Developments to the high-resolution UK ensemble – MOGREPS-UK

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Met Office

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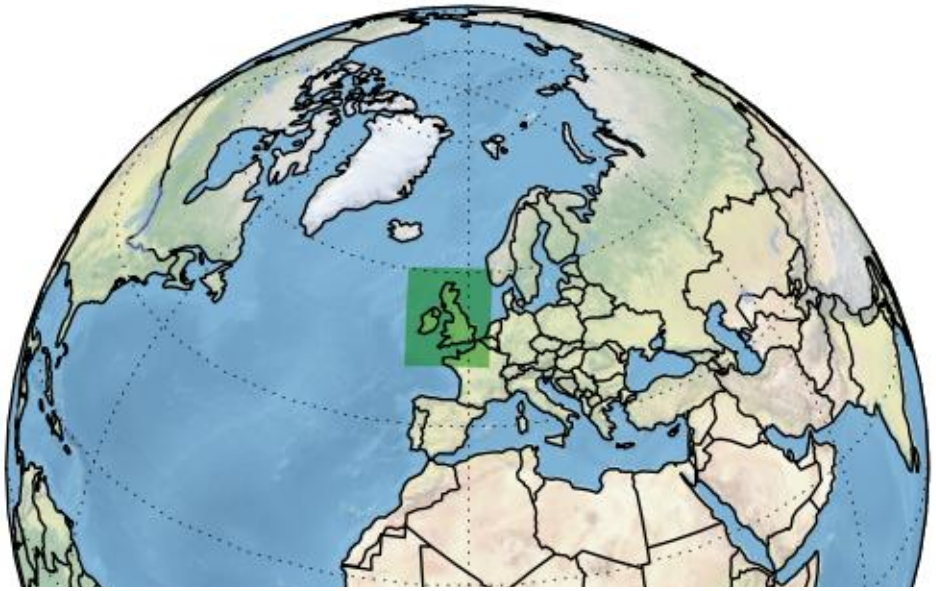
MOGREPS - overview

