Consortia Presentation

for 31st EWGLAM and 16th SRNWP Annual Meeting 2009
28th September – 1st October 2009 Athens, Greece

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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

US Naval Research Laboratory

- US Naval Research Laboratory have had a research licence since Nov 2008
- UM/4DVar global model being evaluated for operational use at the Naval Oceanographic Office in Mississippi
- Resources to validate and adapt UM/4DVar have recently been extended
- Collaboration activities are likely to include: data assimilation, enhanced 4DVar using ensemble covariances, post-processing and tropical cyclone initialisation

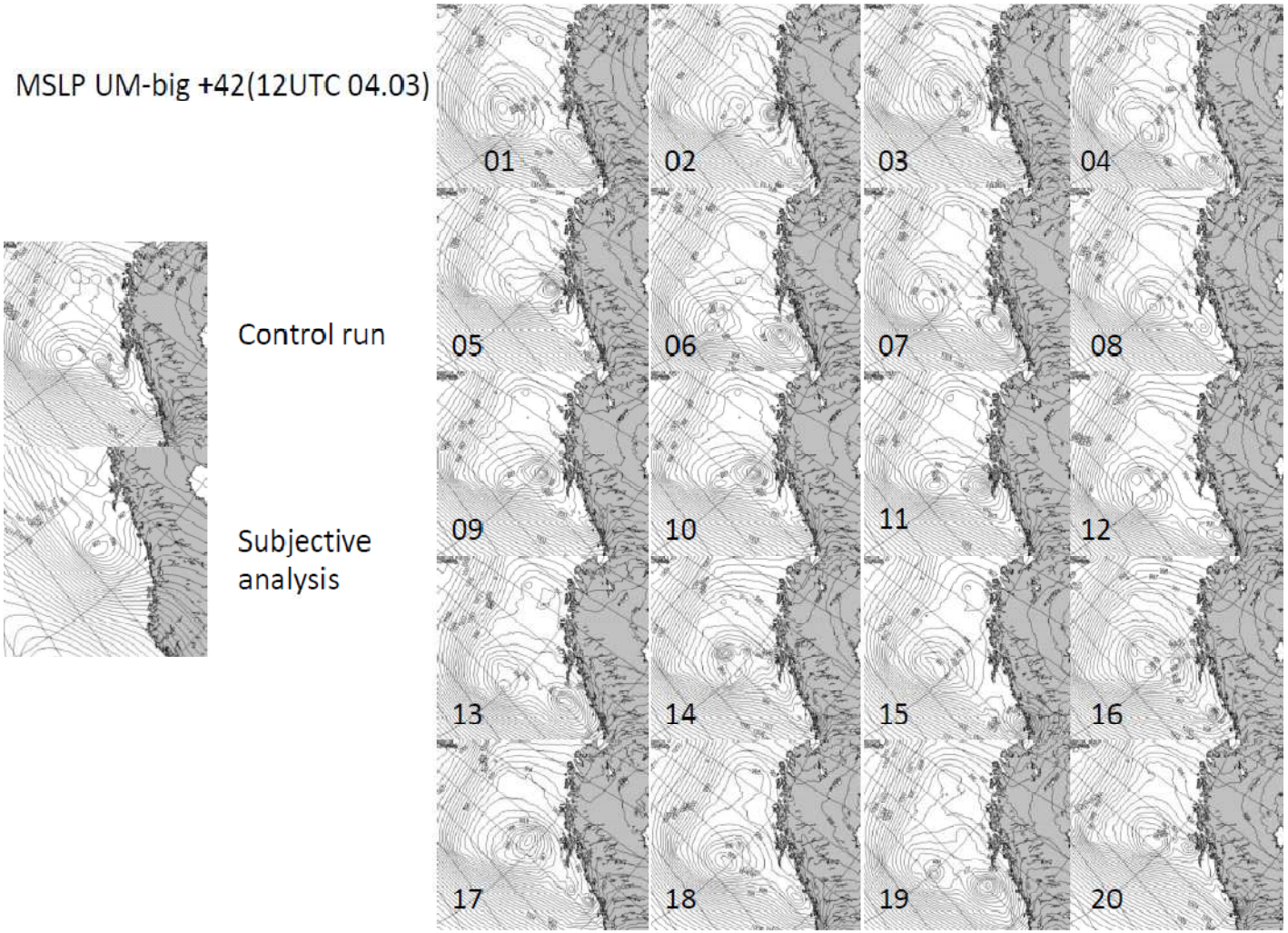
met no: UM cold bias in Winter

- As a result of model changes, the bias has been cut in half between the last two winters
- Currently the met.no version of the UM, UM4, is driven by interpolating HIRLAM8 initial conditions and LBCs.
- A one month test period (November 2007) showed that the cold bias bias is related to a sub-optimal initialization of the soil temperatures when using HIRLAM8 initial conditions (ICs).
- Based on these results, it is suggested that the UM4 is driven with NAE ICs.
- However, the domain would have to be slightly reduced compared to the current one.

Extreme wind downscaling

