Storm-permitting ensembles

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Met Office @ Reading

Getting the forecast right

Bournemouth angry after Met Office predicted ... http://www.dailymail.co.uk/travel/article-1189...

Mail Online

Bournemouth angry over wrong Bank Holiday weather forecast

Last updated at 10:04 AM on 29th May 2009

A seaside resort accused the Met Office of losing it £1 million because it got the weather forecast wrong on Bank Holiday Monday.

Bournemouth in Dorset was supposed to suffer thundery showers, according to the Met Office, but instead it had sunshine and was the hottest day of the year so far, with temperatures hitting 22 degrees.

However, because of the 'negative' prediction for rain, tourism bosses said around 25,000 visitors stayed away from the town.

Feeling the heat: The Met Office is being criticised for wrongly predicting thunderstorms in Bournemouth on Bank Holiday Monday

Mark Smith, head of Bournemouth Council's tourism department, said: "We do suffer badly from inaccurate weather reports.

"The forecast was for thundery showers throughout the day but after 9am it remained bright and sunny and was the hottest day of the year so far.

"The average amount spent by visitors per head is £41, so even for one day that cost us over a million pounds."

Met Office spokeswoman Helen Chivers said it did get the forecast for Bournemouth wrong.

"The forecast was for a bright start, clouding over with showers, heavy and thundery in places, during the morning and continuing throughout the afternoon," she explained.

1 of 3

02/01/11 14:17

Questions being asked

What is the nature of predictability and realism of convection in ‘storm-permitting’ models?

More resolution or a bigger ensemble?

How small an ensemble is sufficient?

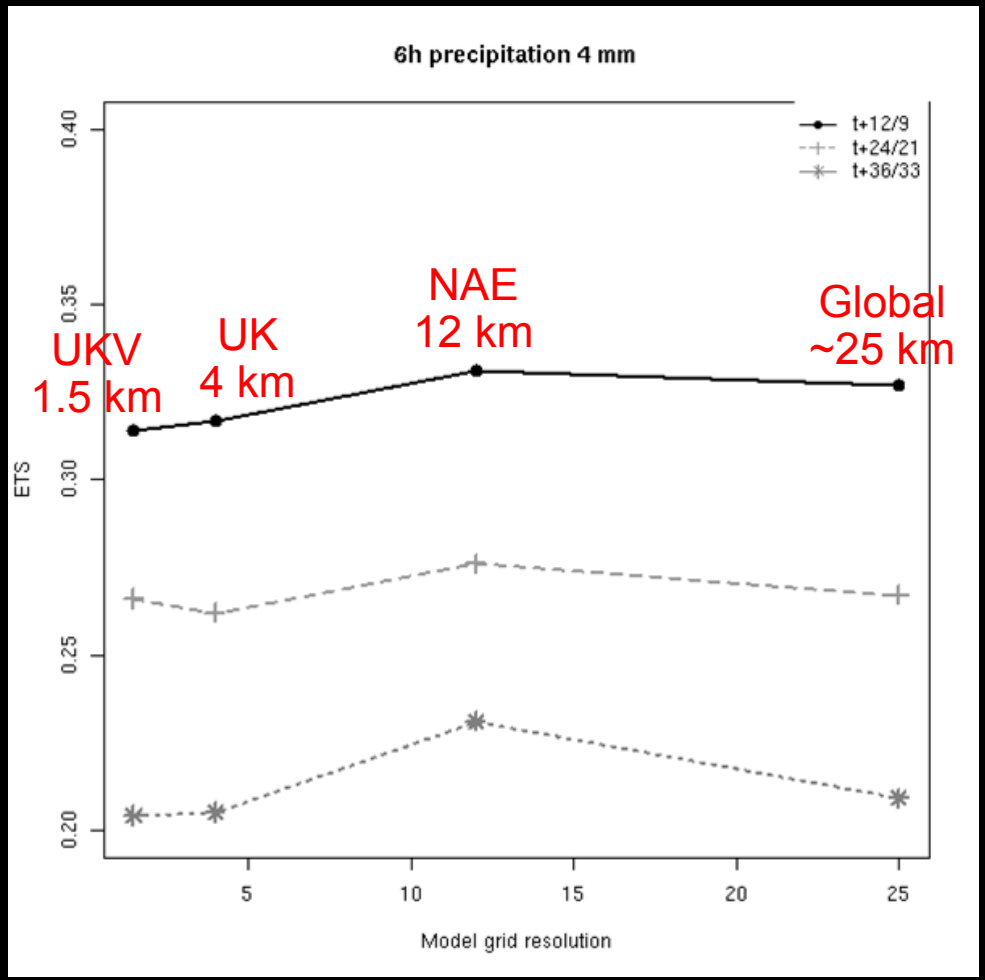
Does higher resolution give more skilful forecasts?

Apparently not! Has it all been a waste of time?

April to Oct 2010

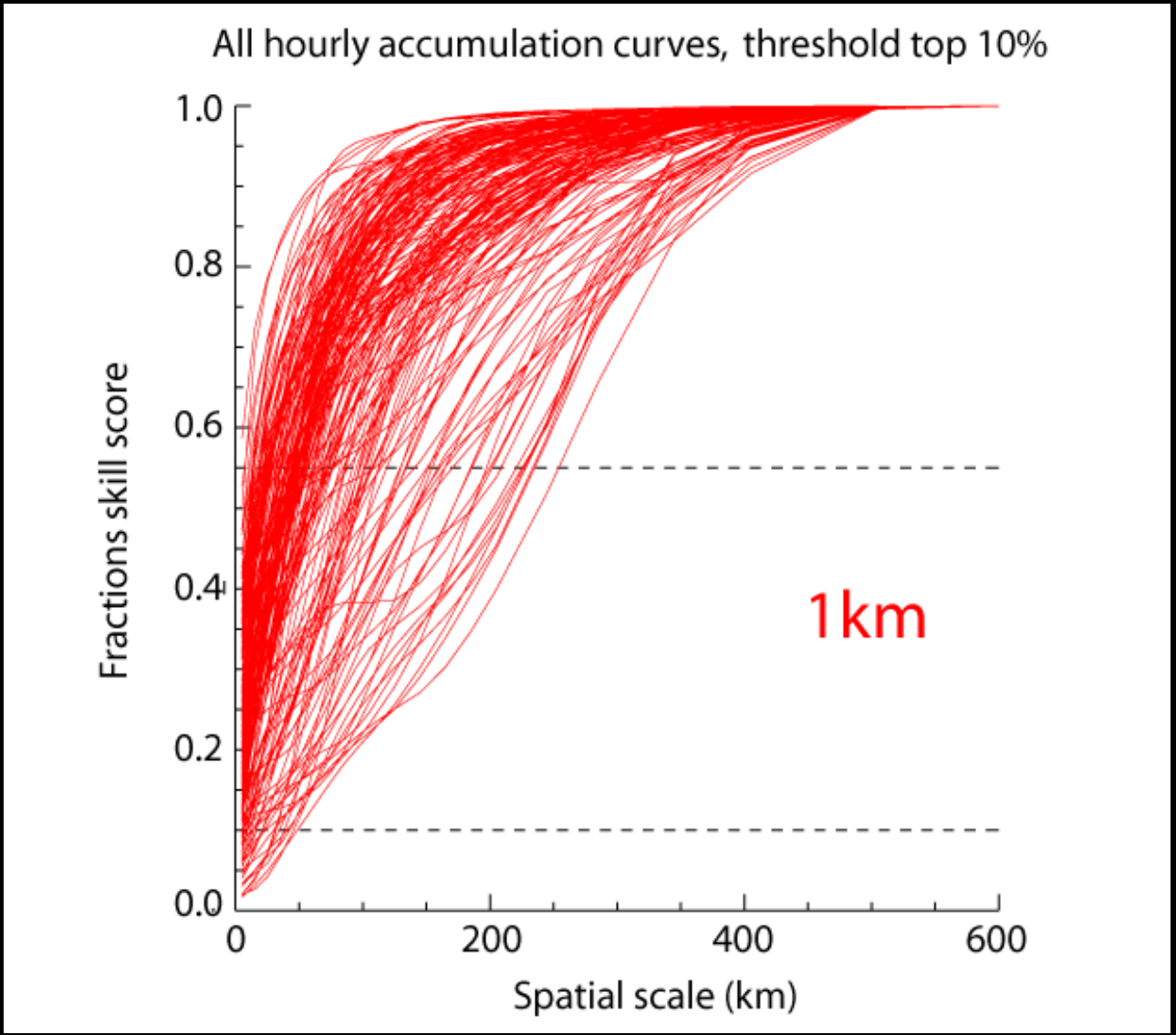
Equitable Threat Score (ETS)

