



Met Office

Weather prediction for the road industry

SIRWEC ID:16

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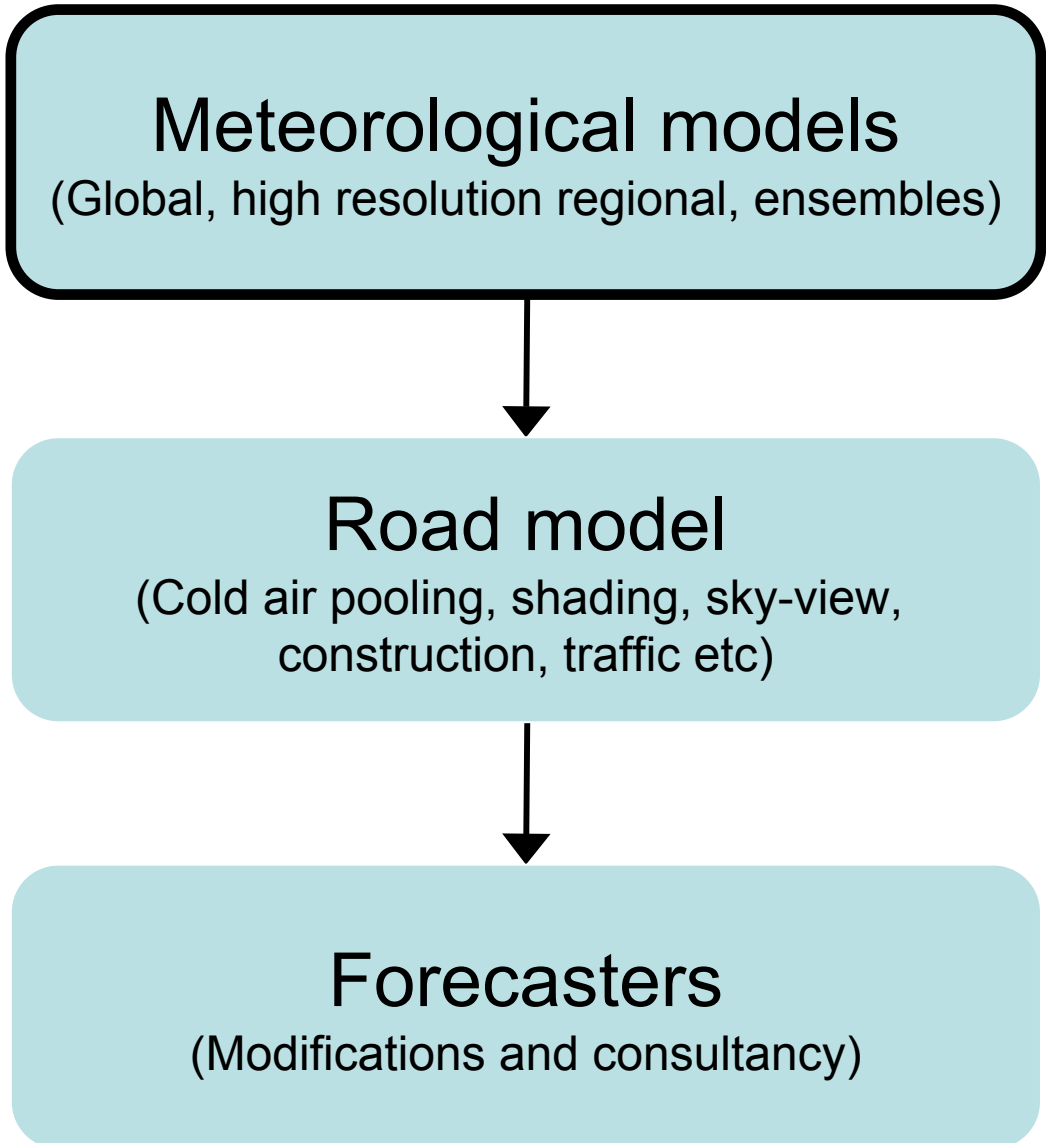
Met Office, U.K.

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Producing a road forecast

- The skill of the meteorological forecast is crucial
- What can the road industry expect from NWP models now and in the future?



