SRNWP Dynamics Review 2010

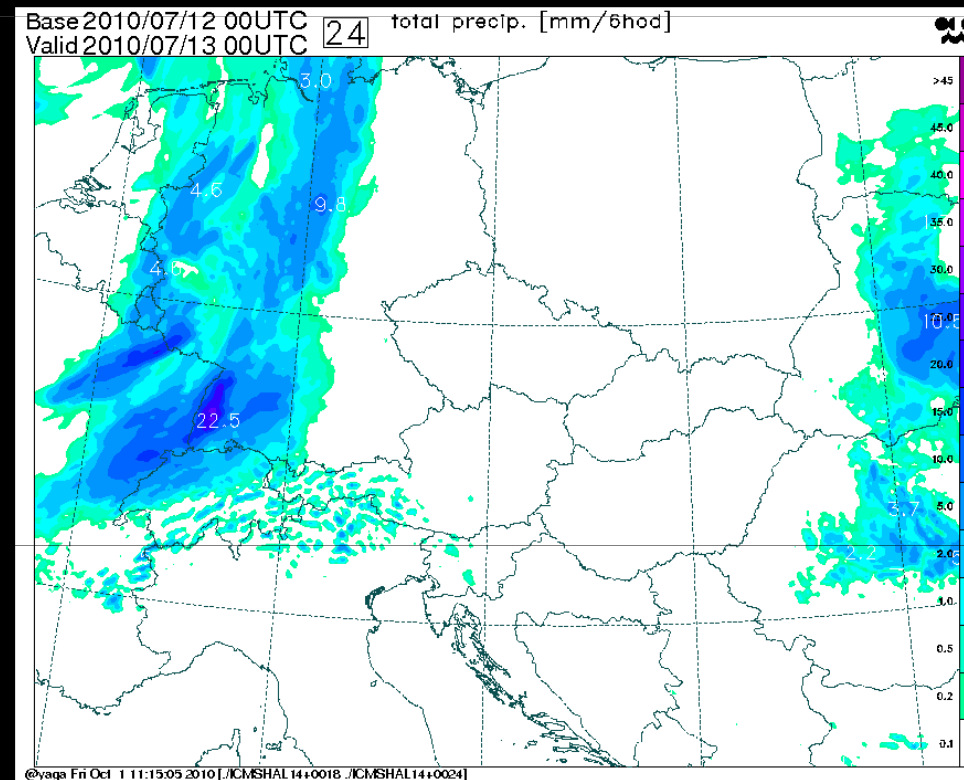Terry Davies Dynamics Research

Plan
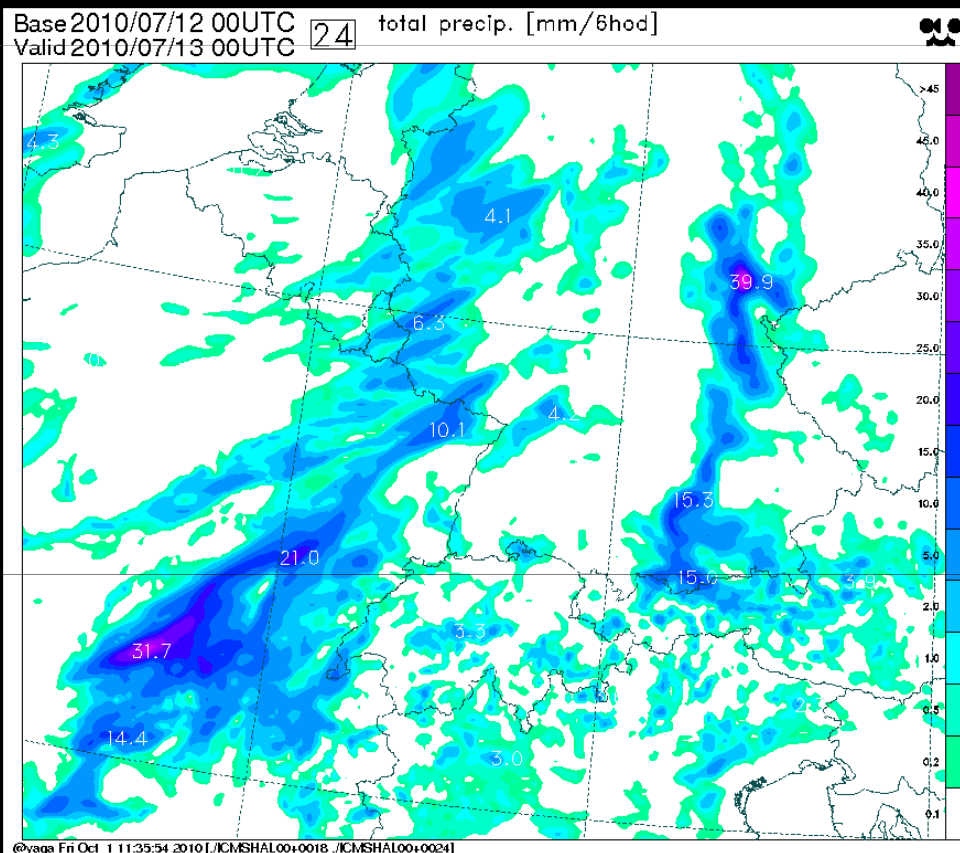
- **High resolution and precipitation**

