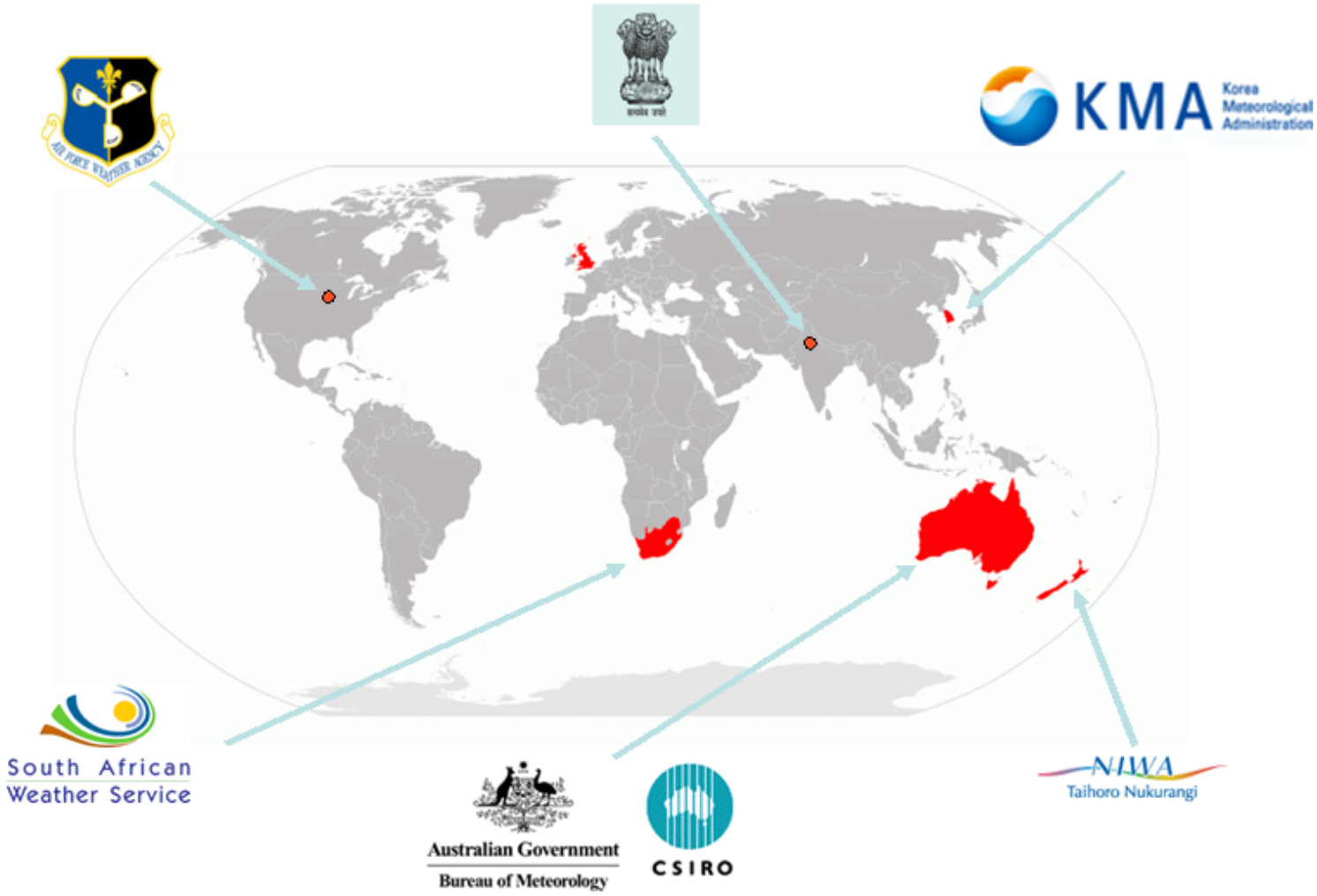
Consortia Presentation

Mike Bush
Stuart Bell, Jorge Bornemann, Kirsty Hanley, Amanda Lindsay, Tom Melvin, Sean Milton, George Pankiewicz, David Price, Simon Vosper and Clive Wilson

36th EWGLAM and 21st SRNWP Annual Meeting 2014

29th September - 02nd October 2014 Offenbach, Germany

International UM partnership: Operational users 2014



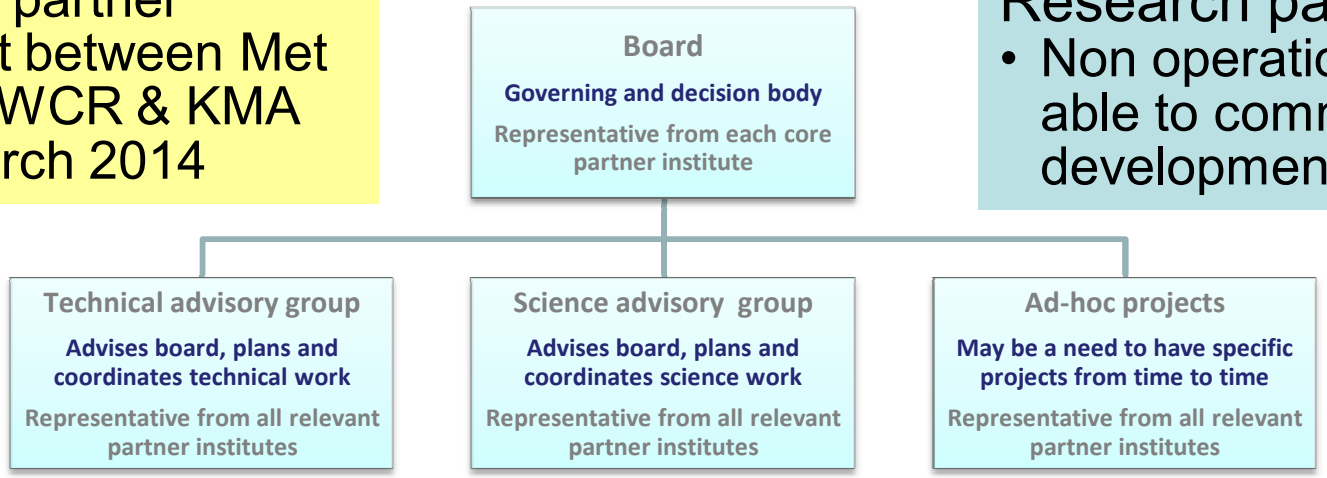
Principles of UM partnerships

The more a UM partner can invest and support itself, the more a partner can influence strategic direction of model development and own the UM

Core partners:
- Commit 4FTE to joint development
- Locally able to run and support operations & upgrades and fund central support
- Member of board sets direction of joint work, controls funds & influences decisions on model development
- Initial core partner agreement between Met Office, CAWCR & KMA signed March 2014

Associate partners:
- Some commitment to joint development
- Locally able to run and support operations & upgrades and fund central support
- Feed views to the board

