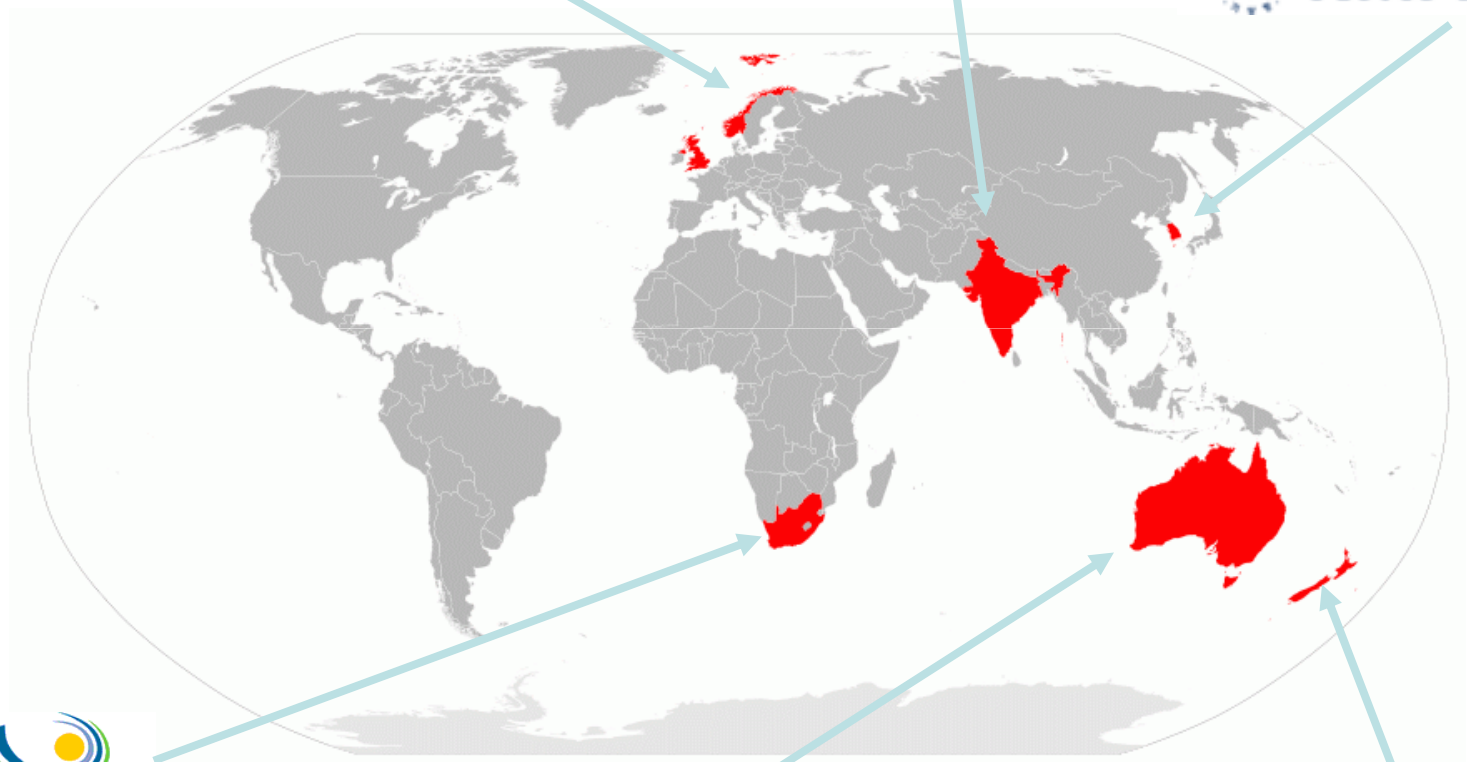
Consortia Presentation

for 32nd EWGLAM and 17th SRNWP Annual Meeting 2010
4th – 7th October 2010 Exeter, U.K

Mike Bush

Collaboration status

Operational users



Norwegian Meteorological Institute Met No.

- The various UM1 configurations use UM7.3
- The main operational UM4 configuration uses UM6.1+. Plans to upgrade to UM7.5/UM7.7
- If time savings can be made (use of OpenMP) then there is a proposed revision to the UM4 domain that will be 10 grid points further south and west and stretched N-S.
- This is intended to better capture incoming weather from the south and west and move boundary further from coast.
- Operational backup linux cluster at SMHI since July
- Forecasters complain of too much fog in the fjords.
- JULES snow scheme evaluation has started

KMA Korea Meteorological Administration

- KMA UM NWP systems for global and regional models were declared operational on 14/05/10
- Retire old systems later this year
- New supercomputer (Cray XT5)
- Plans for 4DVAR to go operational in the regional model in 2011.