- **Lateral boundary conditions**

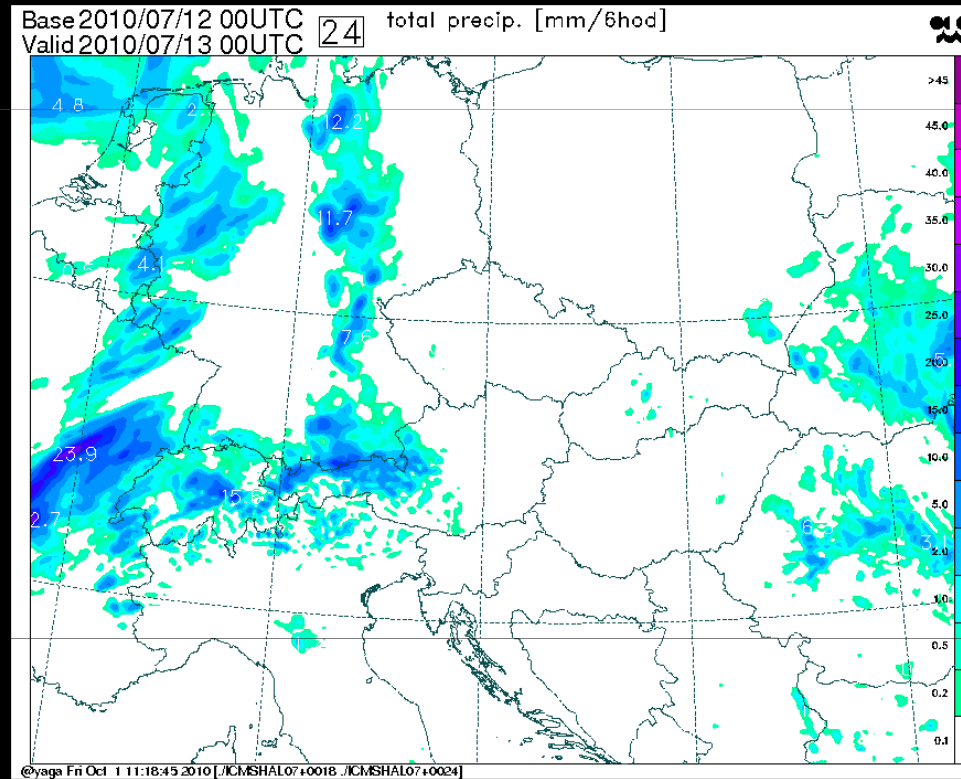- **Scalability**

AROME rainfall

AROME rainfall

Base 2010/07/12 00UTC 24   total precip. [mm/6hod]
Valid 2010/07/13 00UTC

Base 2010/07/12 00UTC 24   total precip. [mm/6hod]
Valid 2010/07/13 00UTC

Plan
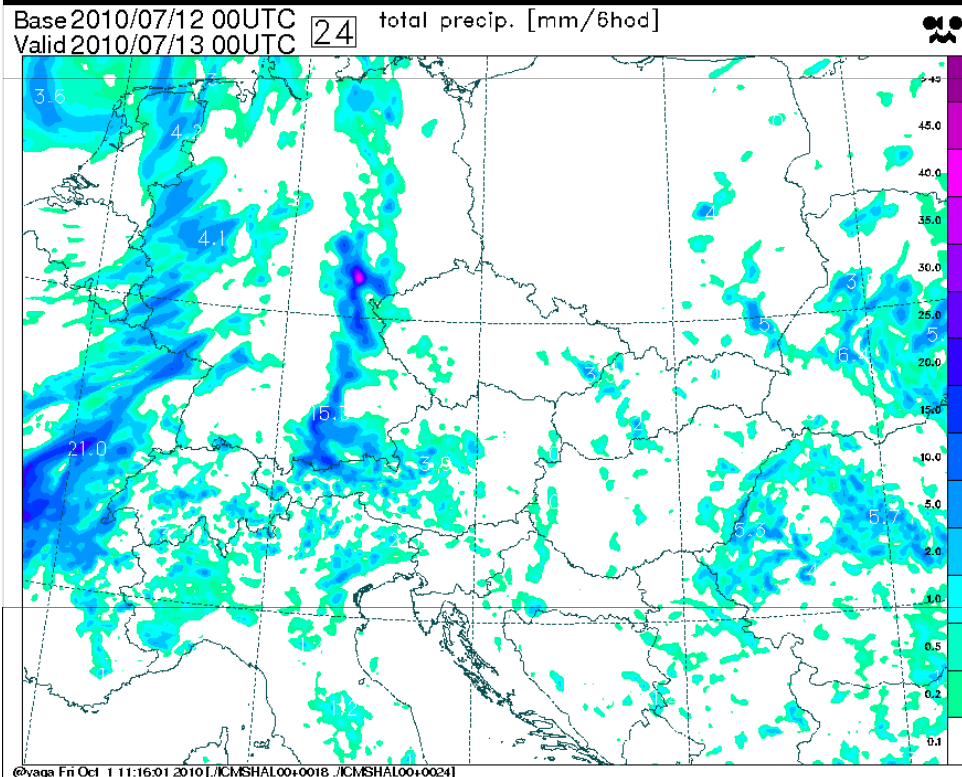
Met Office

- **The "noise" apparently belonged to the turbulence scheme.**

