
# Consortia Presentation

for 30th EWGLAM and 15th SRNWP Annual Meeting 2008
6th – 9th October 2008 Madrid, Spain

Mike Bush

# Collaboration status

# Current UM partners

1. Norwegian Meteorological Institute. met.no (Feb 2007)


2. South African Weather Service (Mar 2007)


3. Australian Bureau of Meteorology & CSIRO (Mar 2007)



4. New Zealand NIWA Ltd (Dec 2007)


5. Indian Ministry of Earth Sciences (Aug 2008)

6. (South) Korea Meteorological Administration

# met.no science projects

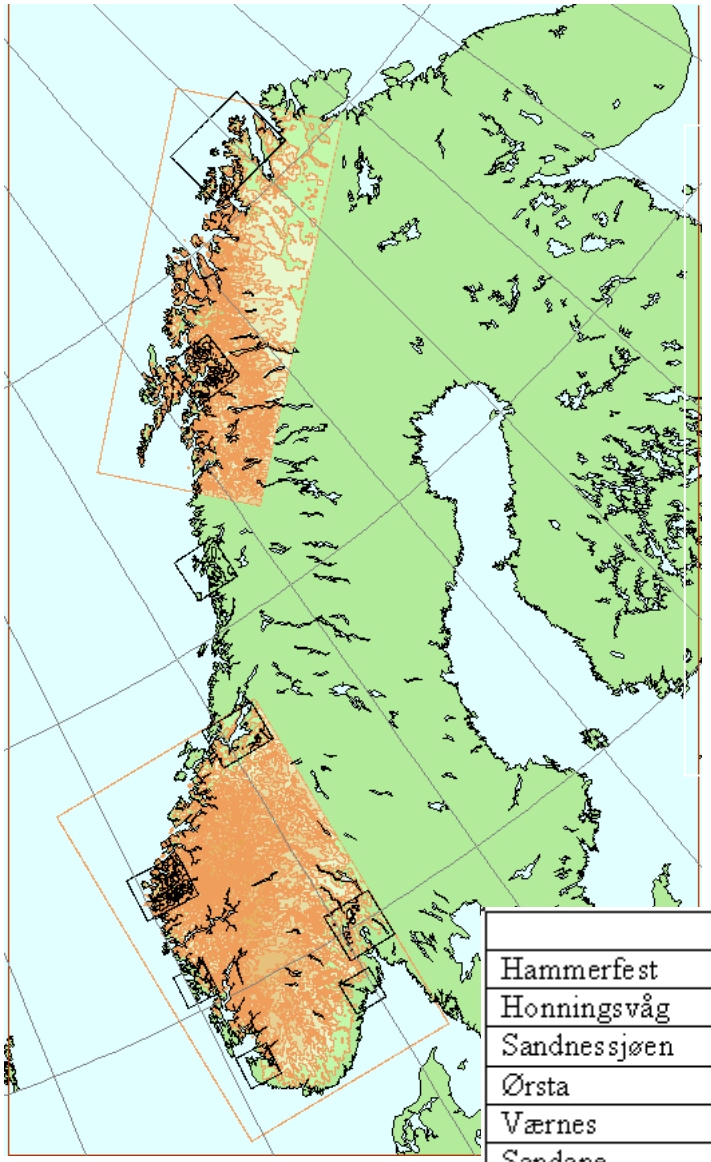
- ECNO01: Porting strategies (UM vs HIRLAM) – D Bjørge, G Greed
- ECNO02: Benefits of high resolution (explicit vs parameterised convection – Sørlandet 2007; turbulence from mountain lee waves; improved land use data) – V Ødegaard, P Clark
- ECNO03: Improved parameterisation of surface processes (cold bias tiger team) – J Kristiansen, A Brown & M Best
- ECNO04: Extreme wind downscaling – M Jensen, K Mylne

# 1km resolution models

UM run daily since November 2007

Provides input to a turbulence model (SIMRA) for seven airports all in mountainous terrain