Table 1. The configurations of a global and a regional UM

	Global UM	Regional UM
Version	vn 6.6	vn 6.6
Platform	Cray XT5	Cray XT5
# of cores	256 (8x32)	224 (8x28)
Horizontal Resol.	N320 (~40km)	~12km (0.11x0.11deg)
# of Layers	L50	L38
Run Length	10.5 days (252 hours)	3 days (72 hours)
Time-step size	900 sec	300 sec
Avg. Wallclock time	60min	20 min
Initialisation	4DVAR (6 hour cycle)	Reconf. from global dump
Boundary Condition	-	3-hourly LBC from global UM

CAWCR Australia

- Porting of the ACCESS numerical weather prediction (NWP) systems to the new SUN supercomputer
- Currently there are a number of 5km resolution domains centred on the mainland state capitals
- Plans for a 2km variable resolution test bed (3D-VAR, latent heat nudging) to explore cloud and precipitation features at this resolution
- Domain likely to be centred on Sydney due to areas of population and observation coverage

Air Force Weather Agency (AFWA)

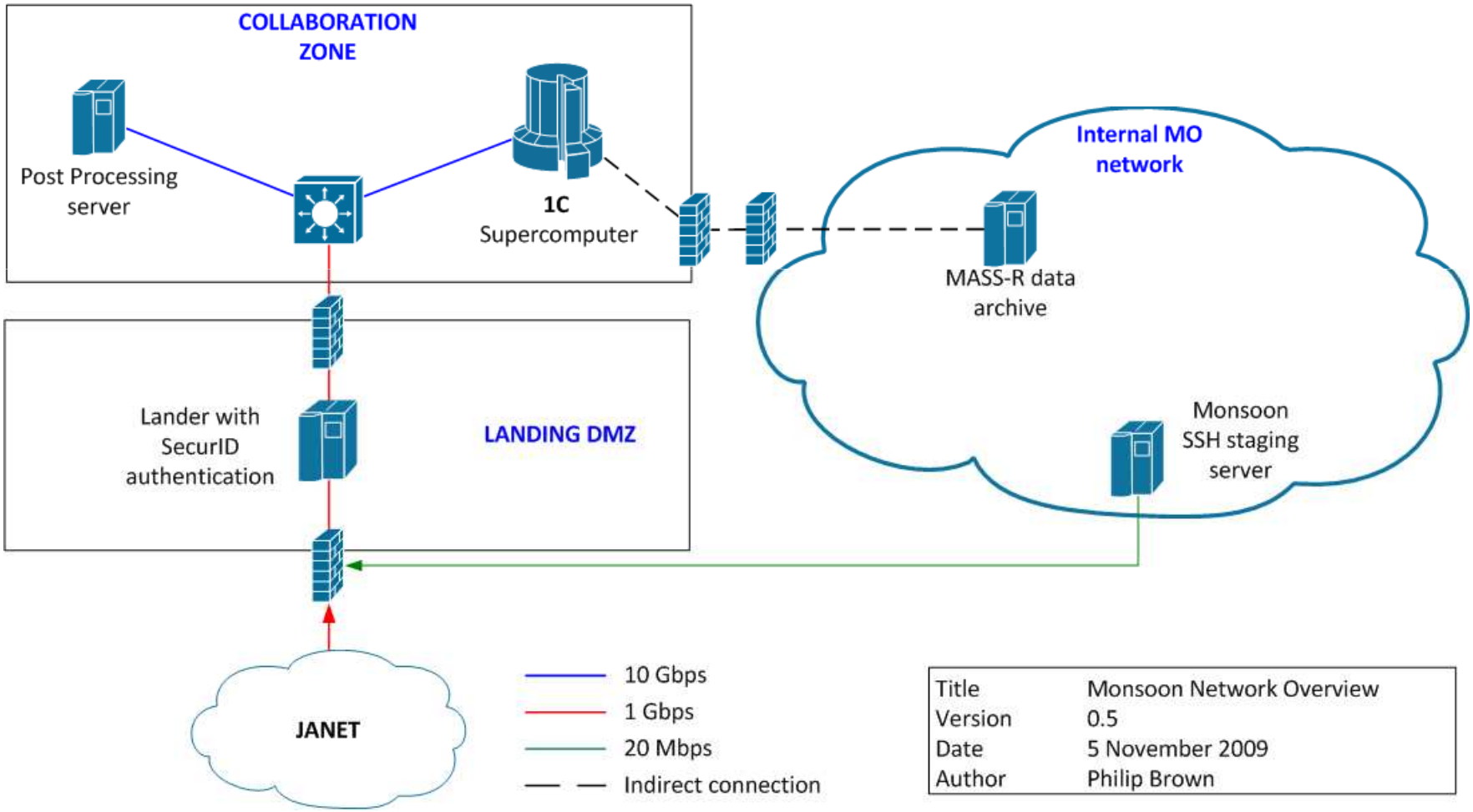
- Field Operating Agency (FOA) and the lead weather centre of the United States Air Force.
- Based near Omaha, Nebraska
- Negotiating an Operational Licence
- AFWA would run the global configuration of the UM to drive their WRF model domains
- AFWA would run the UM on their linux system and the Met Office would send them data to initialise their runs
- Possibility of WRF/UM comparisons in the future

UM user tutorial

1st UM user tutorial: Met Office, 2-6 Nov 2009

2nd tutorial: 28 Jun - 2 Jul 2010

MONSooN: Shared Met Office/NERC resource: 30 IBM p6 compute nodes available 1 Dec 2009