- **A more sophisticated turbulence scheme then has the potential not only to improve model scores but also to stabilize whole model with respect to the noise.**
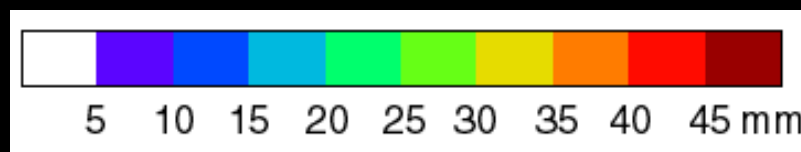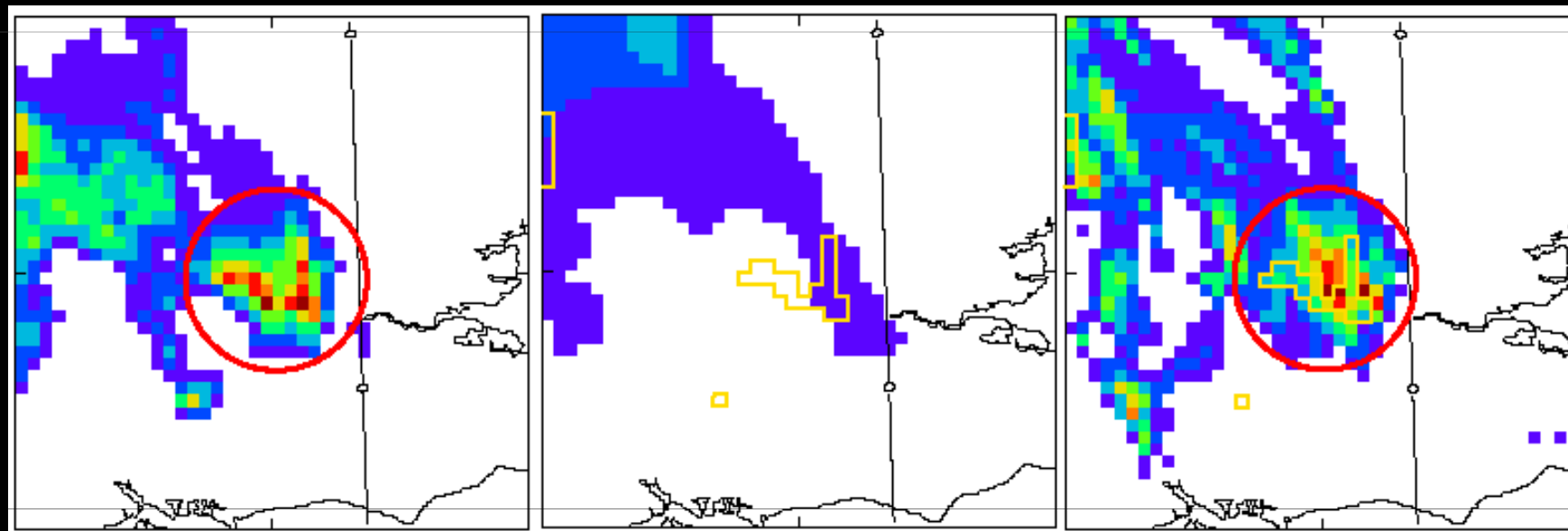
Flooding in London
3rd August 2004

radar   12km from 09UTC 03   1km from 09UTC 03

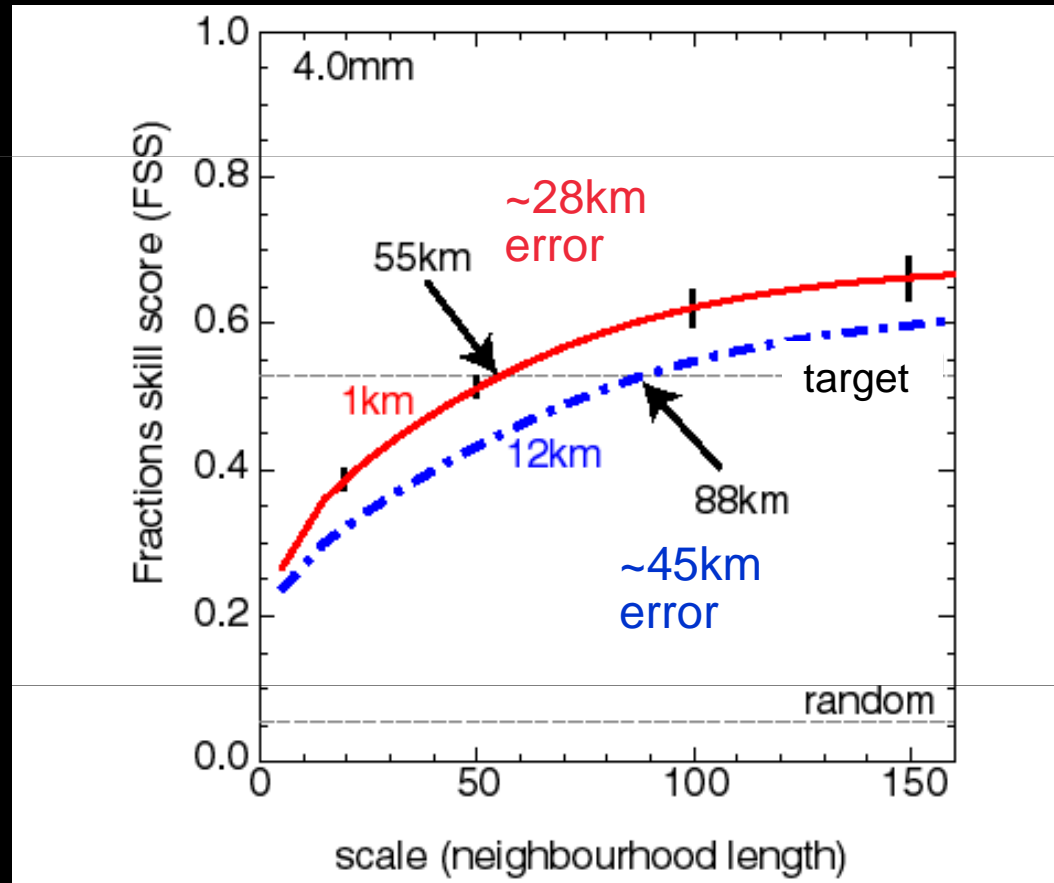5   10   15   20   25   30   35   40   45 mm