Research partners:
- Non operational users able to commit to joint development



Unified Model User Workshop
16-20 June 2014

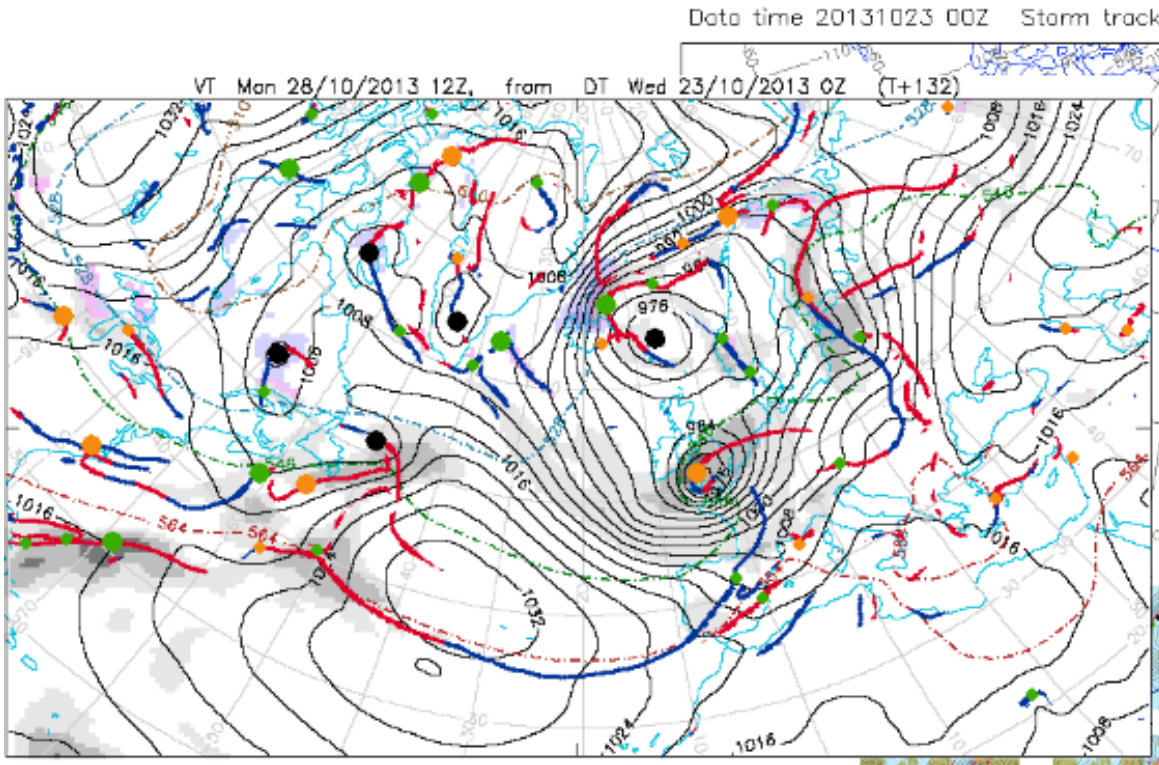
New Met Office CE

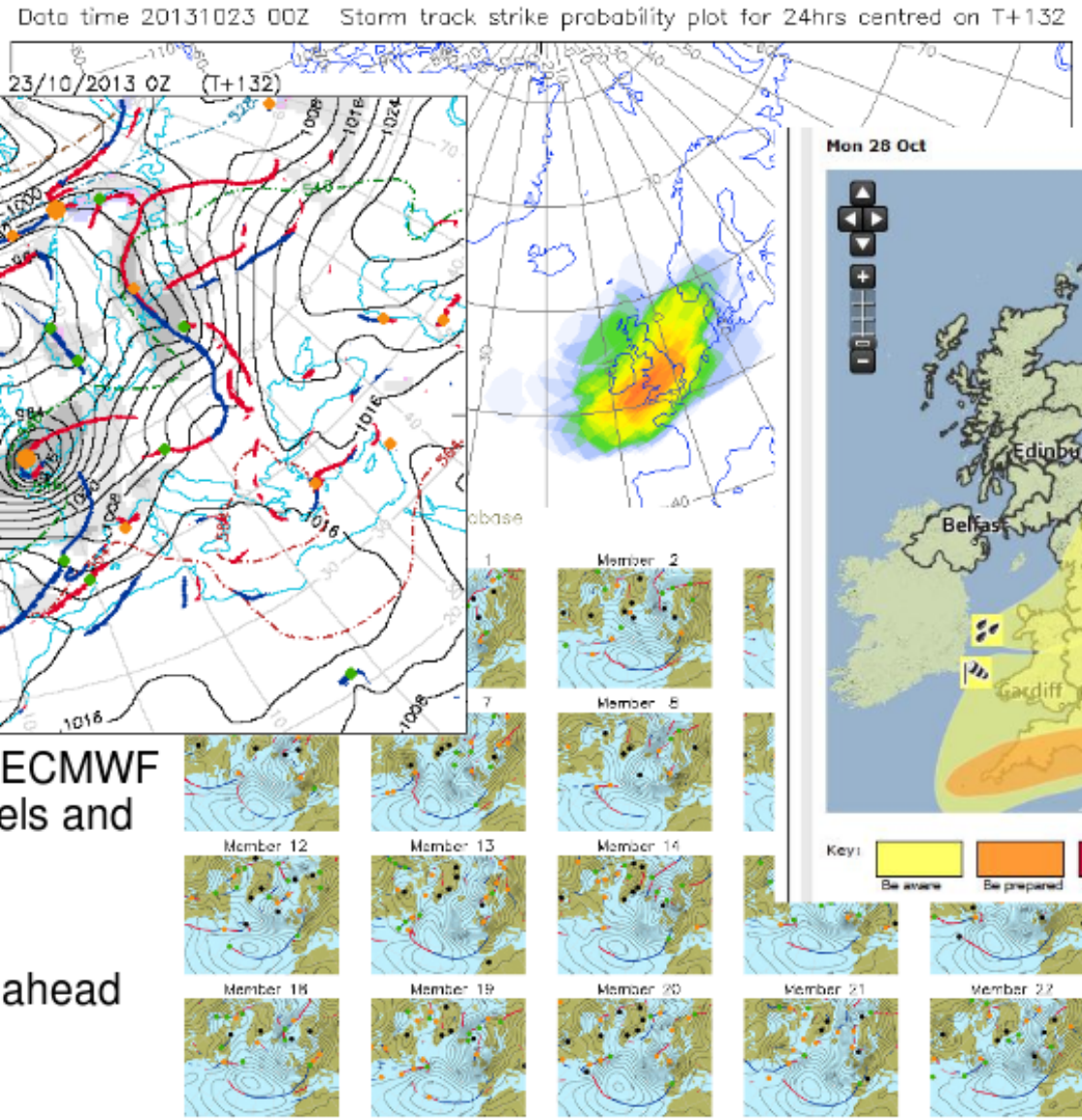
- Rob Varley is the new Met Office Chief Executive having taken over from John Hirst on 01/09/2014
- He has worked for the Met Office for more than 30 years, starting his career as a weather forecaster.
- It is the first time someone from inside the organisation has been promoted to the top job

St Jude windstorm

Example case for 7-day MOGREPS-G

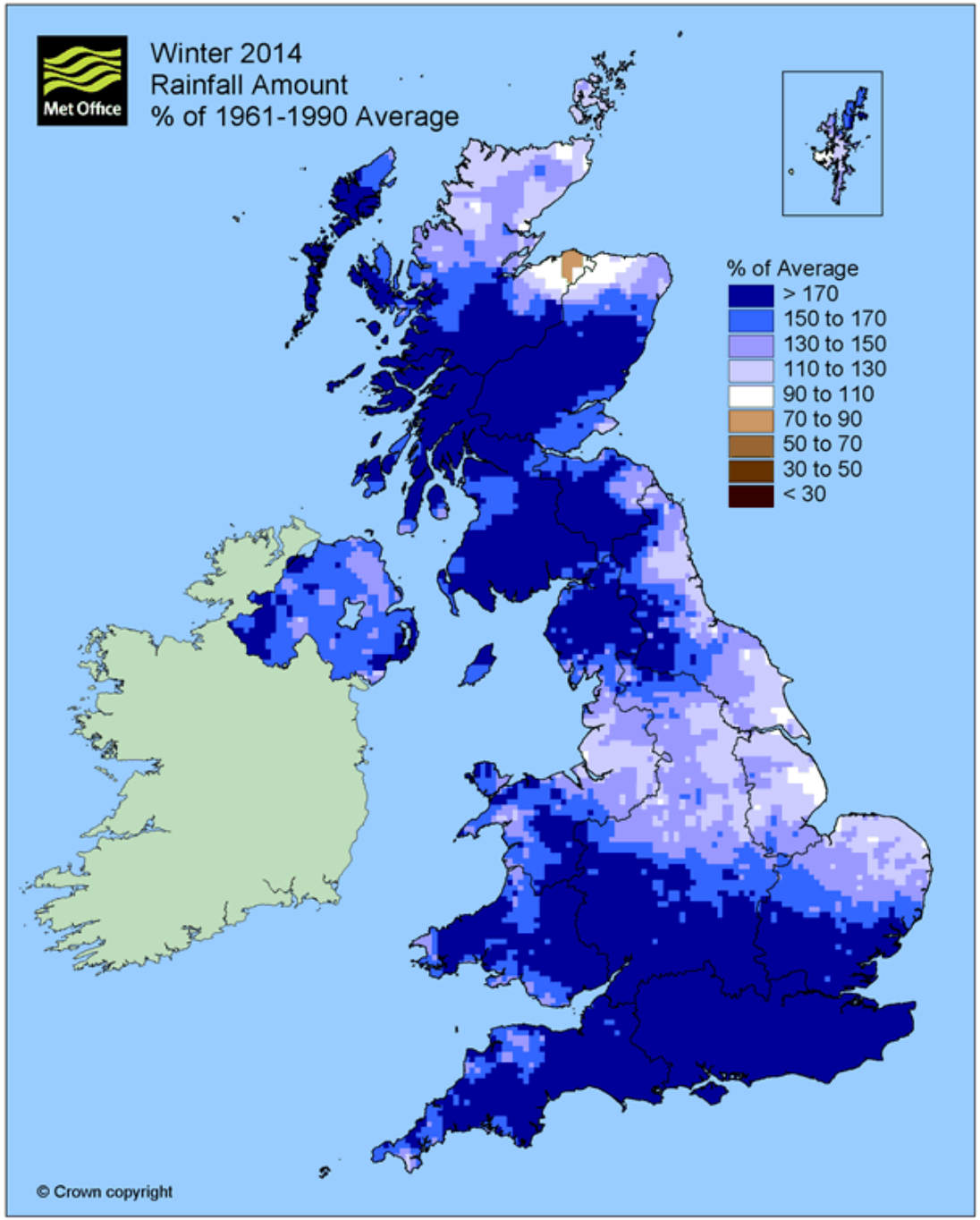
5.5 day forecast for severe storm Mon 28 Oct 2013
Note: risk of this storm first flagged by forecasters Mon 16th

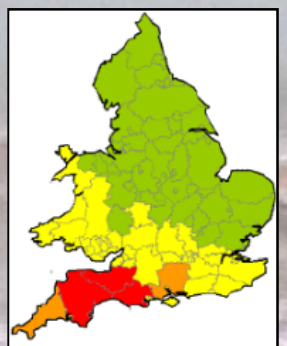




- Forecasters first flagged from ECMWF deterministic but multiple models and ensembles vital in reinforcing confidence.
- Amber warning issued 4 days ahead on morning of Thu 24th

Winter 2013/14: exceptionally wet!