- As a tool, met.no has developed a new ensemble system using UM4, currently allowing up to 7 members to be run simultaneously.
- Aiming for an operational product the downscaled ensemble should be fast to run.
- This means one needs an optimal combination of ensemble size, grid resolution, domain size and forecast length.
- Today we run 21 30hour forecasts with a 220*220*38 grid point domain.
- This UM ensemble finishes in approximately 40 minutes on the met no. IBM supercomputer.

The 20 perturbed UM forecasts together with the control run and verification analysis

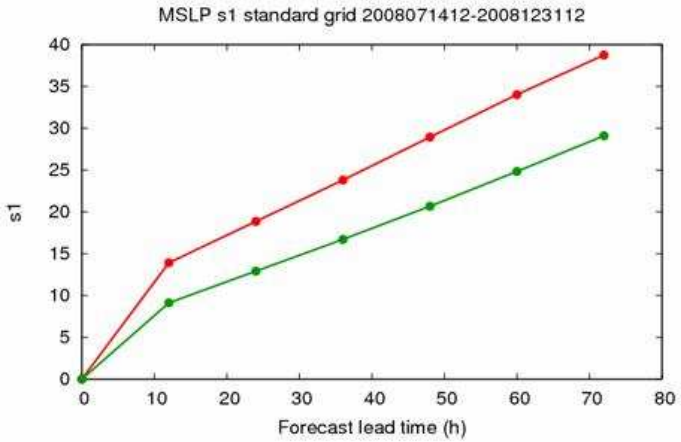


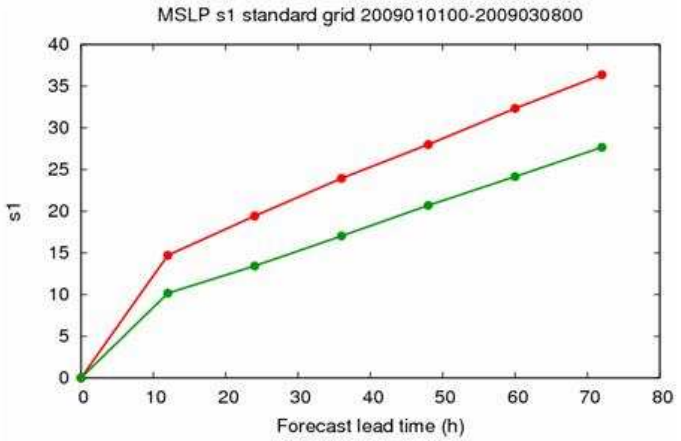
KMA

- A 3km resolution UM configuration covering the whole of the Korean peninsula is being set up.
- It will be nested within the current east-Asian regional model domain (10km resolution).
- The UK 4km model is being used as a reference for dynamics and physics settings and the 1.5km configuration is also being used as a guide.
- The convection parameterisation scheme is to be turned off in KMA's 3km model.
- Work is currently focusing on numerical instabilities which cause failures in the 3km model at early lead times.

ACCESS (Australian Community Climate and Earth System Simulator)

- ACCESS-G and ACCESS-R went operational on 01st September 2009.
- S1 PMSL skill score for ACCESS-R over the Australian region shows superior performance to the LAPS system in both Winter and Summer.