Stability problems have been investigated



9 small and 2 large domains

Northern domain is 288x680 points

Southern domain is 400x656 points

| | $S_{vv}$ UM 4km | $S_{vv}$ UM1km | $S_{vv}$ SIMRA |
|---|---|---|---|
| Hammerfest | 2.84 | 2.25 | 2.28 |
| Honningsvåg | 2.41 | 2.44 | 2.61 |
| Sandnessjøen | 2.60 | 2.18 | 1.99 |
| Ørsta | 2.58 | 2.22 | 2.97 |
| Værnes | 2.05 | 2.12 | 2.02 |
| Sandane | 1.91 | 2.05 | 1.99 |
| Narvik | 2.63 | 3.14 | 2.88 |

# Cold bias in Winter

- Forecast T2m temperatures too low during the cold season above snow covered ground
- Four changes (analysis of spring 2007 data):
  - Increased vertical turbulent mixing in stable boundary layers (Adrian Lock)
  - Decoupled T2M diagnostic (John Edwards)
  - Fractional snow cover for grid boxes (Gabriel Rooney)
  - Snow canopy (snow under and on top of needle leaf trees (Gabriel Rooney)
- Has improved our understanding of UM performance in stable conditions
- UM4 at NMI operational on 10 March

# Warm bias in Summer

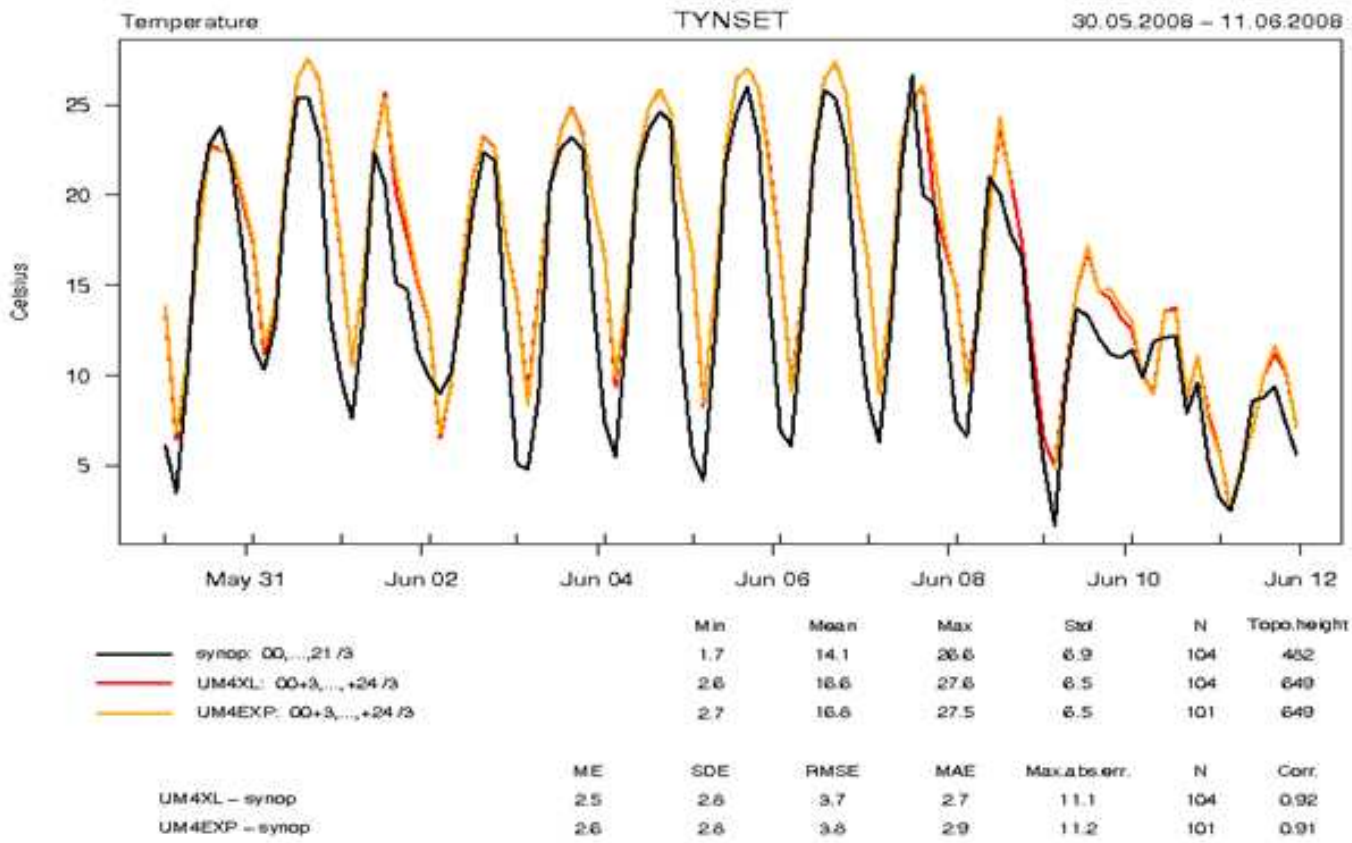


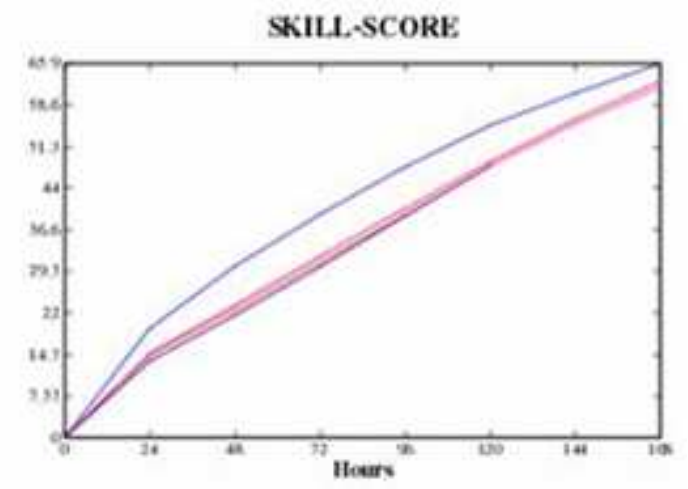

**Figure 1a:** Forecasted and observed T2m at Tynset from 30 May to 11 June 2008. Only forecasts initiated at 00UTC are shown and the results are shown every 3 hours starting at lead time +3 and ending on +24. Two different UM4 forecasts are shown, UM4XL and UM4EXP, where the former is the operational version employed at NMI. UM4EXP is an experimental version where the initial surface fields are interpolated from Hirlam4 rather than Hirlam8 as in UM4XL. Note the warm bias especially during night. Various error scores are shown in the table at the bottom of the figure.