10:30 - 23:59hrs
Wednesday
05 February 2014

Dawlish
Devon

FLOODFORECASTINGCENTRE

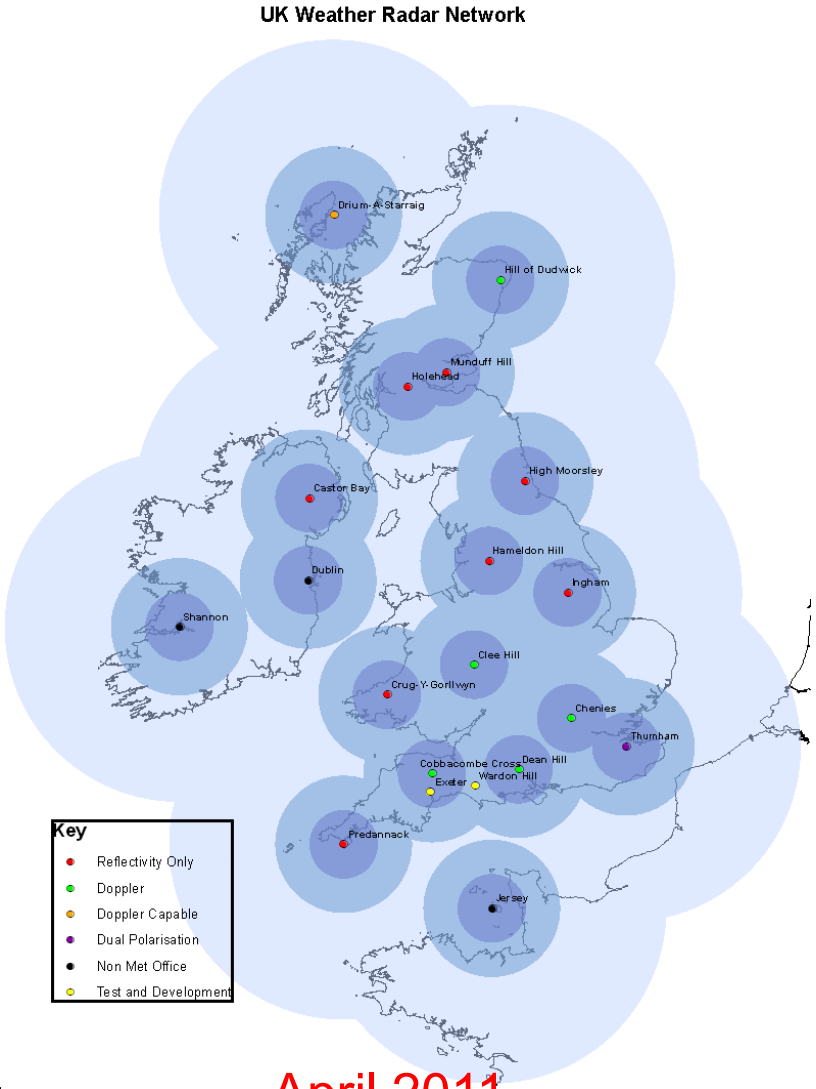
a working partnership between Environment Agency | Met Office

Parallel Suite changes in the last year

- **PS33 (04/02/14)**
- Major technical change for the Operational Suite
  - Moving away from controlling and running the models using the Suite Control System (SCS), replacing it with a new system called ‘Rose’.
- **PS34 (15/07/14)**
- Major upgrade to the Global model
  - ENDGame dynamics (giving improved accuracy, robustness and efficiency).
  - Resolution increase from 25km to 17km
  - Important changes to the model physics, data assimilation and use of satellite data

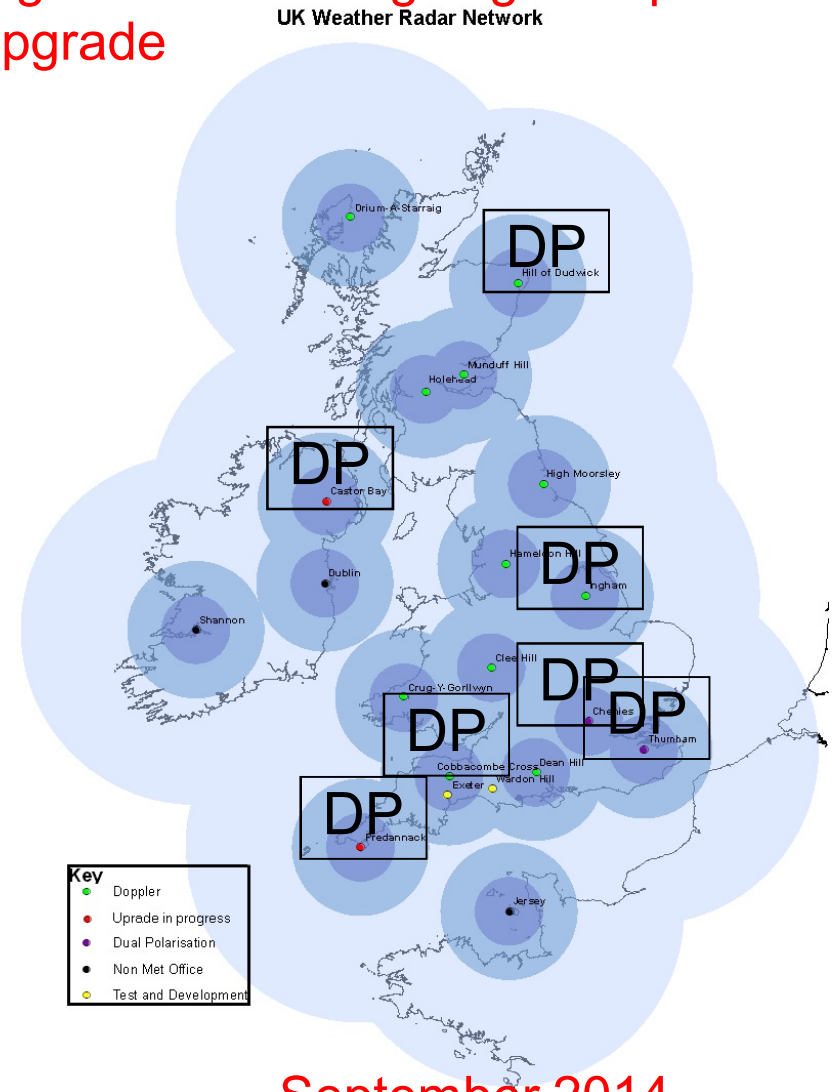
Weather radar renewal project (2011- 2015)

15 Operational Radar:
6 Doppler Radar
1 Dual Polarisation Radar



April 2011

15 Operational Radar:
15 Doppler Radar
7 Dual polarisation (DP) Radar
Ingham still undergoing dual polarisation upgrade



September 2014

Plans for the next year

- **PS35 (Winter 2014/15)**
  - ENDGame dynamical core
  - Blended Boundary layer (scale aware)
  - Warm rain microphysics (scale aware)
  - New Murk sources
  - Geocloud assimilation changes
- **PS36 (Summer 2015)**
  - Porting to the new HPC (1a system)
  - Extension to UKV domain
- **PS37 (Autumn 2015)**
  - UKV Hourly 4D-VAR

See talk by Mike on Tuesday!

See talk by Bruce on Wednesday!