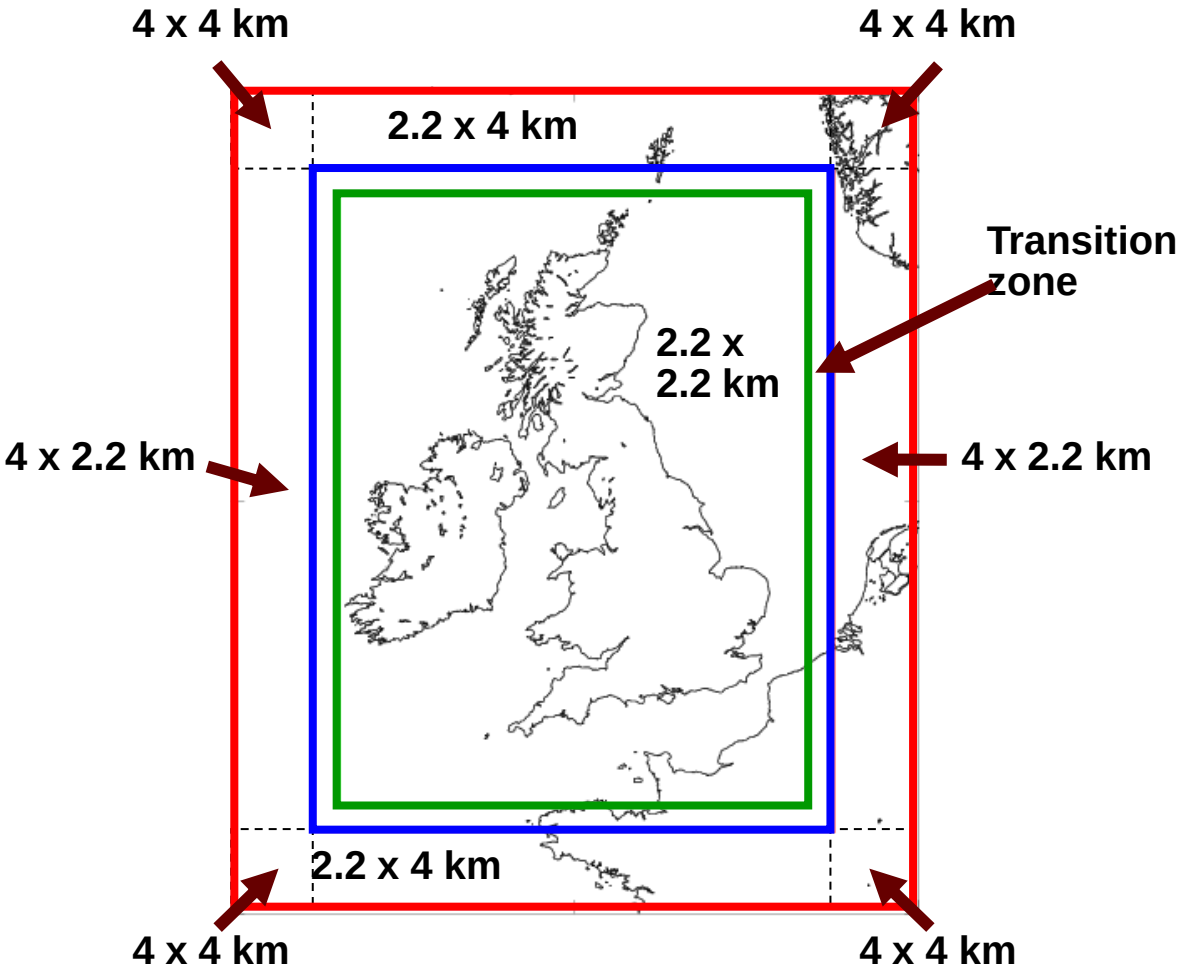


MOGREPS-G
- 33 km
- Up to 7 days
- 00, 06, 12, 18 UTC

MOGREPS-UK
- 2.2 km
- 36 h
- 03, 09, 15, 21 UTC

- Uncertainties in the prediction are represented using:
  - ETKF for (global) initial conditions perturbations
  - Stochastic physics (global)
- 12 members of each ensemble are run every 6 hours
