points).
- The horizontal resolution is 2.5 km.
- The choice of domains is a compromise between
  - a big domain for replacement of deterministic forecast and for downstream applications
  - 2-day forecasts for web products
  - as many members as possible
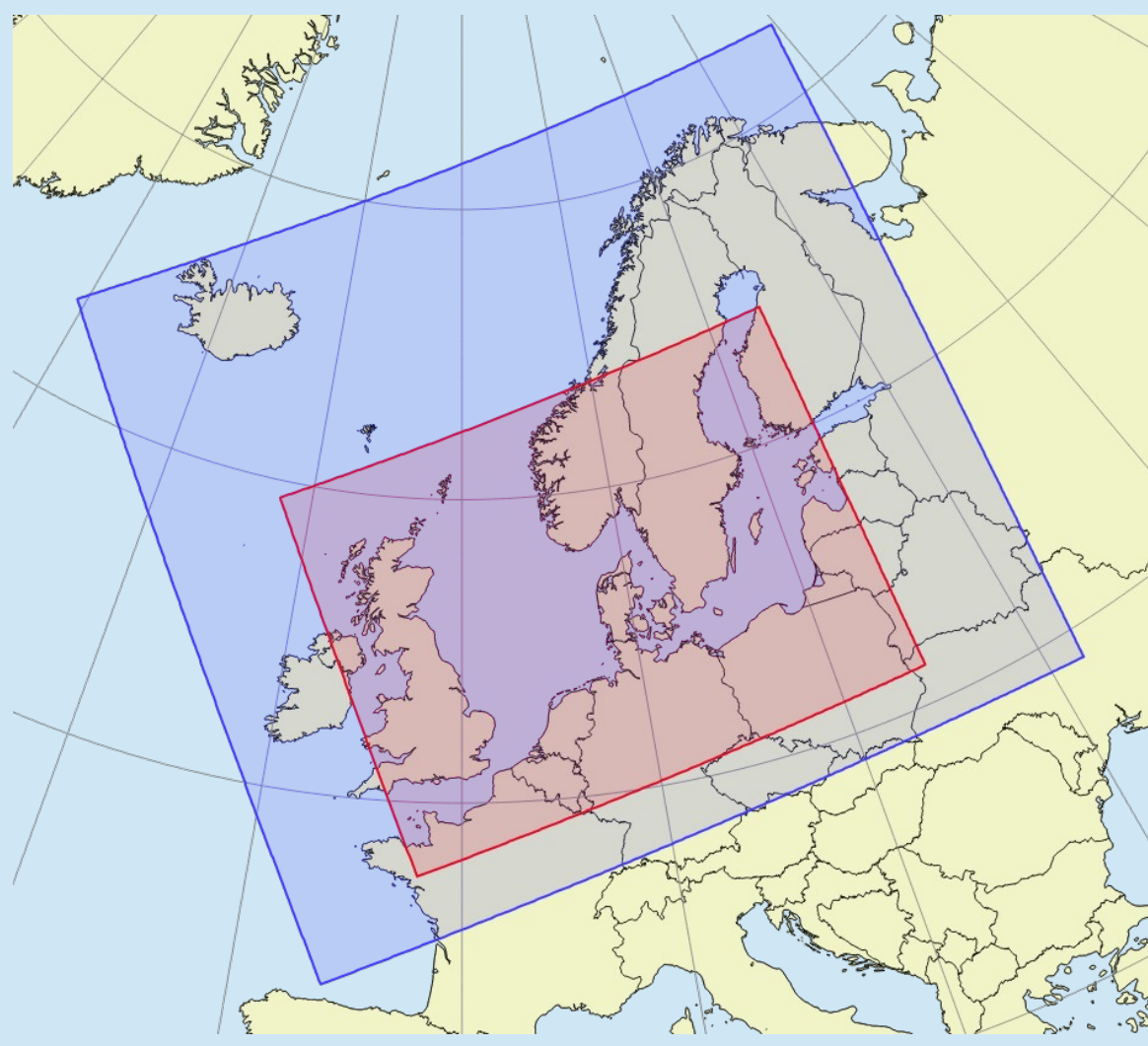
Rapid update control cycles