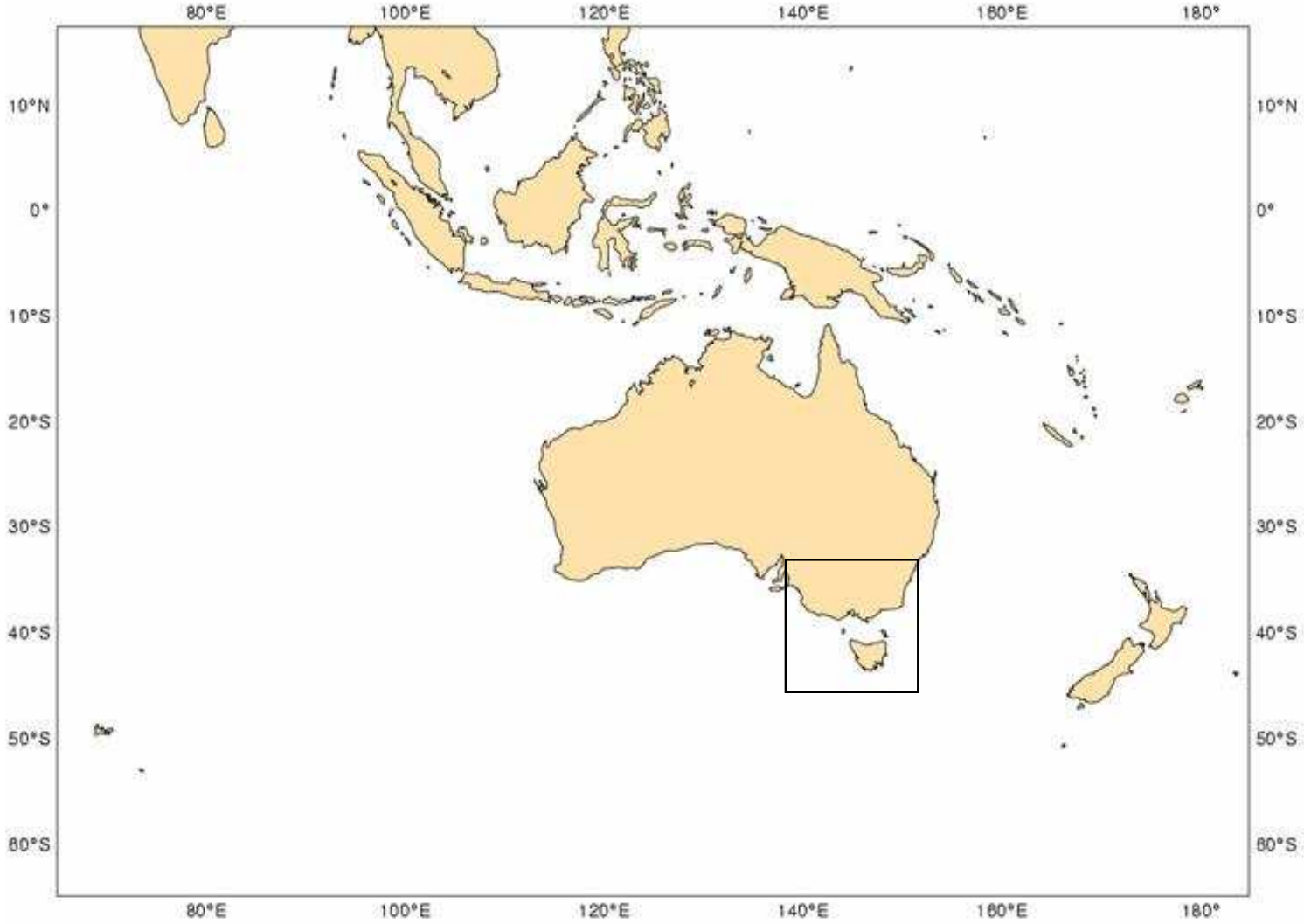




ACCESS-R

LAPS

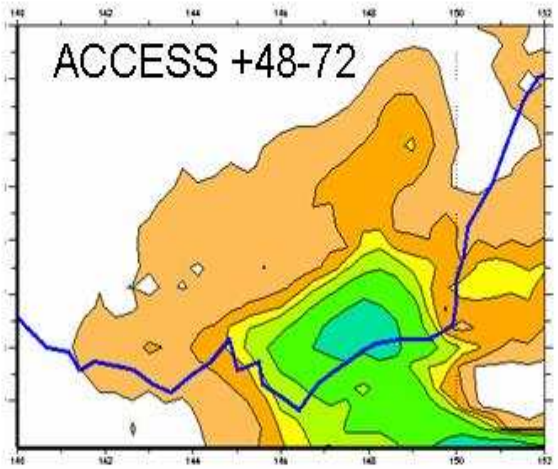
Regional (37.5km resolution) and high resolution (4km resolution) domains