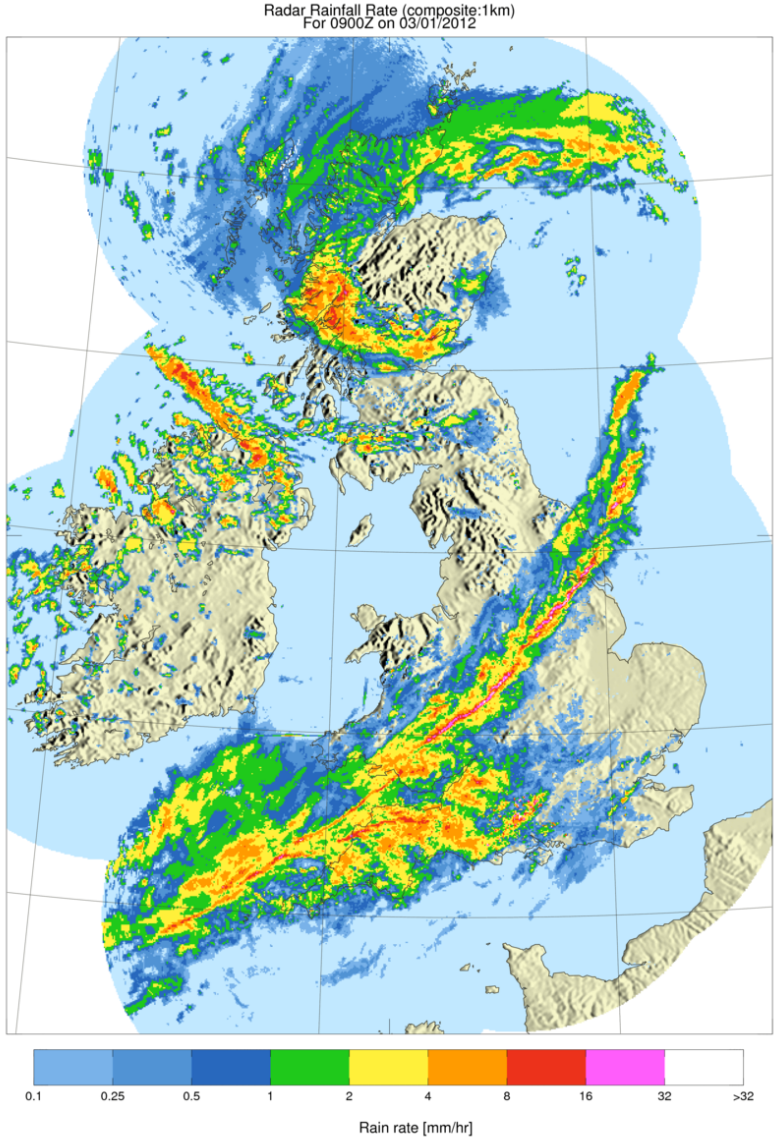
UKV ENDGame Configuration

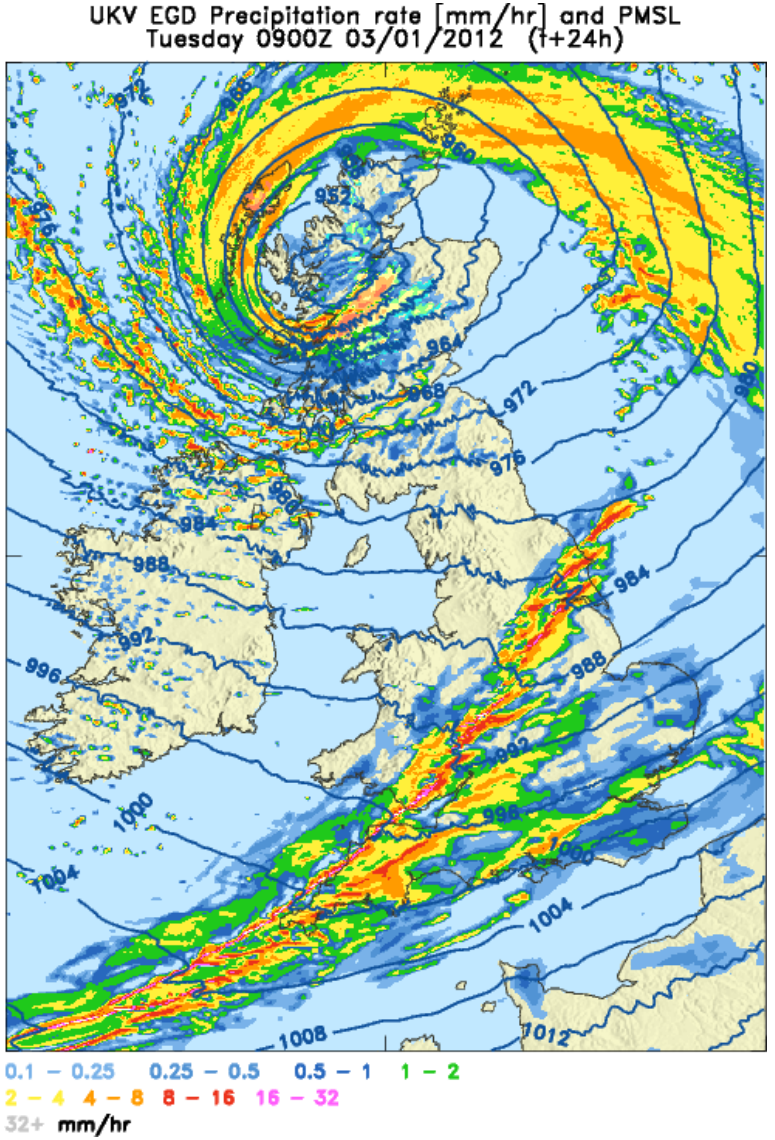
Improved stability/accuracy allows longer timestep.

	New Dynamics	ENDGame
Timestep	50 seconds	60 seconds
Short Timestep	30 seconds	45 seconds
Halo size	5	6

Case Studies (Winter Storm)

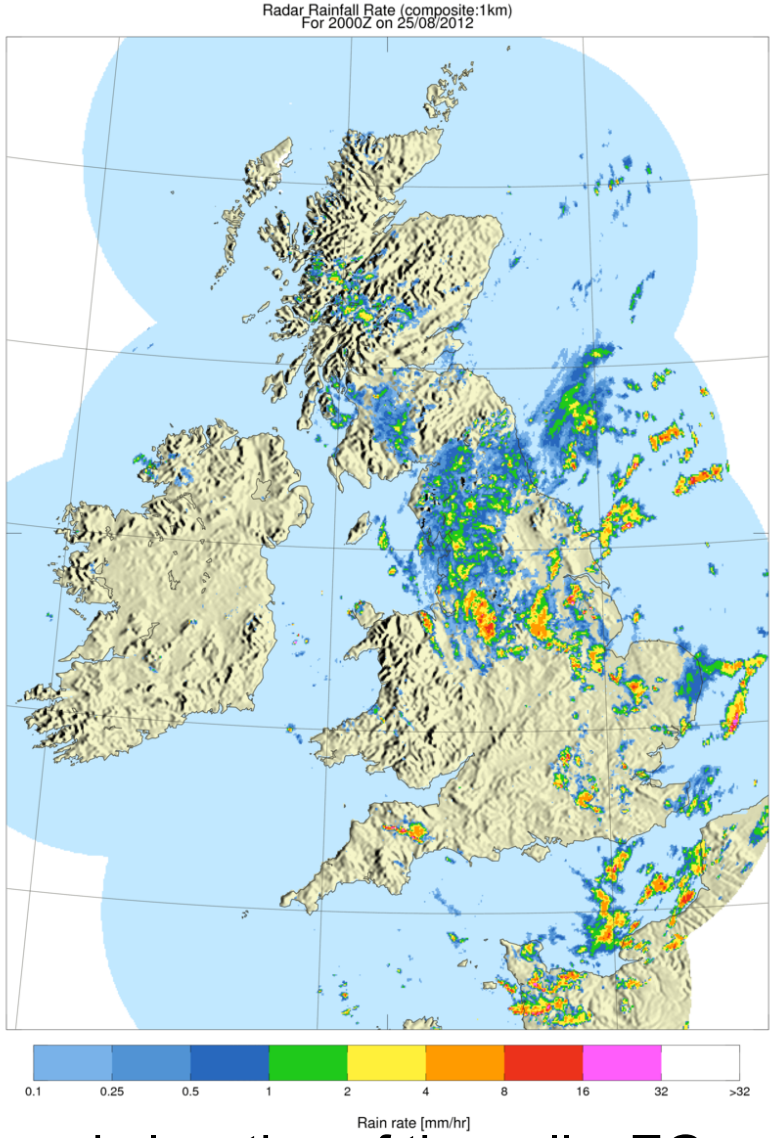
ENDGame

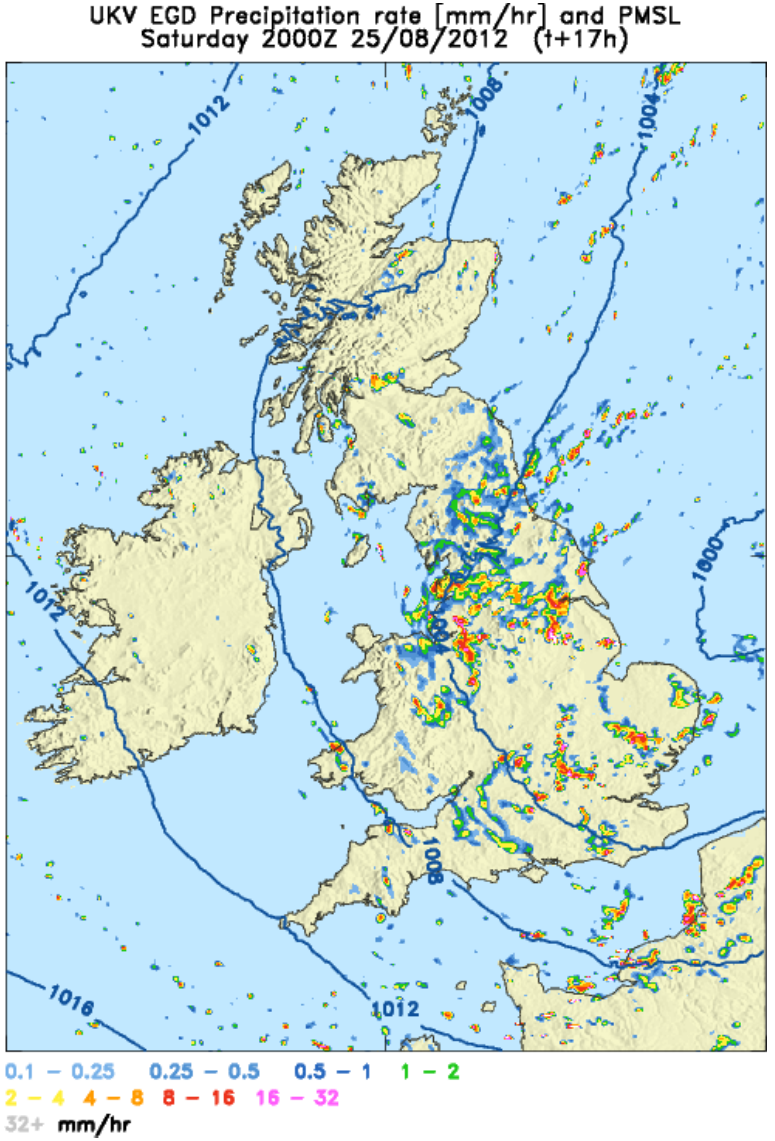




Case Studies (Summer convection)