- Many probabilistic forecast products are based on a lagged pair of ensemble runs (24 members)

MOGREPS-UK

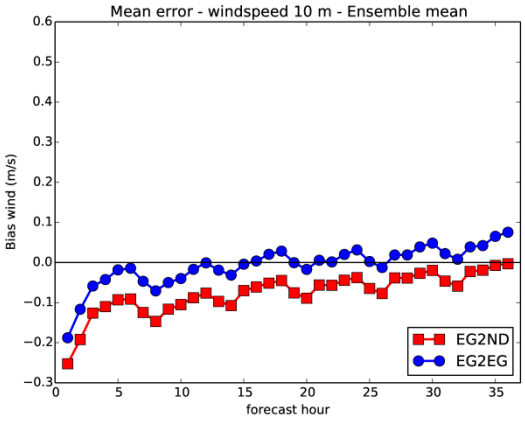
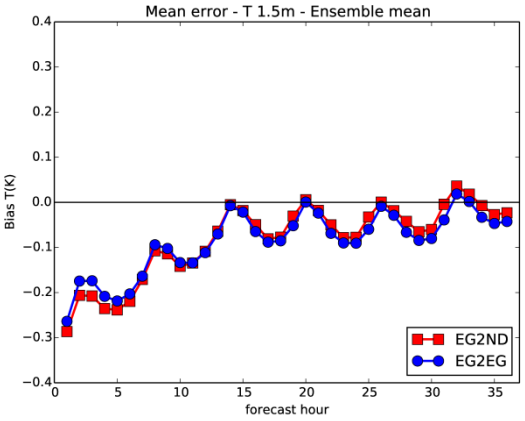
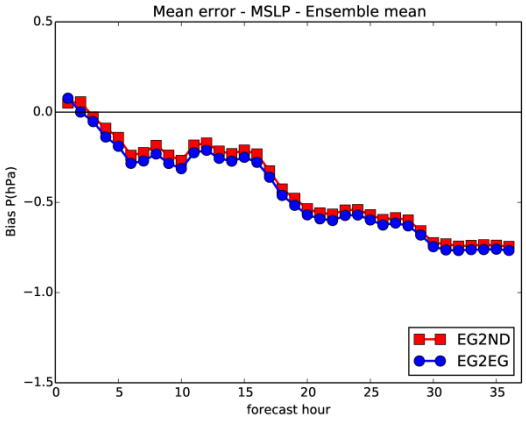
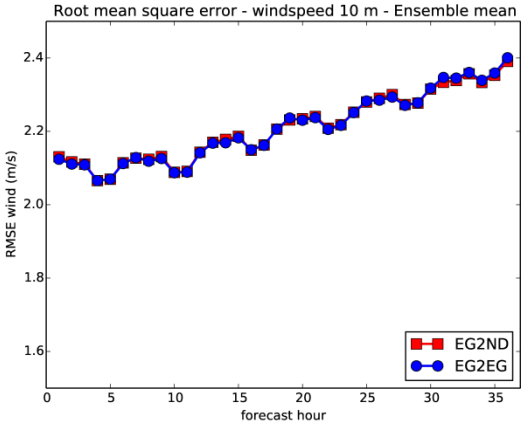
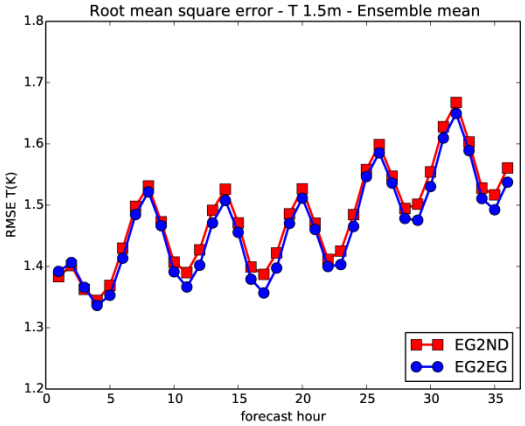
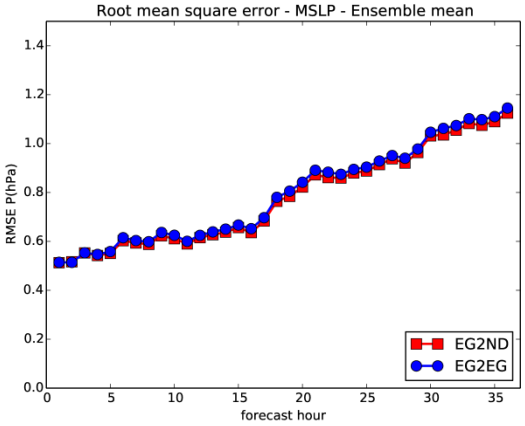