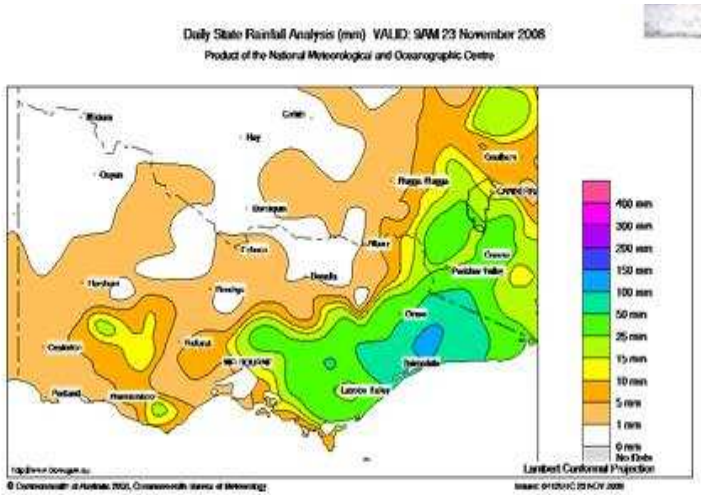


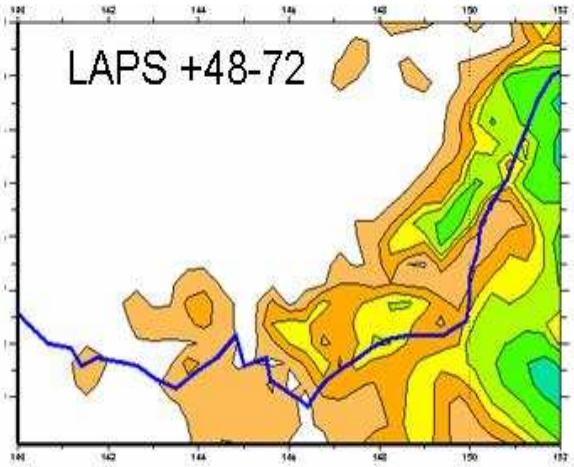
East coast low on 22/11/2008

- A deep low pressure centre formed off the southern New South Wales coast on the morning of 22nd November.
- This east coast low advected warm moist air from the Tasman Sea south around to eastern Victoria and the resultant heavy rainfall produced flooding throughout the East Gippsland region.
- The event was relatively poorly forecast by the legacy LAPS system at T+72.
- The ACCESS-R T+72 forecast was much better. The development of the Bass Strait low was predicted well and the there was a high rainfall accumulation over Gippsland.
- This is consistent with experience to date, that ACCESS-R forecasts extra-tropical cyclogenesis events particularly well

48-72h precipitation forecasts valid for 00 UTC 22/11/08 from ACCESS-R (top left), LAPS (bottom left), and the verifying rainfall analysis (top right)