Using gauges



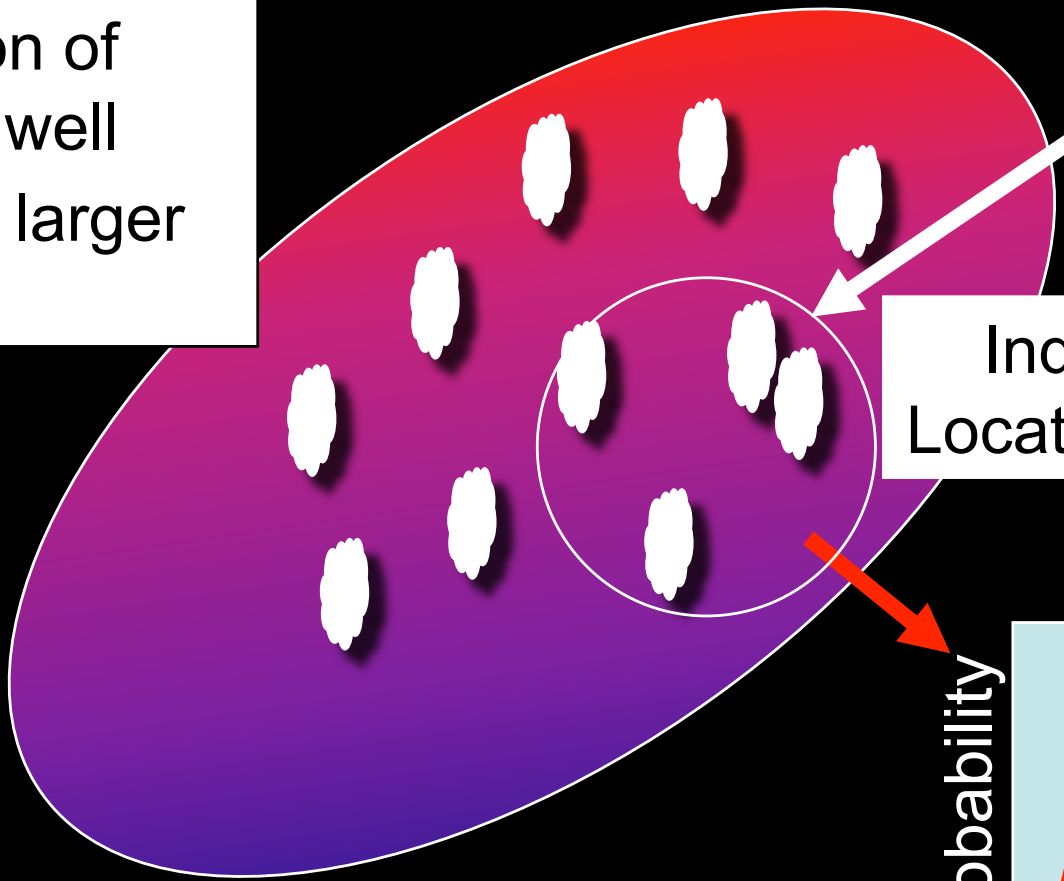
M Mittermaier, N Roberts & S Thompson submitted to Met Apps

Skill depends on the scale you look at



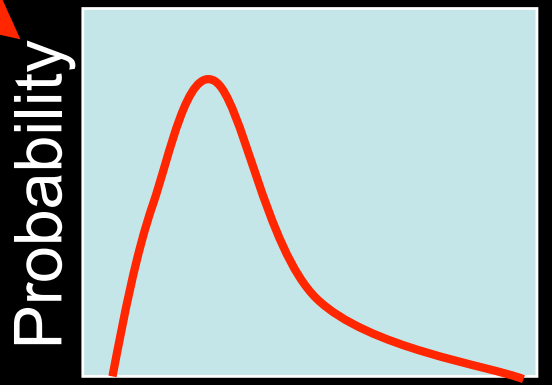
We shouldn't believe high-resolution at face value (at or near the grid scale)

Distribution of instability well predicted at larger scale



'Unreliable' Scale

Individual cell Locations 'random'