Initial Joint Research Programme projects

- Very high resolution modelling of cold-air pooling (COLPEX): Andrew Ross (Leeds), Stephen Mobbs (NCAS) & Pete Clark
- Ensemble based DA for very high resolution modelling: Stefano Migliorini, Ross Bannister, Roger Brugge (NCEO) & Mark Dixon
- CASCADE model development (tropical convection): Steve Woolnough (NCAS), Adrian Matthews (UEA), Doug Parker (Leeds), Robin Hogan (Reading) & Paul Field
- Convective precipitation predictability in COPS (Convective Orographic Precipitation Study): Daniel Kirschbaum, Kirsty Hanley, Stephen Belcher (Reading) & Nigel Roberts

Joint Chairs (co-funded)

Academic Partnerships

Met Office

UNIVERSITY OF EXETER

- Application of mathematics and statistics for weather and climate
- Climate, Weather and Human Health (CWHH).
- Earth System Science

John Thuburn, David Stephenson

UNIVERSITY OF LEEDS

- Atmospheric observations and process research
- Atmospheric chemistry and aerosol modelling and evaluation
- African climate and impacts

Doug Parker

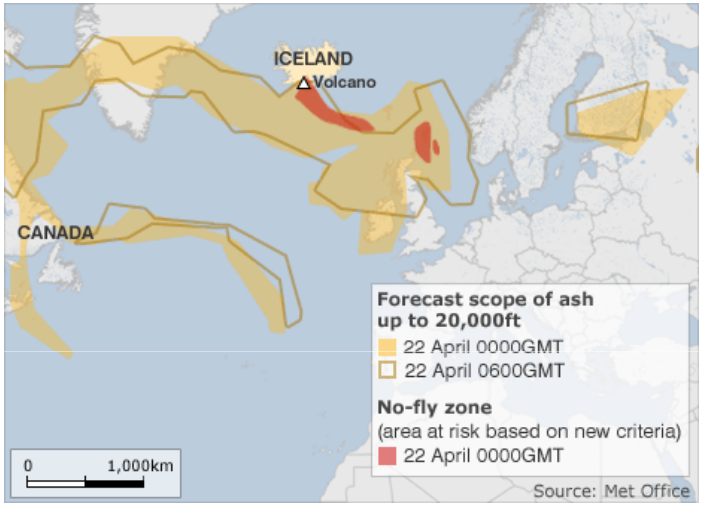
University of Reading

- High resolution regional weather forecasting
- High resolution global climate modelling
- Attribution of climate change and variability

Stephen Belcher

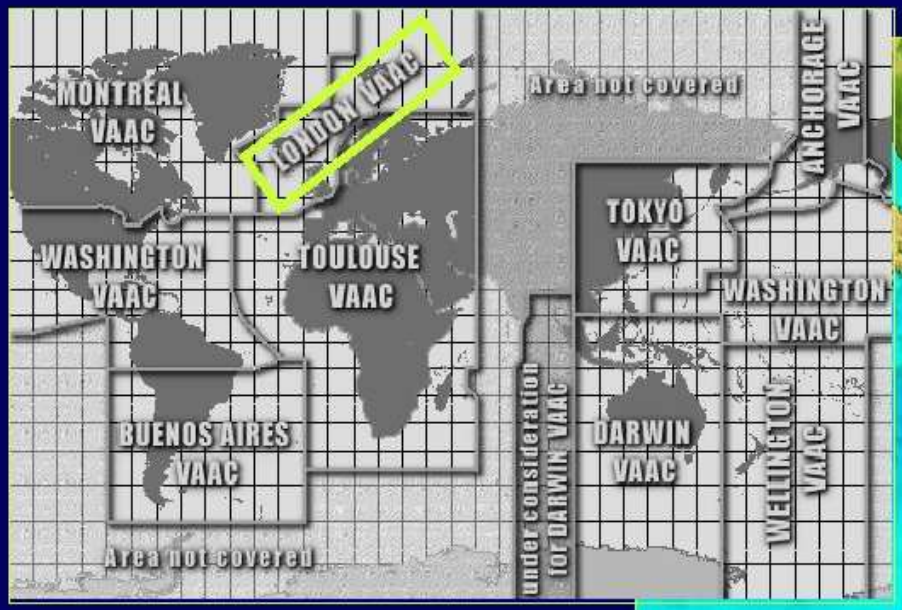
Met Office news

Eyjafjallajökull eruption



- Explosive eruption started on 14th April and continued for more than one month
- The ash cloud affected much of Europe's airspace causing enormous disruption to air travel

London VAAC area



19 volcanoes active in the last 10,000 years

Map from Smithsonian Institute Global Volcanism Program

Met Office

Daily Telegraph headline

Volcanic ash: Ryanair boss Michael O'Leary in withering attack on Met Office

Michael O'Leary, the head of airline Ryanair, has launched a vitriolic attack on Met Office forecasters after they triggered an unprecedented six-day lockdown of British airspace in April.