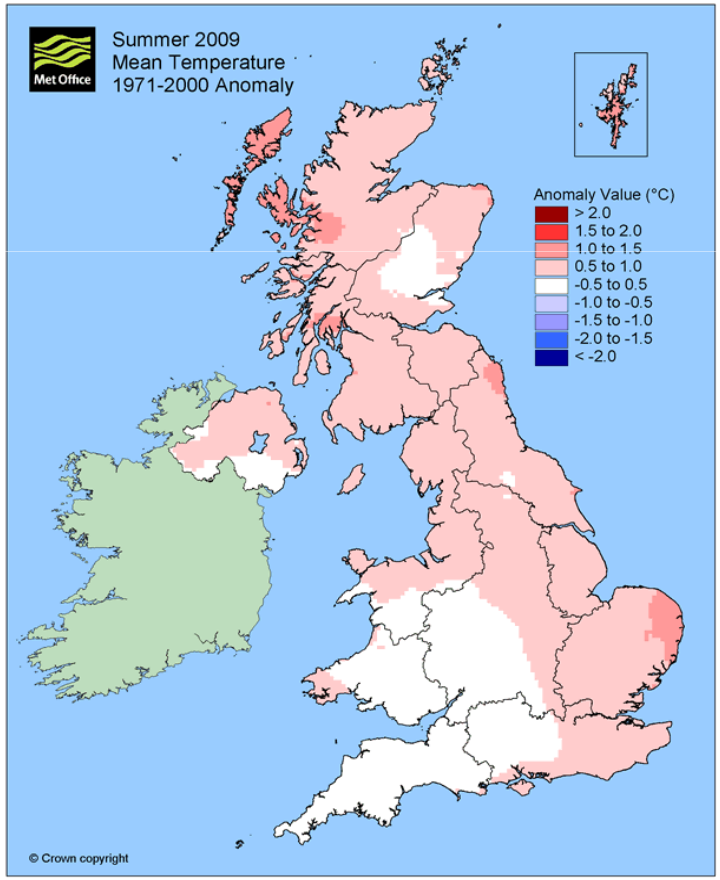
Met Office news

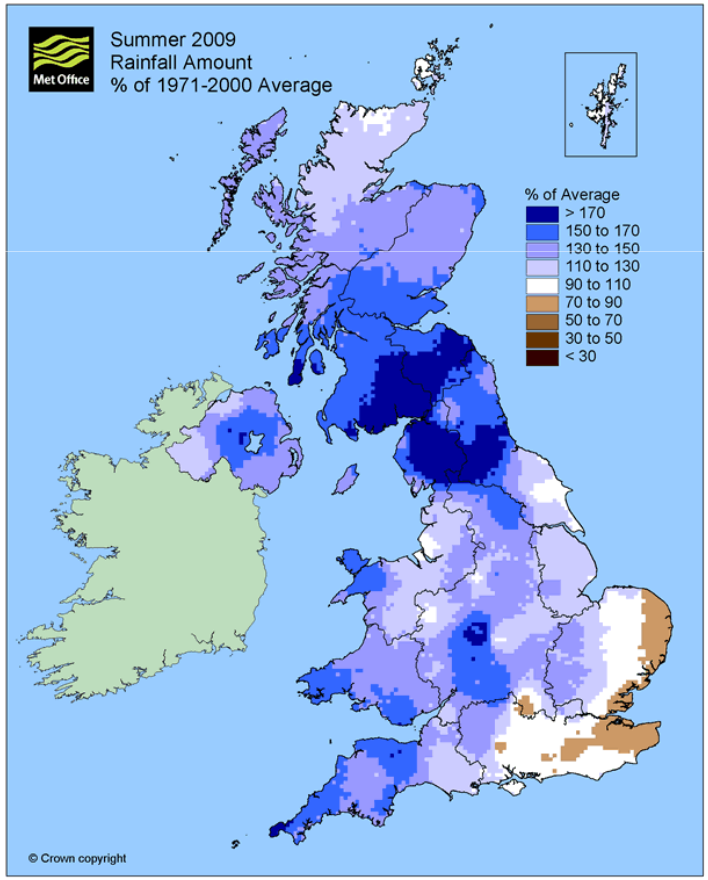
U.K Climate service vision

- Aim to produce a weather and climate service that transcends the artificial boundaries between weather forecasting and climate prediction.
- Seamless prediction system from weekly weather to seasonal, interannual, decadal and centennial.
- Integrate the UK climate science community to work towards a common purpose. Growing partnership between Met Office and UK academia.
- NERC - Met Office Joint Climate Research plan launched in March 2009 is specifically aimed at maintaining and strengthening the UK's position in climate science

Summer forecast

- Forecast of a 65% chance of a warmer and drier Summer for the U.K.





Seasonal forecasting

- The GloSea4 seasonal forecasting system uses an N96 L38 version of the Met Office Hadley Centre coupled climate model HadGEM3_AO
- Model uncertainties represented by Random Parameters and SKEB2 schemes (as used in MOGREPS)
- Low skill for European region. Greater skill for temperature than precipitation and greater skill in winter than summer
- Lessons for how we communicate probabilities and deal with the media.