ENDGame



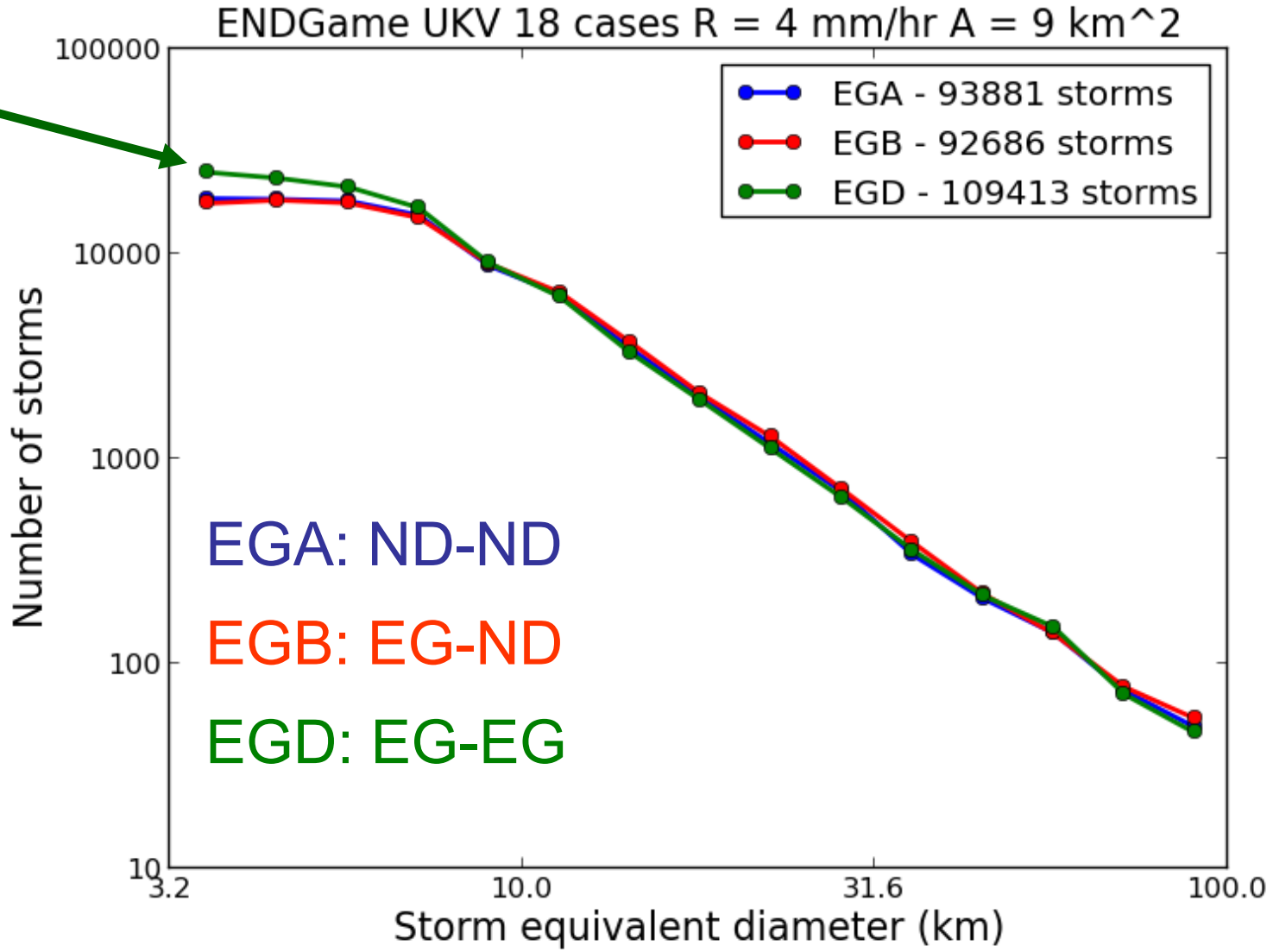


Differences in location of the cells. EG seems to have a larger number of small cells

Case Studies (Cell size stats)

ENDGame produces more small-size cells

Based on previous studies of model characteristics this indicates that ENDGame is closer to radar statistics.

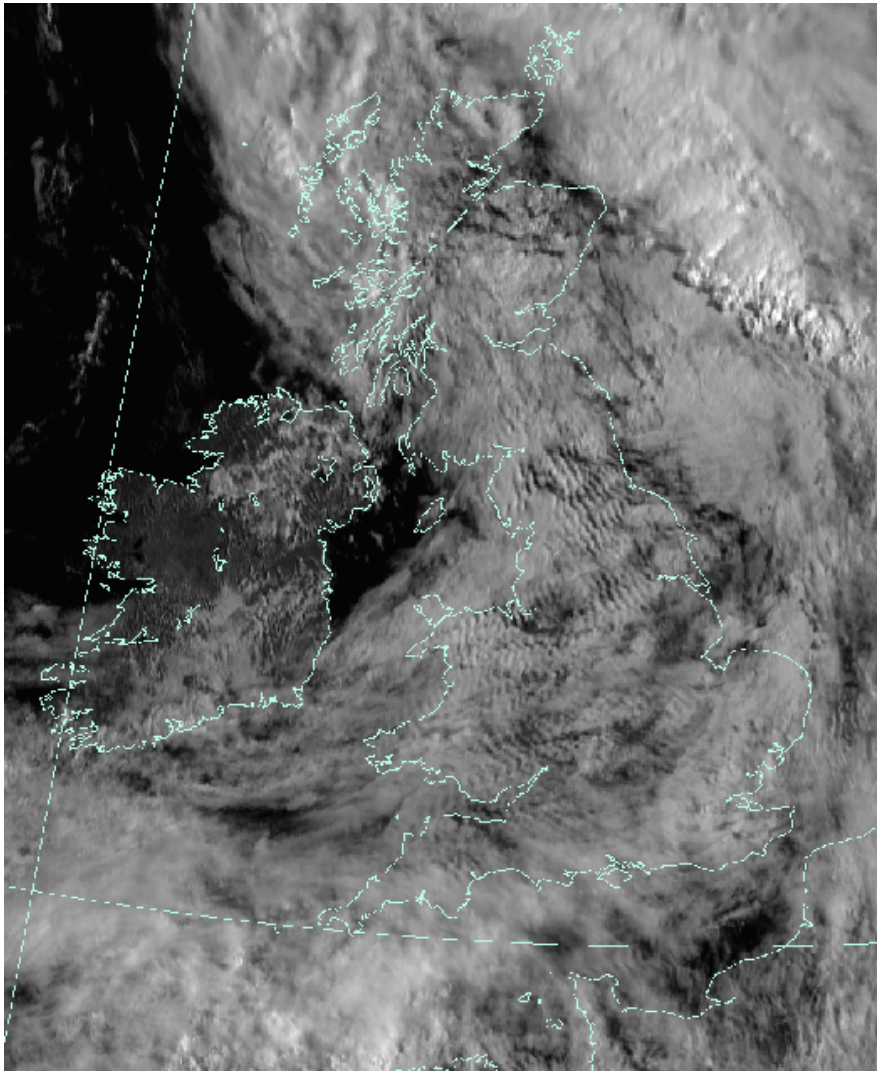


Courtesy: Kirsty Hanley

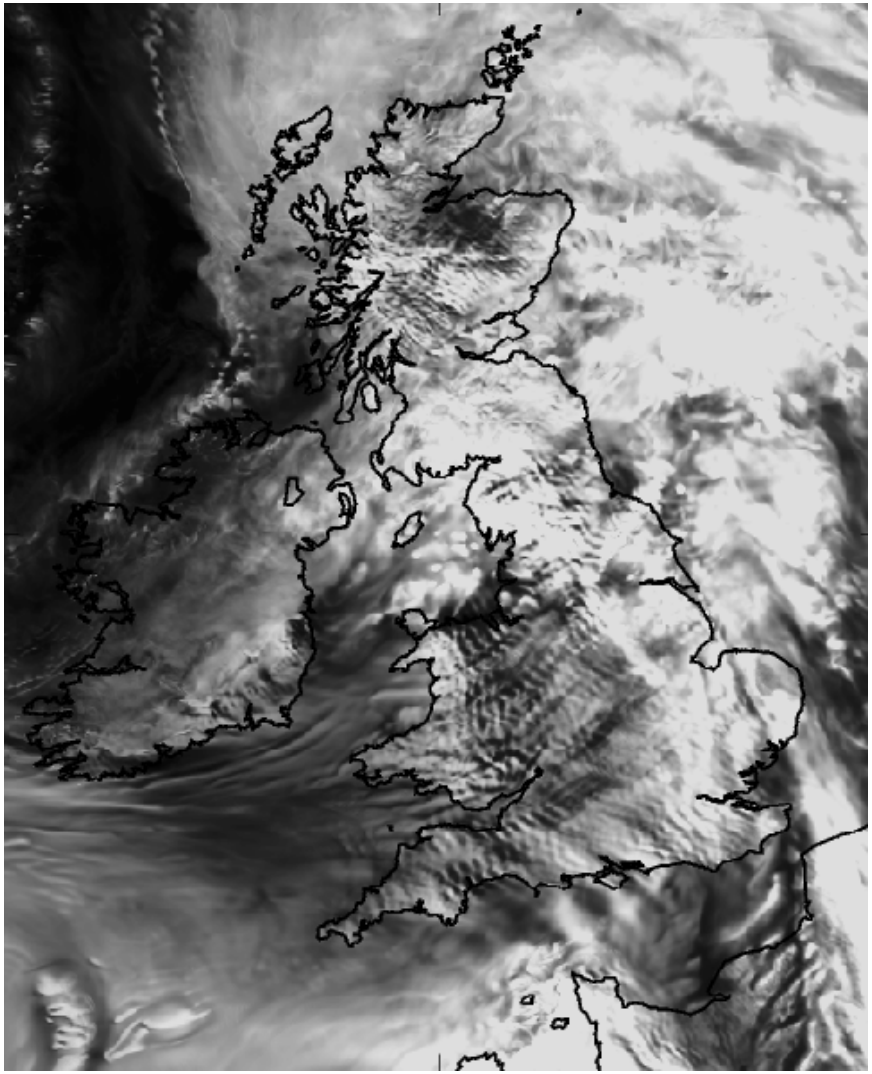
Case Studies (Lee Waves)

Standing orographic gravity waves that were wiped out in New Dynamics but are sustained with ENDGame