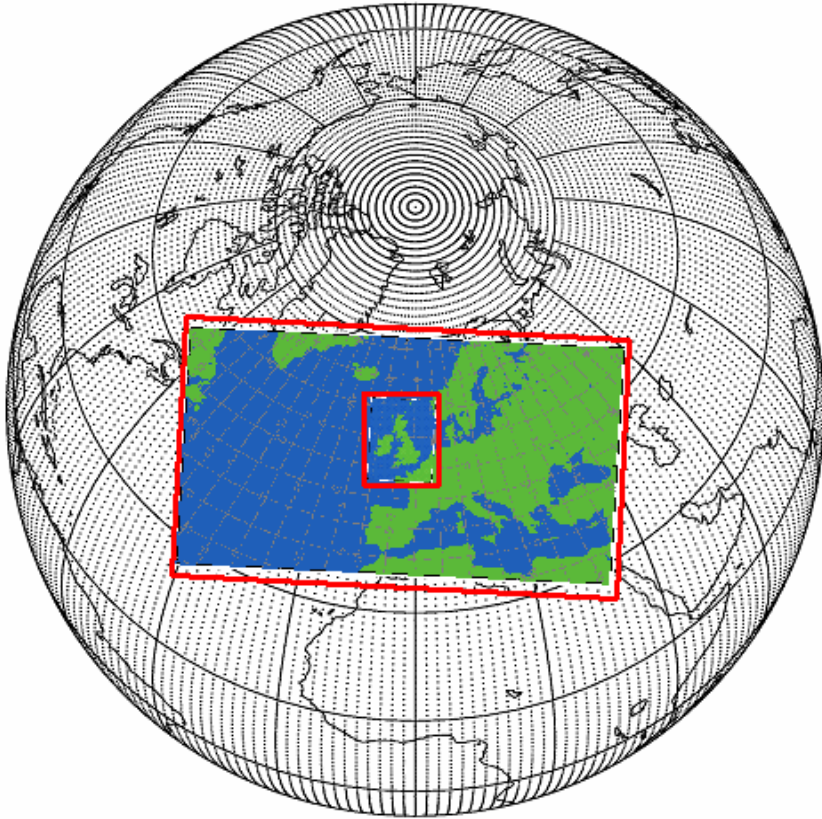


Contents

This presentation covers the following areas

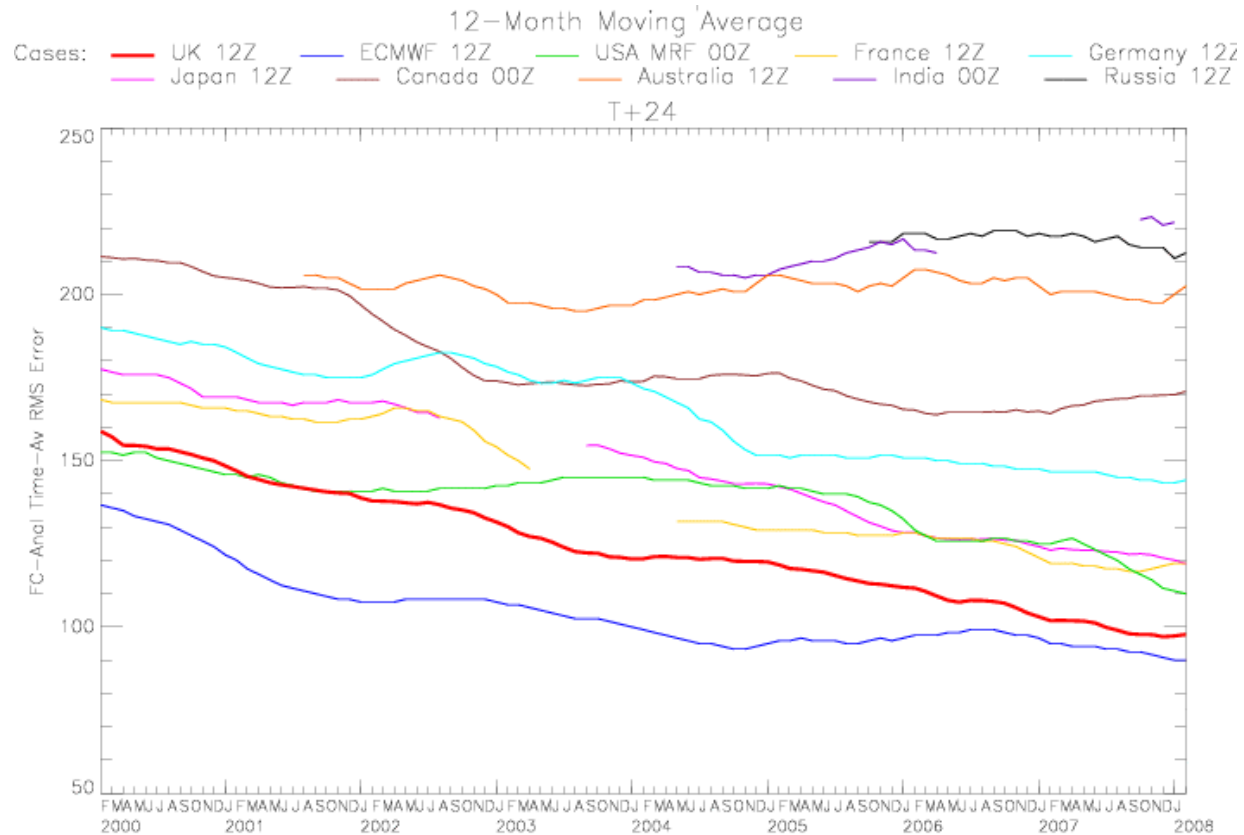
- Numerical Weather Prediction
 - Introduction
 - Strengths and weaknesses
- Opportunities (and challenges) presented by the next generation of models

NWP models



- Start with initial state using recent observations and information from previous forecasts
- Solve equations on three-dimensional model grid
- Horizontal spacing between grid points = resolution
- Finer resolution gives more detail
 - Global: 40 km
 - Atlantic/Europe: 12 km
 - UK: 4km
 - UK development: 1.5 km