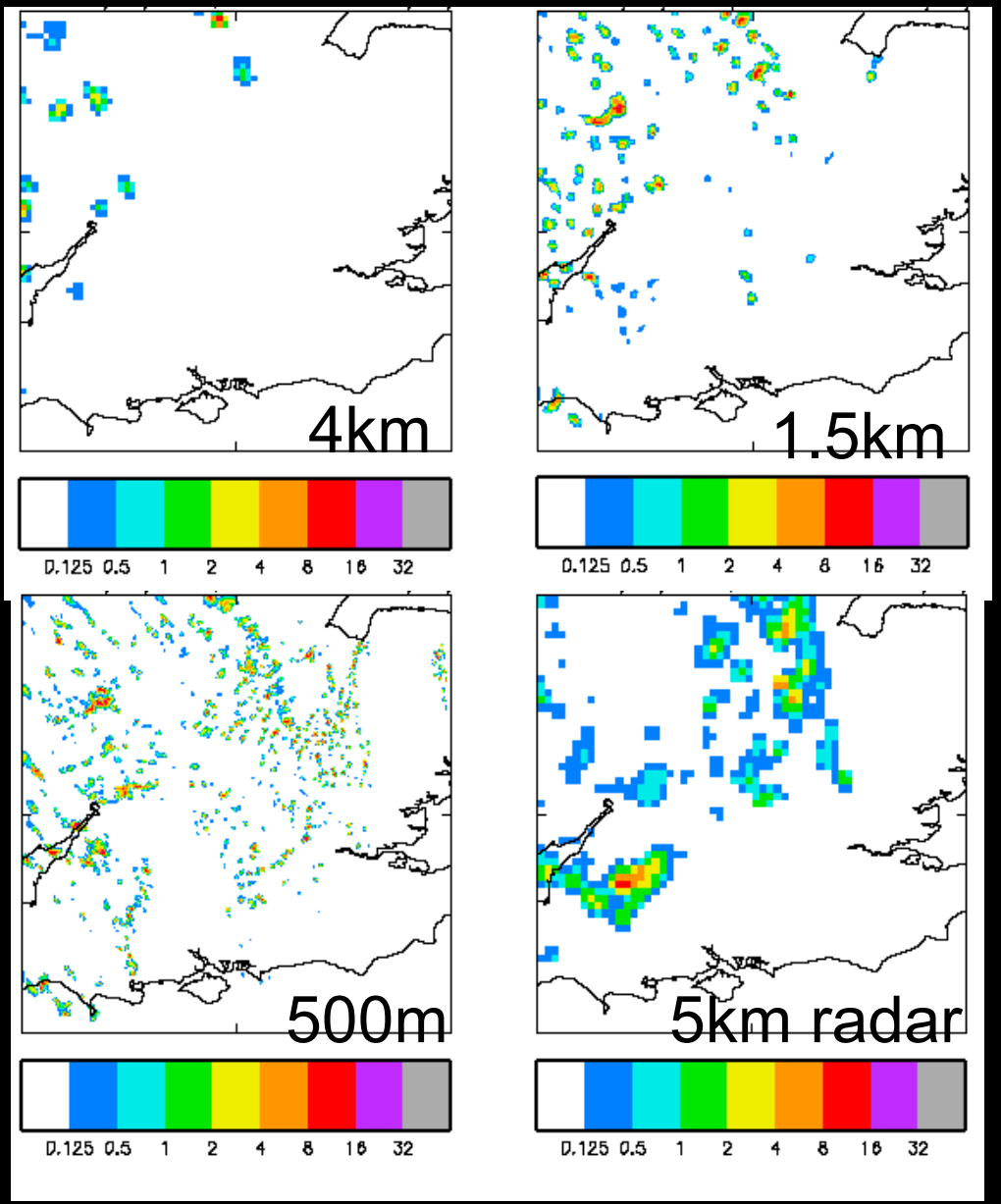
Courtesy of Peter Clark

Multi-resolution storm-permitting simulations

Emilie Carter

and

Humphrey Lean



Improvements and difficulties with increased resolution

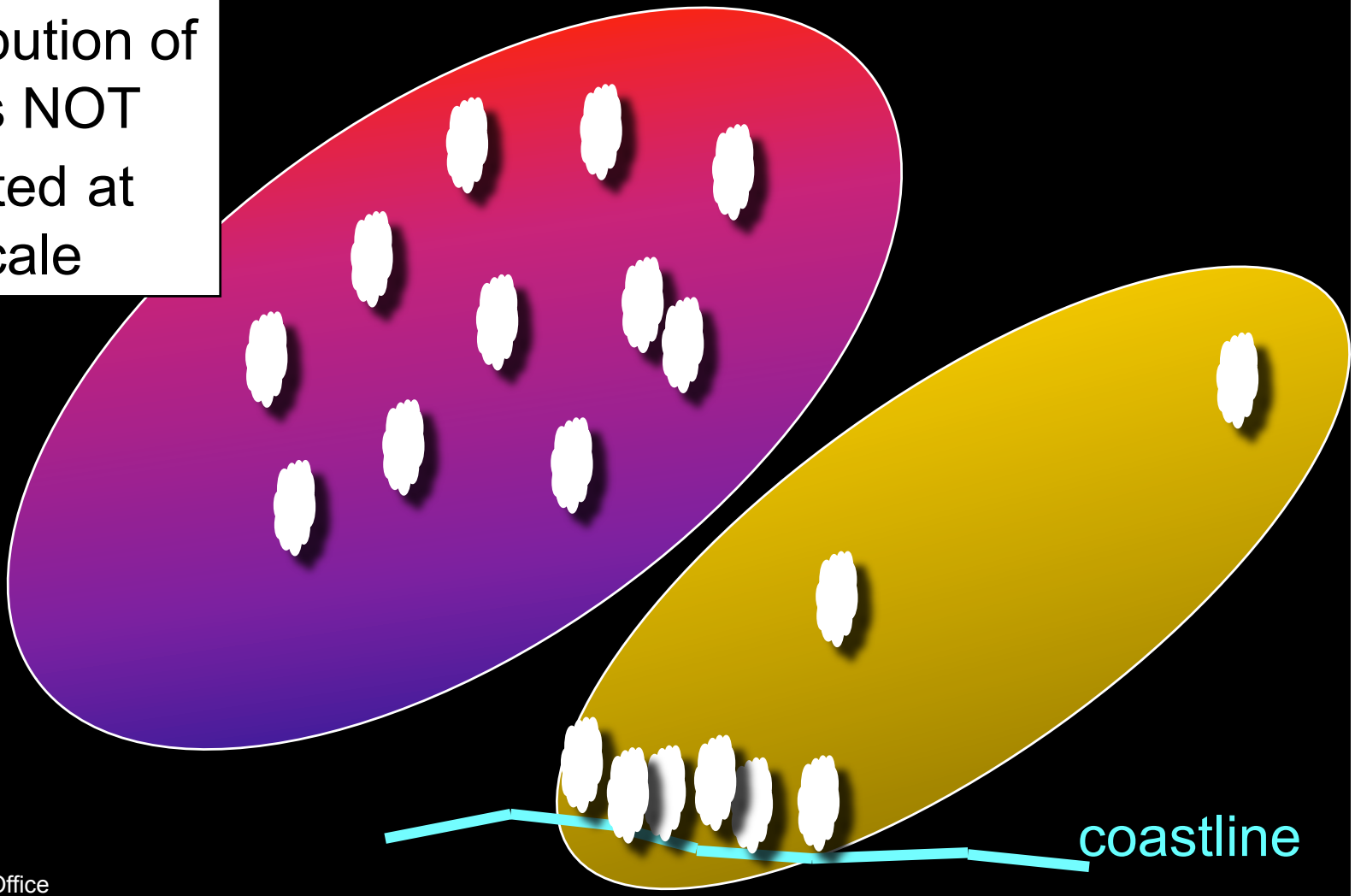
500m at least 45 times more expensive than 1.5km. (200 times 2.2km)

100m ~25,000 times 2.2km

… very high-resolution model research still essential

We shouldn't believe high-resolution at face value

What if distribution of instability is NOT well predicted at larger scale



MOGREPS-UK

2.2 km ensemble from summer 2012 (MOGREPS-UK)

embedded within either MOGREPS-R (EU) (12 km) or MOGREPS-G (~30 km) ensemble.