# Australian Community Climate and Earth System Simulator (ACCESS)

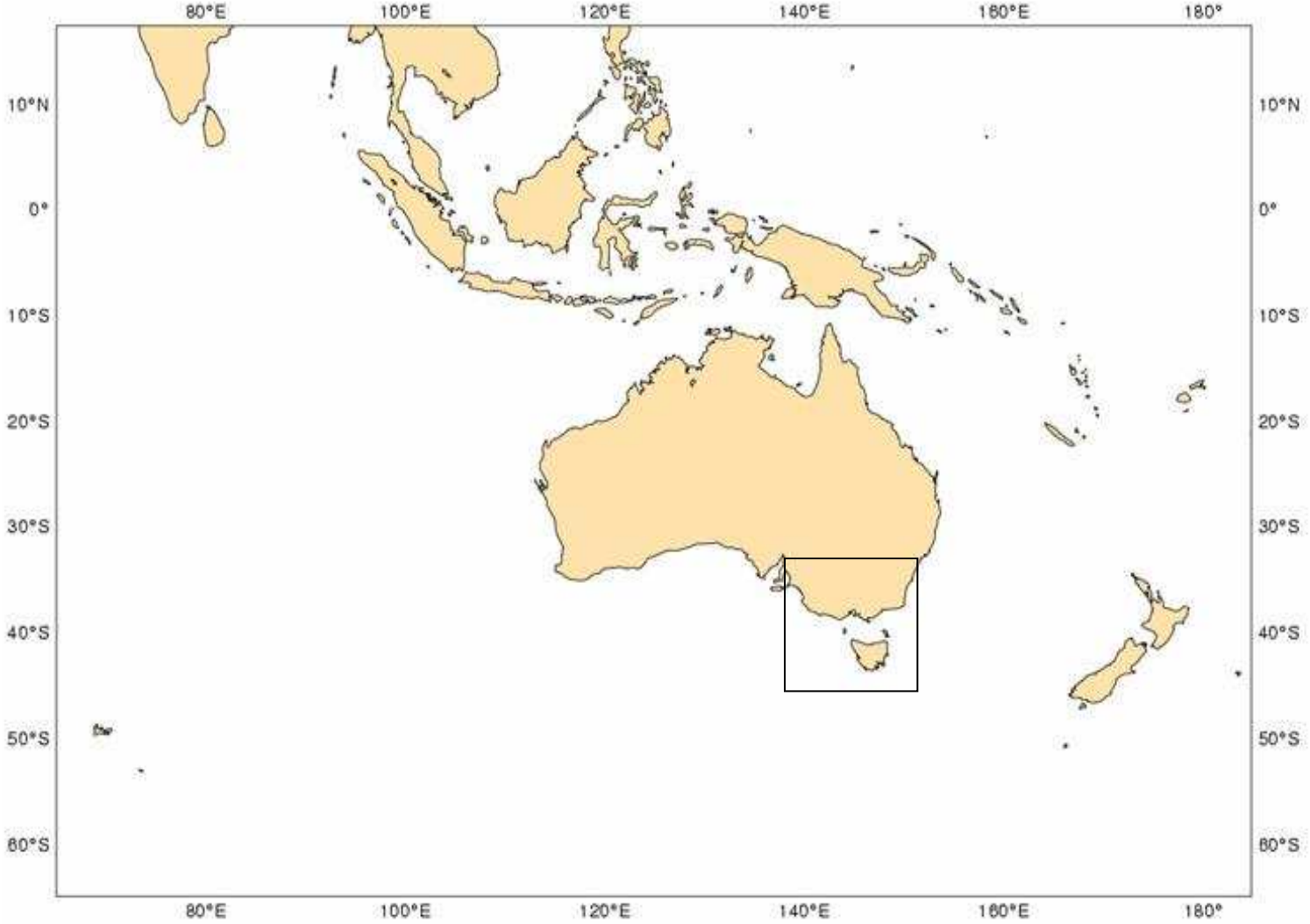
- Implementation and continuing development of the UM/OPS/VAR system from the Met Office, Observation Data Base (ODB) from ECMWF, MOM-4 from GFDL and CICE-4 from Los Alamos National Laboratory;
- Coupling of ocean (MOM-4), sea-ice (CICE), land-surface/carbon cycle (CABLE) models to the UM;
- Numerical weather prediction (NWP) implementation including evaluation and verification;
- Experimentation with physical parametrisations, including the SES2 (Sun-Edwards-Slingo) radiation scheme.
- Experimentation with background error covariance statistics that vary with latitude.