Published: 7:50PM BST 01 Jun 2010

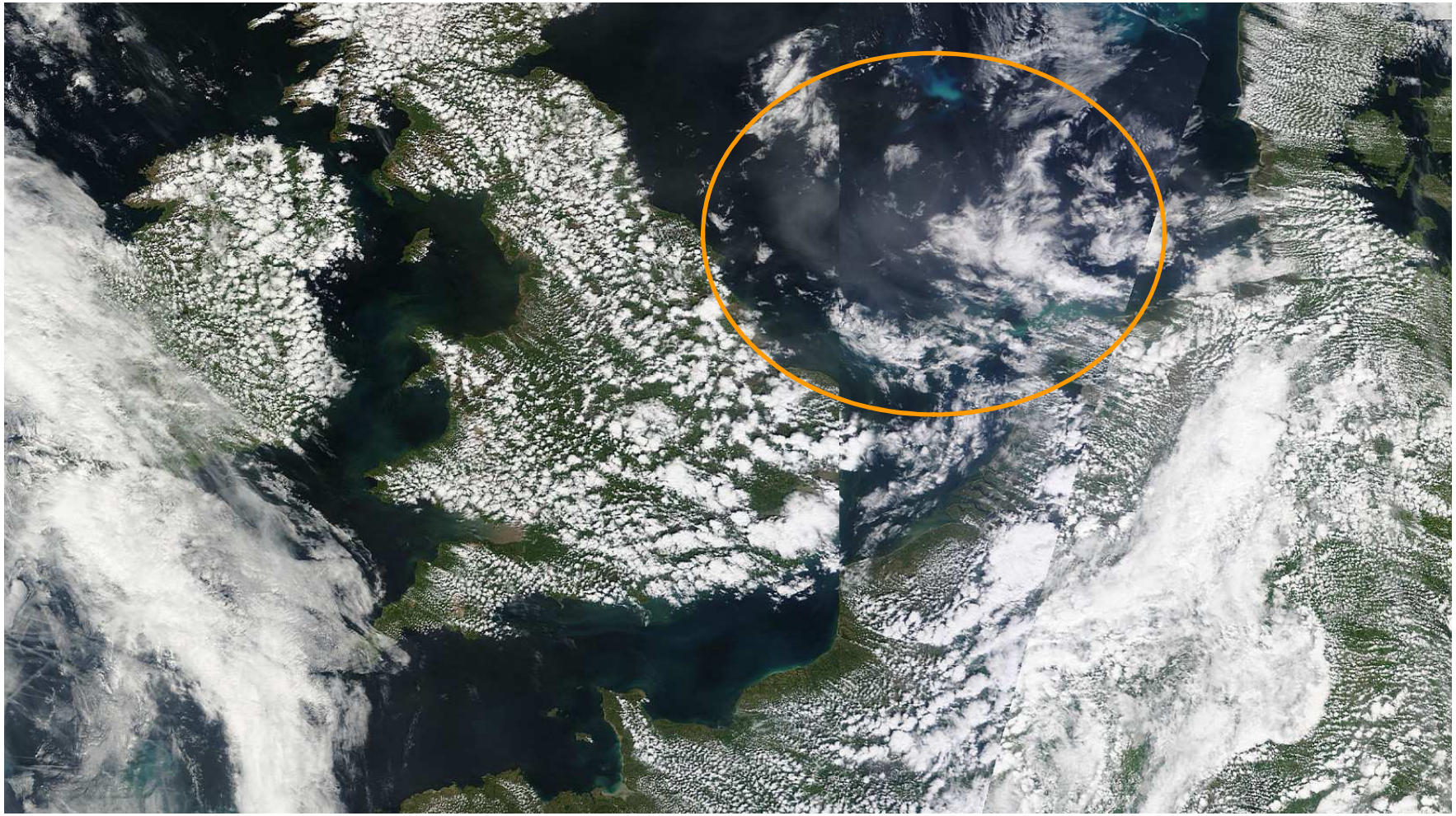
Comment

Ryanair boss Michael O'Leary Photo: JULIAN SIMMONDS

Mr O'Leary, the airline's chief executive, rounded on the Volcanic Ash Advisory Centre for its handling of aviation's biggest crisis since the war.