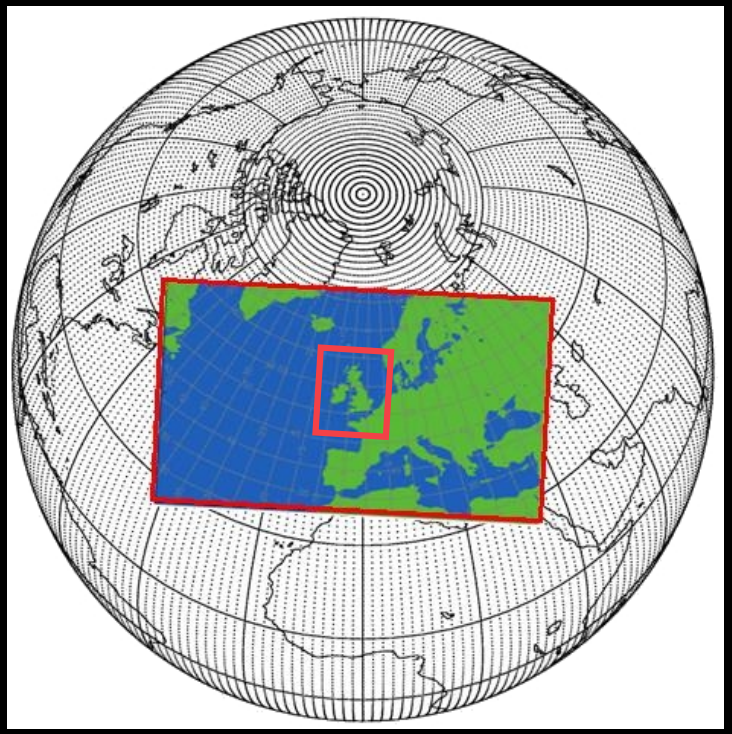
36-hour forecasts

~12 members

New ensemble every 6 hours

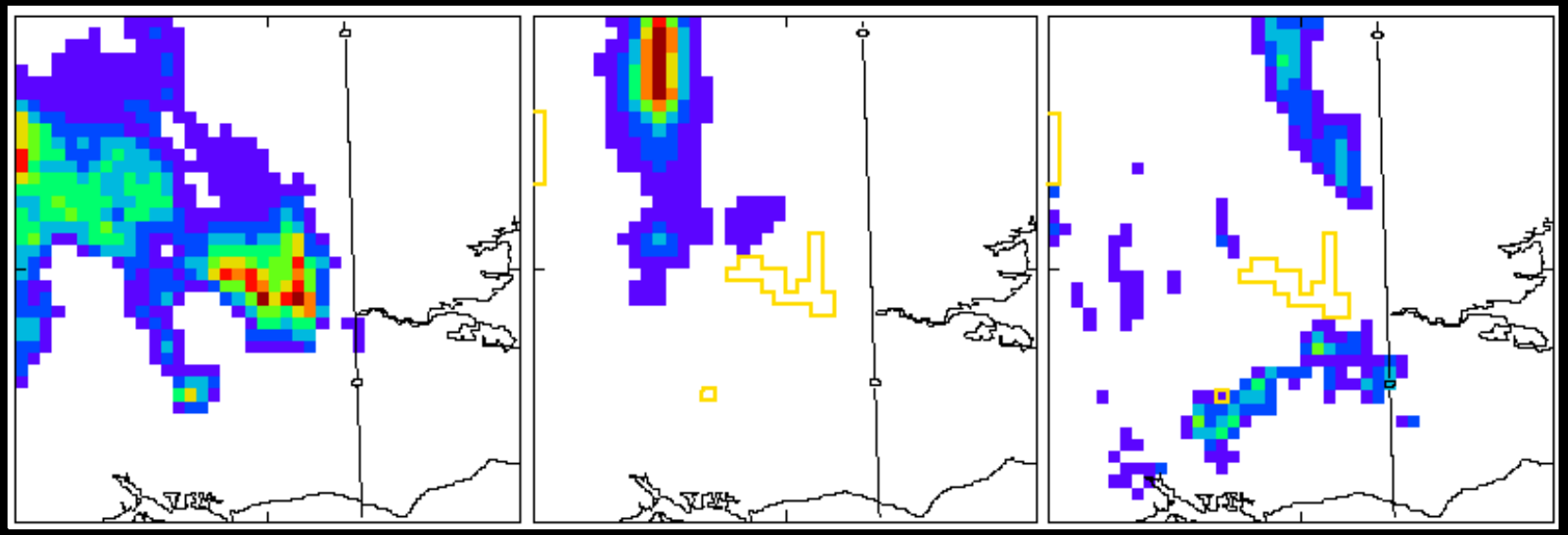
Downscaling – starts from coarser-resolution fields