# ACCESS progress and plans

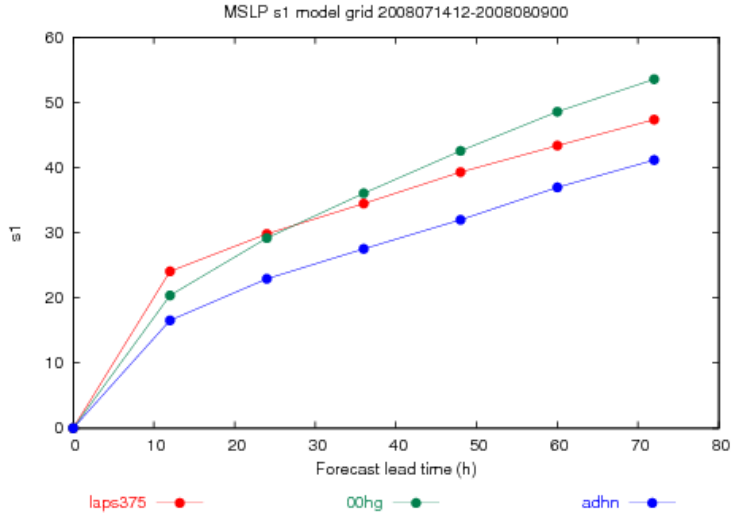
- 1Q 2007 – preliminary runs in NWP mode
- 1Q 2008 – parallel trials
- 4Q 2008 – operational implementation
- S1 skill score MSLP verification for Australia:

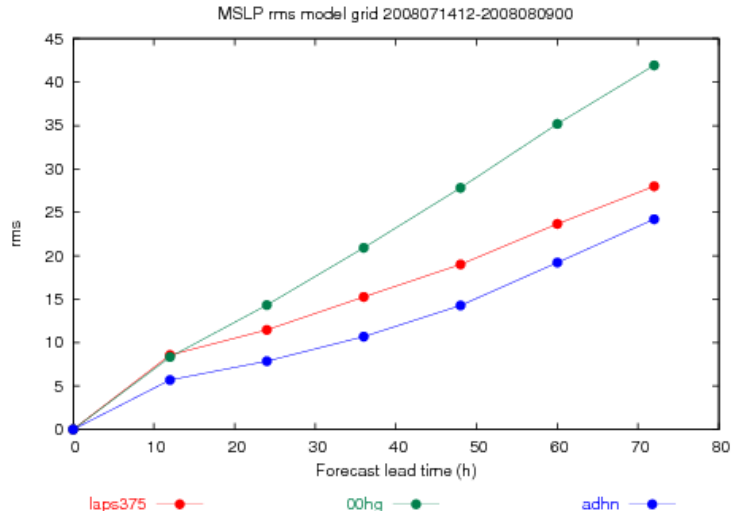


# Regional (37.5km resolution) and high resolution (4km resolution) domains



# Regional model verification
# PMSL s1 skill score




**00hg – earlier ACCESS LAM**

**laps375 – operational**

**adhn – latest ACCESS LAM**

# Met Office news

# New Chief Scientist

- Professor Julia Slingo will take up her position this month.
- Professor Slingo is currently Professor of Meteorology at the University of Reading and Director of Climate Research at the National Centre for Atmospheric Science.
- Her research interest has focused on tropical climate variability, its influence on the global climate, its role in seasonal to interannual climate prediction and its response to climate change.

# Pitt Review

- Sir Michael Pitt was asked by Government Ministers to conduct an independent review of the flooding which affected parts of the UK in June and July 2007.
- Recommends a more integrated approach to flood warnings which combines the expertise of the Met Office and the Environment Agency.
- A joint centre will be set up to deal with the issue of severe weather and flooding in the UK.

# Extreme Rainfall Alert service

- Pilot service runs for six months from 2nd July 2008
- These advisories and alerts are based on probabilities and will be issued up to twelve hours ahead of an event.
- During the pilot, an Environment Agency flood forecaster will be sitting in the Met Office Operations Centre.
- Available to emergency responders who register for the service.


# Model upgrades 27th November 2007

# Global model: Cycle G46

Three satellite data changes:

1) IASI (METOP)

- IASI provides high vertical resolution temperature and humidity profile information and is very similar to AIRS (used operationally since 2004).
- The data quality is much better than AIRS
- The vertical resolution of the temperature and humidity information which can be extracted in cloud-free regions is also better.
- IASI has 8461 channels compared, for example, to 15 for AMSU-A. Studies have shown that most of the information is contained in 300 channels and also that the data can be thinned to one observation in four before storage.

