EWGLAM, 2009

Athens

Review topic – Impact of High-Resolution Data Assimilation

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Contents

This presentation covers the following areas

- impact of DA at high resolution in UK and US
- in COSMO community
- in ALADIN community

Impact of High-Resolution Data Assimilation

- Is it worth doing DA at high-resolution, or do we only need to run the model at high resolution from interpolated analyses made at lower resolution?

- ie should ETDA be planning a scientific workshop or a retirement party?

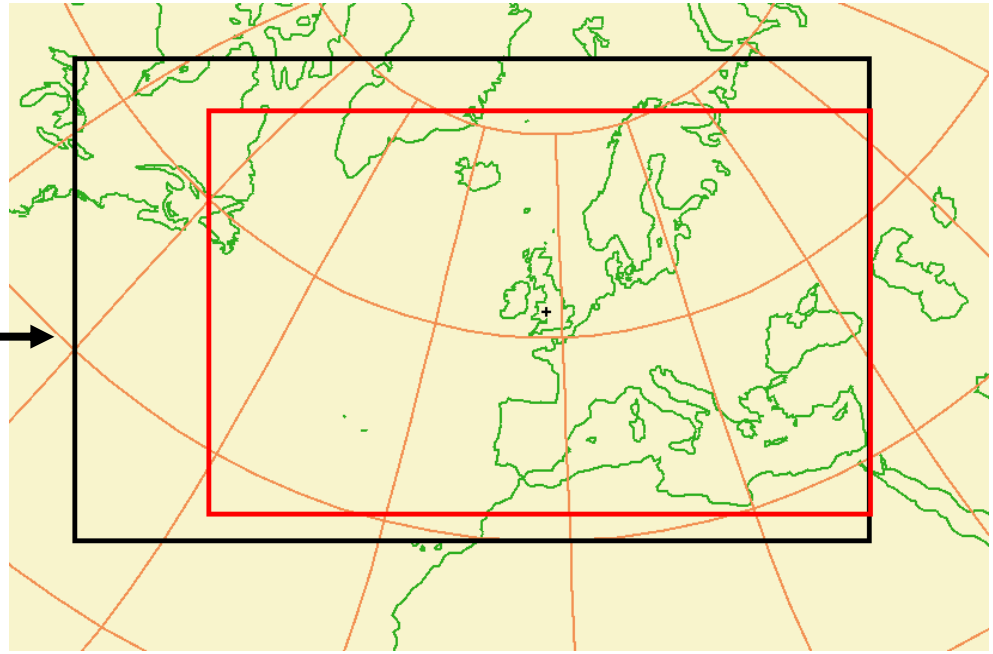
Impact of High-Resolution Data Assimilation

- **Is it worth doing DA at high-resolution, or do we only need to run the model at high resolution from interpolated analyses made at lower resolution?**
  - ✓ High resolution forecasts with DA may be scheduled to take advantage of later observations than those available to most recent large-scale analysis;
  - × BUT use of early cut-off for same data time as coarser-resolution run may disadvantage high resolution DA run
  - *High resolution DA systems*
    - ✓ may extract more information from high-resolution observations (eg those affected by detail of land surface or radar)
    - ✓ may suffer less from spin-up problems in the moisture field
    - × may struggle to represent the large-scale analysis satisfactorily, especially near boundaries

North Atlantic & European Model

- **Impact of operational NAE analysis/forecast v**
  - **Operational Global analysis/forecast**
  - **Global analysis/NAE forecast**
  - **Previous global analysis, one cycle NAE DA + NAE forecast**