Flood Forecasting Centre

- Joint centre between the Met Office and the Environment Agency opened on 01st April 2009.
- Based in London, the centre issues flood forecasts and advice to the emergency response community in England and Wales.
- River, tidal and coastal flooding as well as extreme rainfall leading to flooding

New Supercomputer

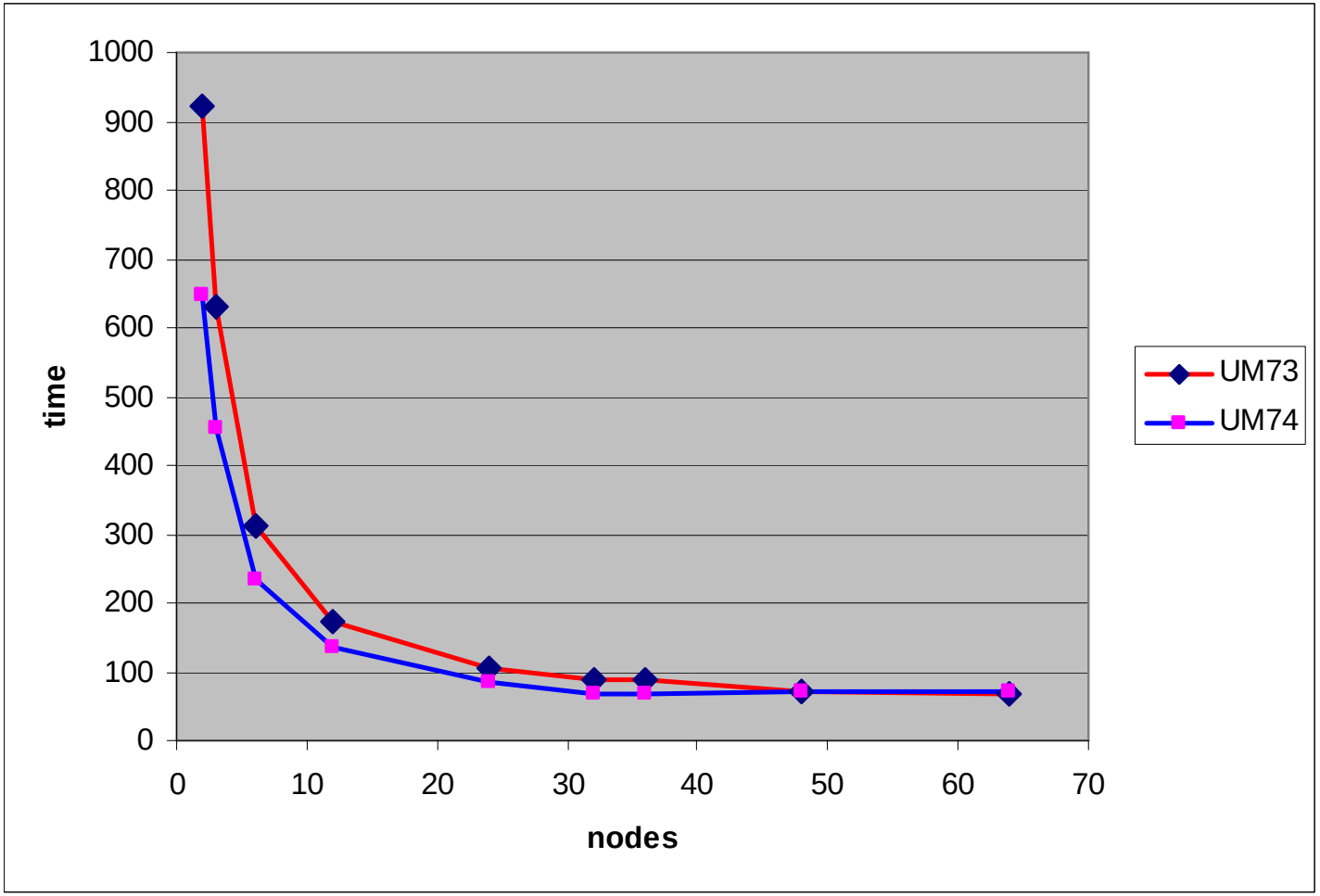
NWP and Climate Prediction

- Met Office has installed a new supercomputer.
- IBM Power 6
- Test Installation started – Oct 08
- Machine accepted – 24th June
- Operational running started – 13th -22nd July
- NEC SX turned off – 3rd August
- IBM has been very reliable
- The IBM system will be upgraded again in 2011.