# Cycle G46 (2)

2) ASCAT (METOP)

- ASCAT is similar to the ERS scatterometer which has been used since the mid-1990s.
- ASCAT has a much wider swath than the ERS scatterometer, which was a demonstration research mission.
- Unlike the current QuikSCAT instrument ASCAT is unaffected by precipitation so provides near surface wind vector information in all weather conditions.

3) GPSRO

- Increase the number of COSMIC GPS radio occultation satellites from 4 to 6 to give a more uniform global coverage

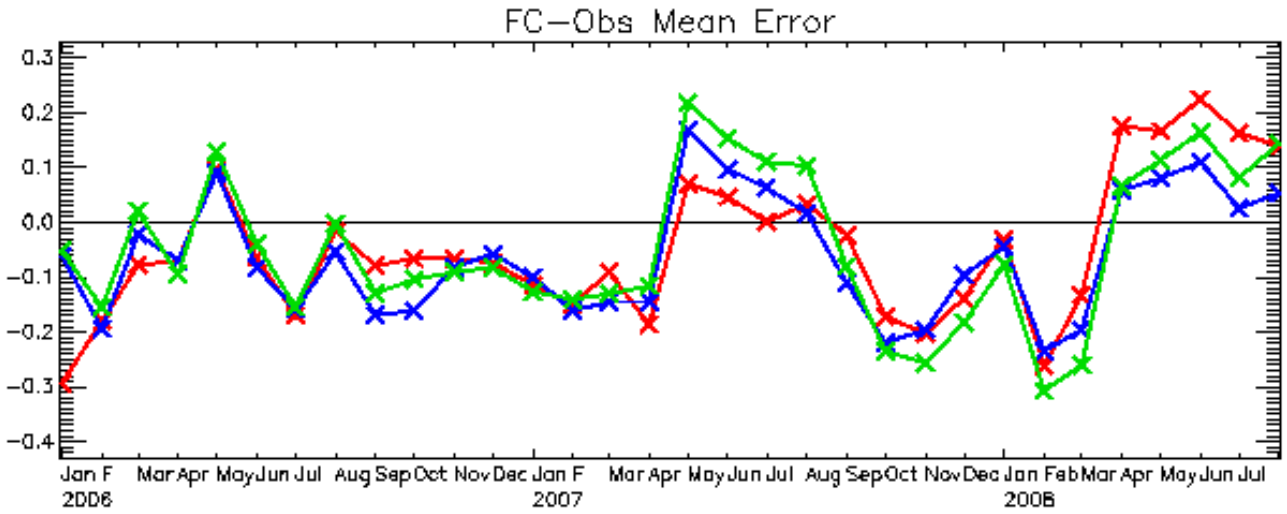
# NAE model: Cycle E18

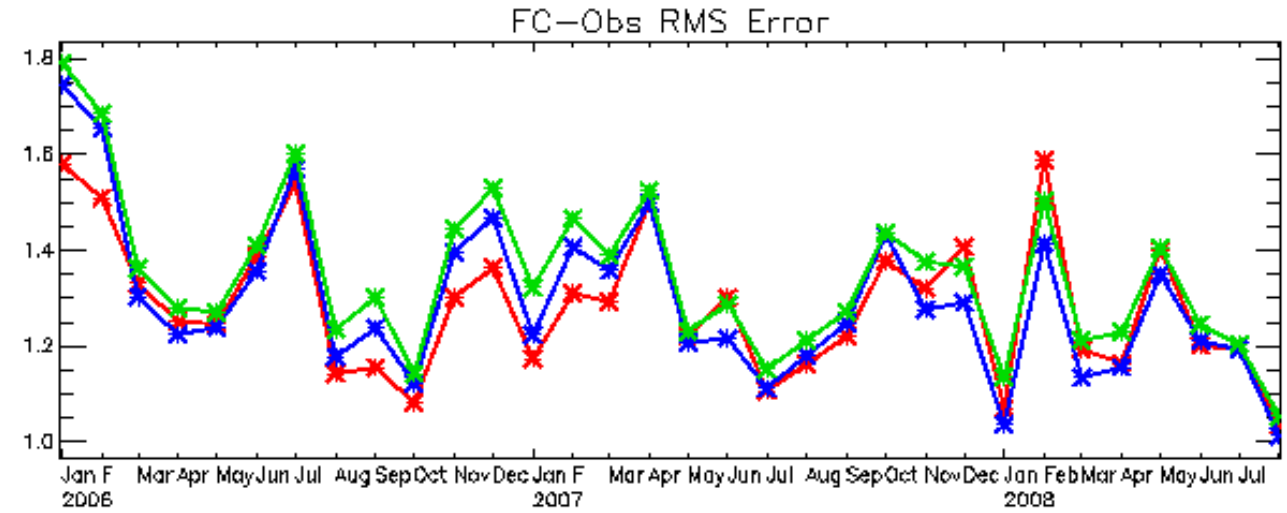
- Introduction of IASI and ASCAT following global model
- Introduce OSTIA SST data to replace the current SST analysis (global model changed on 02nd October 2007)

# UK4 model: Cycle U4.10

- Increase in vertical levels from 38 to 70 (30 in the boundary layer)
- Marked improvement in most variables
- Particularly screen temperature and cloud
- 10m wind speed reduced – due to lack of model level at 10m?
- For more details see poster
- OSTIA SST change following NAE model

# UK4 vs NAE: Screen temperature




# Model upgrades 1st April 2008

# Global model: Cycle G47

- Two changes  to UM soil properties:

a) Correction of UM soil hydraulic properties

b) An improved parameterisation of soil thermal conductivity.

- Assimilation of surface T, RH and winds over land
- Removal of RH boost for sondes.
- GPSRO. Increase vertical range over which COSMIC refractivity data is assimilated from 4-27km to 0-40 km

# NAE model: Cycle E19

- Same soil changes as Global plus two extra changes:

a) Use of MODIS soil albedos