Measuring the skill

From a sample of 40 forecasts of convective rainfall events

4-hour accumulations T+2 to T+6

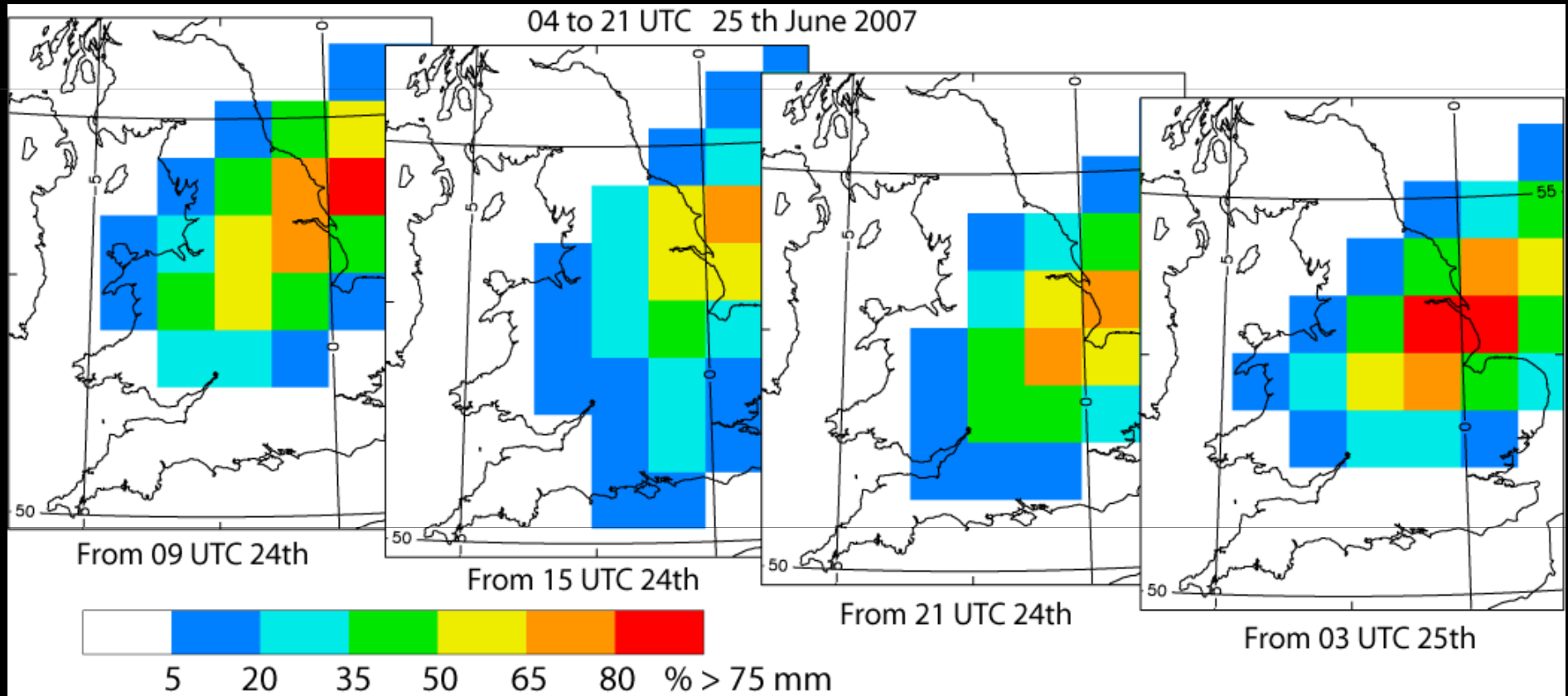Starting from same 12-km fields. No additional data assimilation at 1 km.