- New control runs are run every hour (one for each domain)
- The control runs comprise 3 HARMONIE suites each running 3-hourly cycling
- By using different observation types the three control runs form a simple ensemble data assimilation system

Suite	Analysis times
ctl_0	00 – 03 – 06 – 09 – 12 – 15 – 18 – 21
ctl_1	01 – 04 – 07 – 10 – 13 – 16 – 19 – 22
ctl_2	02 – 05 – 08 – 11 – 14 – 17 – 20 – 23

Perturbations of initial and lateral boundary conditions

- The perturbations are based on approximate ECMWF HRES forecast errors of the day, using the Scaled Lagged Average Forecast (SLAF) method.
- The number of SLAF perturbations is limited – additional perturbations are flow-independent (random field perturbations).
- The perturbations do not depend on a coarser-resolution ensemble system such as ECMWF ENS, i.e. we can run locally using lateral boundary data that is already available for deterministic limited-area models.
- Experiments suggest that using SLAF and flow-independent perturbations yield forecast skill similar to that using ECMWF ENS perturbations.

Multiphysics

The ensemble members use different combinations of
- turbulence scheme (HARATU/CBR)
- mass-flux scheme (EDMFM/EDKF)
- LCRIT condensation threshold function (on/off)
- subgrid scale orography (Z01D/NONE)
- OCND2 microphysics scheme (on/off)

Lagged members

- We run 4 perturbed members (2 for each domain) every hour
- Members from the 6 most recent runs + the most recent control run are collected to form a 24+1 member ensemble
- By continously updating the ensemble, the HPC load is evenly distributed throughout the day
- Less forecast jumpiness when the ensemble is updated every hour

Member	Analysis						
	00Z	01Z	02Z	03Z	04Z	05Z	06Z
mbr001	Ctl_0+Pert_a						Ctl_0+Pert_a
mbr002	Ctl_0-Pert_a						Ctl_0-Pert_a
mbr003		Ctl_1+Pert_b					
mbr004		Ctl_1-Pert_b					
mbr005			Ctl_2+Pert_c				
mbr006			Ctl_2-Pert_c				
...			...	...			
mbr011						Ctl_2+Pert_f	
mbr012						Ctl_2-Pert_f	

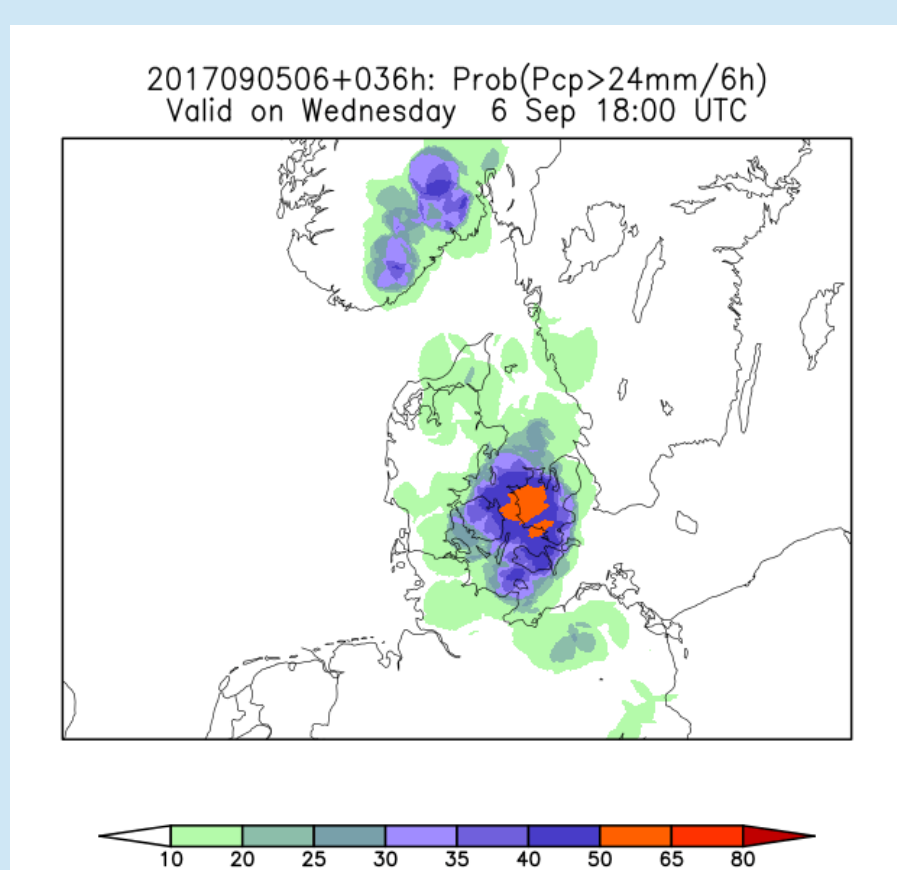*Lagged ensemble members (for one domain)*