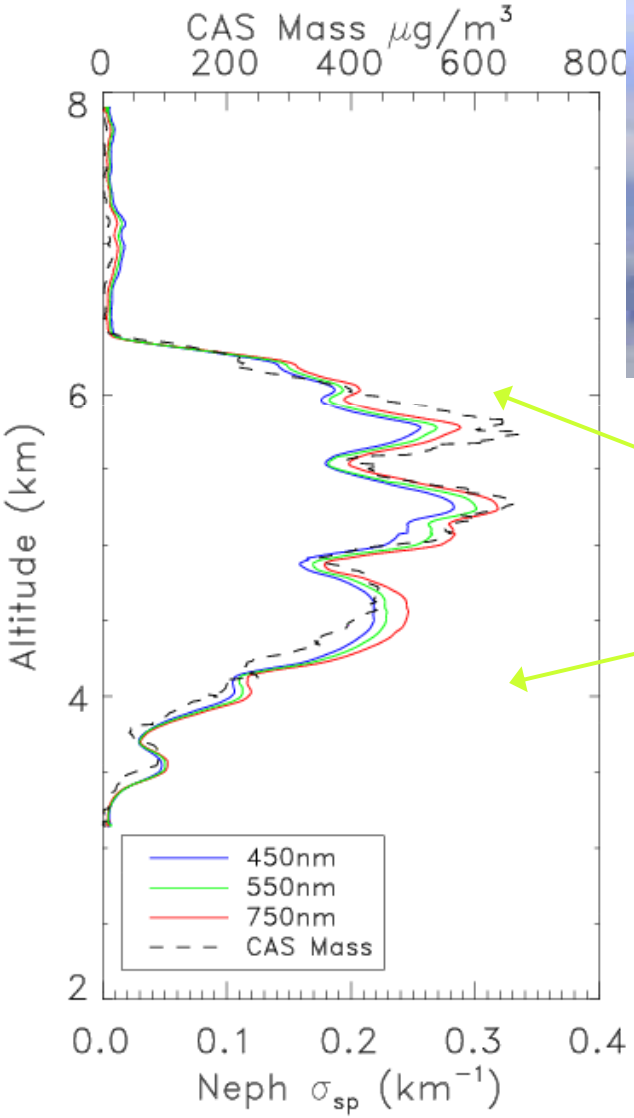
The low-cost airline's outspoken boss, whose initial response to the Met Office's handling of the volcanic eruption had been restrained, described the creation of a no-fly zone as "entirely unnecessary."

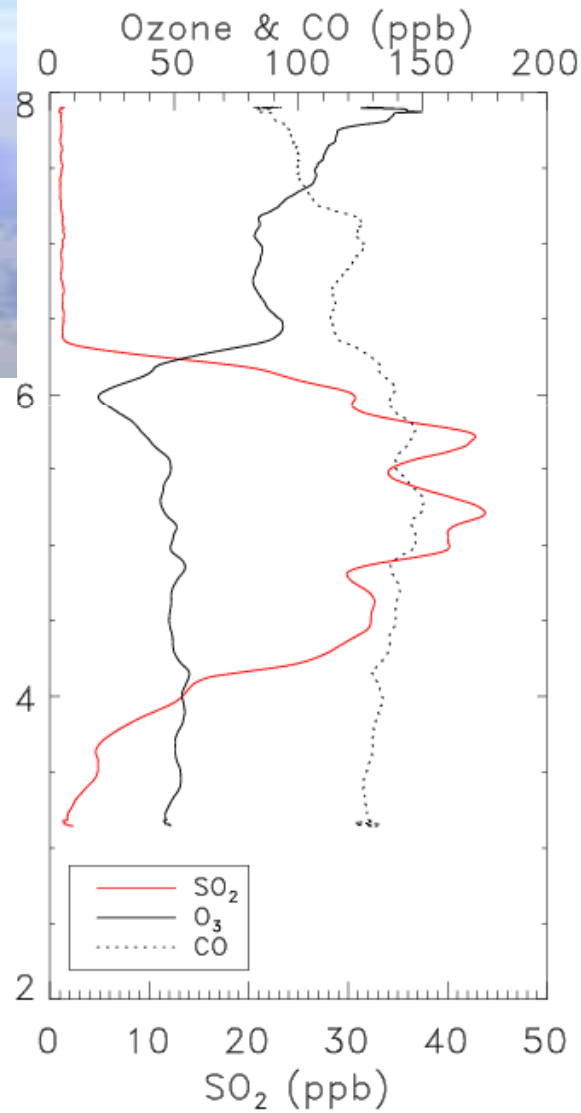
Ash in TERRA MODIS imagery: 17th May 2010