Scale-selective verification methodology

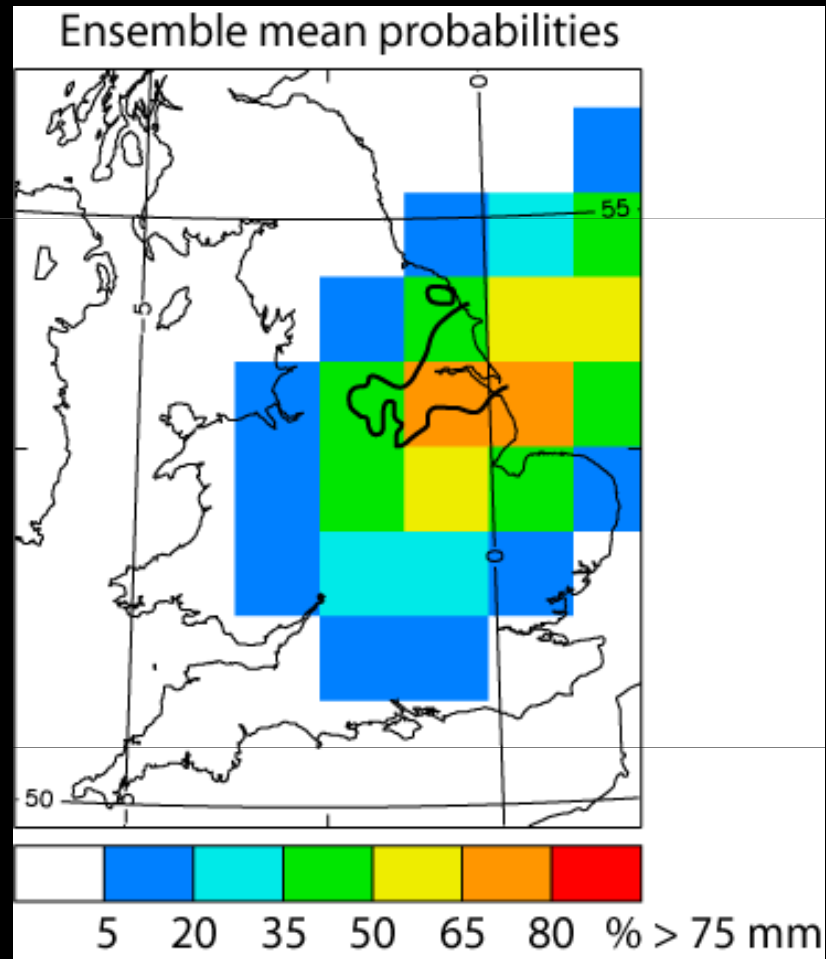Roberts and Lean, MWR, 2008

04 to 21 UTC 25 th June 2007
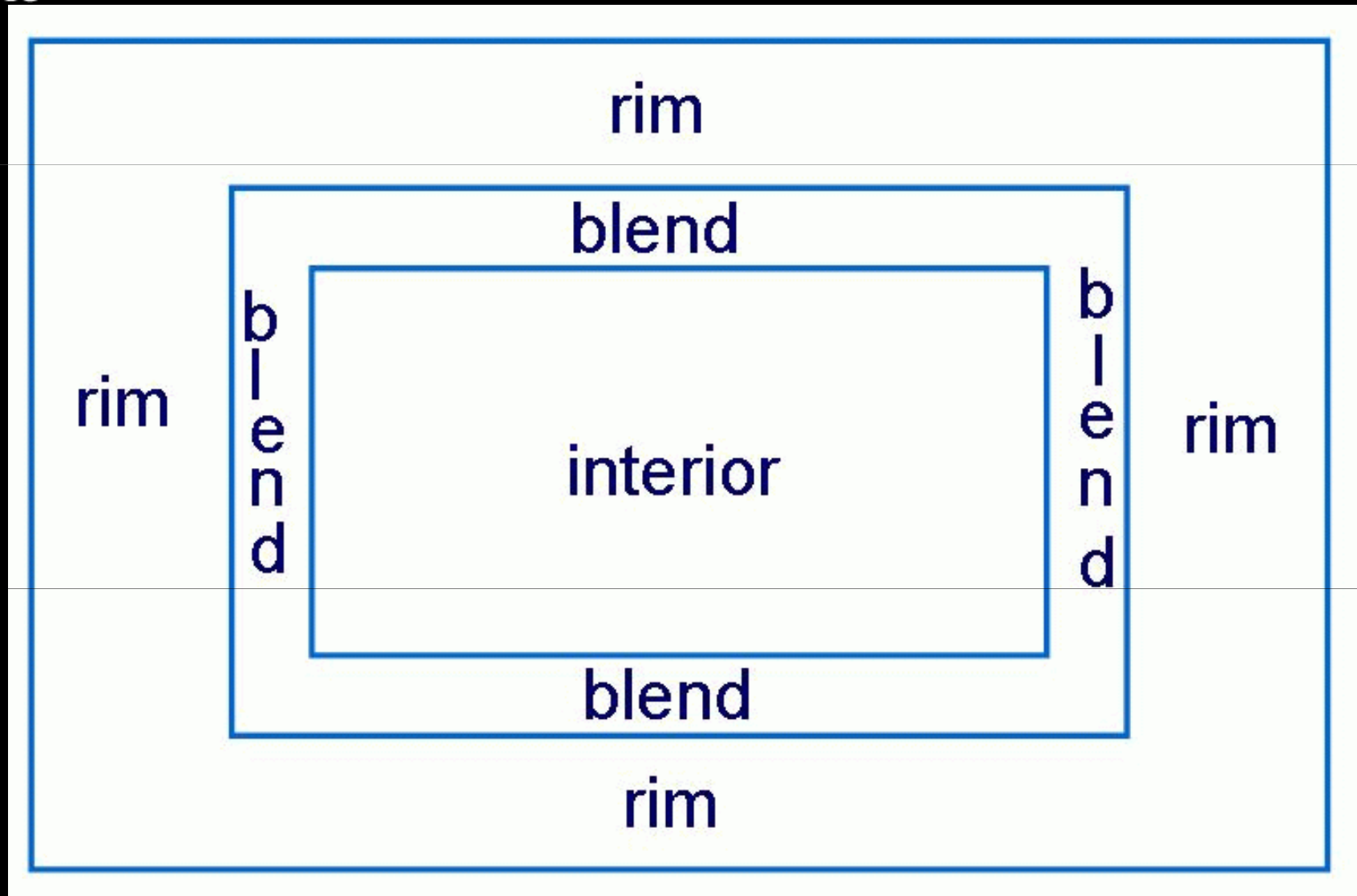
From 09 UTC 24th

From 15 UTC 24th

From 21 UTC 24th

From 03 UTC 25th

5 20 35 50 65 80 % > 75 mm

25th June 2007

Ensemble mean probabilities

5 20 35 50 65 80 % > 75 mm

LAM domain

Lateral boundaries

Semi-Lagrangian predictor applies lbcs naturally

- **Up-winding scheme so lbcs only applied at in-flow (if departure point is inside domain then lateral boundaries are not used)**

- **Departure points outside domain obtained from lateral boundaries but use time-level n information, not time-level n+1 (time-level n+1/2 used for trajectories)**

Lateral boundaries

- **Apply appropriate lbcs to Helmholtz equation**

- **LBC only applied to (Exner) pressure correction (Π' = Π^{n+1} - Π^n) at one point around edge of domain – well-posed Dirichlet problem**

- **For mpp, lateral boundary files do not need external halos – can use a rim (>1 to allow for flow Courant number >1) around inner edge of domain**