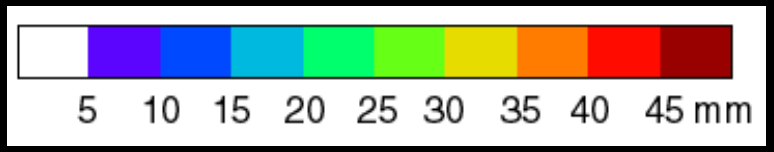
Neighbourhood products



Forecast variability
3rd August 2004

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



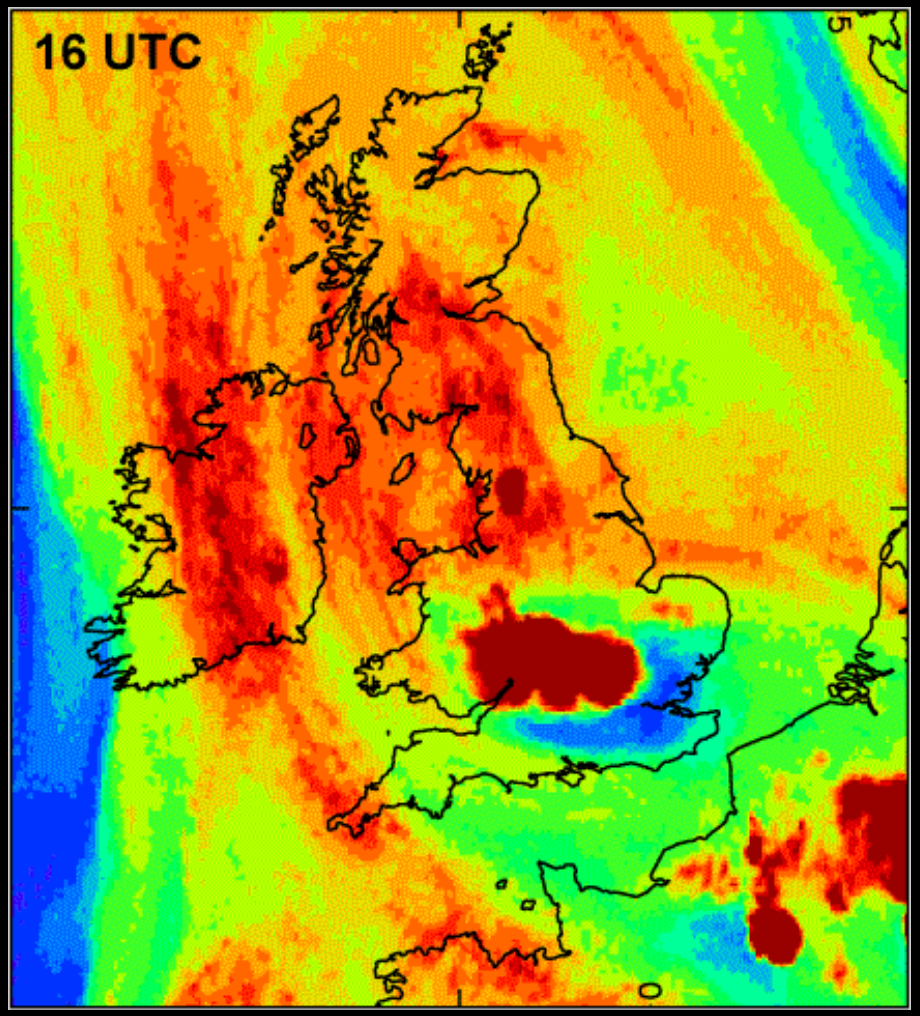


T+ 19 to 24

Nigel Roberts

3rd August 2004
Importance of mesoscale dynamics

Water vapour imagery



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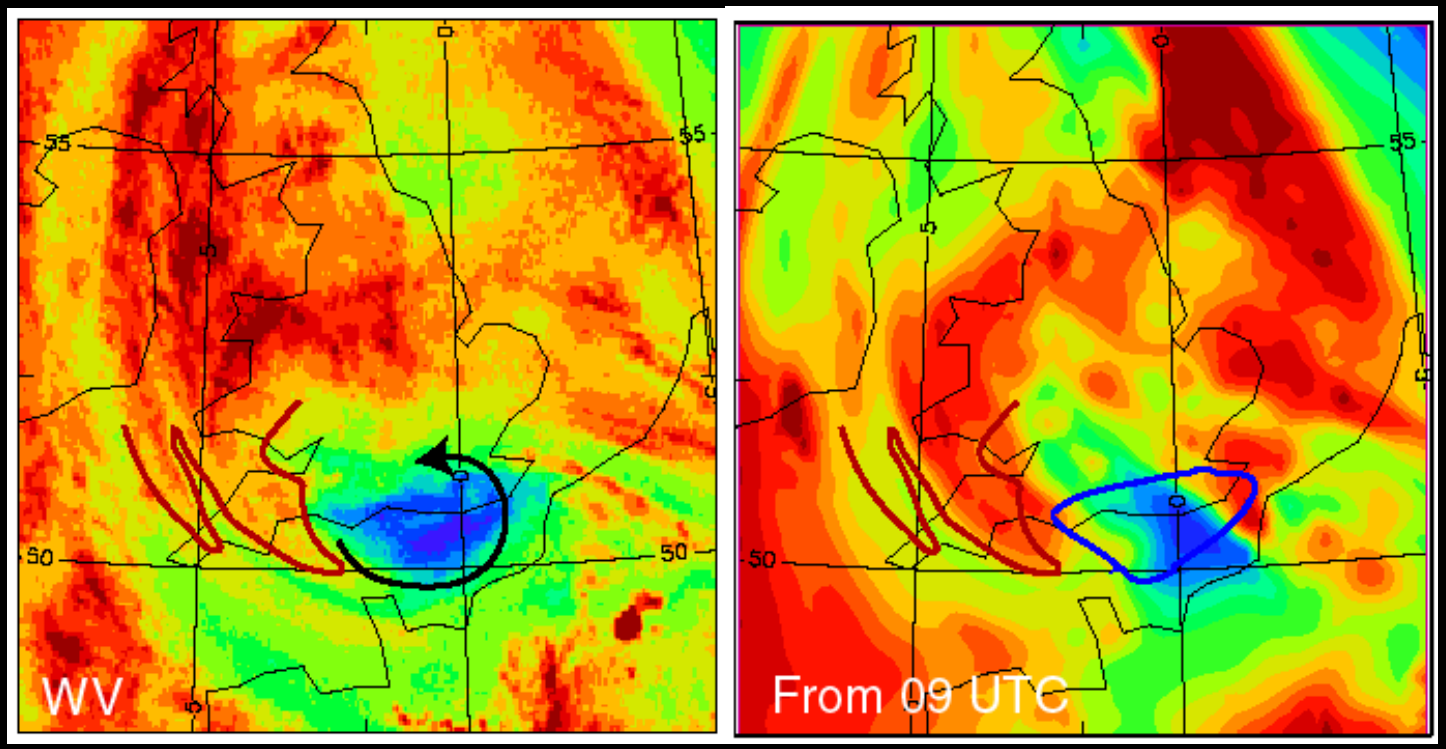
3rd August 2004
Comparison of mesoscale dynamics