FAAM Aircraft flight B530

Profile 1 (~14:45) 54.0°N 001.6°E





AEROSOL MASS > 500μgm^{-3} between 3.5-6.5km

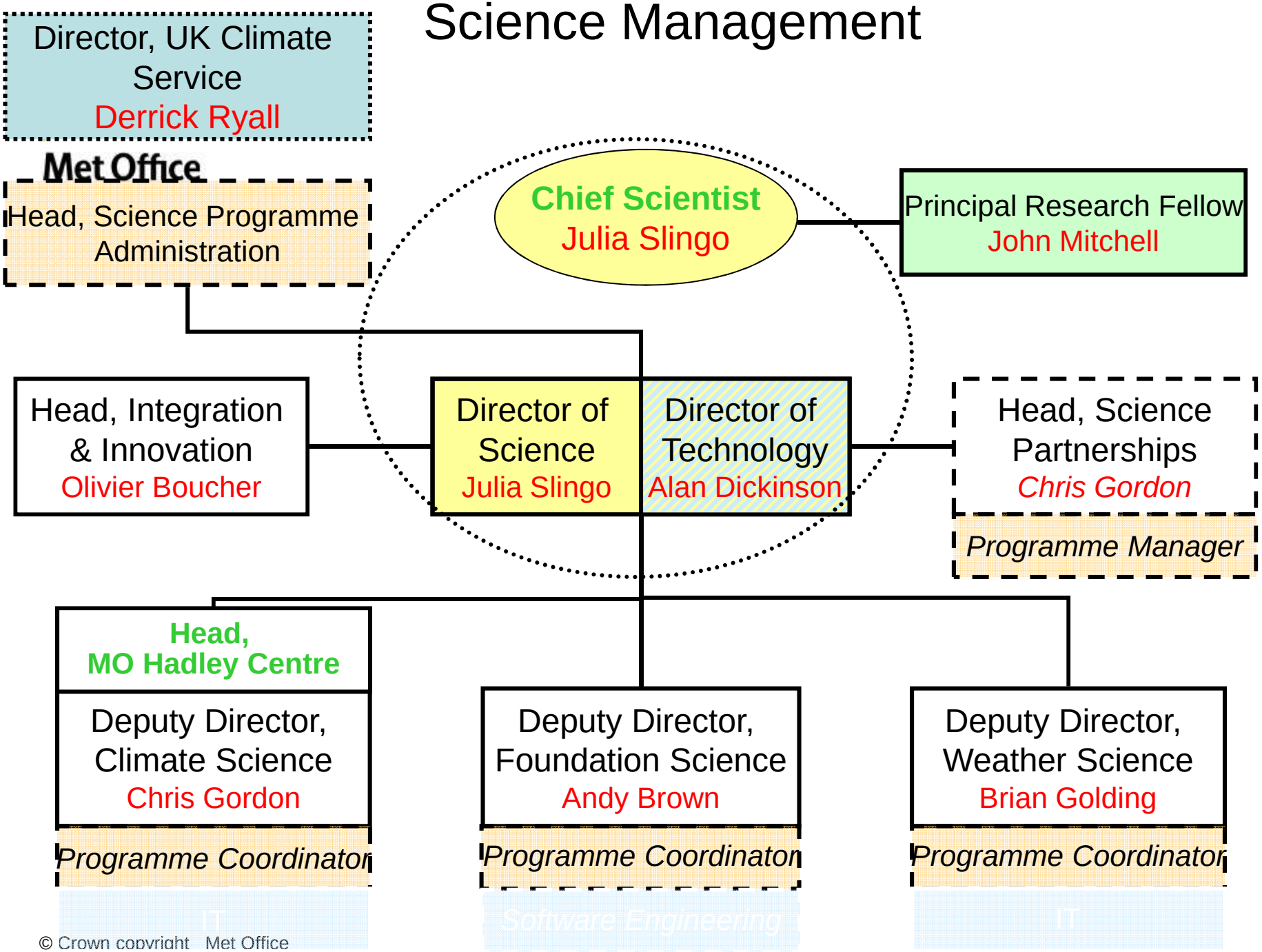
The FAAM aircraft was stripped of instrumentation in preparation for a repaint when the volcano erupted!

General election May 2010

Funding

- Emergency Budget June 2010
- George Osborne announced that nearly all government departments would have to cut an average of 25% from their annual budgets before the next general election
- Some departments e.g. defence might be protected from the worst of the cuts, indicating other departments will face significantly greater cuts.
- Two-year pay freeze for all public sector employees.
- Freeze on recruitment
- Precise figures will be given on 20th October 2010 when the outcome of the 2010 Spending Review is announced
- Impact on Met Office?

Science Management



Science Directorates

Deputy Director, Climate Science Chris Gordon
Understanding Climate Change Cath Senior
Climate Monitoring & Attribution Peter Stott
Monthly to Decadal Variability & Prediction Adam Scaife
Oceans, Cryosphere & Dangerous Climate Change Richard Wood
Earth System Science & Mitigation studies Olivier Boucher
Climate Impacts & Adaptation Studies Richard Betts
IT Mick Carter

Deputy Director, Foundation Science Andy Brown
Observational Based Research Jon Taylor
Atmospheric Processes & Parametrizations Roy Kershaw
Global UM Development & Evaluation Sean Milton
Dynamical Methods *(& Scalable Codes)* Nigel Wood

http://www-hc/~hadpg/chief_scientist/Briefing_Sept2010.pdf

Deputy Director, Weather Science Brian Golding
Operational Weather Forecasting & IT Stuart Bell
Satellite Applications John Eyre
Data Assimilation & Ensembles Dale Barker
Ocean Forecasting Mike Bell
Customer Applications Dave Jones

Met Office web site
Research -> Our scientists

- Ocean Forecasting
- Parametrization
- Satellite Applications
- Seasonal to Decadal
- **Publications**
- **Collaboration**

Information on the wide range of work our climate prediction scientists undertake; the projects they are involved with and their skills and interests.

Information on the wide range of work our climate monitoring and attribution scientists undertake; the projects they are involved with and their skills and interests.

www.metoffice.gov.uk/climatechange

Cryosphere and Oceans scientists

Information on the wide range of work our climate, cryosphere and oceans scientists undertake; the projects they are involved with and their skills and interests.

Assimilation/Ensembles scientists

Information on the wide range of work our data assimilation and ensembles scientists undertake; the projects they are involved with and their skills and interests.

Dynamics Research scientists

Information on the wide range of work undertaken by our scientists in dynamics research; the projects they are involved with and their skills and interests.