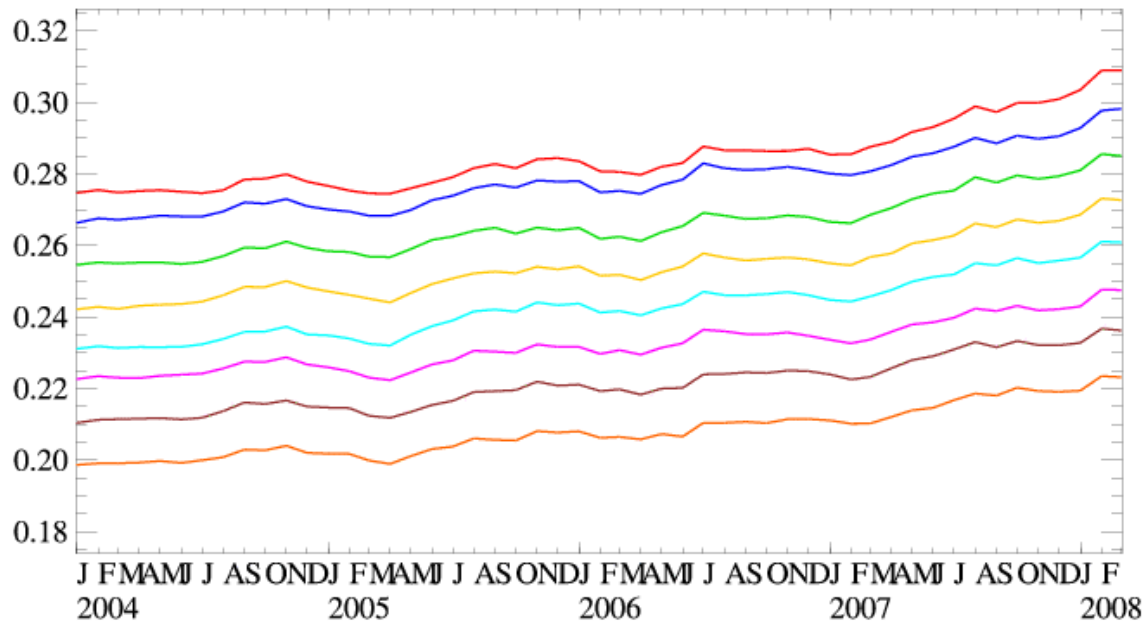
Improving performance



- Global model root mean square sea level pressure errors reducing (improving use of observations, model resolution and model formulation)

Improving performance

Sets: Equitable Threat Score
 FC Ranges: T+6 T+12 T+18 T+24 T+30 T+36 T+42 T+48



- Equitable threat score for $>5/8$ cloud over UK from 12km regional model
- Improving – but still a challenge (especially patchy stratocumulus and cumulus convection)
- Lack of important local detail at 12km



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New high resolution models



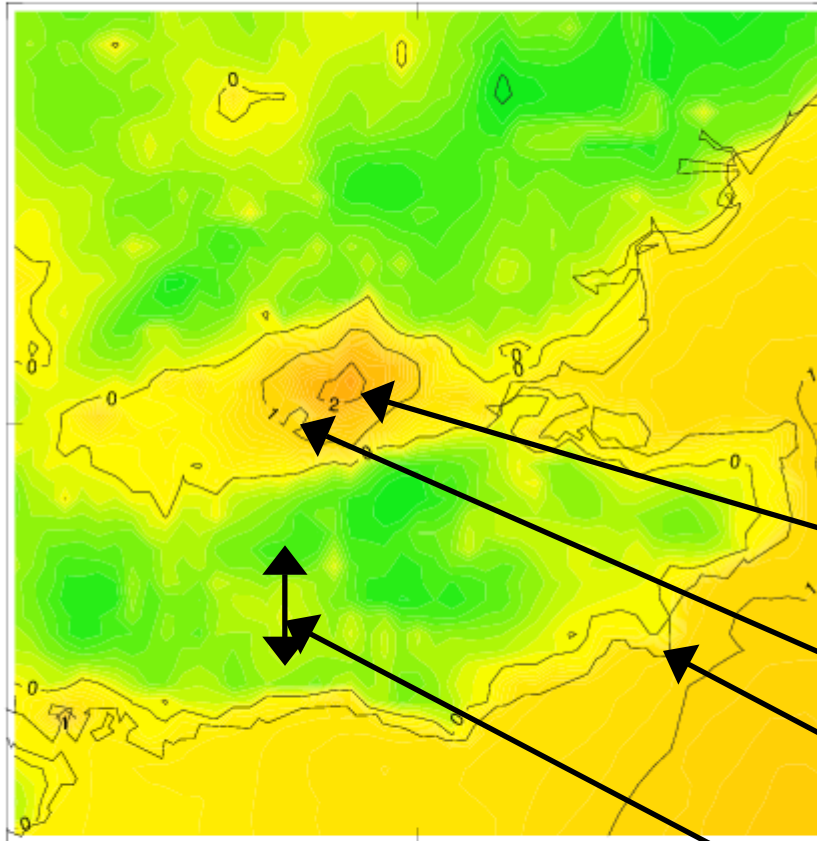
Kilometre-scale models

- Can provide crucial local detail, not captured by global and regional models with resolutions of 10km or more
 - Orographic
 - Coastal effects
 - Urban effects
 - Shower development and movement