- Currently run as a direct downscaler
  - Initial conditions and LBCs from the global ensemble
- Same model physics as the 1.5 km deterministic UK model (UKV)

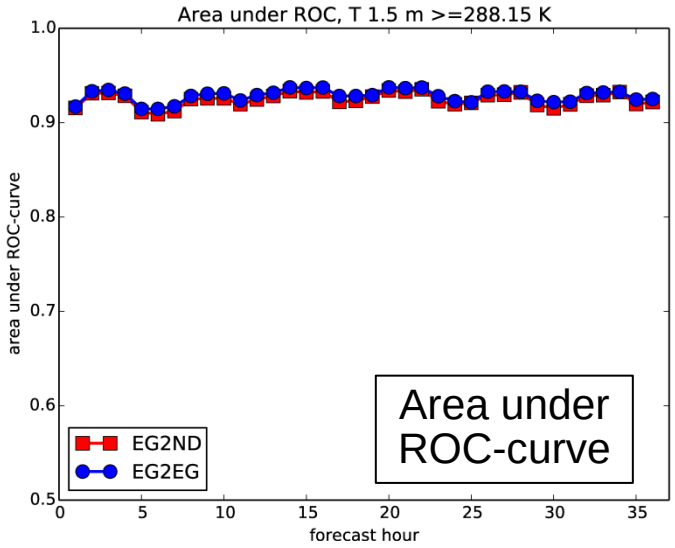
Using ENDGame in MOGREPS-UK

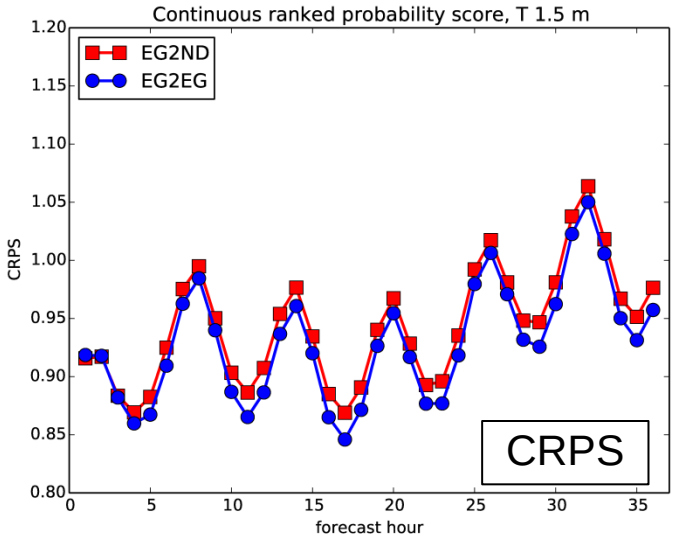
- ENDGame (Even Newer Dynamics for General atmospheric modelling) is the Met Office's new dynamical core, replaces ND (New Dynamics)
- Operational in MOGREPS-G as of 15 July 2014
- Used in MOGREPS-UK from next parallel suite (Nov. 2014)
- ENDGame MOGREPS-UK trial(s)
  - Summer trial 2-29 July 2013
  - Run with 4 cycles for four weeks
  - Dry, warm conditions, more unsettled weather toward the end
  - Summer trial 2014 and possibly also a winter 2013 trial

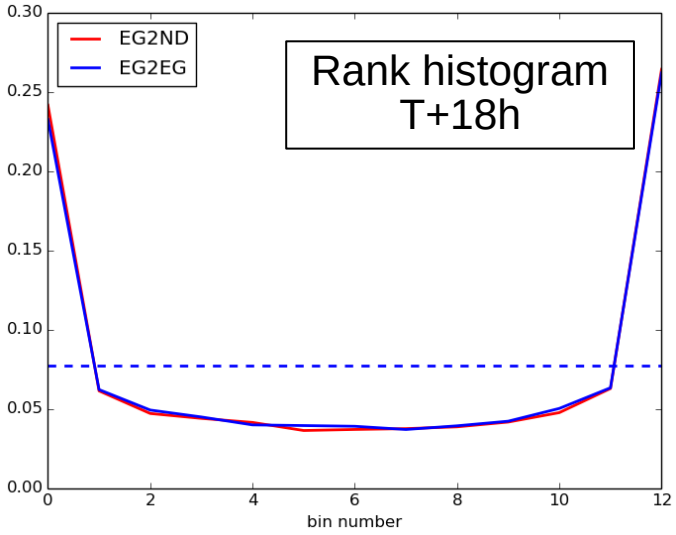
EG2ND: EG - global, ND - UK-model
EG2EG: EG - global, EG - UK-model