Joint Centres scientists

Information on the wide range of work undertaken by our scientists at the joint research centres; the projects they are involved with and their skills and interests.

Numerical Modelling scientists

Information on the wide range of work of numerical modelling scientists and software engineers; the projects they are involved with and their skills and interests.

Observational Studies scientists

Information on the wide range of work undertaken by our scientists in observational based research; the projects they are involved with and their skills and interests.

Ocean Forecasting scientists

Information on the wide range of work our ocean forecasting scientists undertake; the projects they are involved with and their skills and interests.

Parametrization scientists

Information on the wide range of work our parametrization scientists undertake; the projects they are involved with and their skills and interests.

Satellite Applications scientists

Information on the wide range of work our satellite applications scientists undertake; the projects they are involved with and their skills and interests.

Seasonal to Decadal scientists

Information on the wide range of work our seasonal to decadal prediction scientists undertake; the projects they are involved with and their skills and interests.

Met Office Science Strategy 2010-2015

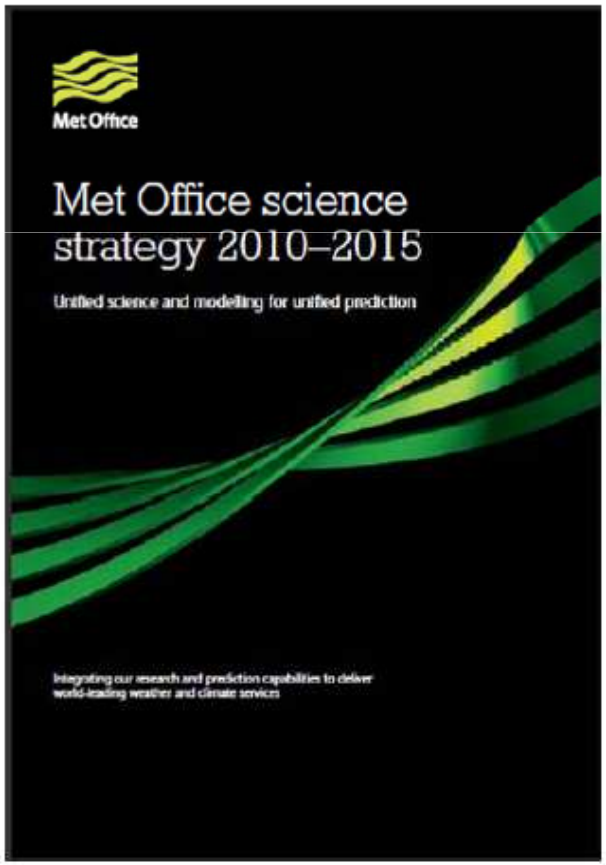
The Met Office research agenda will be focussed around four major science challenges

(i) Forecasting hazardous weather from hours to decades;

(ii) Water Cycle and Quantitative Precipitation Forecasting on all scales;

(iii) Monthly to Decadal Prediction in a changing climate;

(iv) Sensitivity of the Earth System to human activities



http://www.metoffice.gov.uk/research/media/pdf/a/t/Science_strategy-1.pdf

Model upgrade highlights

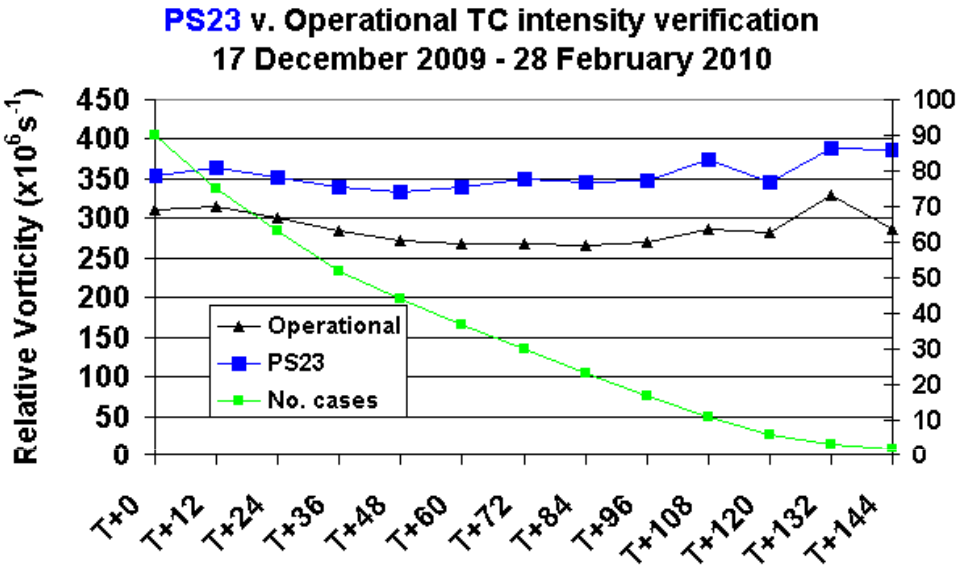
Parallel Suite Highlights

- **Parallel Suite 22 10/11/09:**
- L70 - Increased vertical resolution for Global
- UKV in operational suite with data assimilation
- **Parallel Suite 23 09/03/10:**
- L70 - Increased vertical resolution for NAE
- L70 N216 resolution upgrade for MOGREPS-G
- 25 km horizontal resolution for Global model
- 18km horizontal resolution for MOGREPS-R
- **Parallel Suite 24 14/07/10:**
- L70 - Increased vertical resolution for MOGREPS-R
- Physics upgrade to Global, NAE and UKV