Lateral boundaries

- **Well-proposed lbcs are desirable but not sufficient**

- **Atmospheric states of lbcs and LAM need to be well-matched – blending**

- **How do LAM and lbcs become mismatched?**

1. **Differences in resolution and grids - downscaling**

2. **Differences in data time – freshness**

3. **Data assimilation – new observations**

4. **Model differences – different systematic errors**
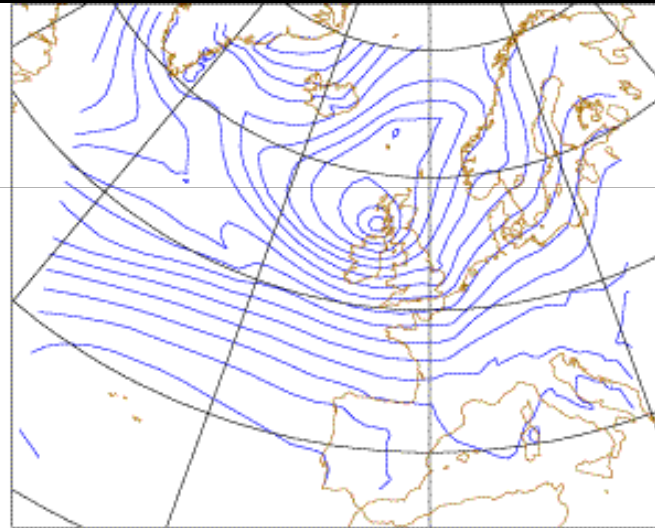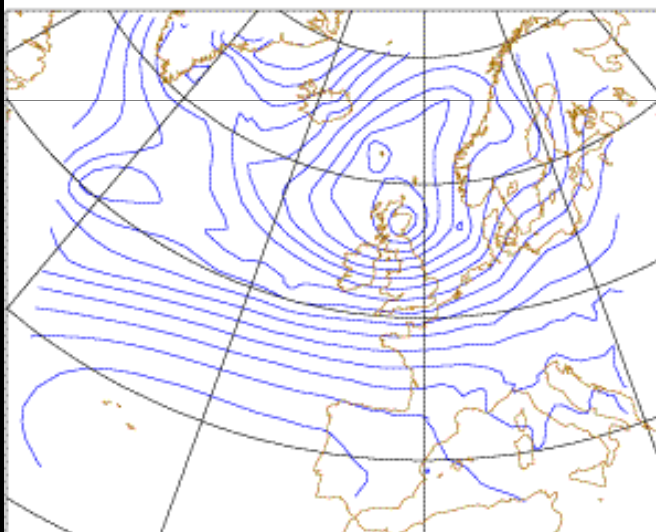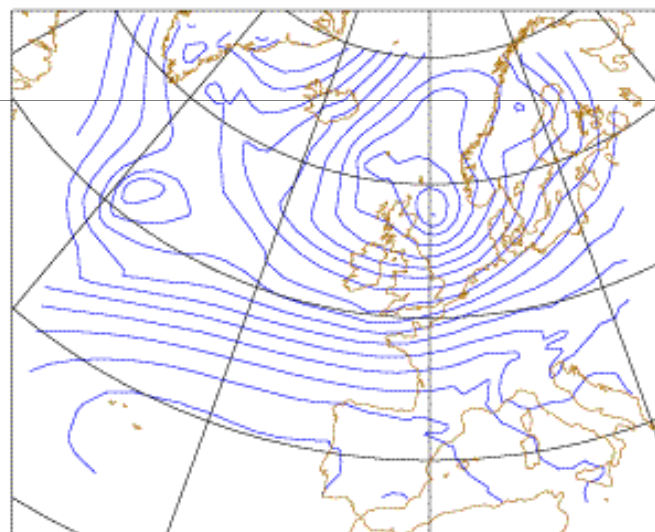
5. **Perturbations for EPS**