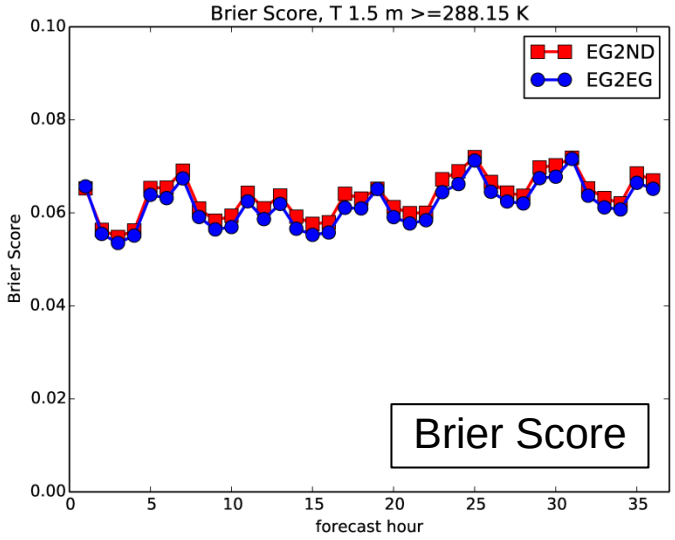
	Wind 10 m	Temp. 1.5 m	MSLP
Bias			
RMSE			

Probabilistic scores for T 1.5m







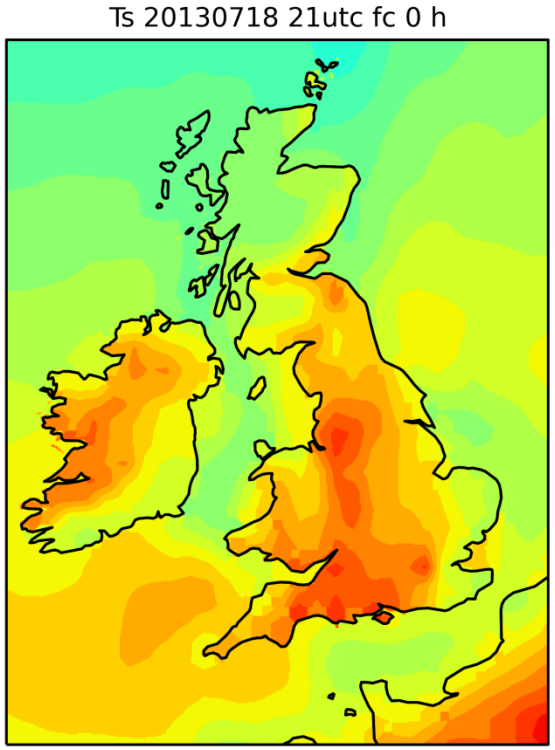


Centring around the UKV

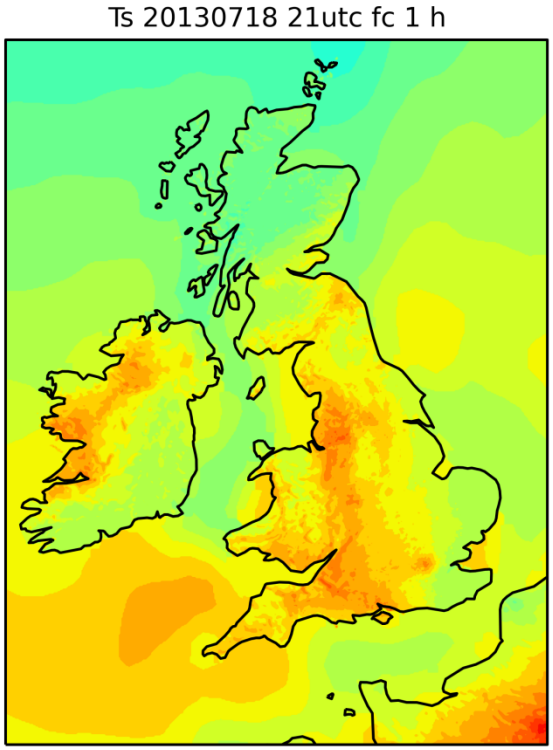
Initialisation:

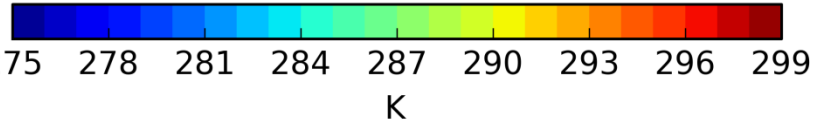
- Currently: 3h forecast from MOGREPS-G
- Instead: use data from UKV (1.5 km deterministic model)
- More recent and more detailed initial conditions
- Benefit from the data assimilation