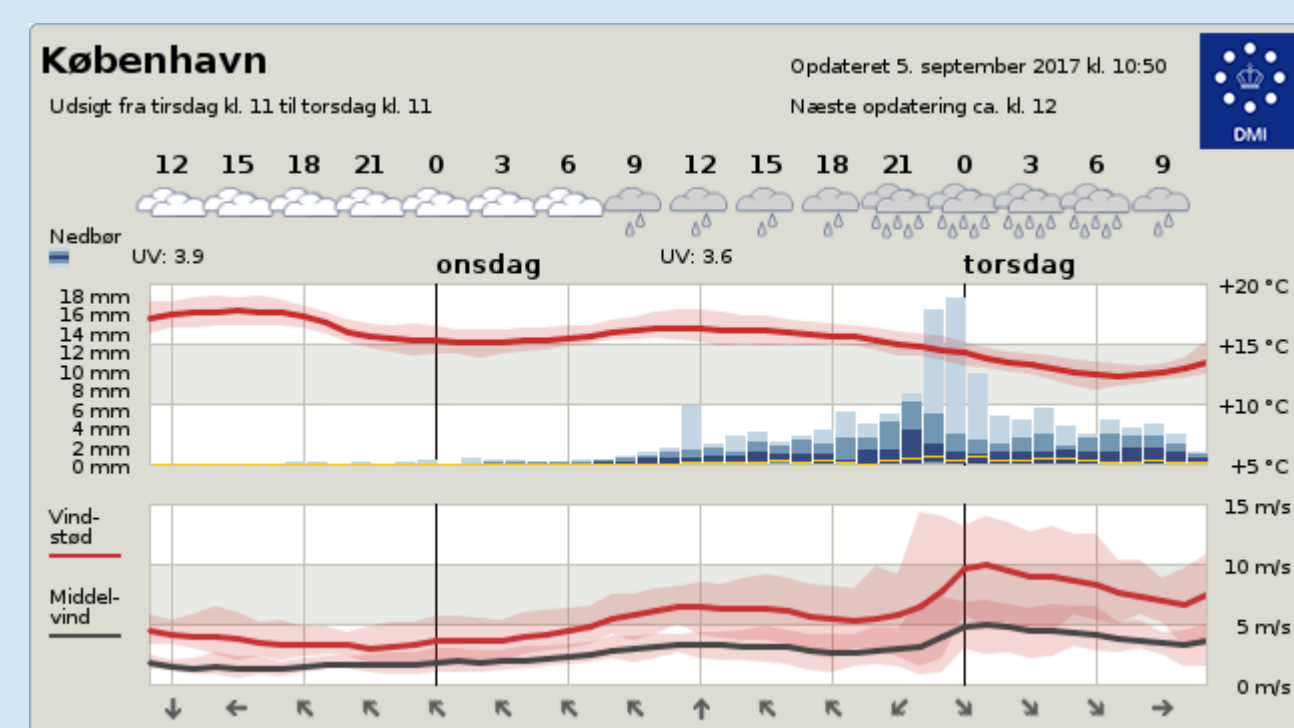## Verification examples (COMEPS v1 