Satellite Visible



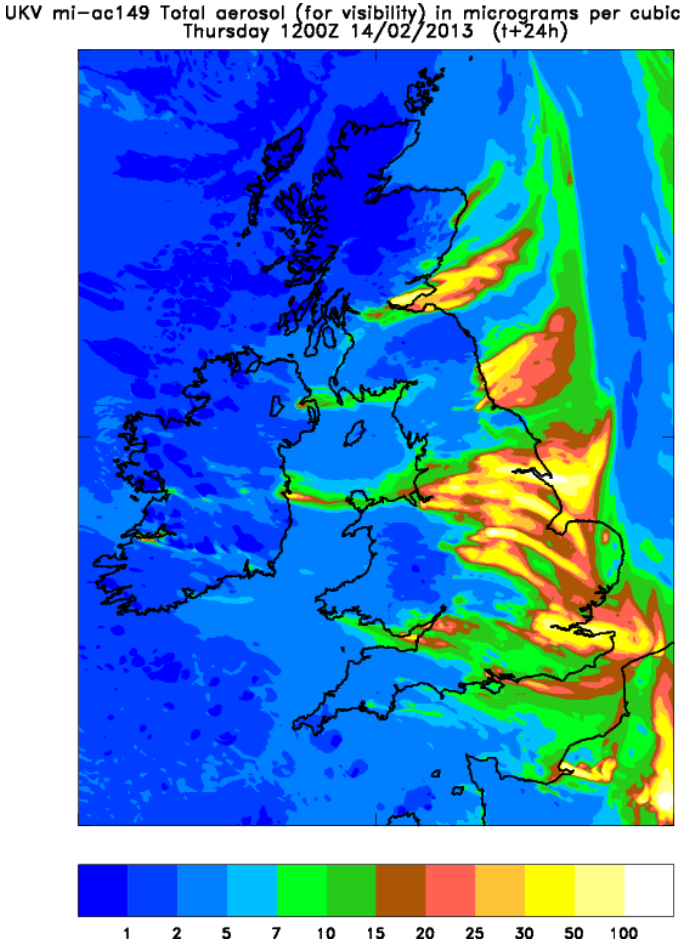
ENDGame



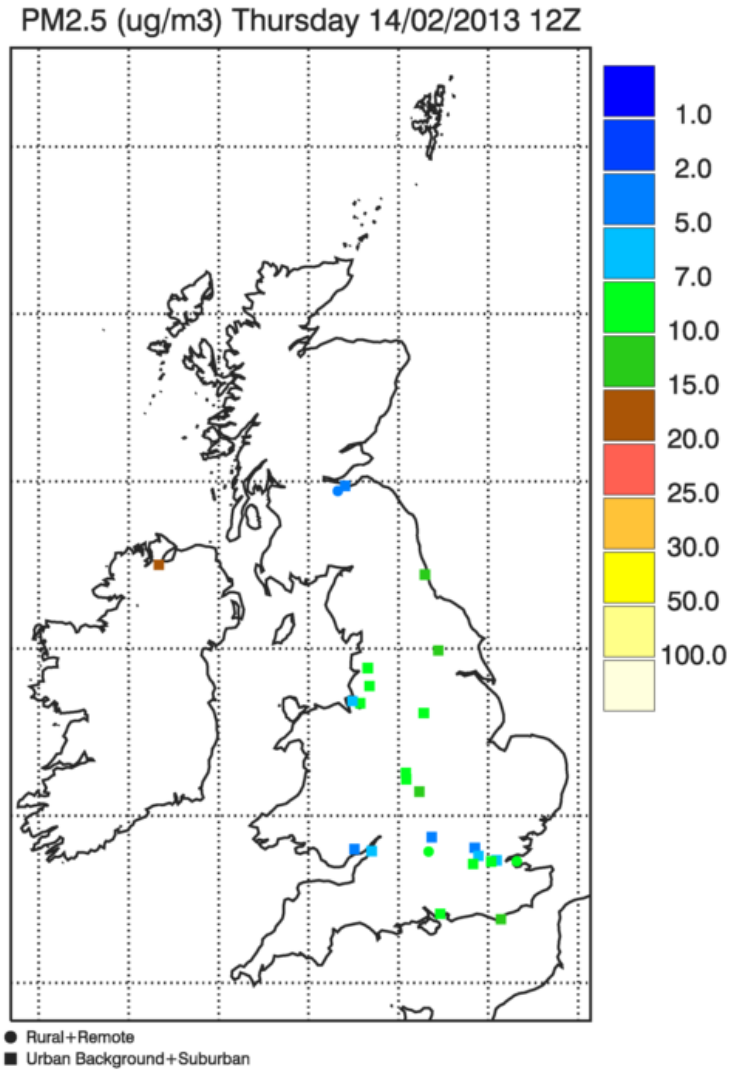
Simon Vosper

DA trials: Impact of new Murk sources

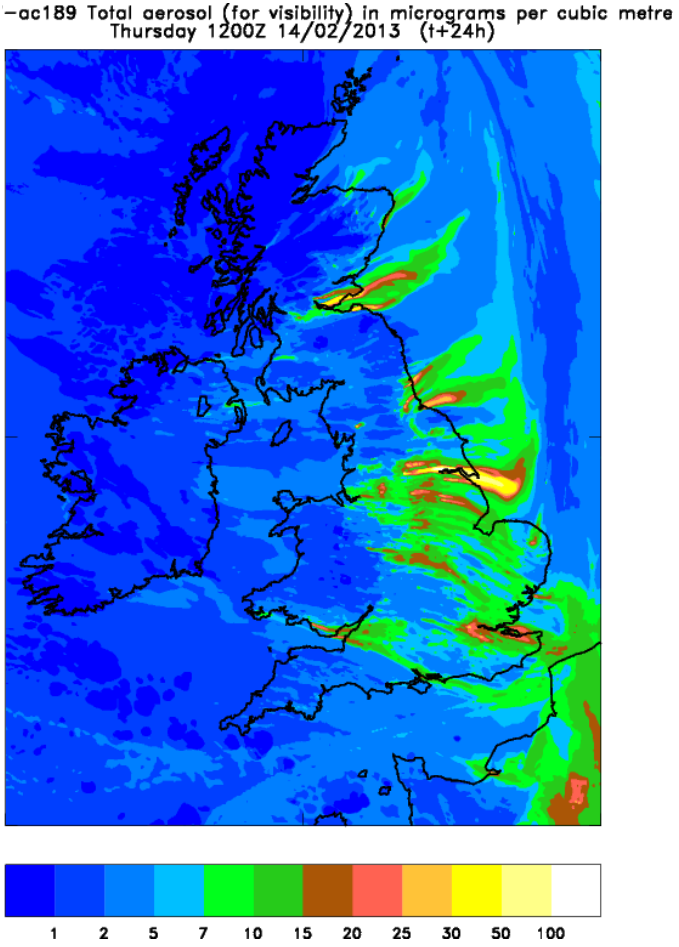
Old Murk sources



PM2.5 obs

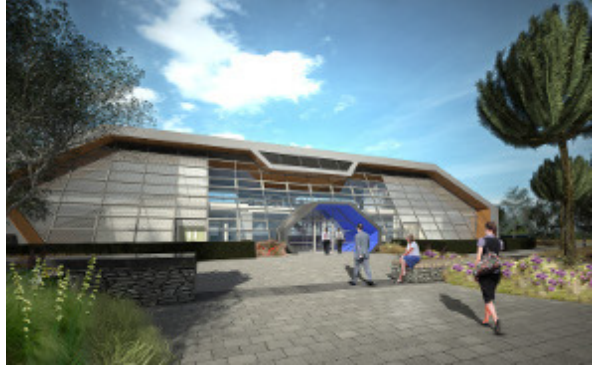


New Murk sources



Courtesy: Mike Bush

New Supercomputer

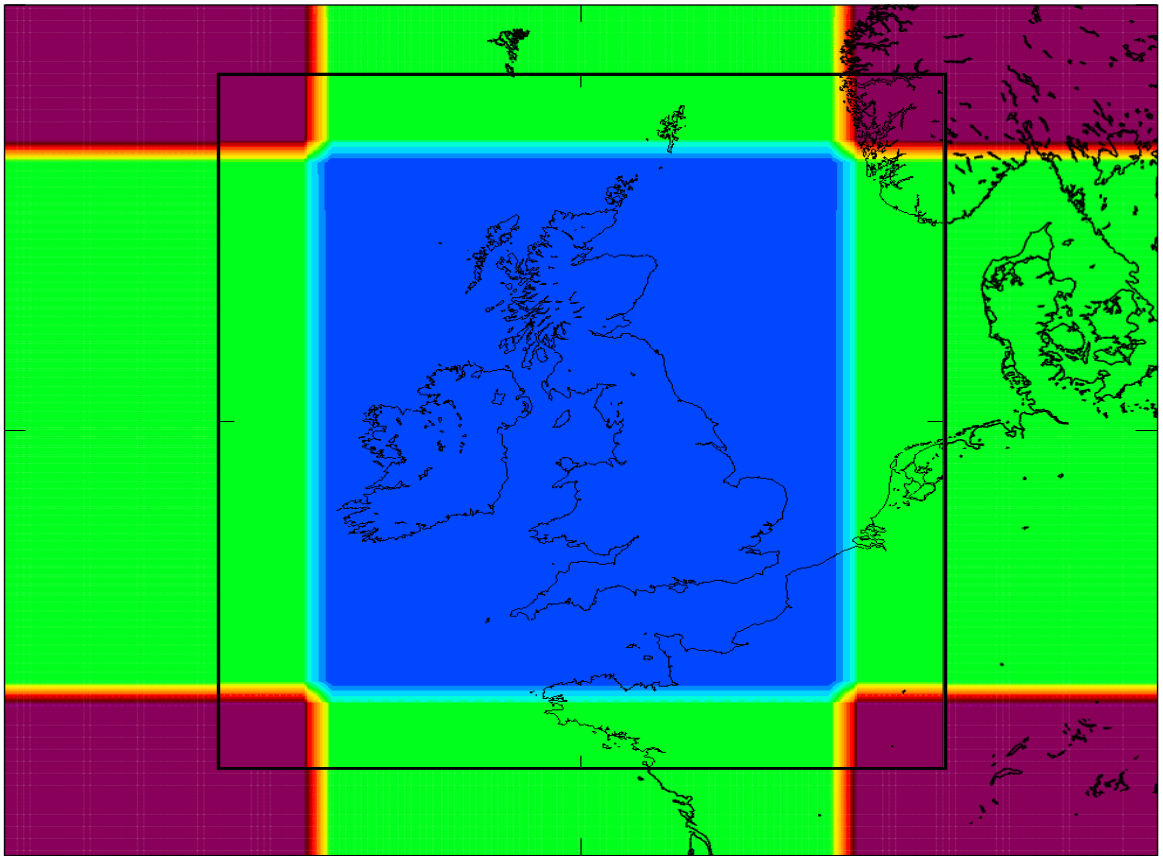


- Official announcement expected end of September
- 3 phase process:
- 1a) Install enough capacity to retire IBM Power 7's (April-May 2015)
- 1b) Expand these systems to the max power we have on site (October 2015 - Feb 2016)
- 1c) Additional machine and IT Hall facility to be installed off site (Feb 2017)
- Currently we are finalising funding and waiting for ministerial approval - then contracts can be signed with the winning bidder