b) Introduction of seasonal Leaf Area Index

- Increase of Aerosol Background Error Length Scale (90km -> 150km)
- Removal of RH boost for sondes.
- New screen temperature diagnostic for testing

# UK4 model: Cycle U4.11

- Same changes as the NAE model
- Plus the addition of Scatterometer winds
- ERS-2 AMI and SEAWINDS scatterometer data have for some time been assimilated into the global and NAE models.
- As a reasonable proportion of the UK4 surface domain is ocean it was felt that it may also benefit from the introduction of these data sources.


# Model upgrades 22nd July 2008

# Cycle G48 22nd July 2008

- Surface stationlist height corrections (SYNOP).
- GPSRO: Add CHAMP and GRACE to current set of (6 COSMIC) satellites.
- Assimilation of cloudy AIRS radiances.
- Satwind changes: update the observation errors to allow for errors in satellite wind height

# Cycle E20 22nd July 2008

- Same changes as Global (except for GPSRO)
- Introduction of convective cloud decay.
- Already in the Global model since December 2006.
- The convective cloud, which is seen by the radiation scheme, is allowed to persist.
- Rather than only exist for the timestep that convection is diagnosed, the cloud exponentially decays until less than 2% CCA remains.
- This improves the coupling between convection and radiation.


# Model upgrade scheduled for 11th November 2008

# Upgrade scheduled for 11/11/08

- Upgrade to physics in all the model configurations.
- Replace nudging with variational assimilation for MOPS cloud fraction (NAE/UK4)
- Introduce clear-sky radiances from SEVIRI on MSG (NAE/UK4).