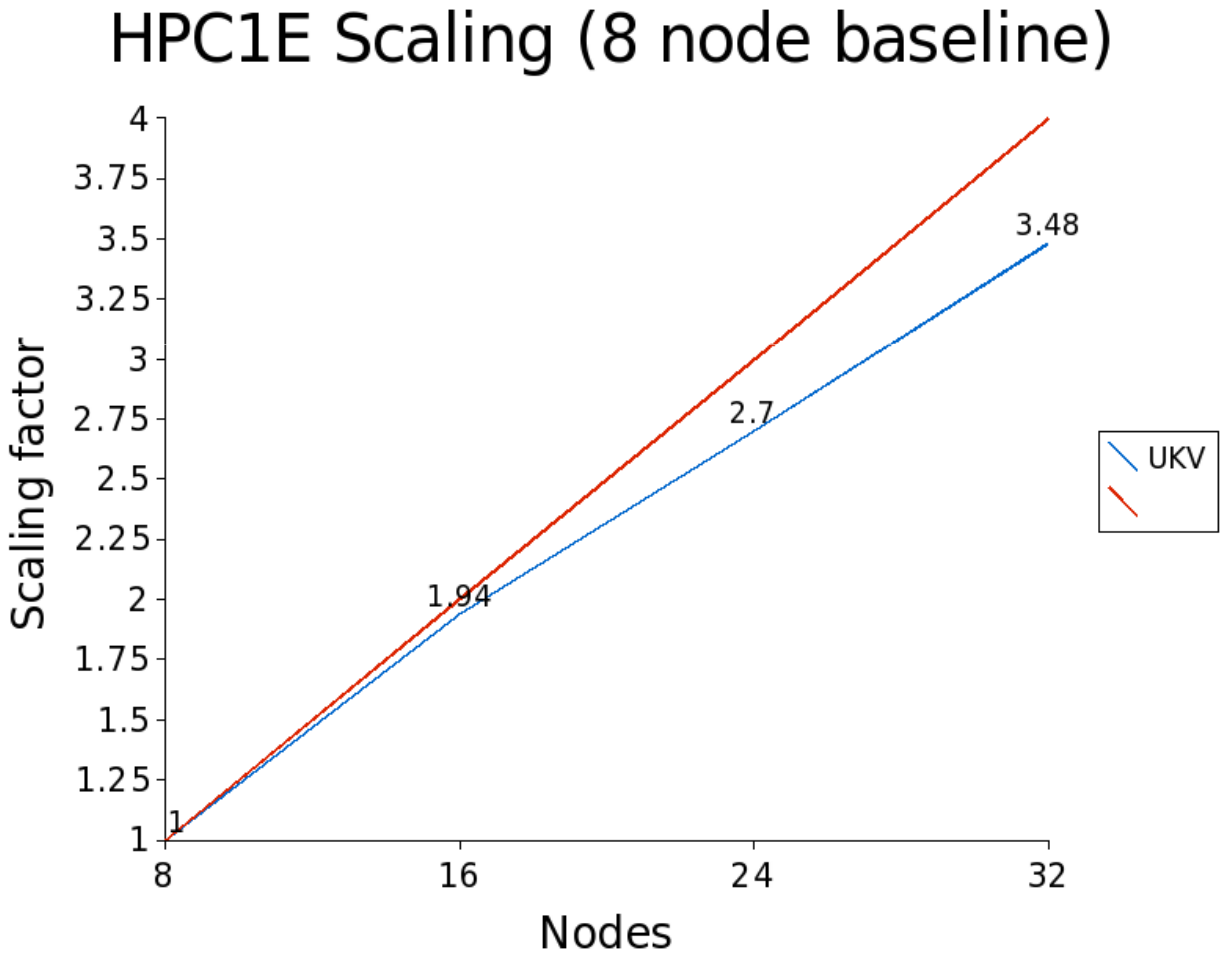
Summary compared with NEC

	NEC SX6/8 3 systems	IBM Power6 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)	241	4.1
Total Peak Performance (TFLOPS)	5.4	141	26.1
Number of CPUs / Cores	472	7712	16.3
Total Memory (TBytes)	2.7	15.1	5.6
Total Disk (TBytes)	36	776	21.5
Disk Performance (GB/s)	~0.15	>1 (24 total per cluster)	~7

Change of run times of UM between code versions



Scaling – UKV model



Model upgrades 25th November 2008

Global model cycle G49
NAE model cycle E21
UK4 model cycle U4.13

Satellite changes

1. Introduction of WindSat (Global)

- Wind Vector retrievals from the WindSat polarimetric radiometer are now assimilated, which has a neutral impact on the NWP index, although in trials it was found to reduce the positioning errors of tropical cyclones.