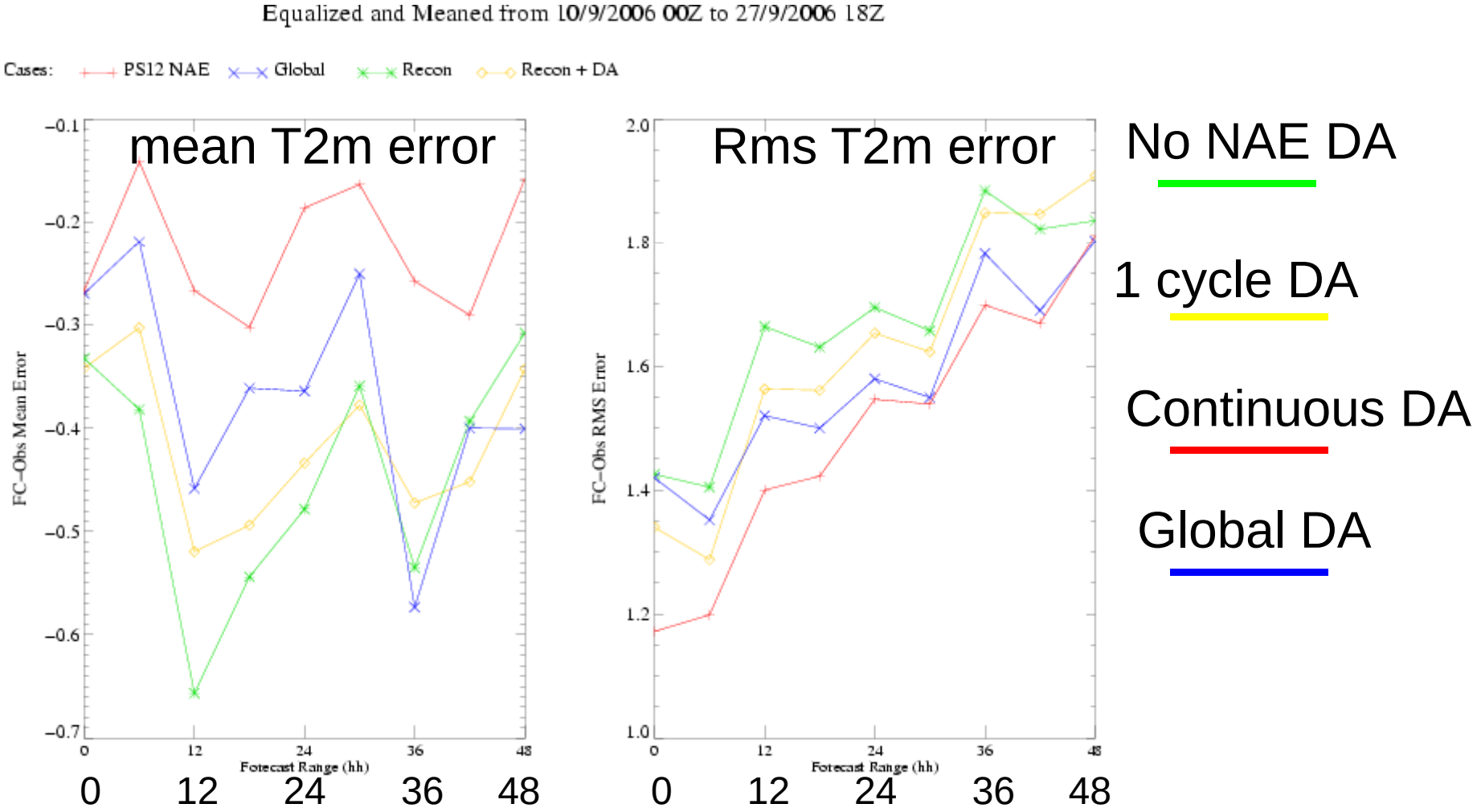
2006 version →



NAE results

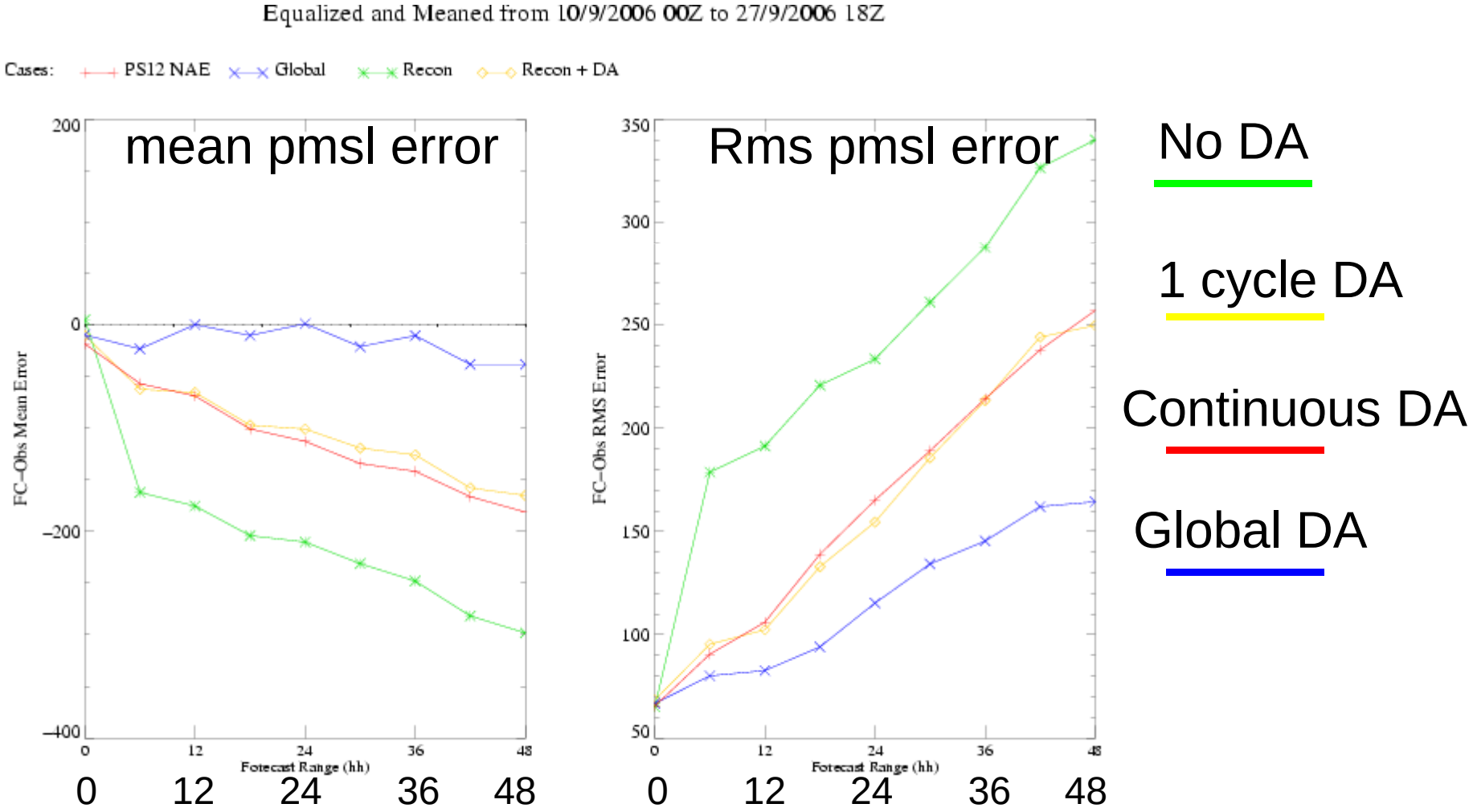
- ❑ **NAE T2m better with continuous NAE DA**
- ❑ **One cycle of NAE DA better than none**

(but global did not assimilate T2m)



NAE results

- Global pmsl better – NAE runs have bias
- One cycle of NAE DA similar to continuous DA



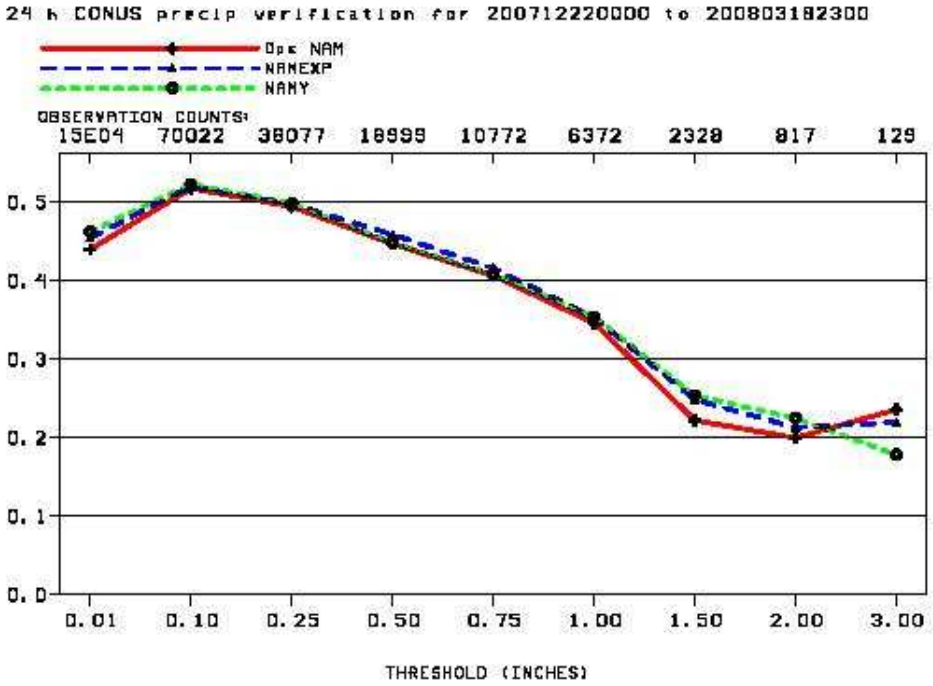
US Experience

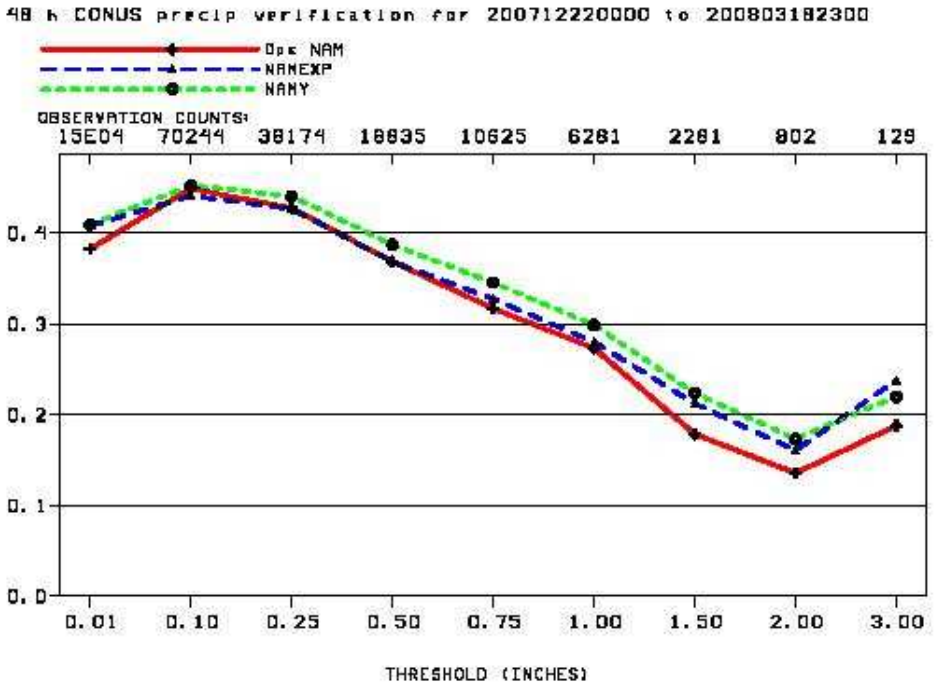
- **NCEP's NAM (similar to Met Office NAE, but *larger*)**
  - NAM run from Global GFS analysis outperforms continuous NAM cycling beyond t+60hr
  - NAM now runs operationally with "partial cycling"
    - Start at t-12hr from global GFS background