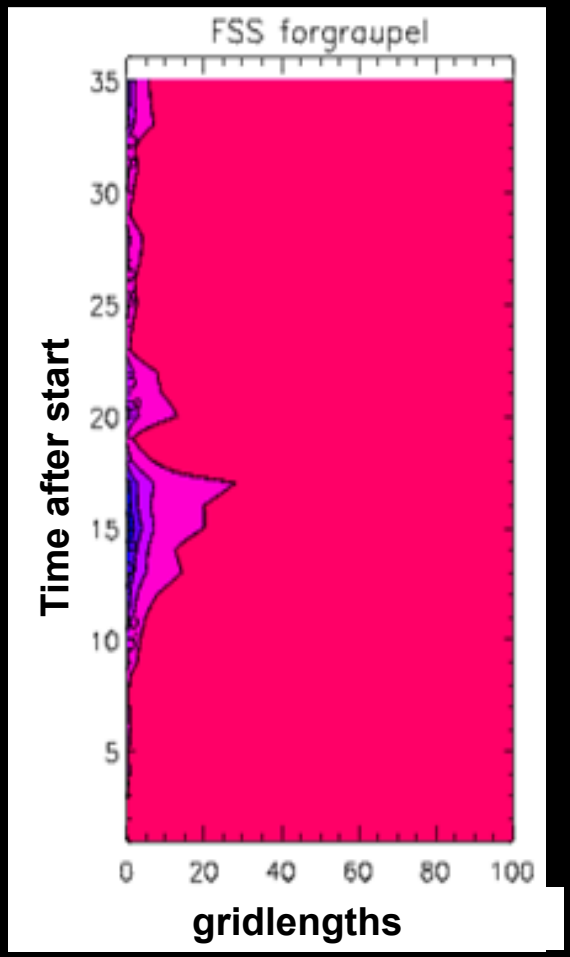


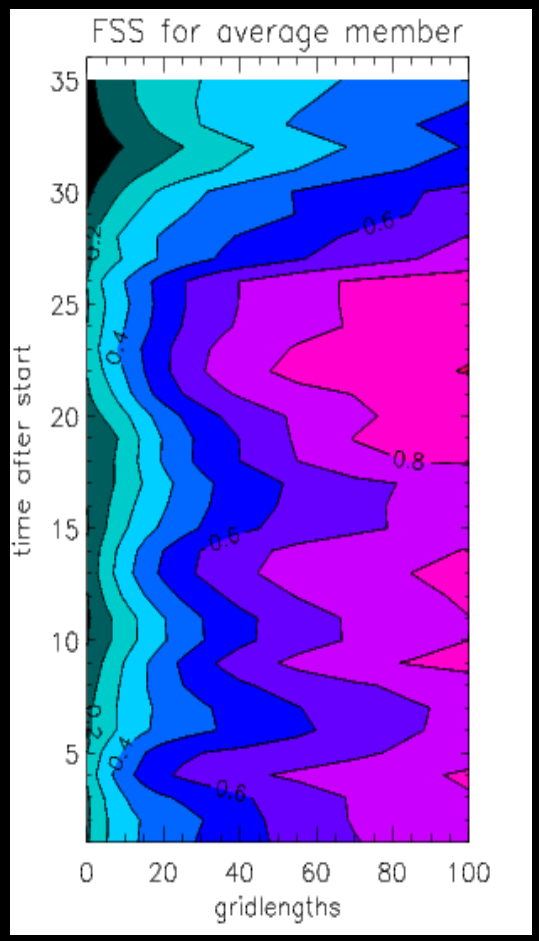
Upper-level vortex

Results: Different physics

Seonaid Dey and Giovanni Leoncini

FSS for precipitation hourly accumulations



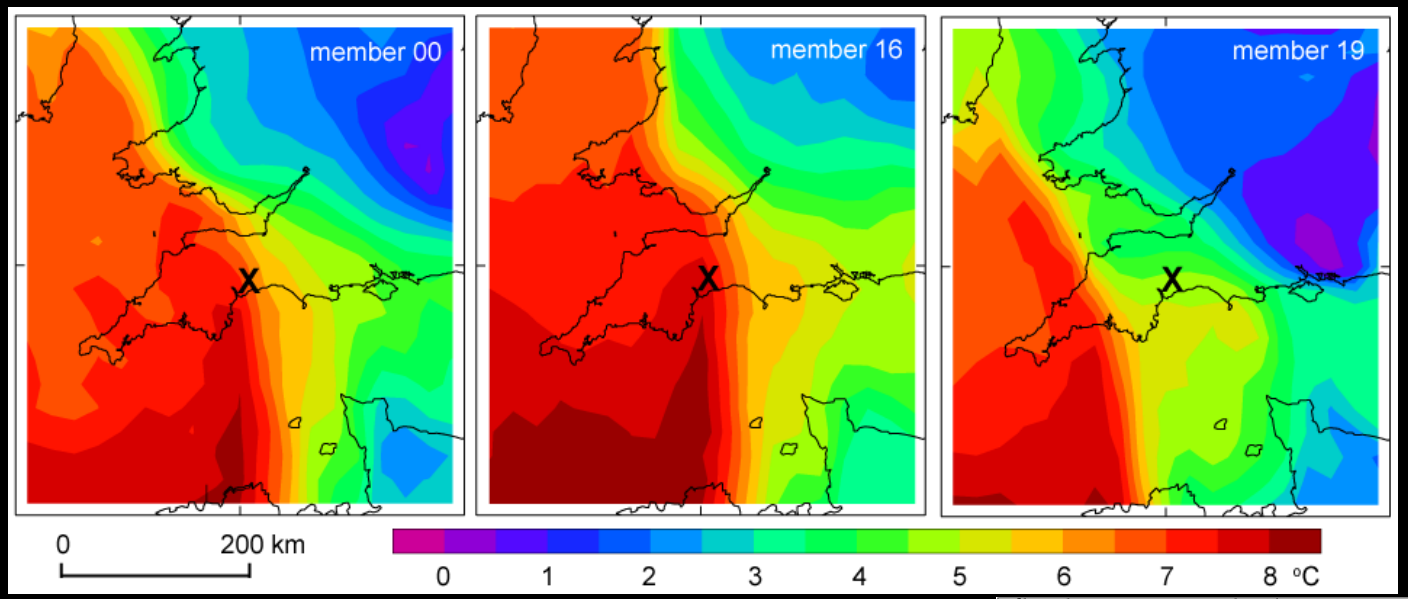


FSS

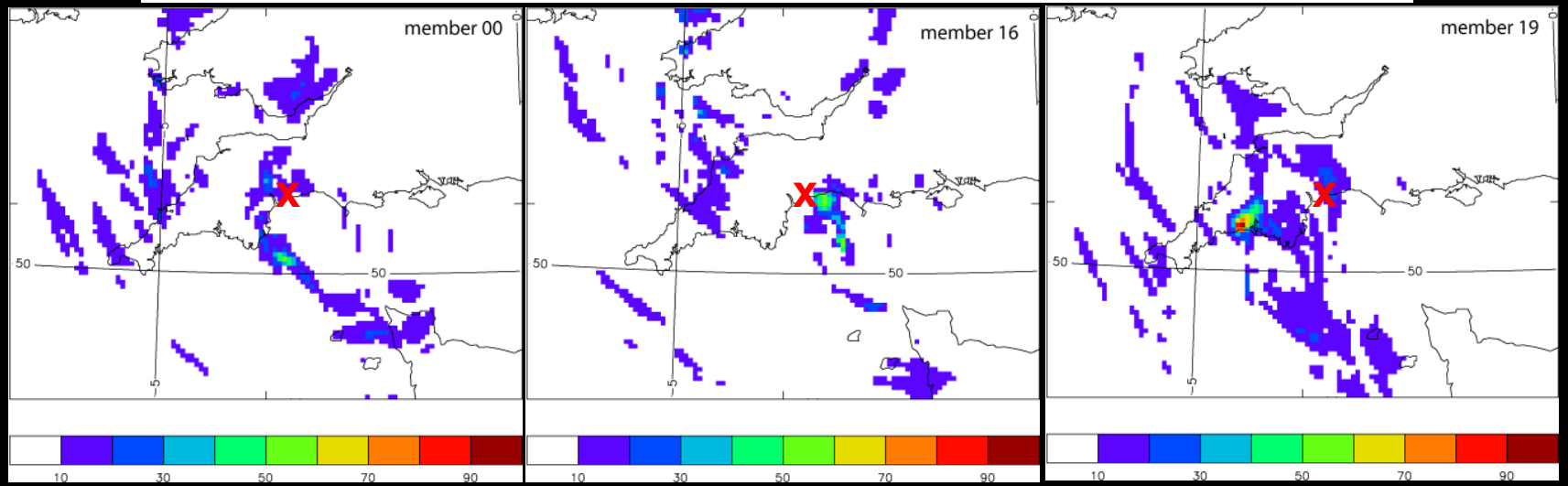
- Values 0-1
- 1 = ‘perfect match’