12km NAE

T+0

T+6

T+12

T+24
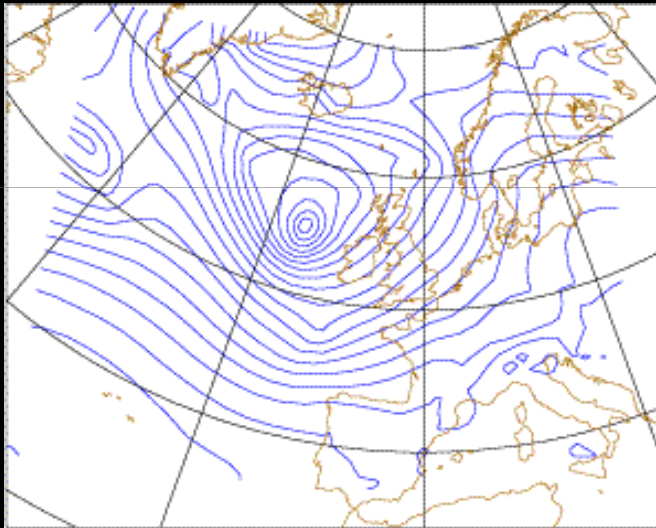
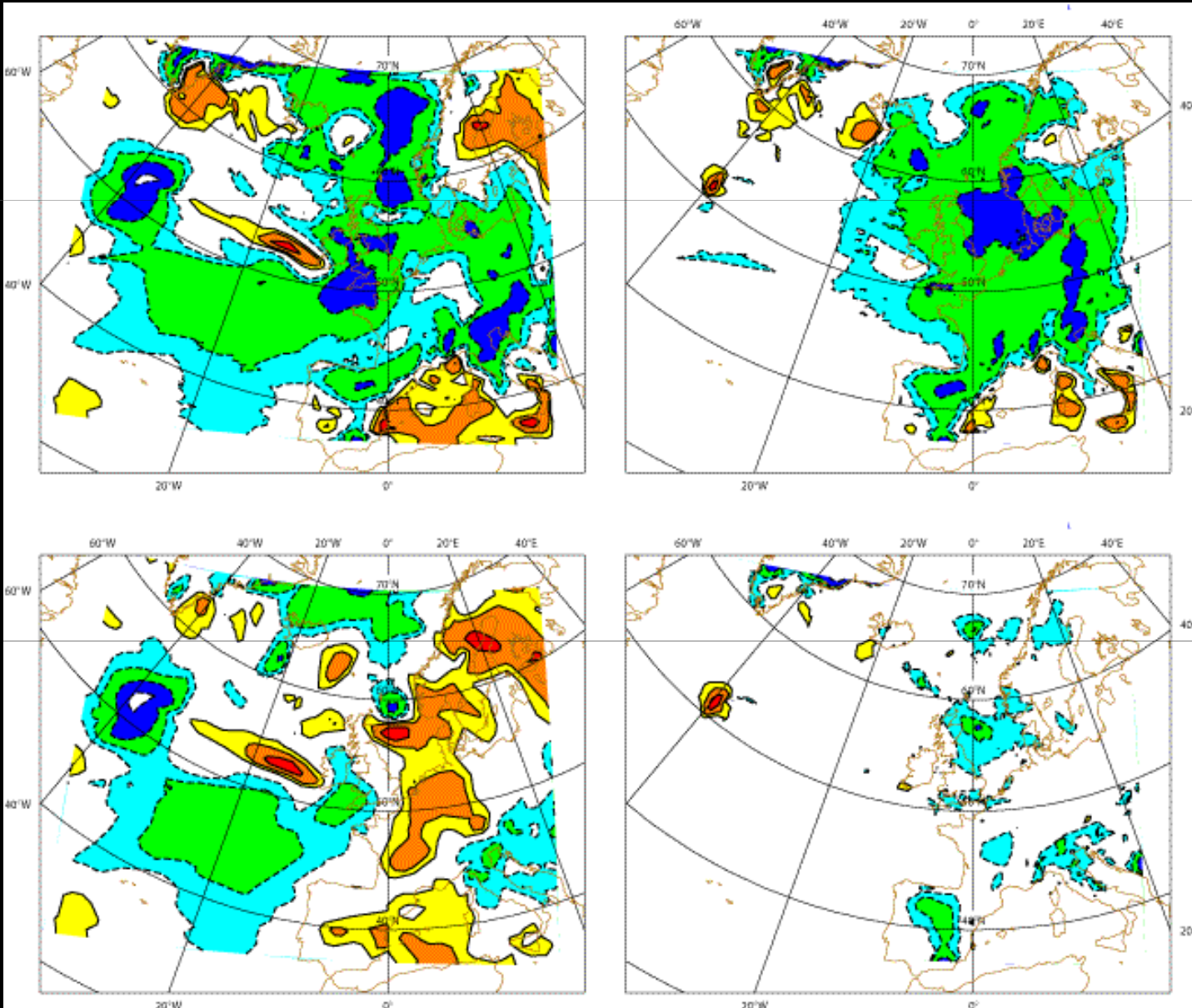# T+24 PMSL differences

NAE-anal

Global -anal

NAE-global

NAE phys

NAE-global

global phys

Lateral boundaries

- **Blending of lbcs needed to match atmospheric states of lbcs and LAMs**

- **Blending upsets geostrophic adjustment**

- **If no blending of lbcs then will need to filter small-scale outflow information otherwise reflection at the boundary (loss of transparency)**

LBCs test set up

- **Regional model (NAE-type) .44/.22/.11 degrees (48/24/12km)**

- **LAMs over UK .44/.22/.11**

- **Run LAMs using lbcs supplied by NAEs. Change frequency and resolution of lbcs.**

- **Main test is to drive LAMs using lbcs from .11NAE and differencing against the .11 NAE forecast.**
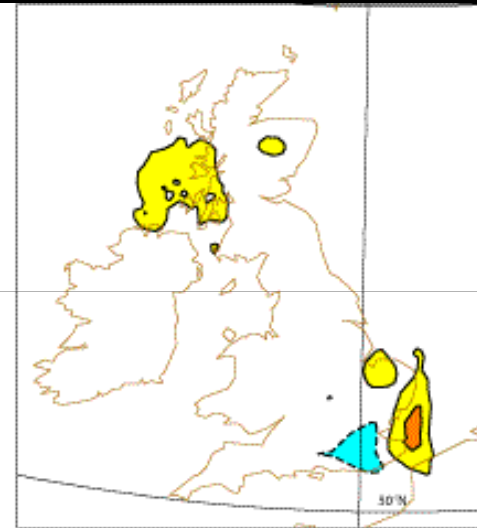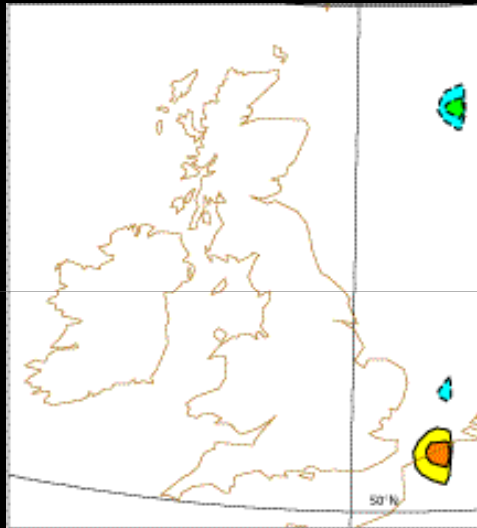
PMSL differences .2hPa