      (except for land surface which has continuous NAM cycling)
    - 12 hours of NAM DA, then NAM forecast

NCEP NAM – partial v full cycling

- **Benefit in skill (ETS) for heavier rain shows by day 2**





24-hr Rainfall threshold

Day 1

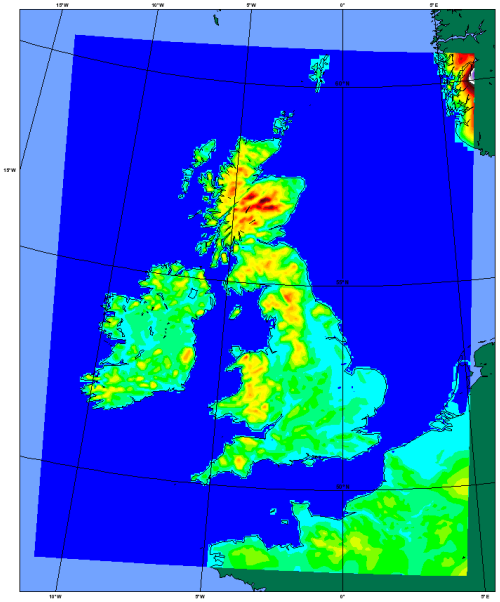
Day 2

UK 4km model

- **Impact of DA & forecast at 4km v**

  4km forecast from 12km NAE analysis

  - **Improved pmsl**
  - **Some times better spin-up of precipitation**

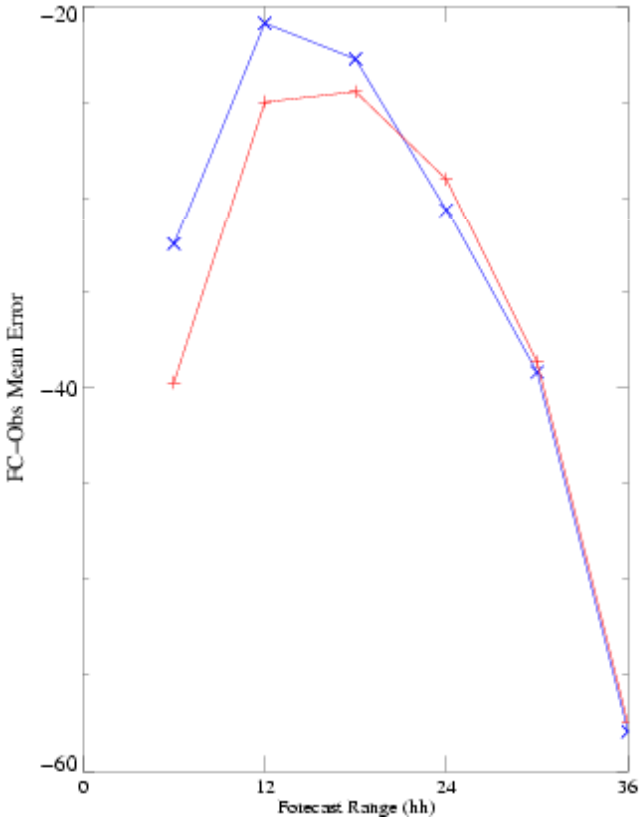


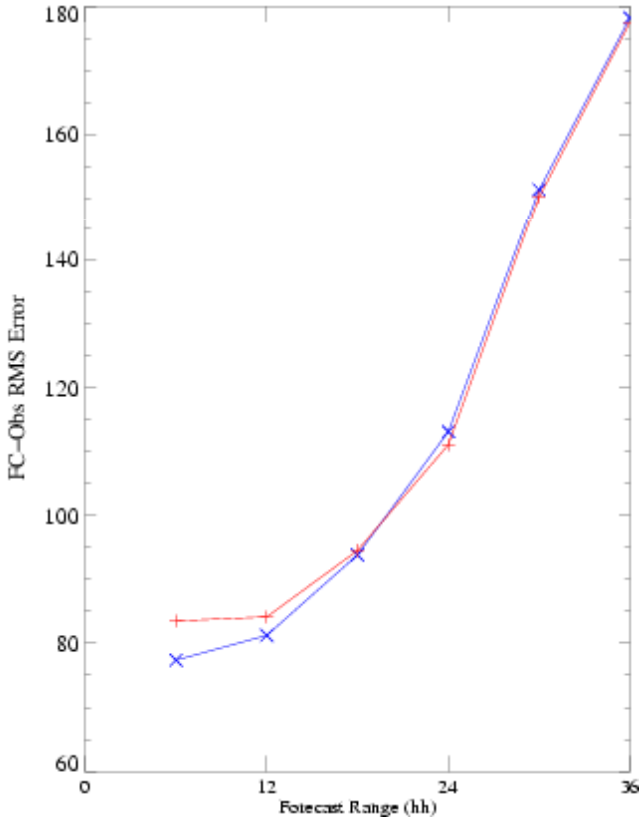
4km UK assimilation trial

4km forecast from 12km analysis

4km forecast from 4km analysis

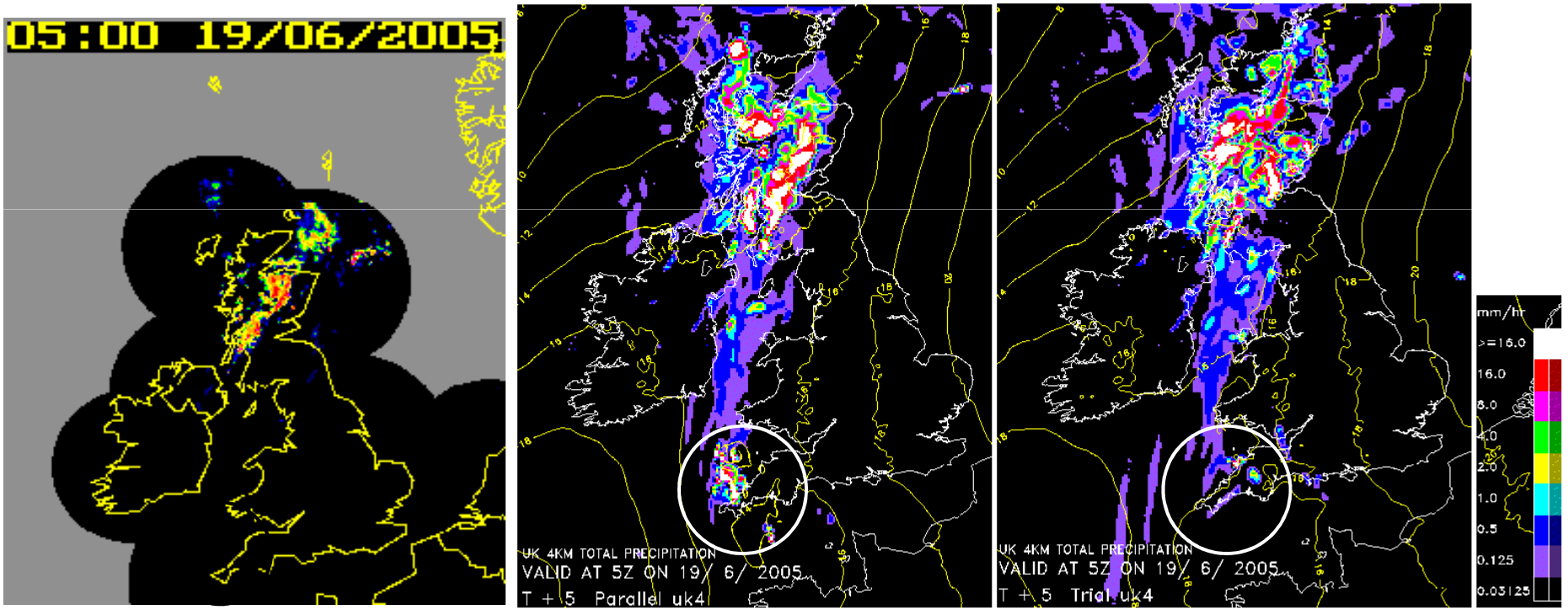