Local detail from 4km model

Mean Anomaly in Screen Temp
00Z 01/06/2006-15-08/2006



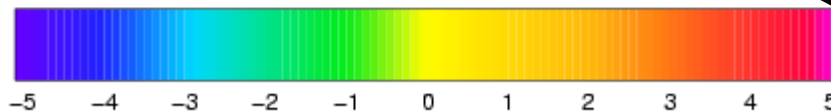
- 2.5 month average of midnight temperature anomaly relative to area mean from 4 km model

London

Richmond Park

Coastal effects

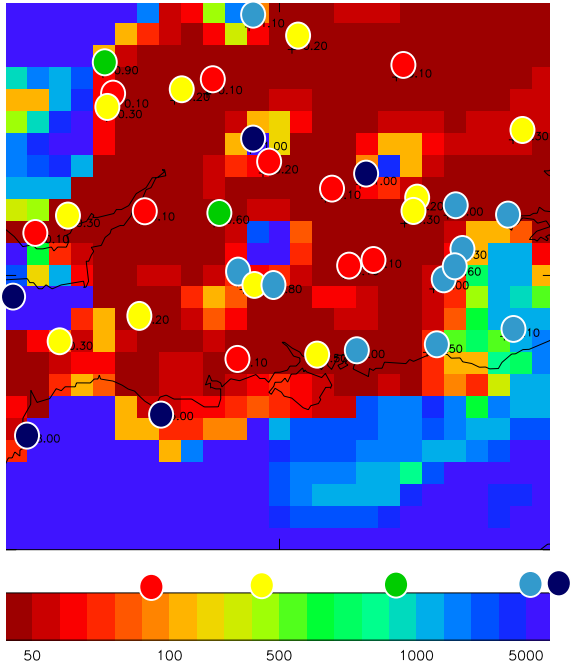
Small-scale hills and valleys



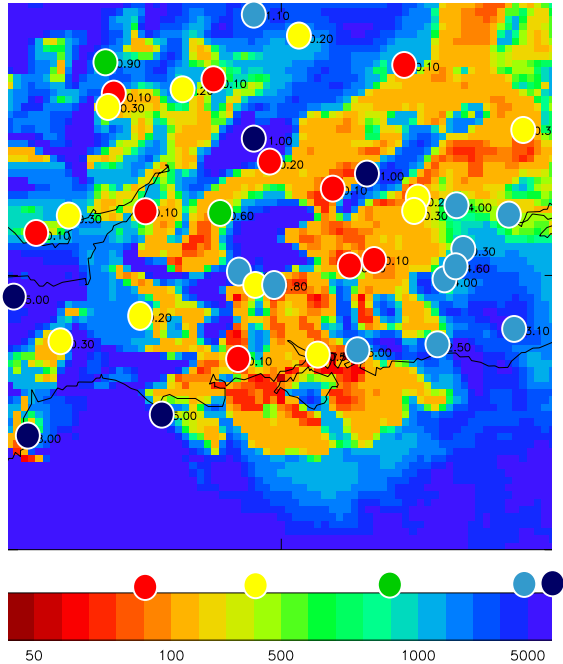


Forecast visibility at 12 UTC 10/12/2003 from 18 UTC 09/12/2003

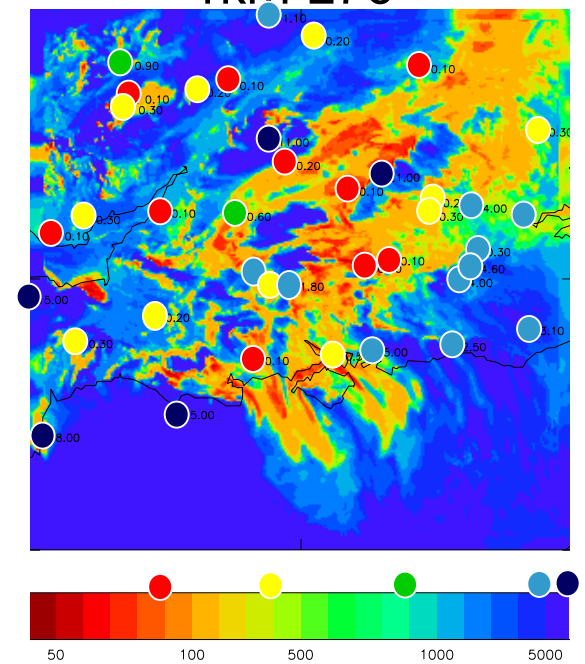
12km L38 (part domain)



4km L76 (part domain)