# New Supercomputer

# Dave Kay (IBM) and John Hirst (Met Office) sign the contract on 01/08/08

# High Performance Computing

**Now** **2009** **2011**

**6x**

**3x**

**NEC SX-6/8** **Phase I: IBM** **Phase II: IBM**

# Summary compared with NEC

| | NEC SX6/8<br>3 systems | IBM Power6<br>3 systems | Factor |
|---|---|---|---|
| ***CPUs or Cores per Node*** | 8 | 32 | 4 |
| ***Peak Performance per node (GFLOPS)*** | 128 **(for SX8)** | 600 | 4.6 |
| ***Number of Nodes*** | 59 (SX6/SX8 mix) | 208 | 3.5 |
| ***Total Peak Performance (TFLOPS)*** | 5.4 | 125 | 23.1 |
| ***Number of CPUs / Cores*** | 472 | 6656 | 14.1 |
| ***Total Memory (TBytes)*** | 2.7 | 13.3 | 4.9 |
| ***Total Disk (TBytes)*** | 36 | 776 | 21.5 |
| ***Disk Performance (GB/s)*** | ~0.15 | >1 (24 total per cluster) | ~7 |

# Implementation plans

- Test System for code porting - acceptance early October 2008
- Collaboration cluster (Met Office use) – acceptance 31/12/08
- Remove NEC SX-6 – January 2009
- First/second main clusters - acceptance early April/end May 2009

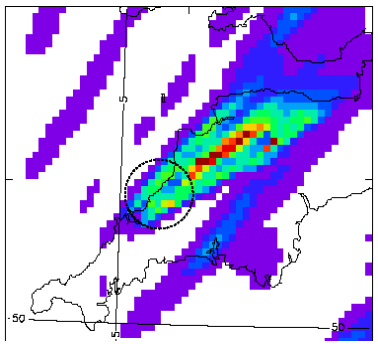
  *(user access ~ 6 weeks before acceptance)*
- Production models operational end June 2009
- Service for NERC users – go-live 01/04/09 tbd
- Phase 2 hardware upgrade – October 2010 to June 2011
- Implementation complex owing to other related projects eg. MASS, HPC for NERC, new security architecture

# Provisional Model Upgrade Timetable 2009

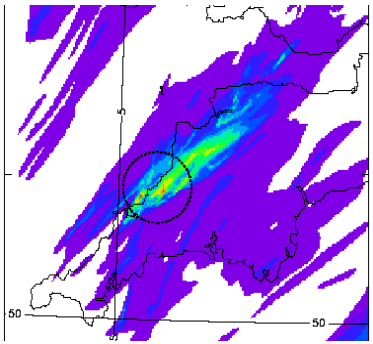
- May 2009
  - System Acceptance
  - UK 1.5km Model trial
- September 2009
  - Global and NAE to 70 levels
  - Global EPS to 60km / 70levels
- December 2009
  - Global Model to 25km
  - NAE EPS to 16km / 70 levels

# Our longer term Forecasting Strategy…

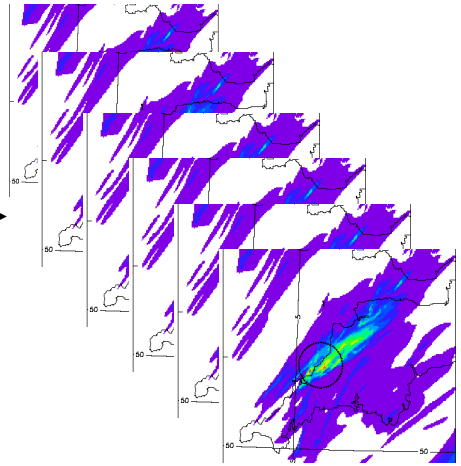
Now | 2009 | 2011/12 | 2014



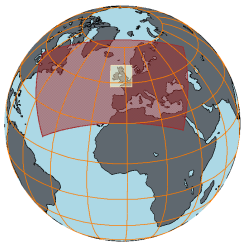
4km UK



1.5km UK



1.5km UK Ensemble



- 40km Global
- 12km NAE
- 24km NAE Ensemble

- 25km Global
- 12km NAE
- 16km NAE Ensemble

- 16km Global
- (12km NAE)
- 12km NAE Ensemble


# Questions?