vs GLAMEPS v2)
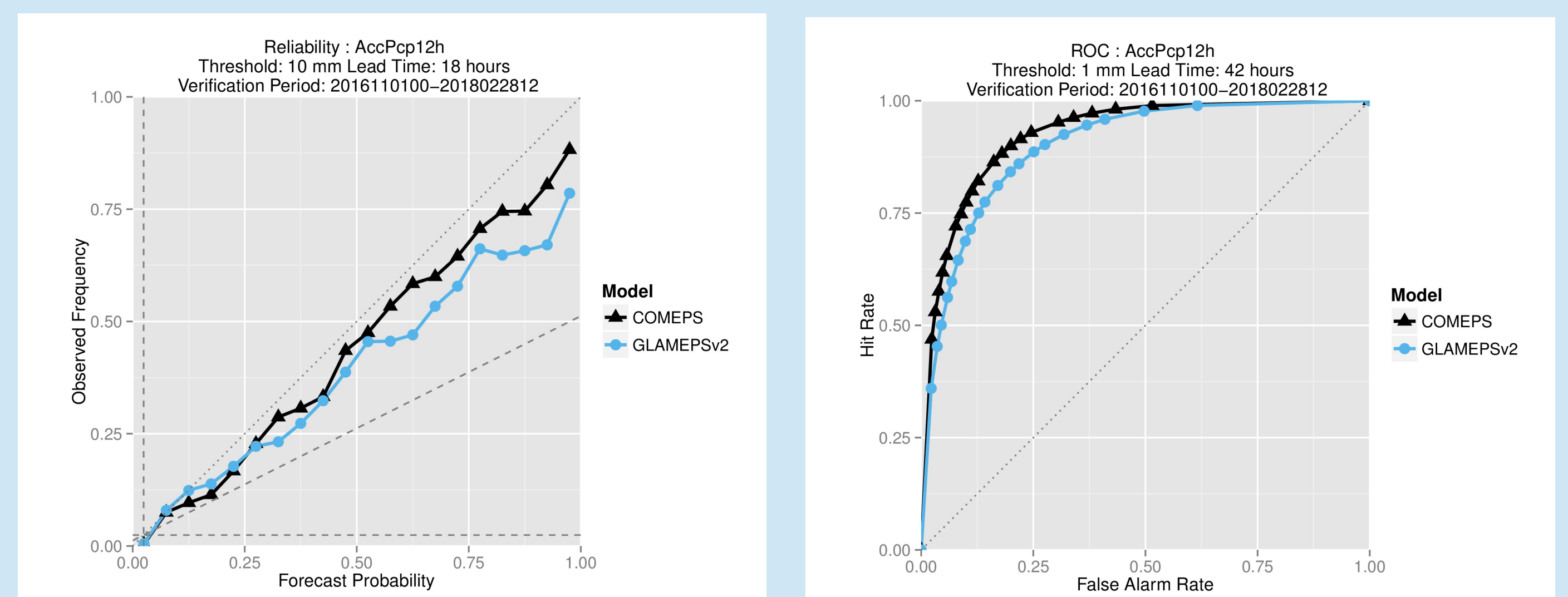
Reliability, 10mm/12h