2. ATOVS data from RARS stations in the Southern Ocean (Global/CAMs)

3. Assimilation of clear sky radiances from SEVIRI (NAE/UK4)

- Small positive impact

4. Addition of GRAS radio occultation data (NAE)

- Catch up with Global

Data Assimilation changes (1)

1. Revised covariances (Global)

- New covariances were calculated by accumulating statistics from T+6 and T+30 forecast differences (valid at the same time), using cycle G45 of global model.
- The covariances were calculated at a resolution of N216 (VAR grid resolution is N108), therefore retaining features and length scales that would otherwise have been lost

2. Improved VAR first guess in update runs (Global/NAE)

- This change reduces the time required to run VAR in update runs by using the main run analysis as the first guess for the minimisation.
- A reduction of up to 40 % in the number of iterations and therefore run time is found with a small improvement in the quality of the update run analysis.

Data Assimilation changes (2)

3. Northern Hemisphere snow analysis (Global)

4. VAR PF GCR efficiency improvements (Global/NAE)

- A major part of the computational costs of running 4D-Var is solving the Helmholtz equation every time step for the PF model
- By not iterating the GCR Helmholtz solver to full convergence in early stages of the minimisation of the penalty function, the run time of 4D-Var is reduced by 20%
- No impact on the quality of the final analysis

5. Assimilation of MOPS cloud data in VAR rather than AC scheme (NAE/UK4)

- Reduces dependency on AC scheme
- Small positive impact on performance

Model changes

1. Land surface changes: CLASSIC Albedos (Global/NAE/UK4)

- This change uses data provided by the Climate and Land-Surface Systems Interaction Centre (CLASSIC).
- Based on MODIS observations this gives a much more accurate specification of albedo of the MOSES vegetated tiles and of the underlying bare soil, particularly in partially vegetated areas.

2. Microphysics changes (Global/NAE/UK4)

- Brown and Francis Ice particle densities give a more realistic ice particle size to density relationship (evidence from radar data).
- The previous relationship gave too much thick ice cloud in the model.
- Droplet settling allows the cloud droplets to fall out slowly (typical velocities ~ 1mm/s) improving fog forecasting.
- 3D microphysics scheme

Model upgrades 30th June 2009

Global model cycle G50
NAE model cycle E22
UK4 model cycle U4.14

Port to IBM supercomputer

- Port of all operational models from NEC to IBM supercomputer
- Withdrawal of On demand 1.5km model and introduction of variable resolution UKV model (no DA - spin up from NAE model)
- For the duration of the parallel suite, we had a 2 member high resolution ensemble (NEC and IBM) for each model !
- Forecast differences after approx one month of parallel running provoked debate as to the level of differences one should expect
- Forecasters were expecting a “null” change…

Planned model upgrades

L70 Global and NAE and introduction of UKV with DA - Autumn 2009

- Upgrade to L70 (Global/NAE)
- The new set of levels provides both enhanced resolution in the troposphere (21 levels in the lowest 3 km) and a higher lid (80km)
- This change combines a physics, dynamics and assimilation package that has been in development over a long period.
- NAE trials show an improvement to cloud cover and a better representation of inversion structures
- Introduction of UKV model with DA.

Provisional Model Upgrade Timetable 2010

- January 2010
  - Global model to 25km
  - Upgrade Global ensemble to N216 (~60km) / L70
  - Upgrade regional ensemble to 18km/L70
  - Replace the stochastic kinetic energy backscatter (SKEB1) and stochastic convective vorticity (SCV) schemes with the SKEB2 scheme (MOGREPS-G).
  - Revised screen T diagnostic
  - New soil ancillaries and van Genuchten soil hydraulics
- Spring 2010
  - Physics upgrade including new PC2 cloud scheme

Questions?