Surface temperature at start of the run



Surface temperature after 1 hour





Centring around the UKV
- results from previous trials using ND

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Temperature

Mean sea level pressure

— Control member RMSE

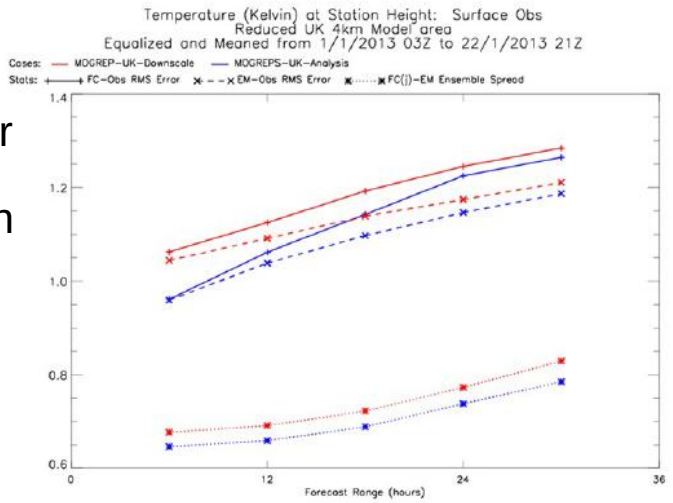
– – Ensemble mean RMSE

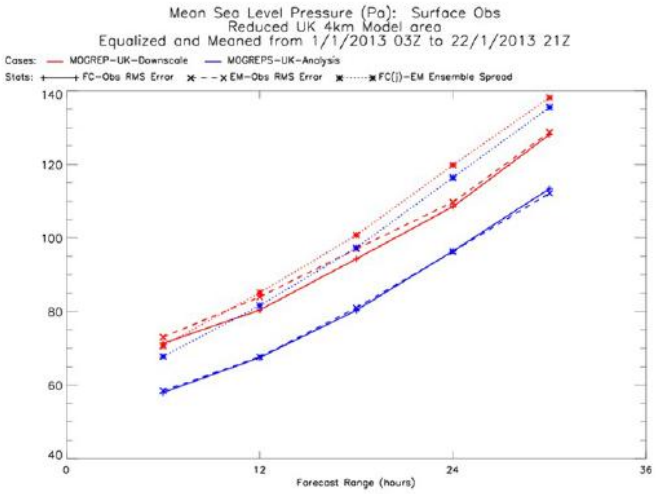
····· Ens. spread

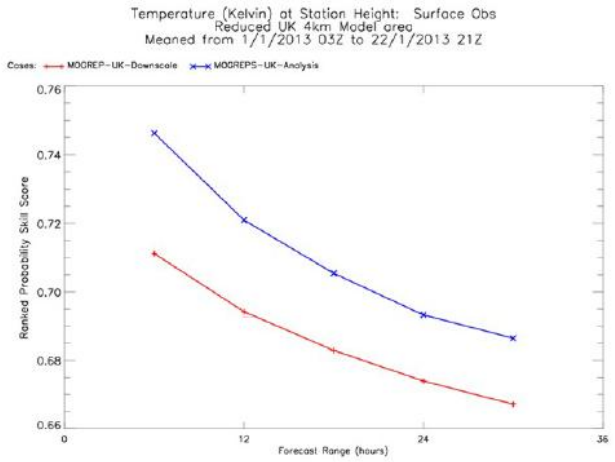
Downscaler

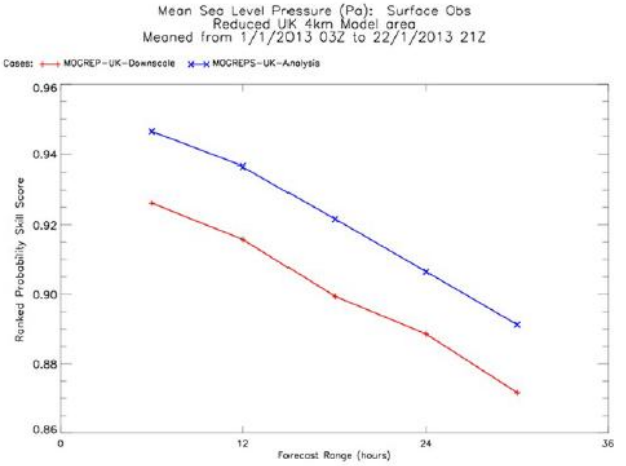
Centring around UKV

Ranked prob. skill score









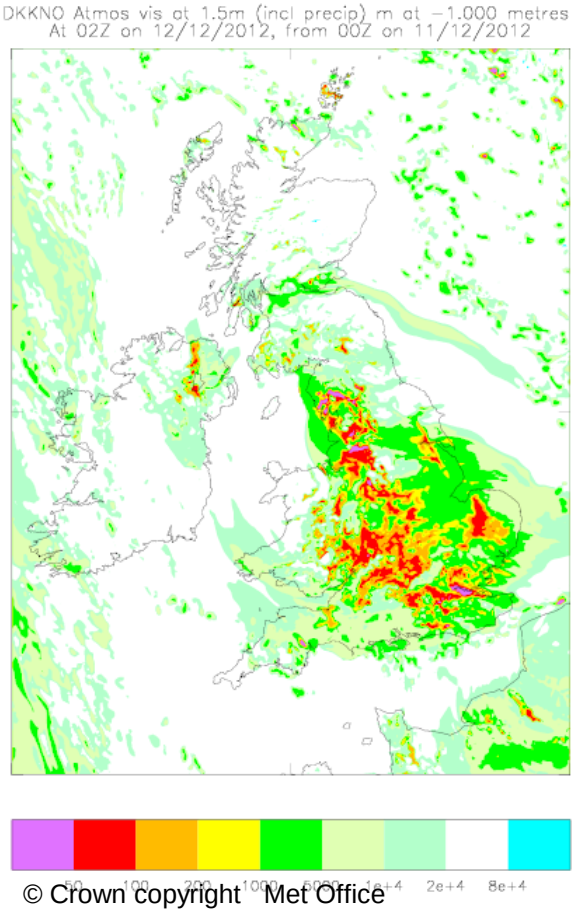
Random parameters scheme

- A first step towards representing the uncertainties in convective-scale forecasts
- Motivation: to better represent uncertainties in low cloud and visibility
- Based on the MOGREPS-G version, but:
  - Targeting appropriate boundary layer and microphysics parameters
  - Combining associated parameters so that they vary together
  - Improved algorithm for time variation of parameters

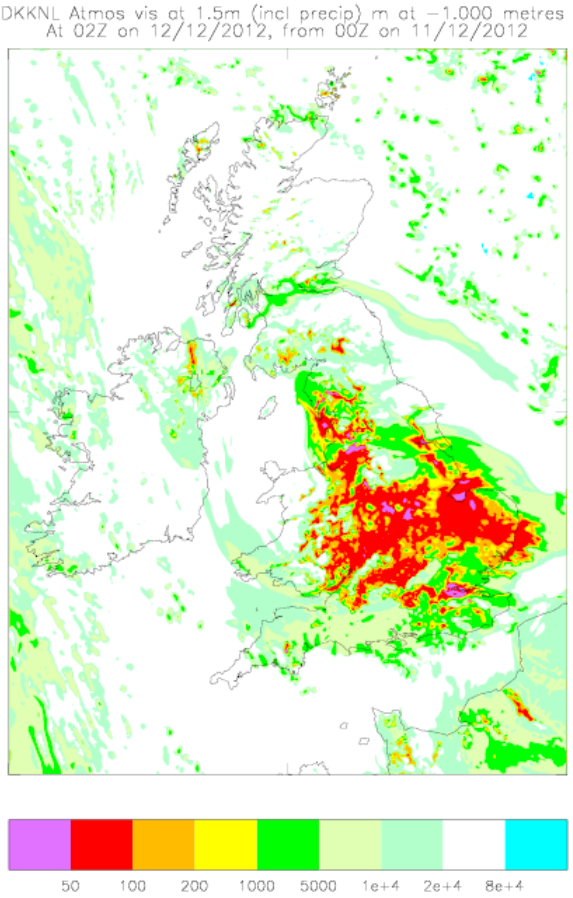
Sensitivity of visibility to parameters

Visibility forecasts for 02UTC on 12th Dec 2012
(start of forecast: 00 UTC 11th Dec)