  0 = ‘totally different’
- Contours every 0.1, colours **black at 0.0** to **red at 1.0**
- Graupel / convection scheme / timestep had little effect at reliable scales

MOGREPS output 00 UTC 30/10/08 (top)
UKV 6-hour accumulations (bottom)



Highest
6-hour totals



55 mm 55 mm 96 mm

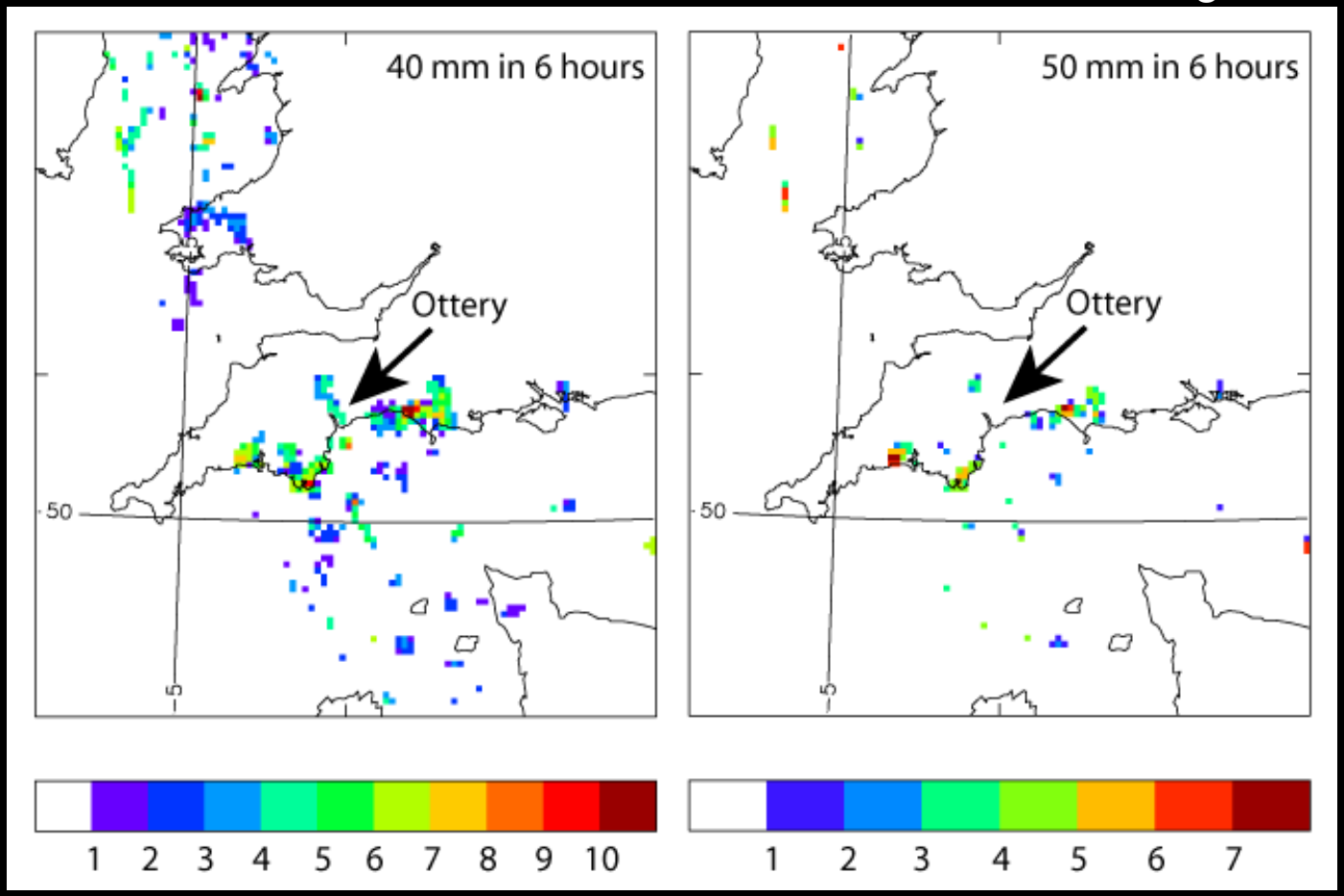
Computed on 4.5km grid – Changgui Wang

Nigel Roberts

All pixels exceeding critical thresholds

‘Extreme’ threshold for surface water flooding

1 in 10 years



1 in 30 years

Computed on 4.5km grid – Changgui Wang

Nigel Roberts

Consequence of uncertainty in forecasting local weather (e.g. pdf for showers)

If a 5km storm can occur anywhere within 50km radius. Assuming discrete non-overlapping positions and only considering positional uncertainty:

Require at least 300 members. In reality 1000s for postcode probabilities.