Increase in vertical resolution

- Increase from L50 to L70 (Global) and L38 to L70 (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)
- A combined a physics, dynamics and assimilation package that has been in development over a long period.
- Improved representation of vertical structures
- Reduced stratospheric errors
- See SRNWP web page for link to my physics talk from last year

Increase in horizontal resolution



- Increase from 40km to 25km (Global)
- Better model energetics (tropical cyclone intensity improved).
- Improved MSLP in extra-tropics (esp. Southern Hemisphere)
- Improved extra-tropical winds (due to GLOBE30 orography)

Physics upgrades

- PC2 (prognostic cloud and condensate) cloud scheme in the Global model
- Radiation (including incremental time-stepping: full radiation calculations are supplemented by more frequent calculations of the radiative increments due to changes in cloud)
- Van Genuchten soil hydraulics and new soil ancillaries (see talk by Bruce Macpherson last year)
- Revised screen temperature diagnostic – physics talk
- Valley cooling package (UKV) – see poster
- Capping of horizontal winds to prevent the Courant number being exceeded near the top of the model (UKV)

Future Plans

Strategic Intervention (SI)

- Currently forecasters modify NWP output fields to generate guidance graphics and images for the BBC, but their modifications cannot be propagated through the production system to other products.
- Under SI phase 1, the forecaster will choose the previous NAE model run (instead of the latest run) to produce graphics and drive UKV/UK4 models
- SI will only be used occasionally where the forecaster believes the latest NAE is seriously in error having a major impact on UK customers.
- It is intended to address 3 key types of error:

  * Missing or erroneous sheets of Sc cloud

  * Significant missing/misplaced areas of ppn

  * Significant synoptic evolution errors

Upgrade plans for 2010/2011

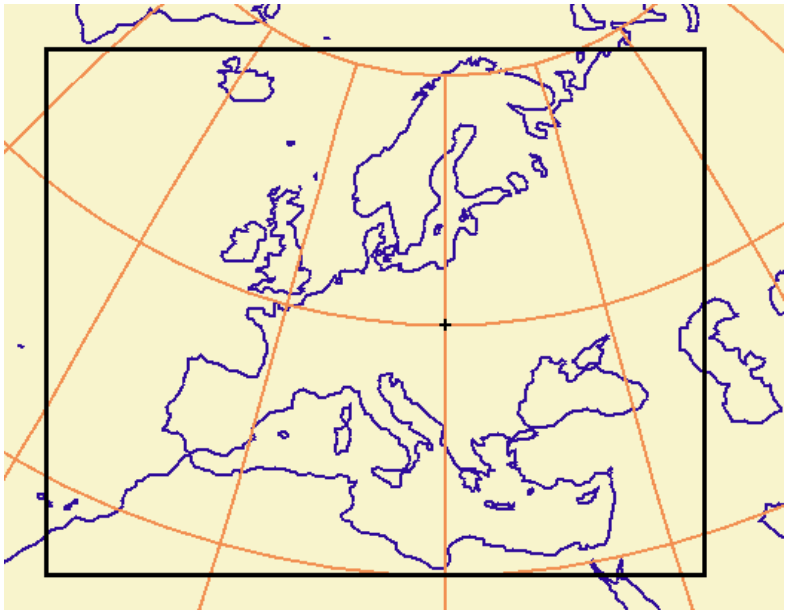
- Autumn 2010
  - Implement new covariance statistics. Moving from the current NMC method with training data derived from T+30:T+6 UM forecast differences (at N216) to using UM T+6 forecast differences (at N320) from ECMWF generated initial perturbations (using 10 members)
- 2011
  - Implement the JULES land surface model
  - Inclusion of radar winds in the UKV
  - FLAKE in the UKV
  - DA upgrades including Hybrid DA, Moist control variable, use of additional IASI/AIRS over land
  - Migration to IBM Power 7

Met Office HPC

- 2009 : IBM p575 Power6
  - Operational from August 2009
  - 145 TFlop peak capacity (7744 cores)
  - 2 identical systems (2*106 node) for resilience plus small system (30 node) for NERC Collaboration
- 2011 : IBM Power7 system
  - ~3 faster than Power6 measured by benchmark application speedup (>25000 cores)
  - At least 25000 cores with total Capacity approaching 1PFlop

New ensemble set-up on Power 7

- New ensemble structure:
  - N320 (40km) MOGREPS-G. 12 members 4 times/day
  - 12km MOGREPS-R covering reduced domain (cost reasons), with control replacing NAE deterministic 12 members 4 times/day
  - 1.5km MOGREPS-UK 3 members 4 times/day



Questions?