Expected Performance/System size

System	Capacity *(Volume –V)*	Nodes
IBM P7 *(2011 twin clusters)*	0.82	864
IBM P7 *(2014 twin clusters)* *- Baseline for Performance Measurement*	1	1056
IBM P7 *(All 3 clusters)*	1.15	1216
Phase 1a	1	1088
Development /MONSooN	0.11	120
Phase 1b	5.21	4992
Phase 1c	9.63	6060

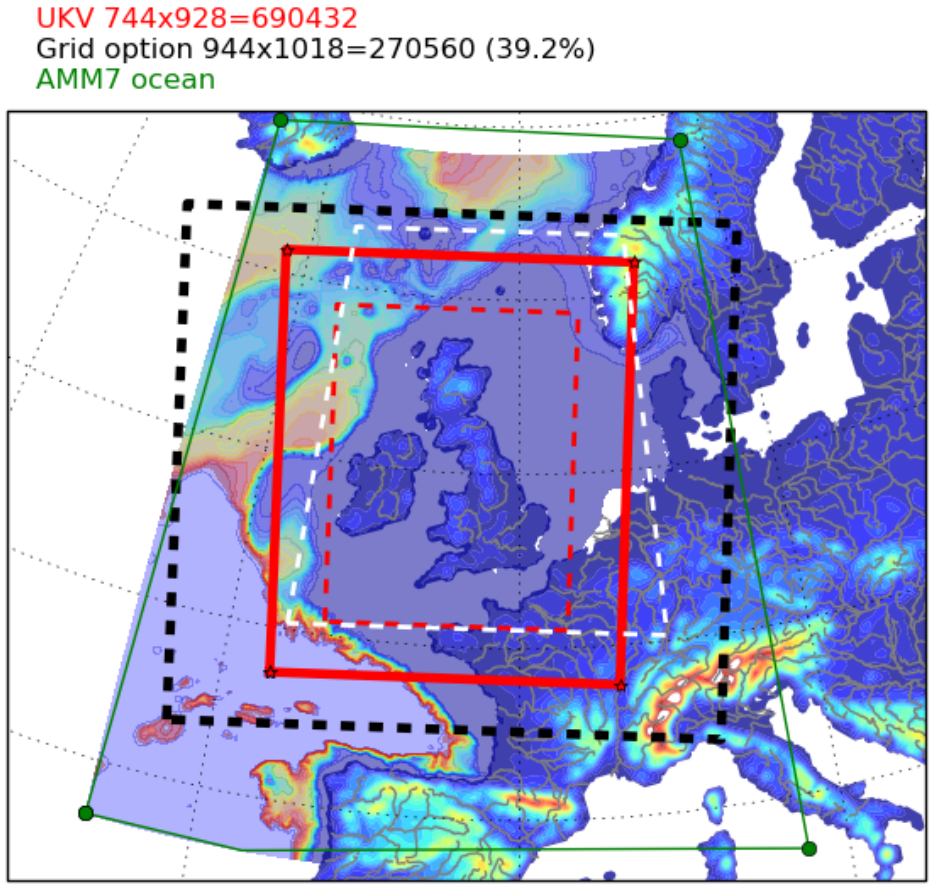
Extension of UKV domain



- Same inner fixed resolution area as UKV. 95% bigger with 38% more grid-boxes
- Larger area will improve spin up of showers
- Improved Spanish plumes with severe convection

UK Environmental Prediction

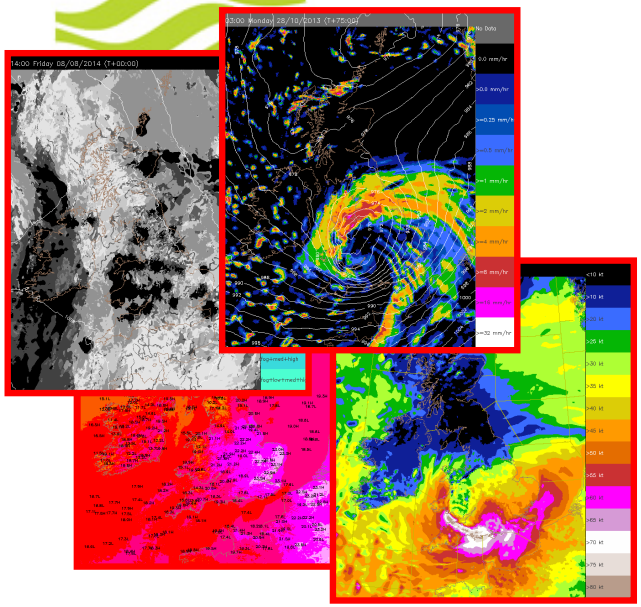
Met Office | Centre for Ecology & Hydrology, Natural Environment Research Council | National Oceanography Centre, Natural Environment Research Council | PML Plymouth Marine Laboratory



- Plan to develop the first high resolution probabilistic environmental prediction system for the UK at 1km scale

Towards a UK coupled model

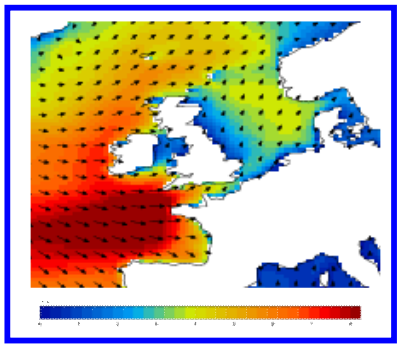
ATMOSPHERE



Wind

Wave height, Period, Surface stress

WAVES



Wind, Pressure, Temperature, Radiation, Surface fluxes

SST

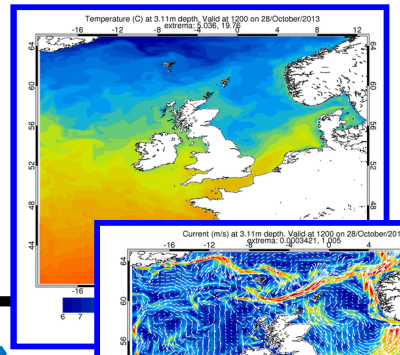
Wave height, Surface stress, Bottom stress, Dissipation

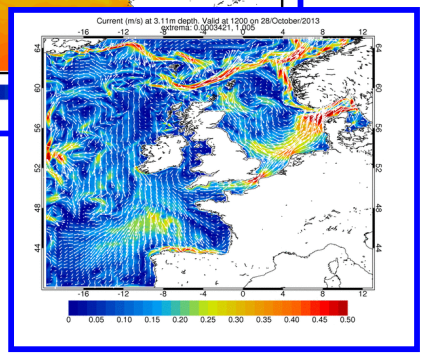
Currents, height, Roughness

Bottom stress

Surface fluxes

Radiation, Temp, Precip, Evap





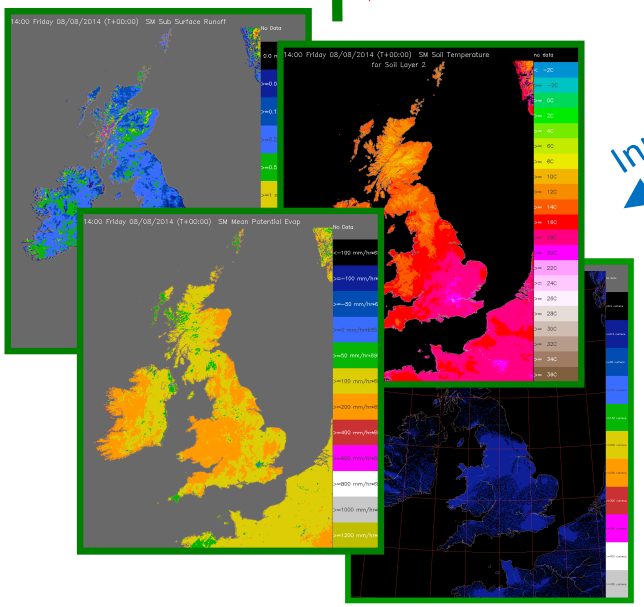
Inundation

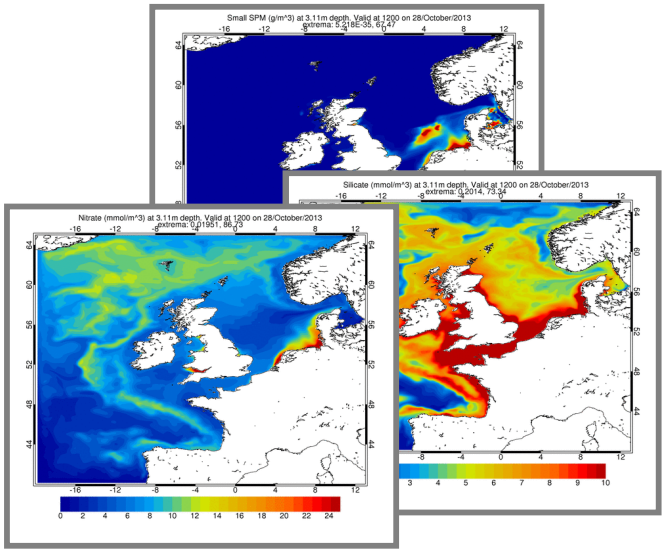
Freshwater discharge

OCEAN

Currents

Bottom stress





Freshwater, Nutrients, Temperature

LAND SURFACE

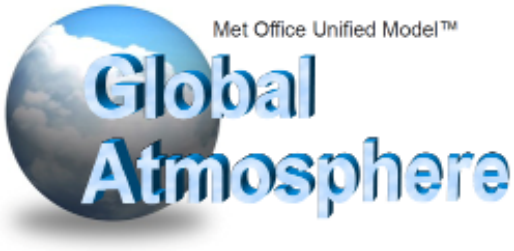
SEDIMENTS/BIOGEOCHEM

Horizontal Resolution - NWP

Current Future

Benefits

Deterministic Global NWP -2016+



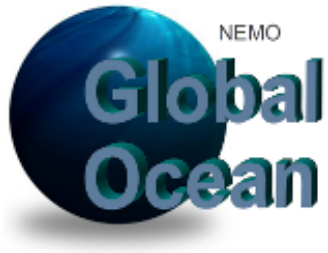
17km (N768) (60 nh)

12km (N1024) or 10km (N1280)?