1km L76

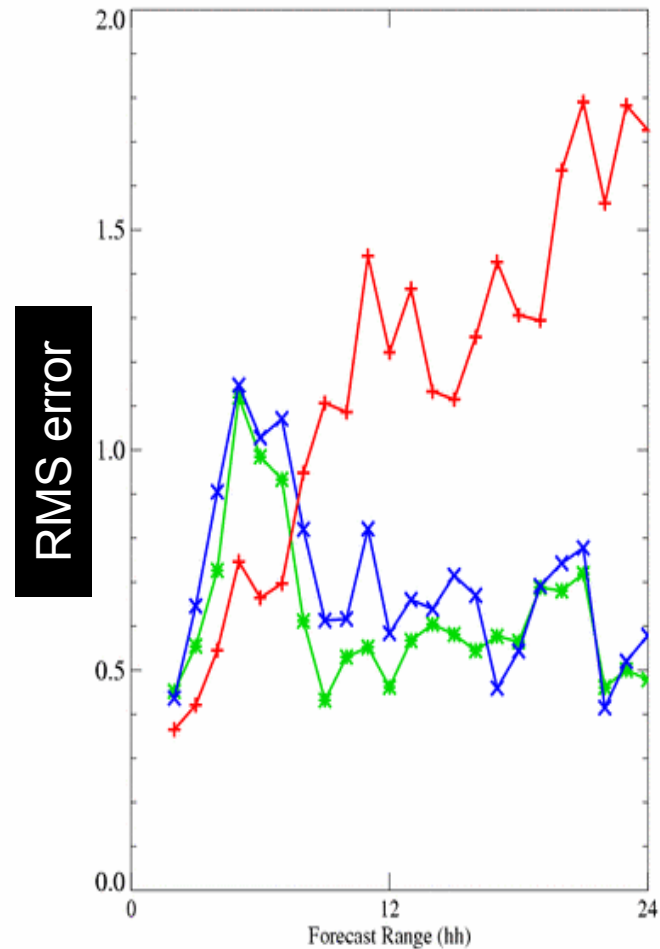
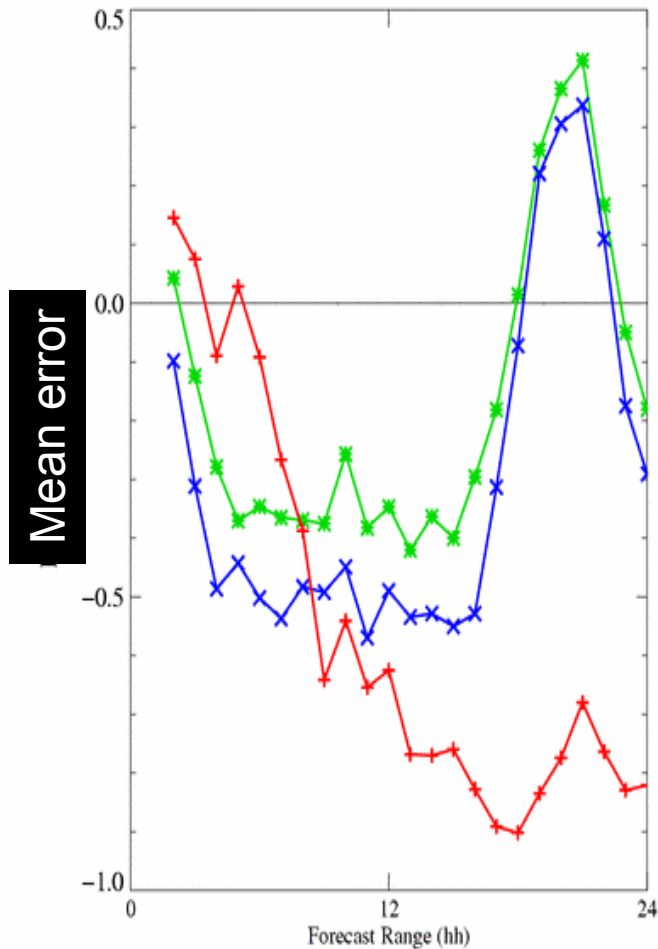




Verification –18 UTC 09/12/2003 Forecast

Log Visibility

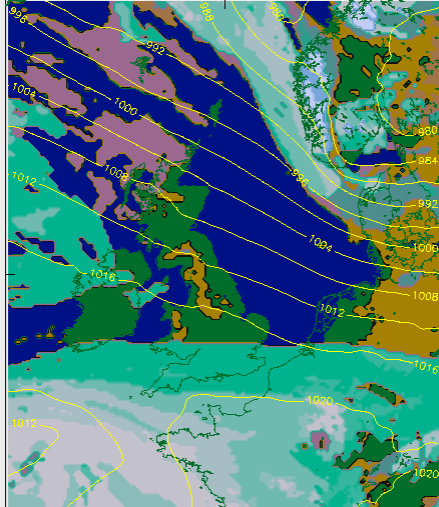
Cases: —+— 12km —x— 4km —*— 1km





Representation of convective showers

At 09Z on 27/ 2/2008, from 00Z on 27/ 2/2008
Cloud cover and PMSL Operational euro