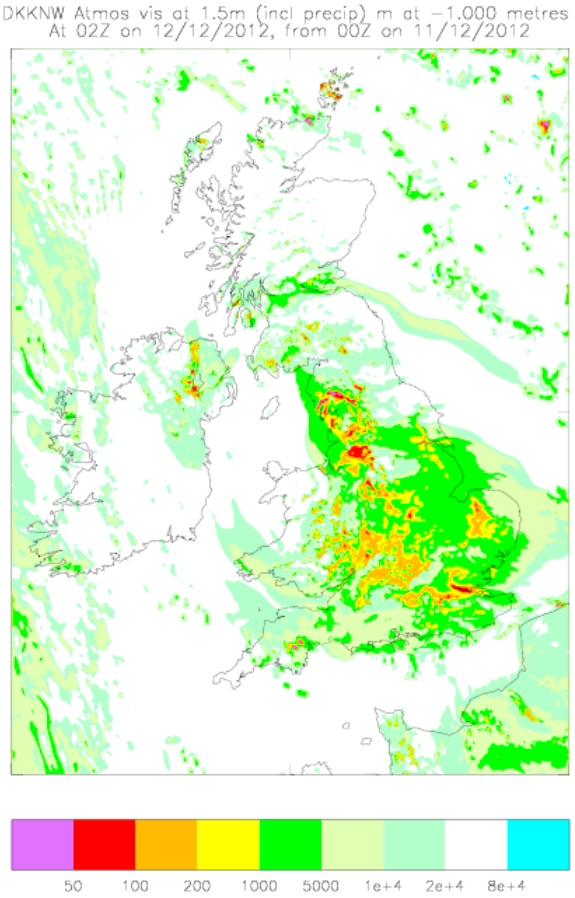
Standard parameters



Minimum A_1



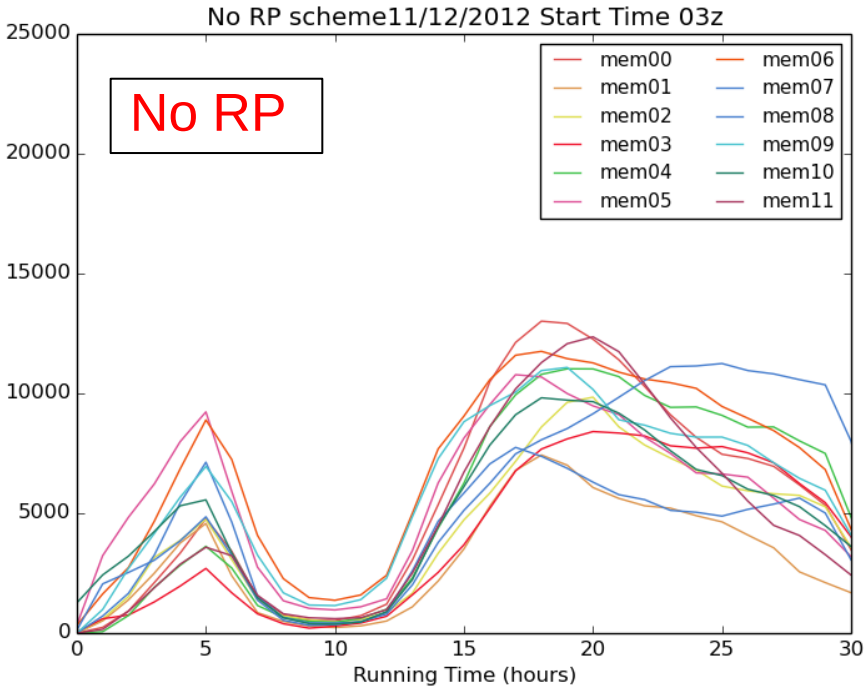
Minimum nd_min

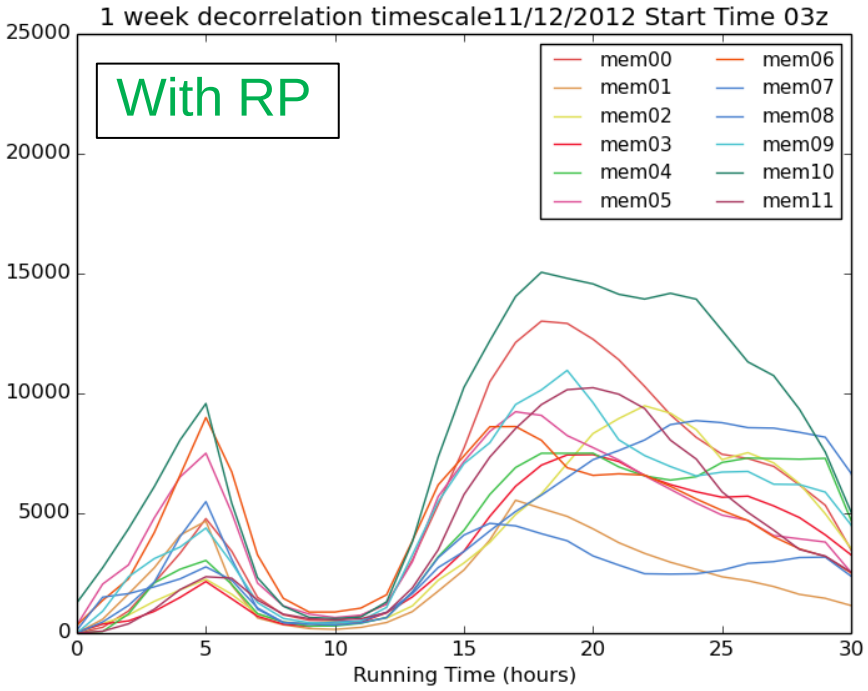


Increased variability of fog

- The new microphysics and boundary layer parameters lead to a wider range of low-visibility points, compared with no RP scheme.