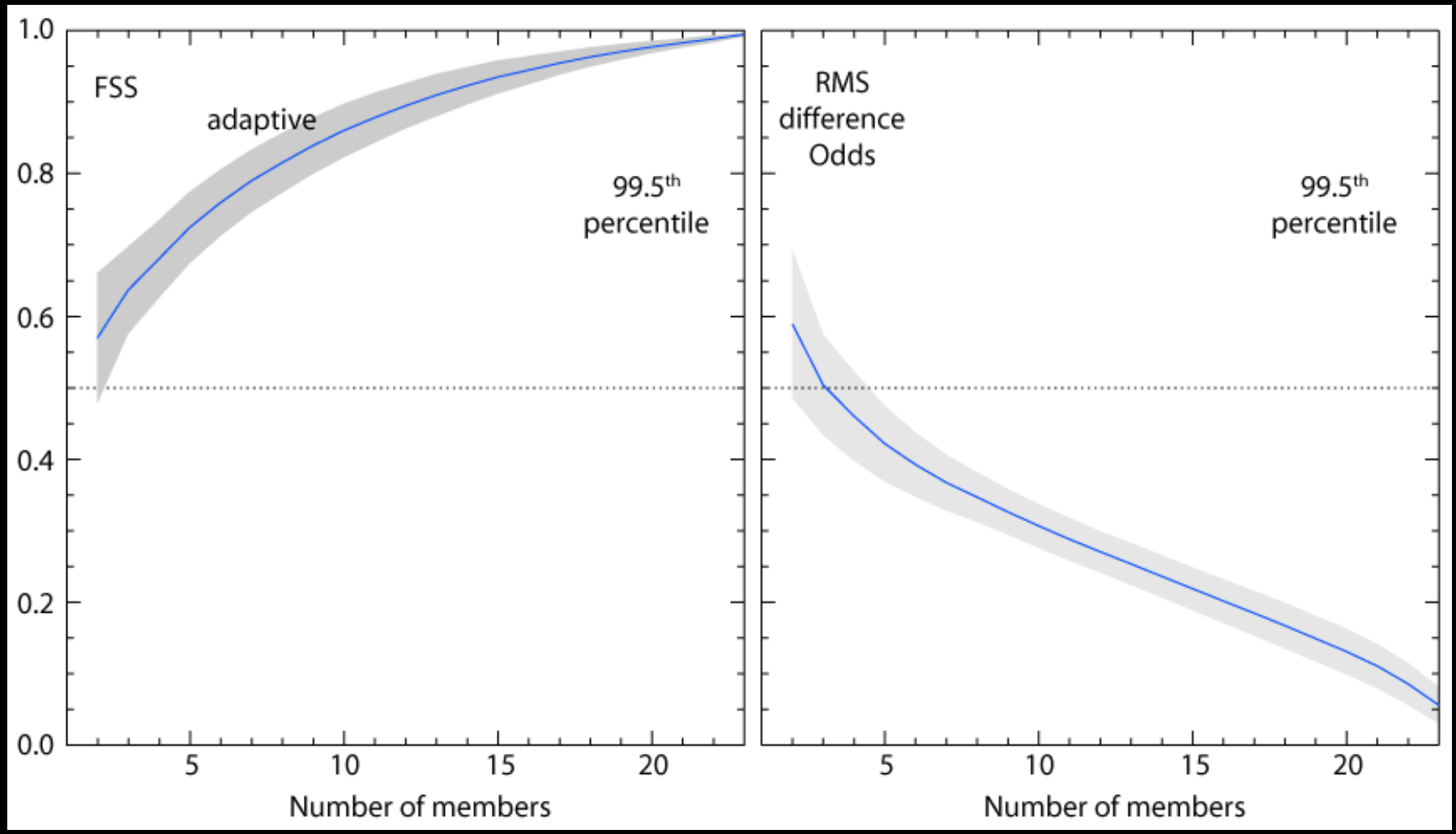
But we don't need an ensemble to produce a probability forecast

Nearby grid squares provide plausible alternative scenarios – and can therefore be treated as ensemble members

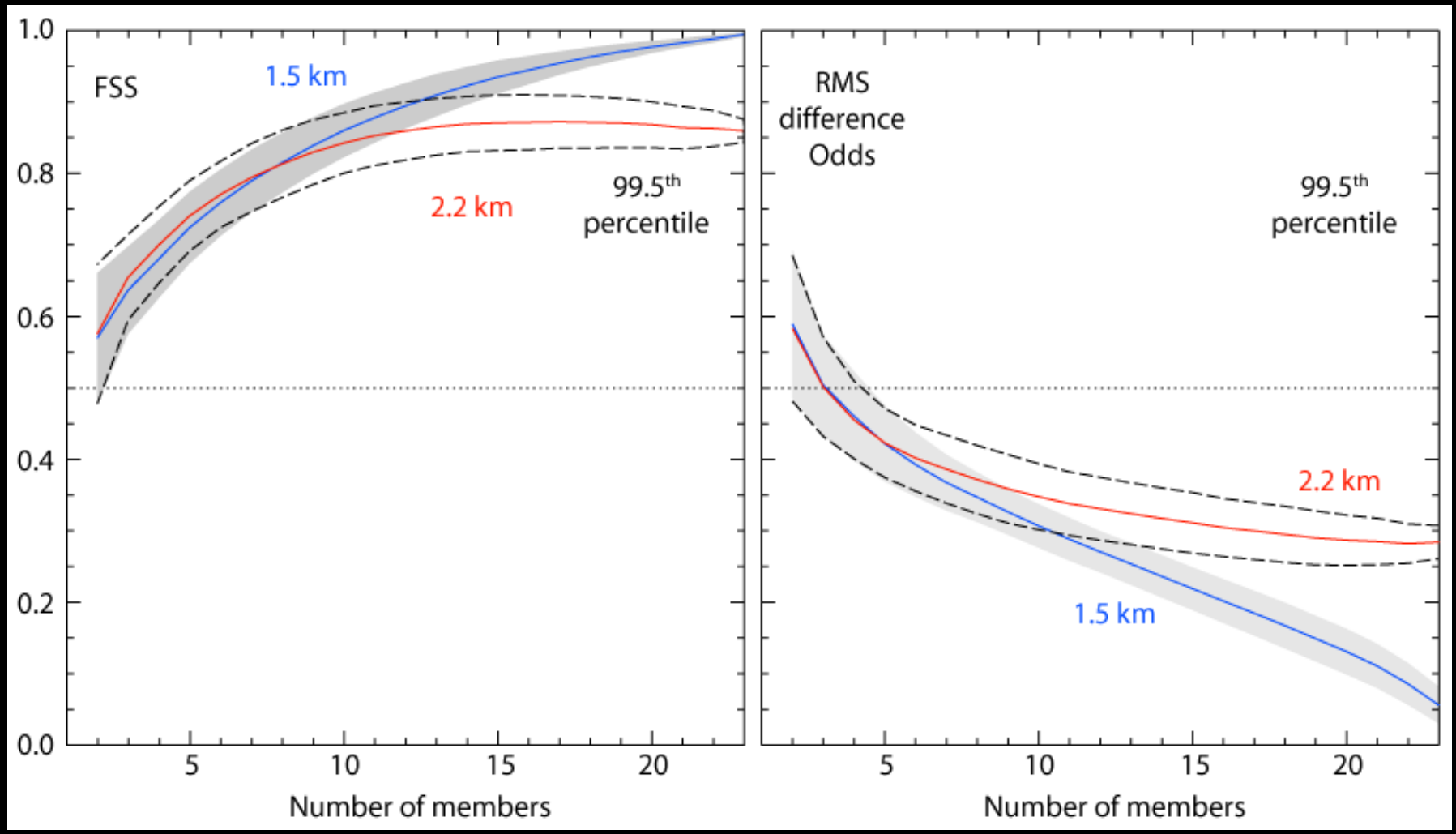
The so called 'neighbourhood' approach can be combined with an ensemble. (Theis et al 2005, UKMO, Schwartz et al 2009,2010)

How many members do we need now?

Comparison of ensemble sizes



Comparison of ensemble sizes and resolution



Storm-permitting ensemble - findings

High resolution crucial for predicting high-impact local weather

Important to represent mesoscale uncertainty (larger-scale flow)

Neighbourhood processing can effectively increase ensemble size and represent small-scale uncertainty

Neighbourhood processing can adapt to ensemble spread and scales of uncertainty

Ensemble size – a small ensemble can do a reasonable job if processed intelligently

Model resolution – 12-member 2.2 km ensemble is comparable or better than 6-member 1.5 km ensemble (except perhaps for most extreme situations)

Beware – resolution dependence can be crucial in some situations. Need to understand biases. Incorporate physics uncertainties.

Thanks for listening.