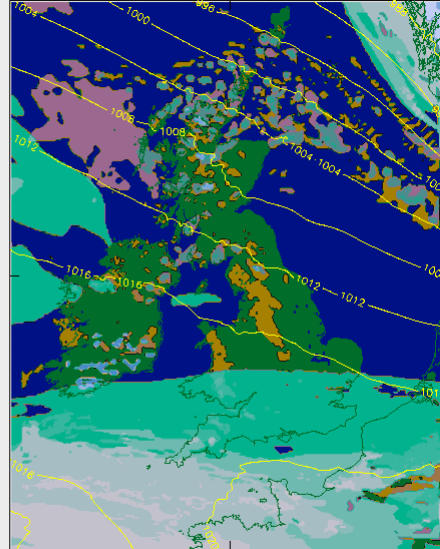


High > 50%
Med > 50%
Low > 50%
Stratus > 10%
Fog > 40%



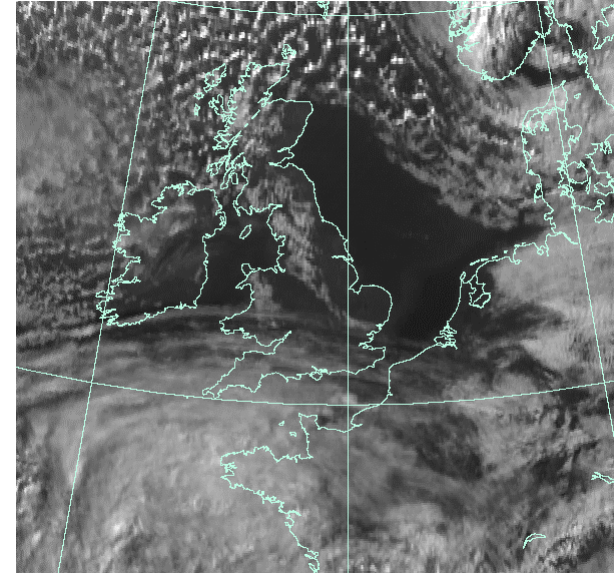
12km

At 09Z on 27/ 2/2008, from 03Z on 27/ 2/2008
Cloud cover and PMSL Operational uk4



4km

EVEA11 MSG 06 micron Visible Image 27 Feb 2008 0900 UTC

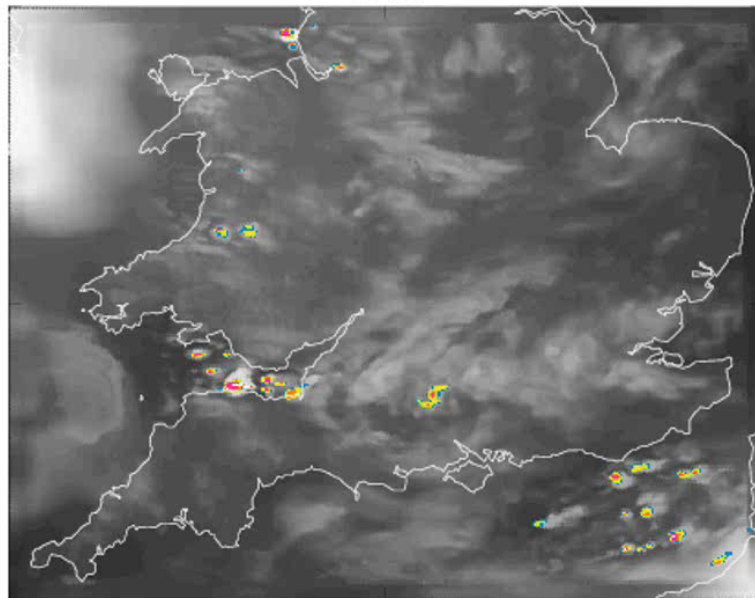




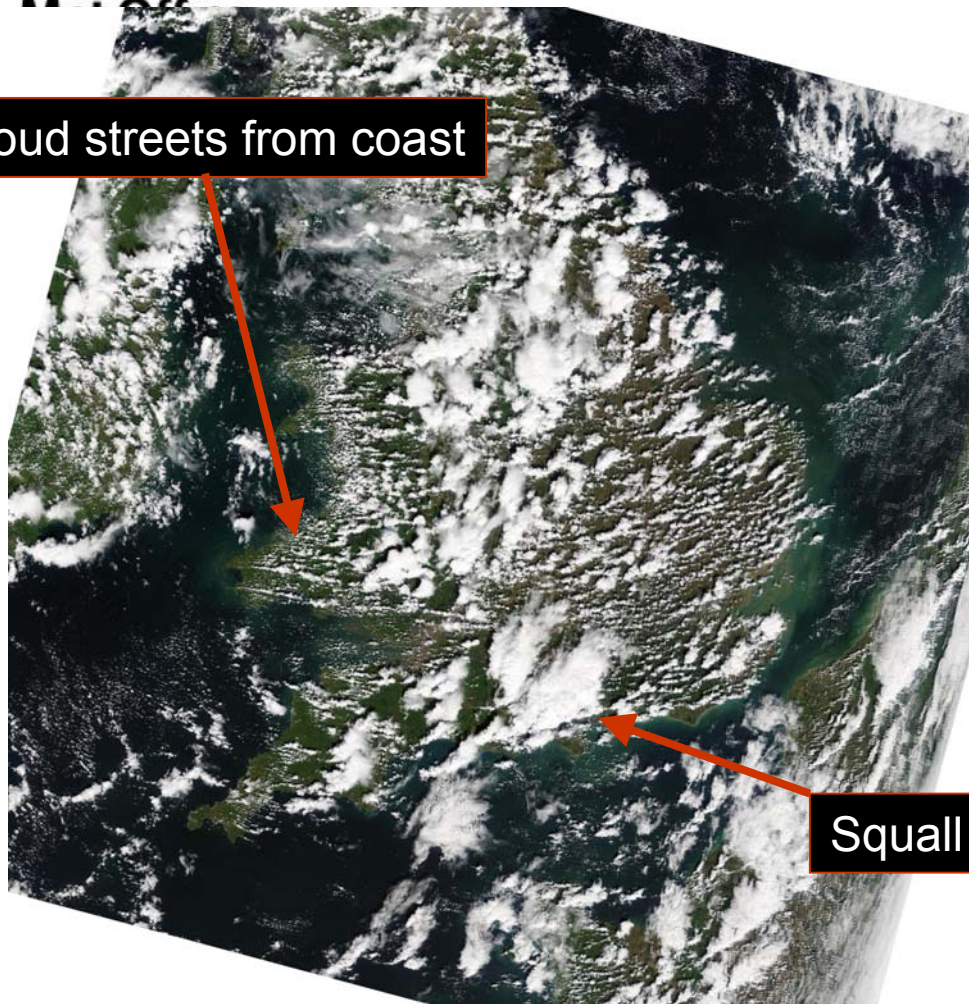
Convective development with kilometre-scale model