mean error PMSL rms error





Operational trial of 4km assimilation

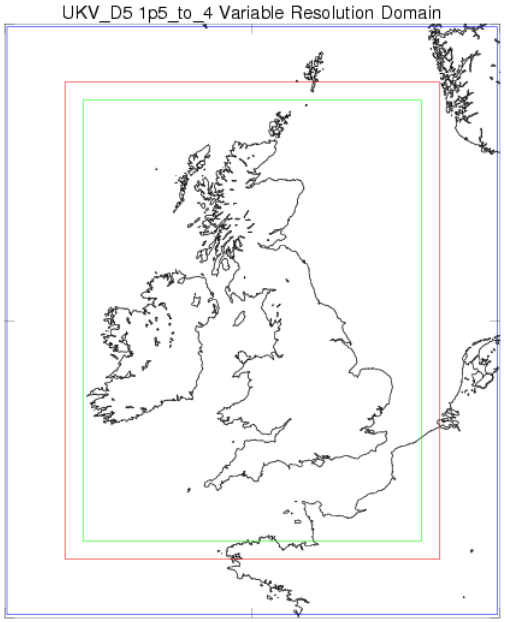
Spurious rain area due to spin up effects reduced.



4km t+5 forecast from 12km analysis

4km assimilation and t+5 forecast

UK 1.5km model

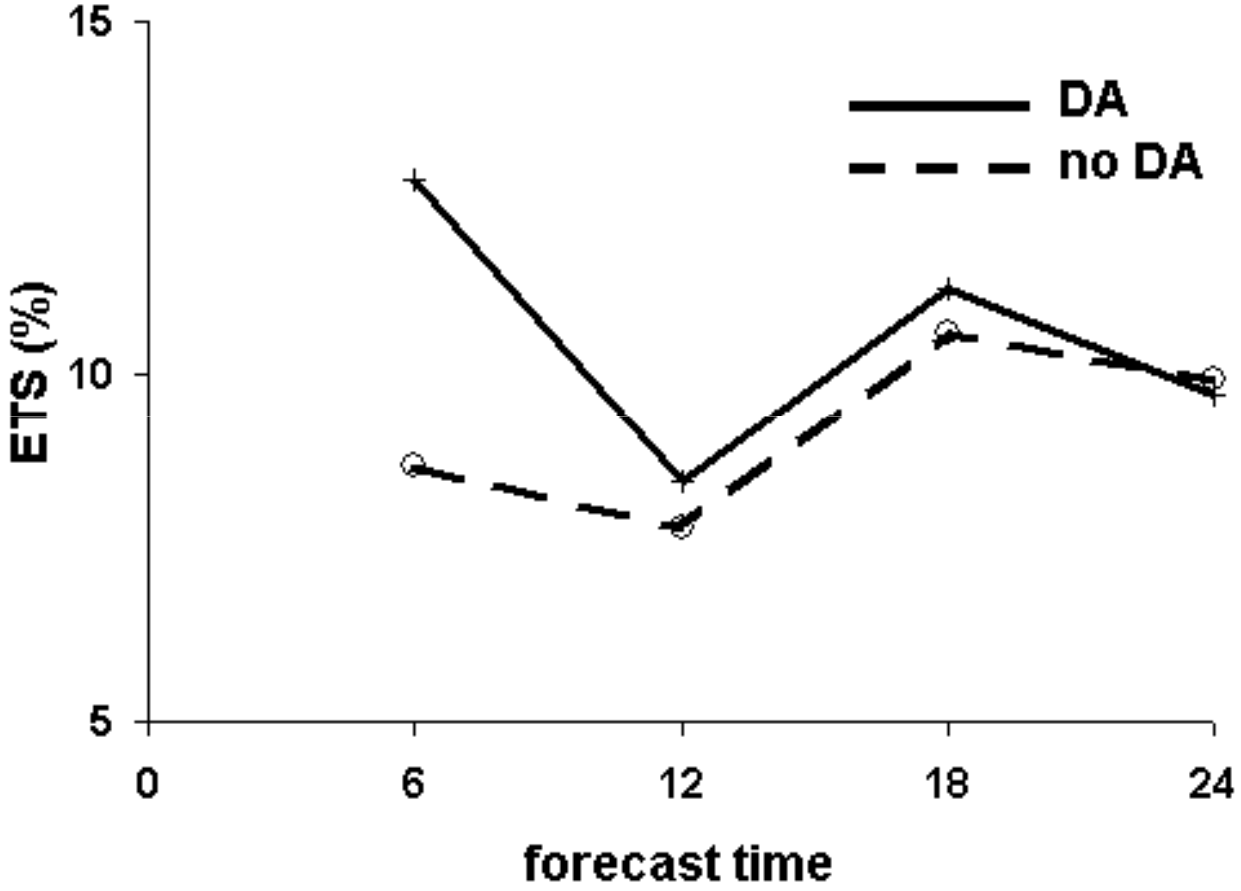


- **Impact of DA and forecast at 1.5km v**

1.5km forecast from interpolated 3-hr NAE forecast (12km)

- **UK1.5 DT's are 03, 09, 15, 21 UTC**
- **NAE DT's are 00, 06, 12, 18 UTC**
- **New 1.5km DA run uses later obs at t+2,3,4 relative to previous NAE data time**

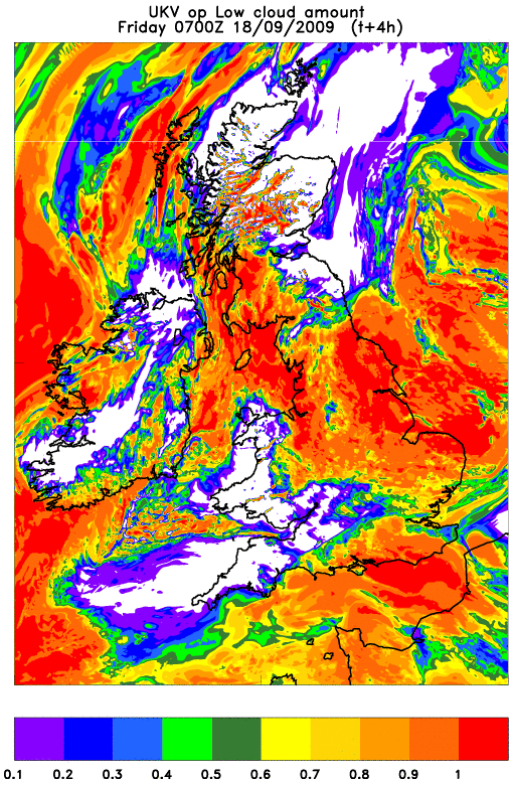
UK 1.5km model – impact of DA on visibility skill (ETS)