Cost – x5 (300 nh)

- Orographic forcing
- Detail in land-surface
- Deeper cyclones
- surface weather

FOAM – 2016+



ORCA 1/4 degree ocean

ORCA 12th degree ocean

Cost – x50 (175 nh)?

- Eddy resolving
- Improved dyn transport
- better air-sea interaction – wind stress-SST

MOGREPS:G

N400 (33km) 24 member ensemble

N512 or N640 - 18 mem. every 6hrs

Cost - ??

- Improved spread?
- Capturing extremes

UM Vertical Levels

2014-15 Research project to evaluate increased vertical resolution across timescales

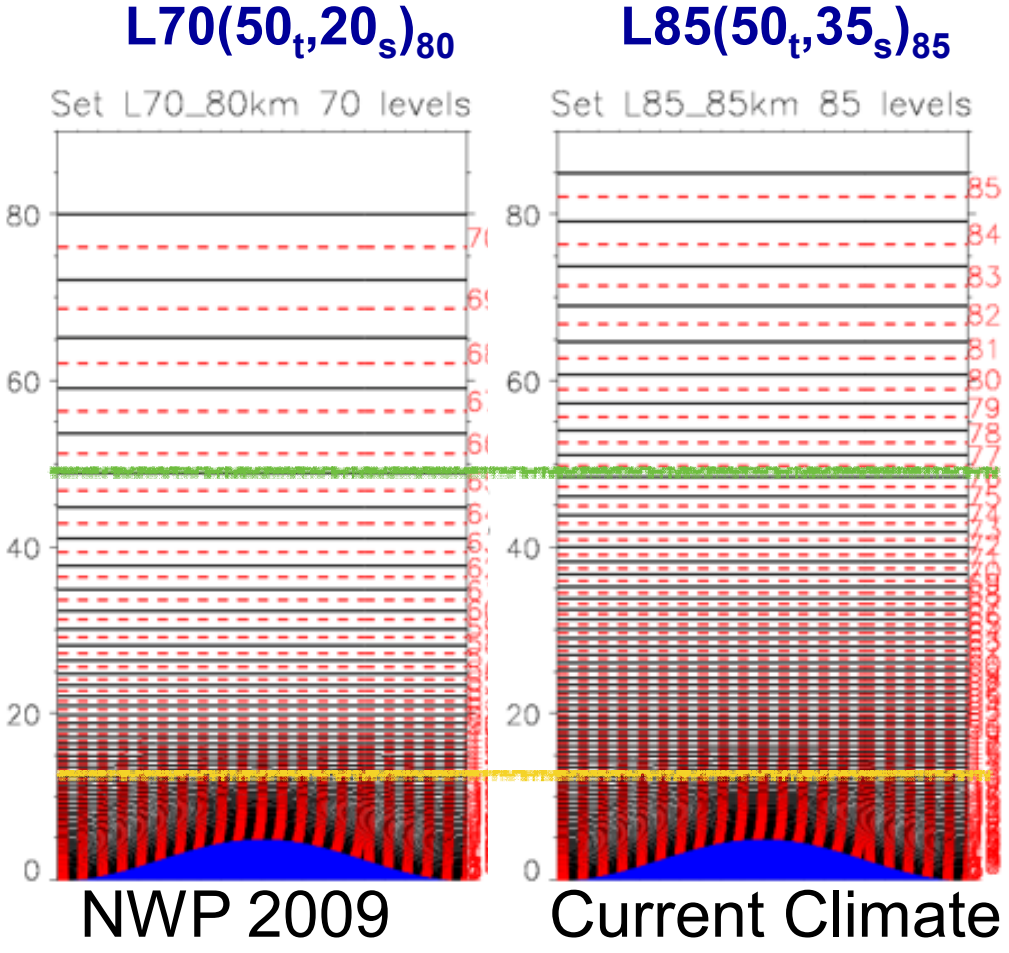
2016 Further research to finalise level sets (include DA)

2017 Operational – L120 to L140 with top at 85km?

Benefits

- Improved cloud?
- Jet level winds
- Tropopause modelling
- Improved vertical transports?
- Improved satellite retrievals?

L120 L180 L300



© Crown copyright Met Office

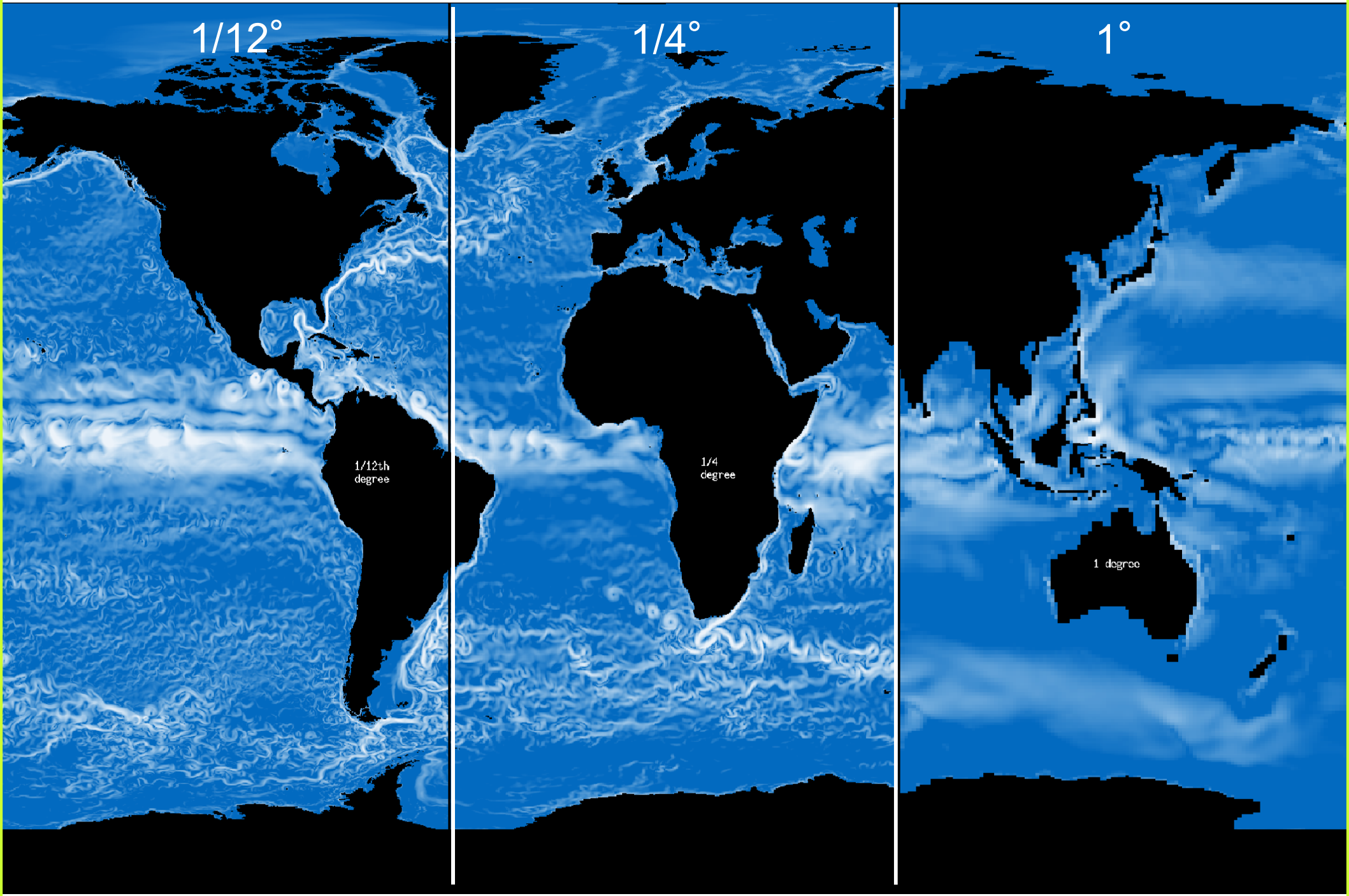
Coupled ocean-atmosphere forecasting on weather timescales

- Recent evidence has been emerging that even on short timescales interactions between the ocean and the atmosphere can be important.
- The FOAM (ORCA 1/4 degree ocean) and GloSea5 (N216 seasonal system) have been integrated into one “seamless” coupled system that provides both seasonal predictions and short-range ocean forecasts.
- Presently the short-range forecasts are used to generate ocean products only, but research on the impacts of the coupled systems continues and this system may prove to be an early sight of the future of NWP Forecasting

National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

Ocean Model Resolution

NEMO Global Ocean



GungHo! Next generation dynamical core

See talk by Mohamed on Tuesday!

Globally

Uniform

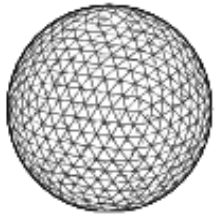
Next

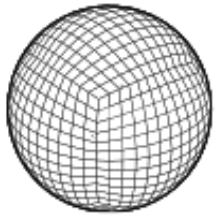
Generation

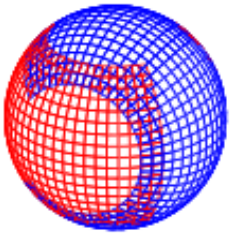
Highly

Optimized

"Working together harmoniously"







NERC SCIENCE OF THE ENVIRONMENT

Science & Technology Facilities Council

Met Office

Questions?

East Lyng
Somerset