Model forecast

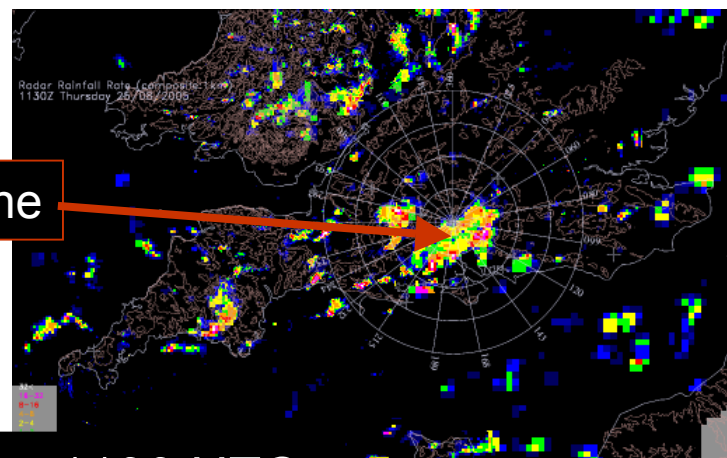
OLR and Surface Rain Rate (mm/hr)
0700



Cloud streets from coast



Squall line



Modis Terra 1125 UTC

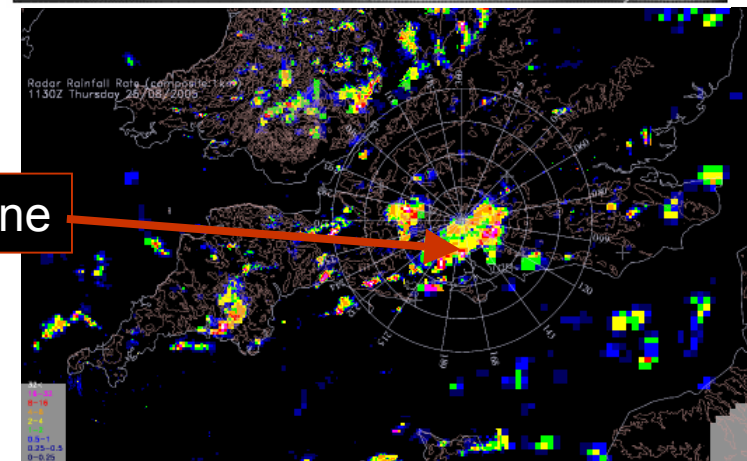
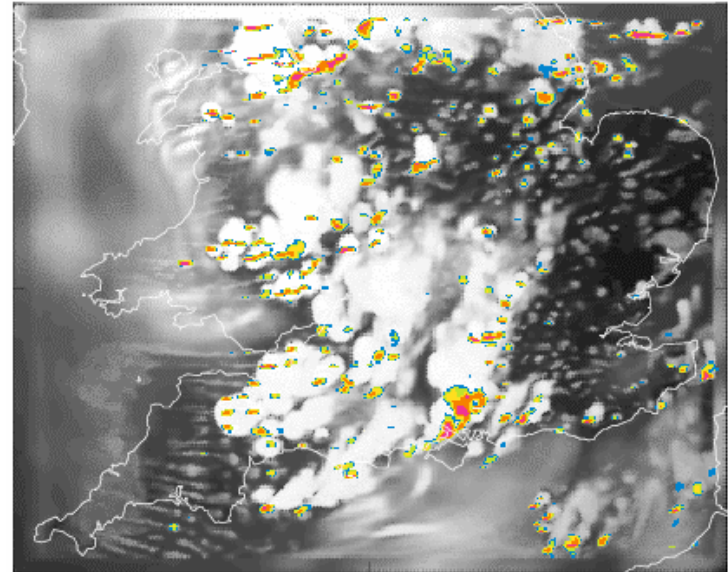
Radar 1130 UTC