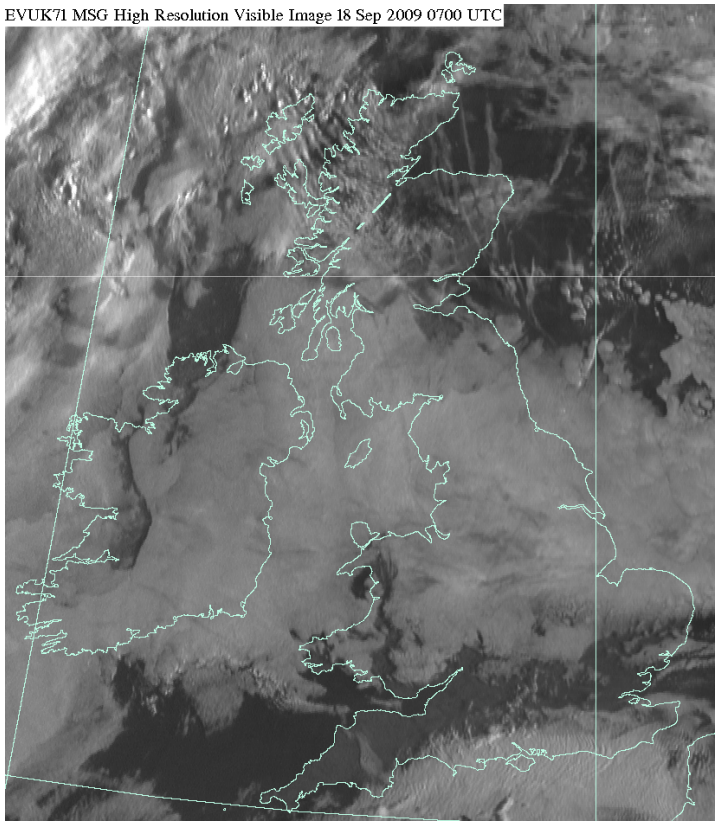


(Average over 200m, 1km, 4km thresholds
for 2 weeks with 4 forecasts per day)

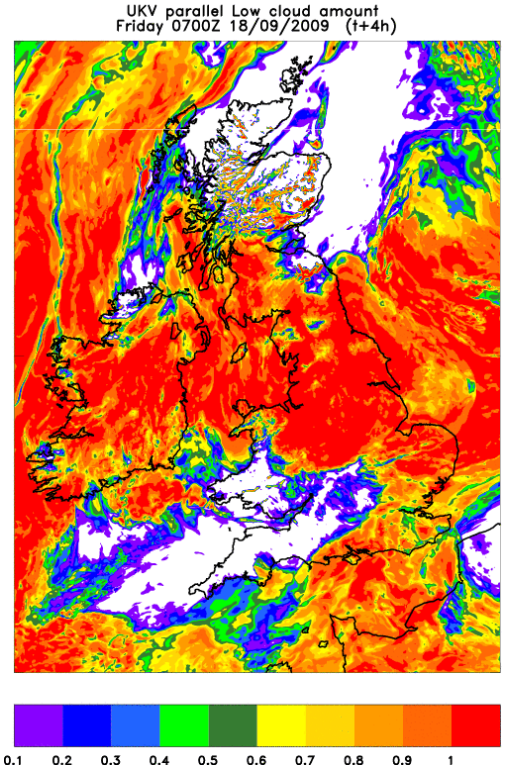
UK 1.5km model – impact of DA on low cloud

T+4 – no DA





T+4 – with DA



Part 2:
COSMO experience

Christoph Schraff

assess importance of km-scale details versus larger-scale conditions in the IC

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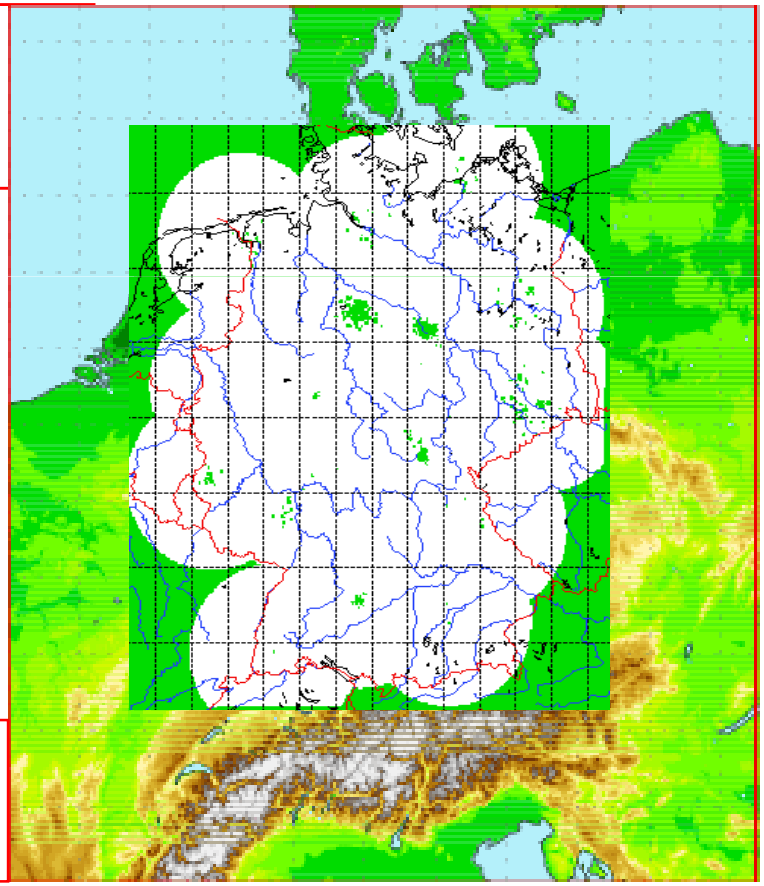
Plots by Klaus Stephan, DWD

COSMO-DE: $\Delta x = 2.8$ km
(deep convection explicit,
shallow convection param.)



16 German radars
2-d precip scan
1km ·1˚, 5 min

Comparison of COSMO-DE free forecasts:

'COARSE': IC from interpolated COSMO-EU analysis (Δx = 7km) of ass. cycle (no LHN)

'NO-LHN': IC from COSMO-DE analysis (Δx = 2.8 km) of ass. cycle (no LHN)

'LHN': IC from COSMO-DE analysis of ass. cycle (IDE + LHN for use of radar-derived precipitation)