ROC, 1mm/12h

Ensemble product examples (COMEPS v1)
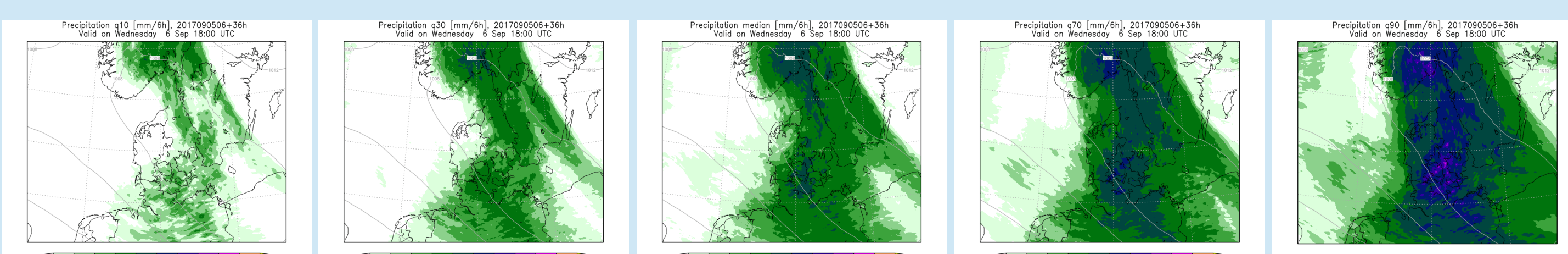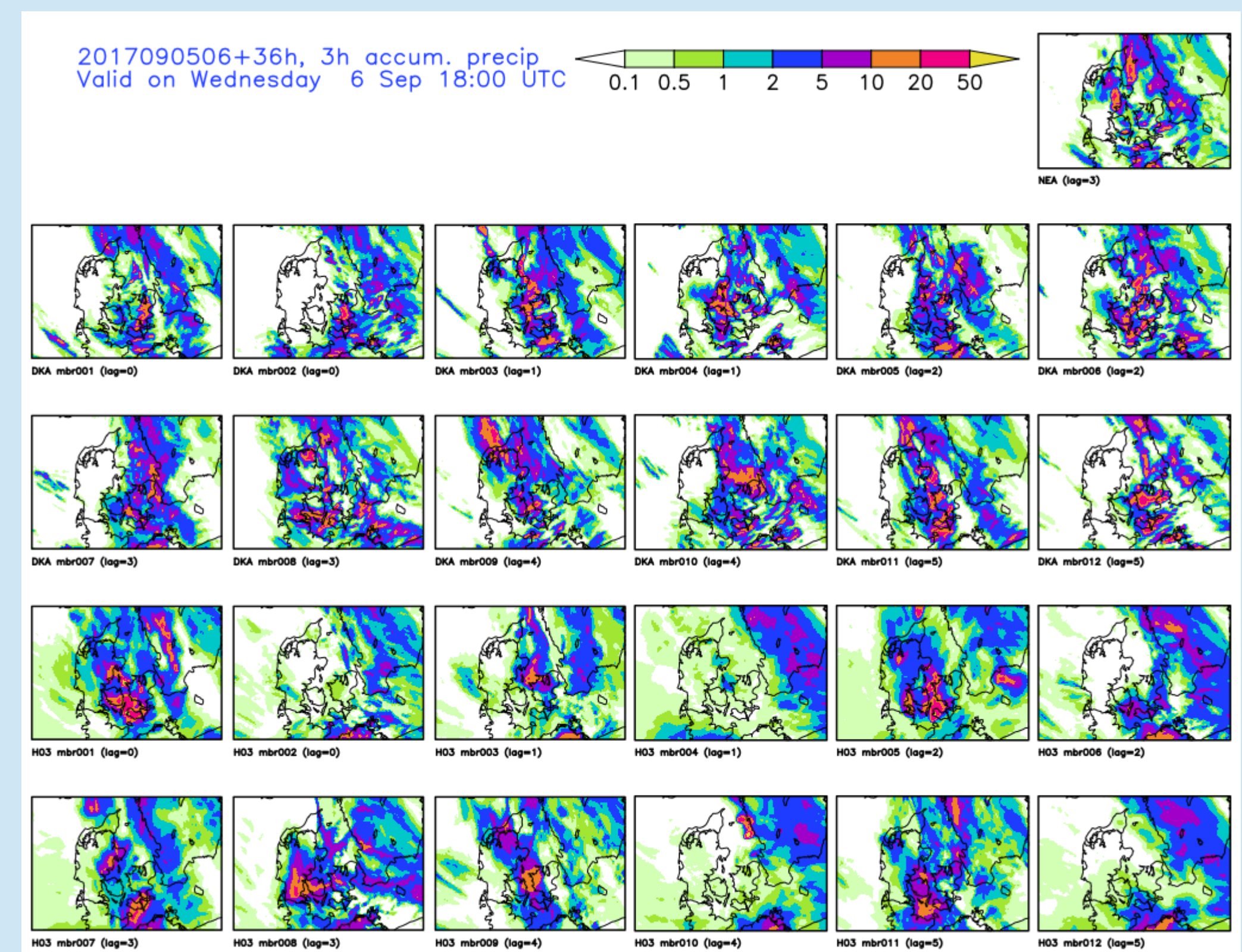

Upscaled probability map

City weather with uncertainty on dmi.dk

Percentile maps

Precipitation postage stamp