T+6
5min
Old lbcs
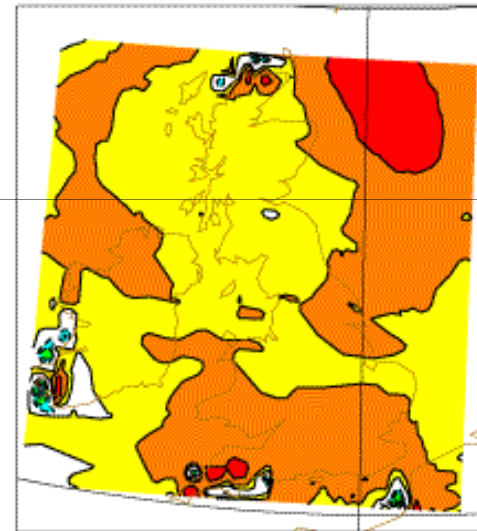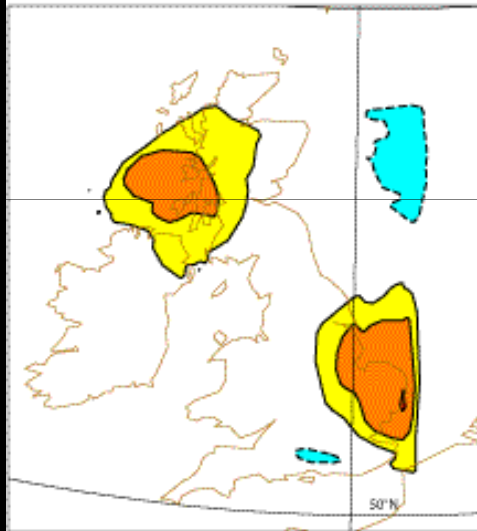.2hPa

T+12
hourly
.11 lbcs
.2hPa

T+12
3 hourly
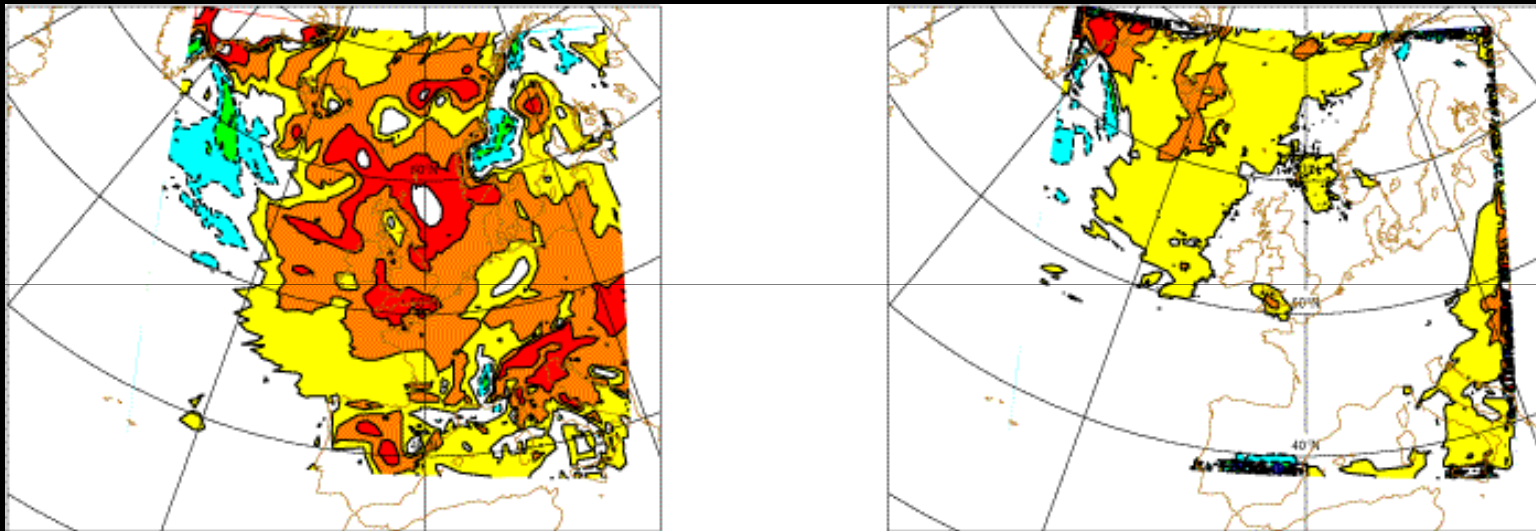.11 lbcs
.5hPa

T+24
5min
.44 lbcs
.5hPa

.11degree LAM

PMSL differences .2hPa

T+24
.44 LAM
20min
.44 lbcs

T+24
.11 LAM
5min
.44 lbcs

ECMWF LBC review recommendations 1-4

- **continued use of the current configuration, where the 00 and 12 UTC BCs are provided by the main medium-range analysis and forecast runs and 06 and 18 UTC BCs by separate BC runs**

- **the introduction of hourly BCs**

- **that the production of backup products by means of the full product generation process be discontinued**

- **revision of the project guidelines to bring them into line with the Amended Convention and remove the restriction on the use of the output from the BC runs**

ECMWF LBC review recommendations 5-6

- **that the strong support for LAM EPS BCs be built upon by continued dialogue between the SRNWP community and ECMWF**

- **taking into account fast moving developments in the LAM community, that a BC users' workshop be held at ECMWF within the next eighteen months and a technical review of the BC configuration take place within 2 to 3 years**

Scalability

- **UM unlikely to scale well on next generation computers**

- **Joint project UM/NERC/STC NGWCP begins next year – NERC 5ftes for 5 years, STC 3ftes**

- **Collaboration with NCAR MPAS (Model for Prediction Across Scales) group – workshop March 2011**

- **PDEs network for nearly 20 years (cubed spheres, icosahedral, Ying-Yang)**

- **ICON development ends soon?**

Questions.

UK 1.5 km domain

UKV_D5 1p5_to_4 Variable Resolution Domain