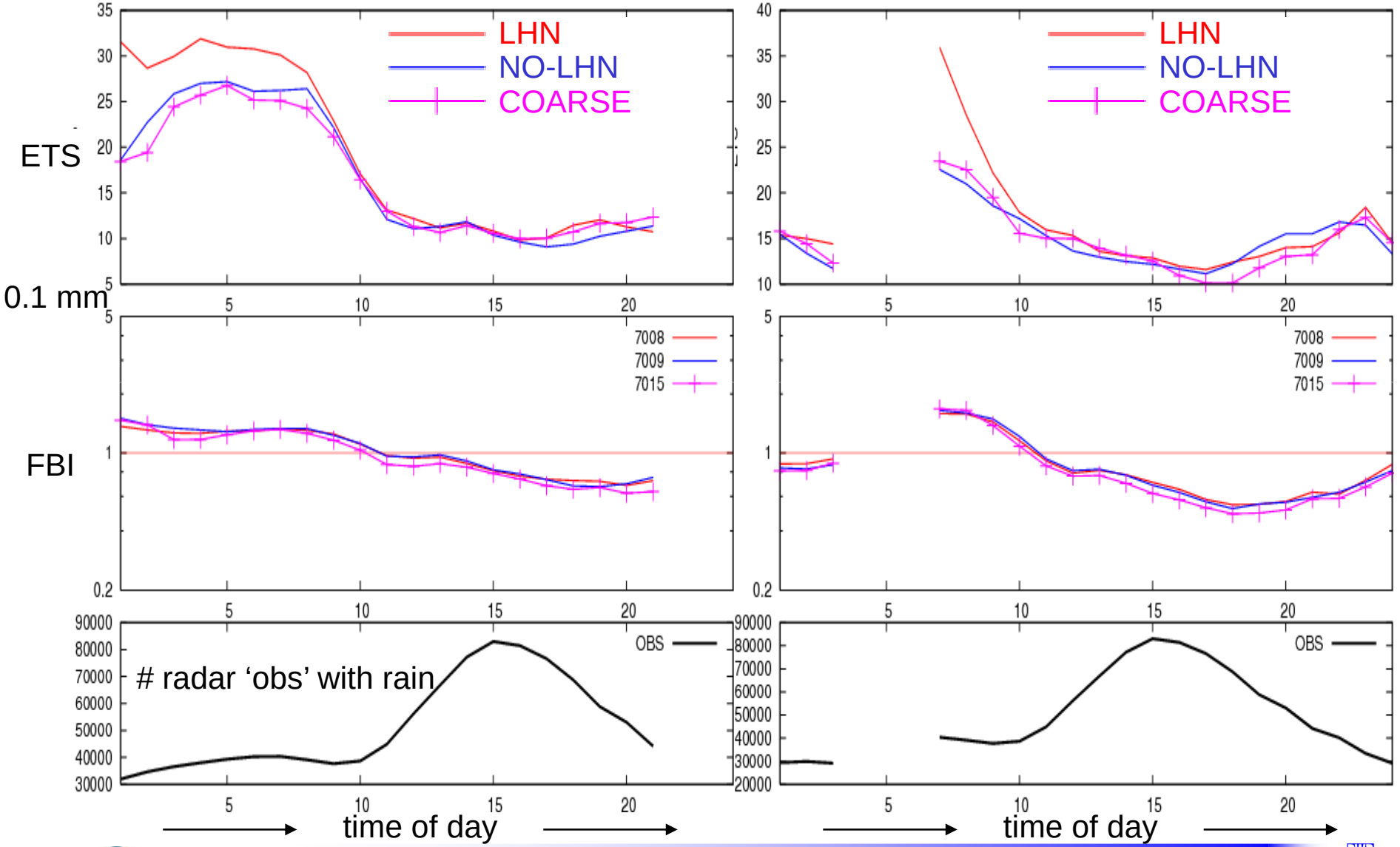
Note:
- IC from assimilation cycle $\rightarrow$ late cut-off, very similar set of observations
- **identical correlation functions** (scales) used in nudging for COARSE and (NO-)LHN
- **identical soil moisture**, taken from COARSE (with variational soil moisture initialisat.)
- model version as operational in summer 2009, Δx = 2.8 km

Period: 31 May – 13 June 2007: air mass convection

31.05. – 13.06.07:
air-mass convection

00 UTC runs

06 UTC runs



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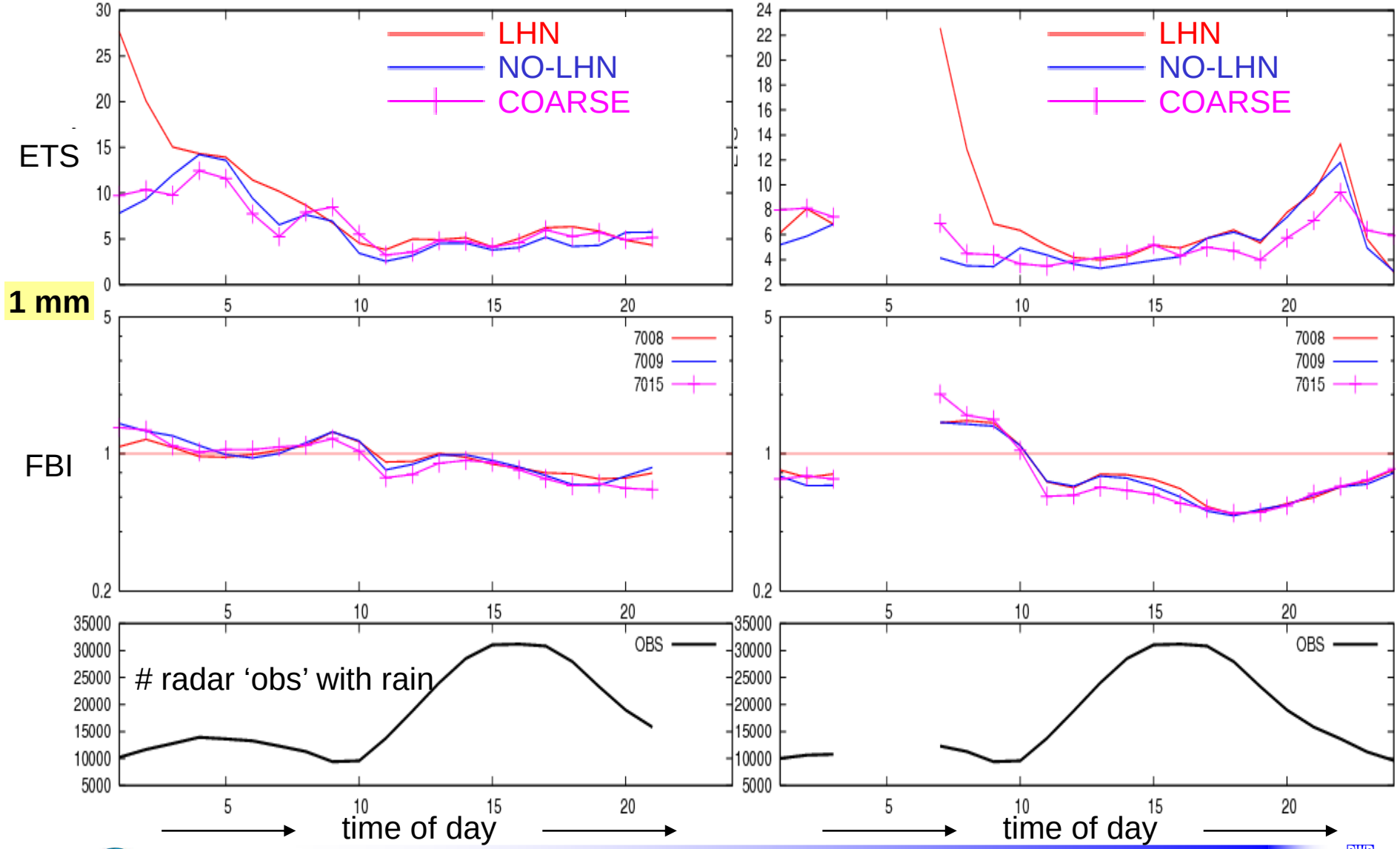
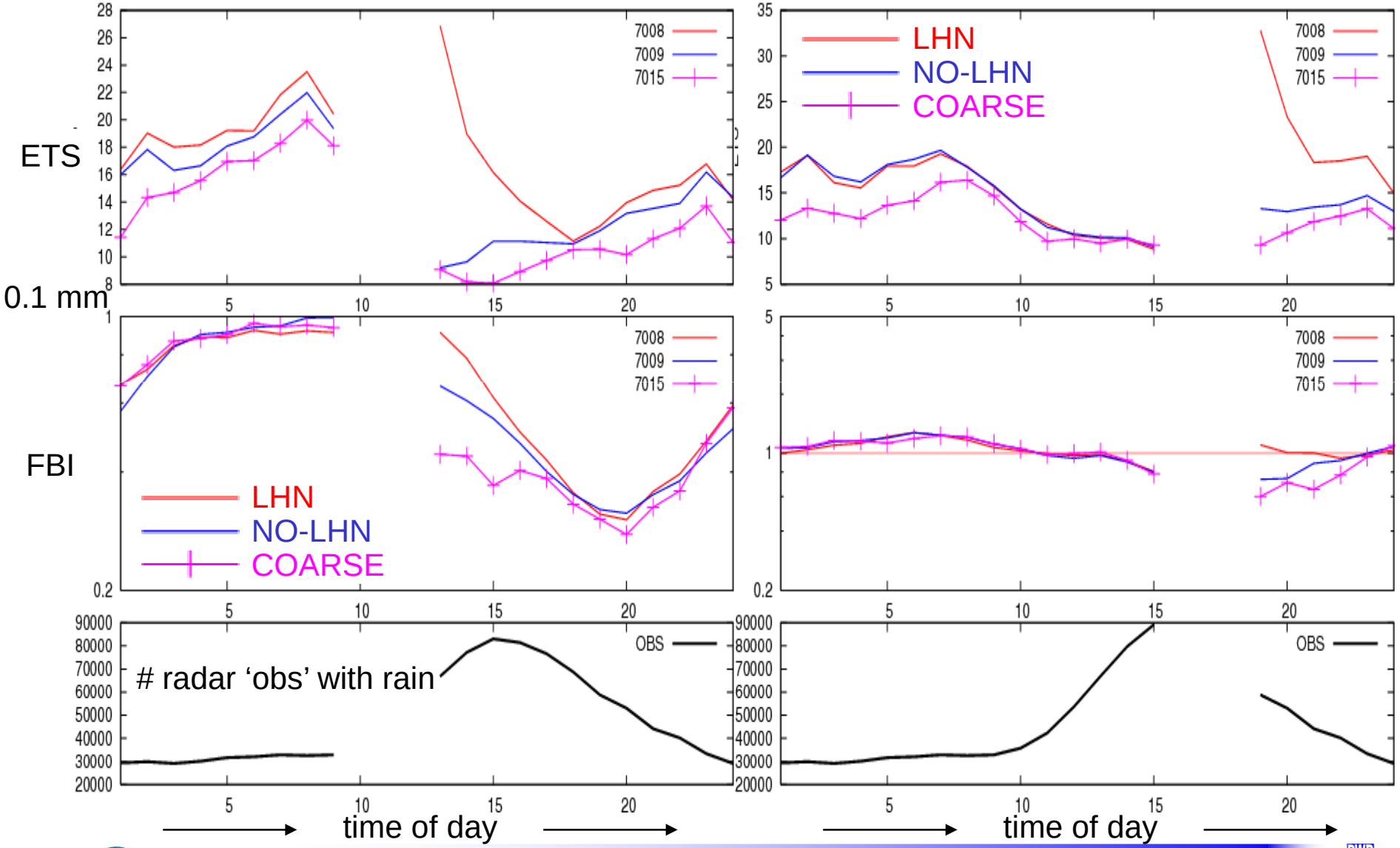