Number of points with visibility < 1km, for each member

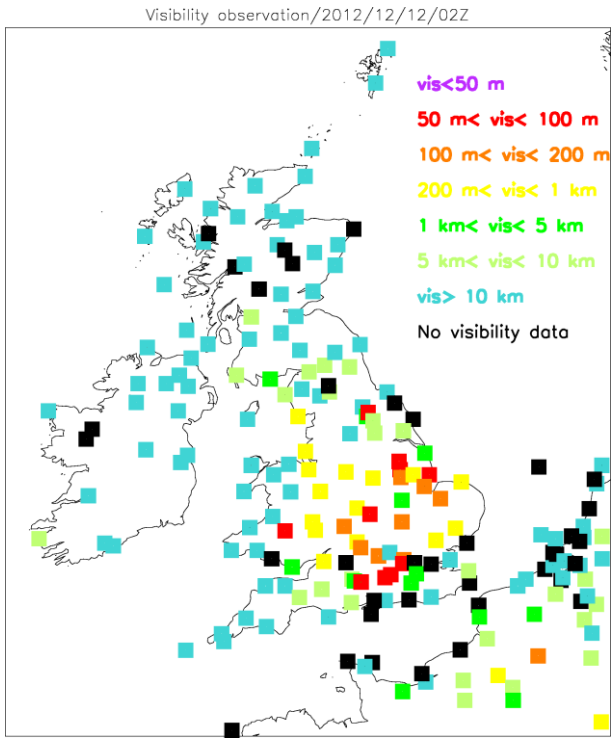




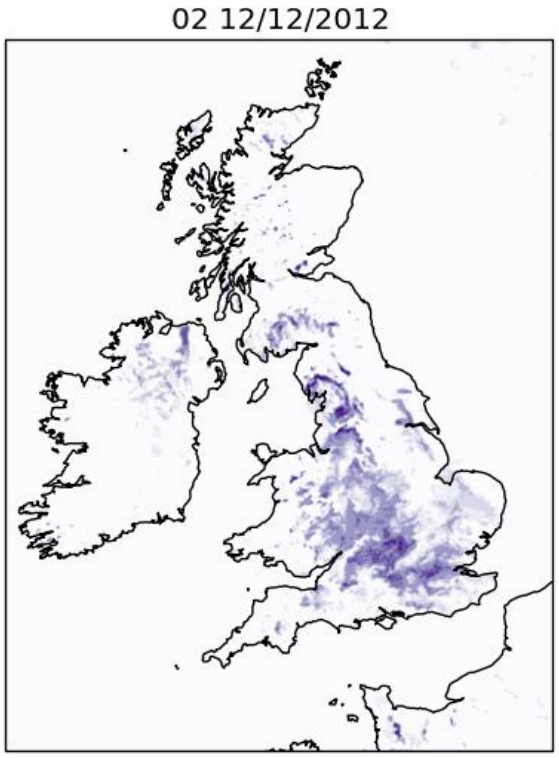
Impact on fog probability

Forecast probability of visibility less than 1km

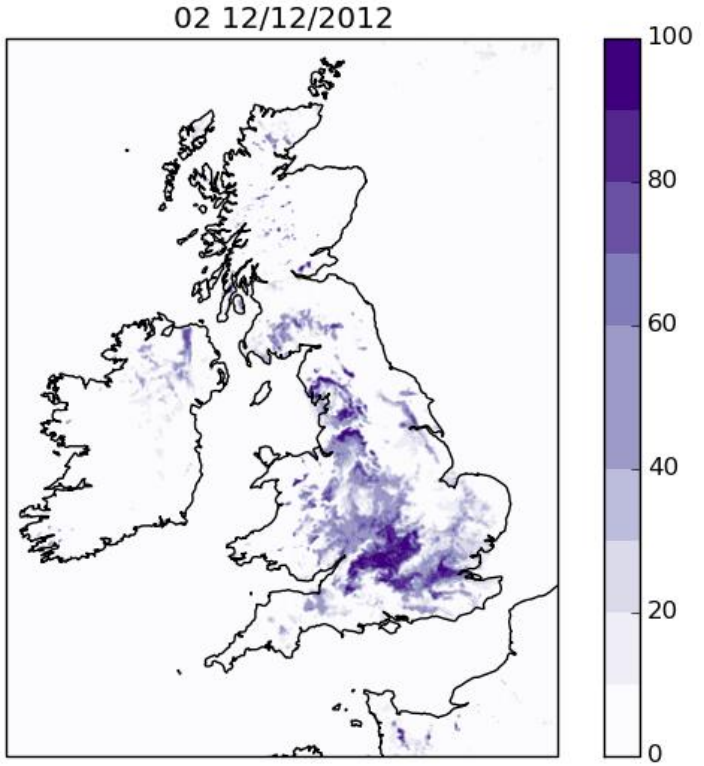
Observations



With RP scheme



No RP scheme



Future developments

Short term

- Use UKV analysis combined with perturbations from MOGREPS-G
- Stochastic physics – suitable version of random parameters scheme
- Ensemble size
  - More members
  - Higher vertical and horizontal resolution
  - Larger domain (better catch weather systems from the south)

On new HPC

- Time-lagged ensemble with 3-4 members run every hour
- Convective scale ensemble data assimilation (needing much larger ensemble for DA cycling)
- Investigate specialist stochastic physics for MOGREPS-UK

Summary

- Using ENDGame improves the forecast (or is neutral) for MOGREPS-UK
- Centring around the deterministic high-resolution UK model also improves the forecast scores
- The random parameters scheme shows promising results for visibility and fog forecasts
- New configurations to investigate in preparation for the next HPC (2016-2017)

Thank you for your attention