Convective development with kilometre-scale model

Model forecast

OLR and Surface Rain Rate (mm/hr)
1130



Cloud streets from coast



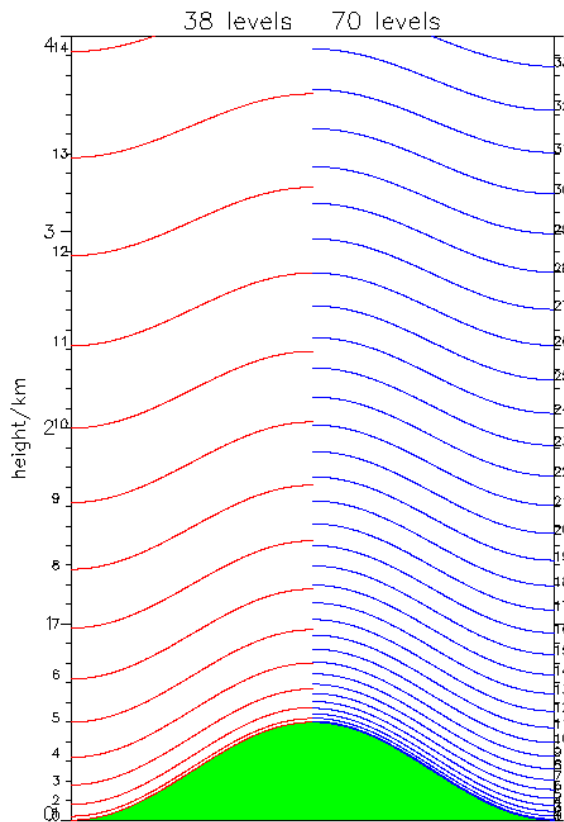
Squall line



Modis Terra 1125 UTC

Radar 1130 UTC

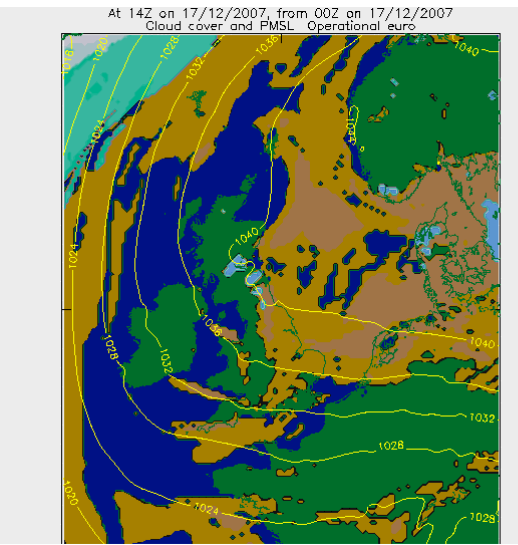
Benefits of increased vertical resolution



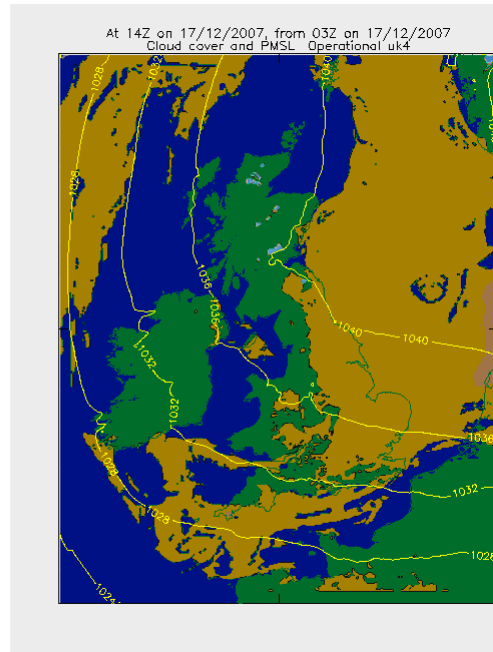
- Better able to represent the rapid variation of temperature with height close to the surface on an extreme night
- Better able to represent thin stratocumulus cloud at the top of the boundary layer
 - Consequential benefits for surface and near-surface temperature forecasts



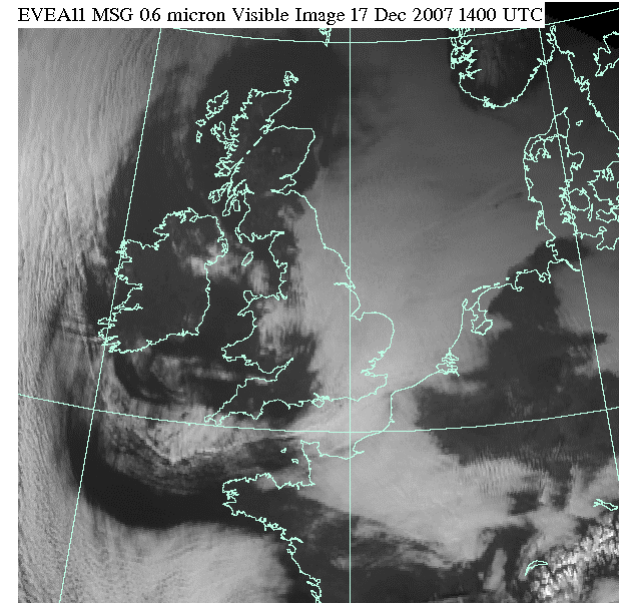
Stratocumulus



L38 12km



L70 4km





Screen temperature verification

| | Mean error (deg C) | RMS error (deg C) | Hit rate | FAR | % Correct | % within 2 deg C |
|-----|--------------------|-------------------|----------|------|-----------|------------------|
| 38L | -0.25 | 1.83 | 86.1 | 20.6 | 91.9 | 79.1 |
| 70L | 0.08 | 1.68 | 83.3 | 15.3 | 92.9 | 81.5 |

- Implemented in Met Office 4km model, Autumn 2007



Summary

- NWP models are at the heart of modern forecasting systems
- Performance steadily improving
 - Patchy cloud remains a challenge – and accurate forecasts crucial for road surface temperatures
- New high resolution models offer extra detail crucial for route-based forecasting
 - Care needed in interpretation



Questions