12 UTC runs

31.05. – 13.06.07:
air-mass convection

18 UTC runs



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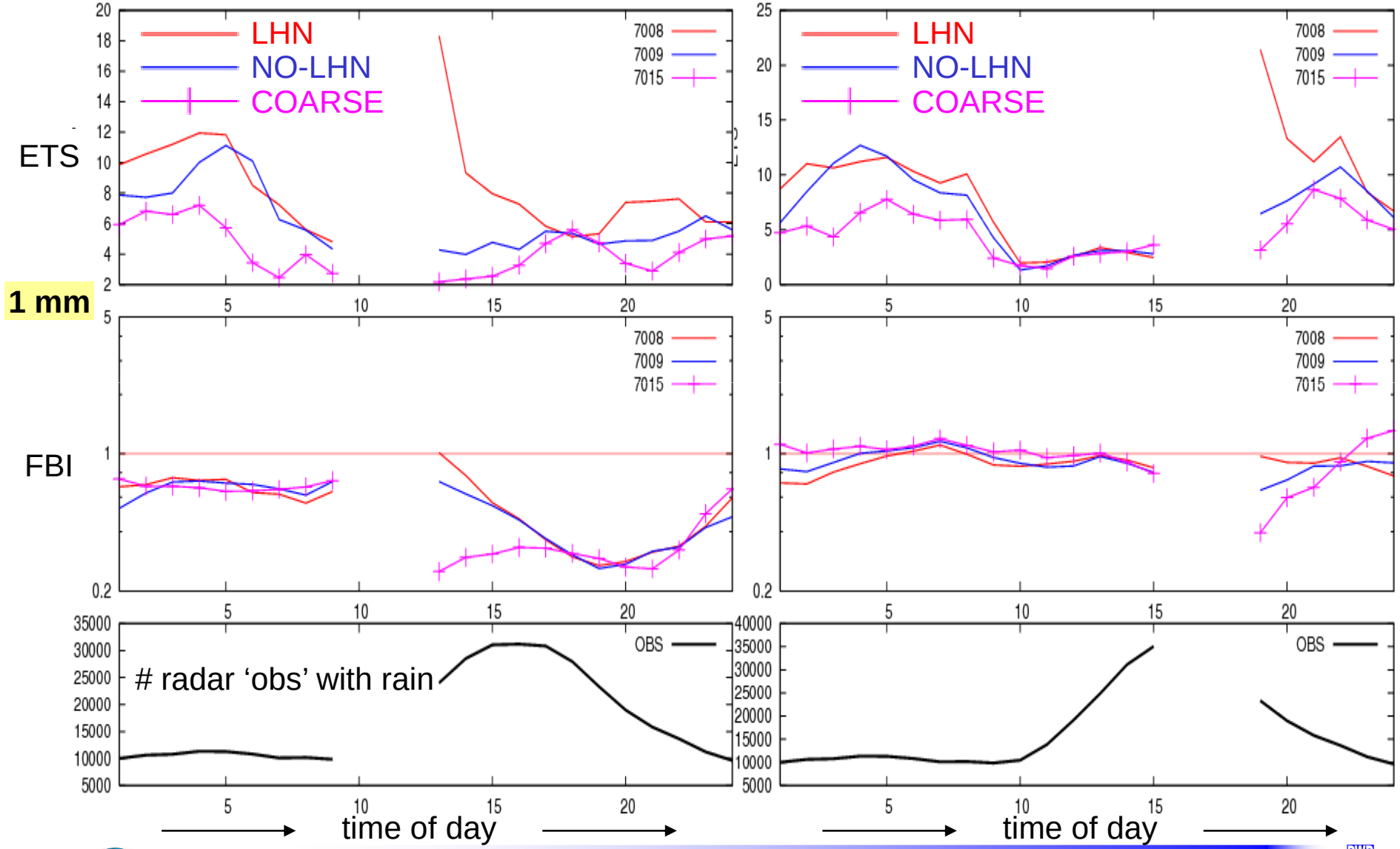


impact of fine-scale analysis in COSMO

Examples

12-UTC runs, 6 – 18 h fcsts.

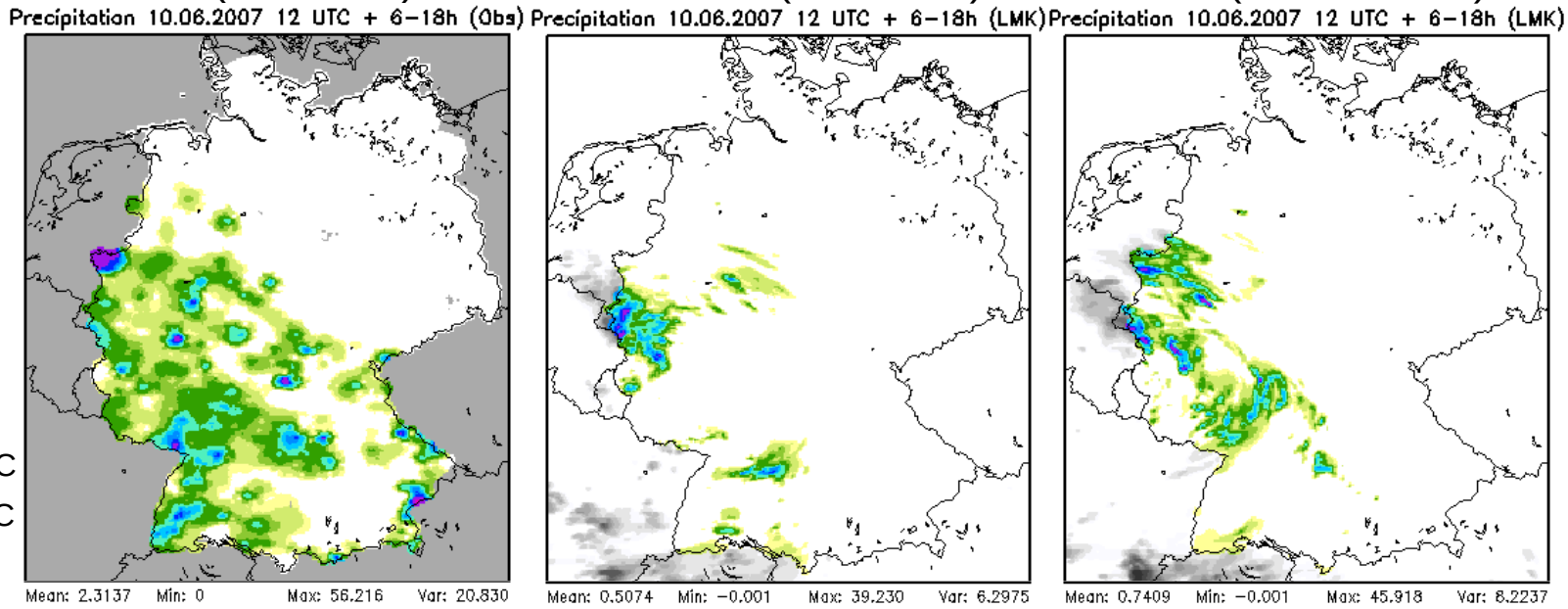
(nighttime precipitation)

radar (12-h sum)

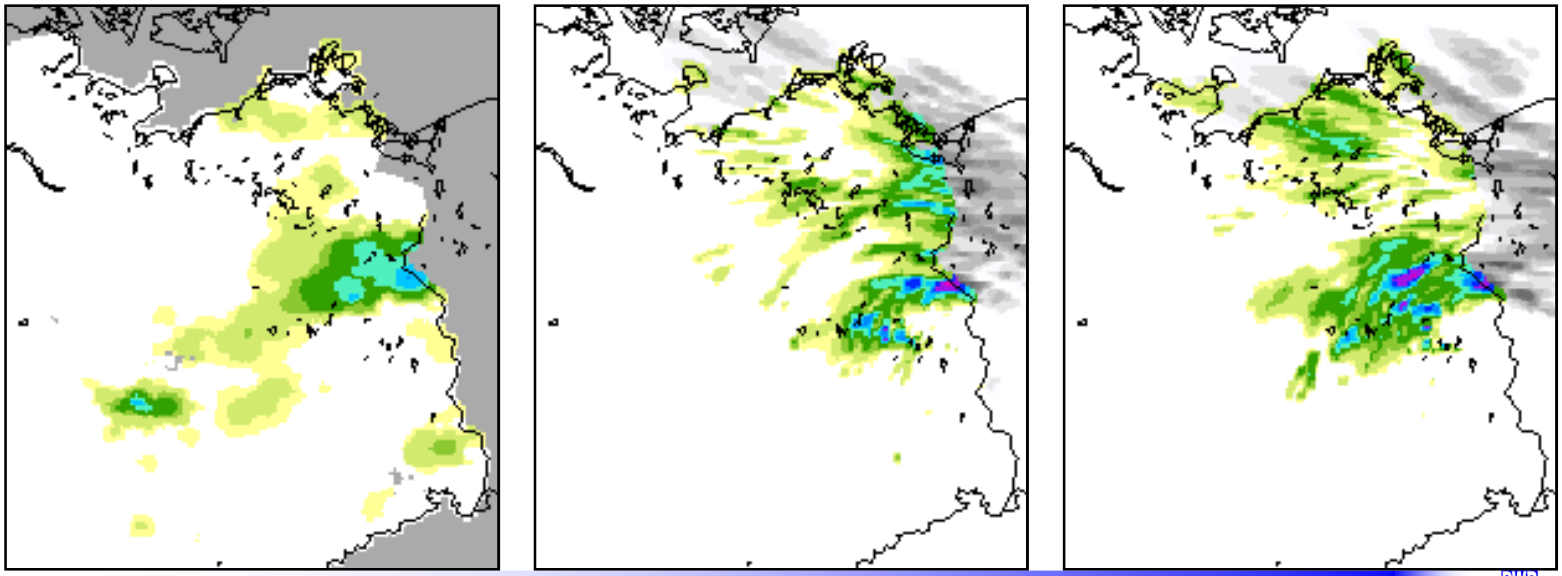
COARSE (coarse IC)

LHN (fine-scale IC)

10 June 18 UTC – 11 June 06 UTC 2007



4 June 18 UTC – 5 June 06 UTC 2007



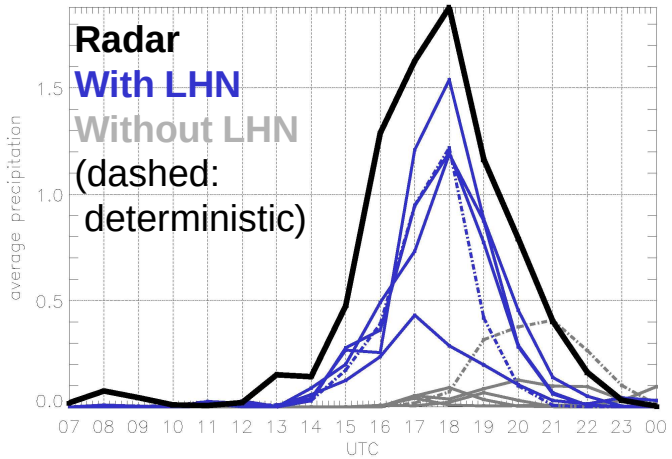
Results of comparison fine-scale versus coarse-scale initial conditions :

– ‘NO-LHN’ better than ‘COARSE’ for 12- and 18-UTC runs up to +15h
(similar FBI, higher ETS)
similar for 0- and 6-UTC runs

– improvement by LHN during first 3 – 8 hours

– ‘LHN’ has better precipitation patterns (6 – 18 h forecasts) than ‘COARSE’ in some cases

Past experiments (Leuenberger):
environment affects impact (first 6 hrs)
of fine-scale details in analysis from LHN



Part 3:
ALADIN experience

Claude Fischer

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Questions?