WGNE activities and future directions

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ECMWF & UK MetOffice

 ECMWF

WGNE: TERMS OF REFERENCE

- Advise the JSC and CAS on progress in atmospheric modelling.

- **Review the development of atmospheric models** for use in **weather** prediction and **climate** studies on all scales, including the diagnosis of shortcomings.

- Propose numerical experiments aiming to refine **numerical techniques** and the formulation of **atmospheric physics processes**, boundary layer processes and land surface processes in models.

- Design and promote **coordinated experiments** for:

  - **validating model results** against observed atmospheric properties and variations;

  - exploring the **intrinsic and forced variability and predictability of the general circulation of the atmosphere on short to extended ranges**;

  - assessing the intrinsic and forced variability of the atmosphere **on climate time-scales.**

- **Promote the development of data assimilation methods** for application to numerical weather and climate predictions, and for the estimation of derived climatological quantities.

- Promote the **development of new methods** for numerical weather prediction and climate simulation.

- Maintain **scientific liaison** with other WCRP and CAS groups as appropriate.

- Promote the timely exchange of information, data and new knowledge on atmospheric modelling through **publications, workshops and meetings**.

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Co-ordinated experiments and projects

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- Transpose-AMIP   **GOOD PROGRESS**

- Cloudy-radiance   **DONE**

- Grey-zone   **GOOD PROGRESS**

- Verification

    - NWP performance (eg TCs, precipitation)   **ONGOING**

    - Polar (CBS-style; ConcordIASI intercomparsion**)   DONE (⇒ PPP)**

    - Climate metrics   **GOOD PROGRESS**

    - Issues with verification against own analysis   **(still) NEW**

    - MJO / Boreal Summer Monsoon Intraseasonal Oscillation intercomparisons (with MJO-TF)

      ONGOING / NEW (⇒ S2S)

- Importance of aerosols for weather and climate   **DISCUSSION WGNE 2012. PROJECT BEING SPAN UP**

- Quality of monsoon simulations for weather and climate   **DISCUSSION WGNE 2012 (⇒ S2S)**

- Comparison of model momentum budgets   **NEW**

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Evaluating aerosols impacts on Numerical Weather Prediction (NWP)

Saulo Freitas with contribution from Angela Benedetti et al (ECMWF)

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Select strong or persistent events of aerosol pollution worldwide that could be fairly represented in the current NWP model allowing the evaluation of aerosol impacts on weather prediction.

Perform model runs both including and not the feedback from the aerosol interaction with radiation and clouds.

Evaluate model performance in terms of AOD simulation compared to observations (e.g. AERONET/MODIS data) or any other related aerosol observation available.

Evaluate aerosol impacts on the model results regarding 2-metter temperature, wind, rainfall, surface energy budget, ...

3 cases:
- **Egyptian dust storm – 18 April 2012**
- **Air pollution event, Beijing – 14 January 2013**
- **Biomass burning over South America**

Dust Storm on April 18 2012

Dust over the Nile delta from satellite imagery. Image courtesy of Chelys.
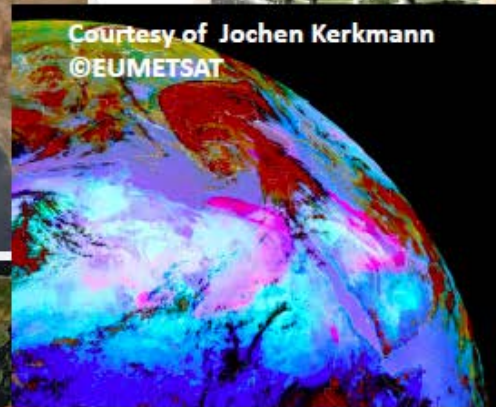
Courtesy of Jochen Kerkmann
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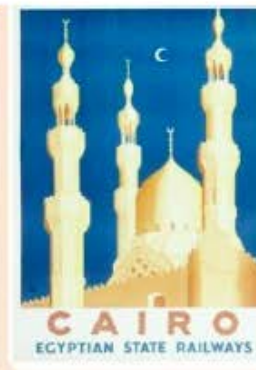
Wednesday, April 18, 2012

#Sandstorm in #Cairo

We are having the worst sandstorm in Cairo today. It is the Khamsin in its official time after Easter. The storm started at 8:30 AM this morning. Suddenly we got this yellow color in the air.

Here is Tahrir square from short awhile ago .
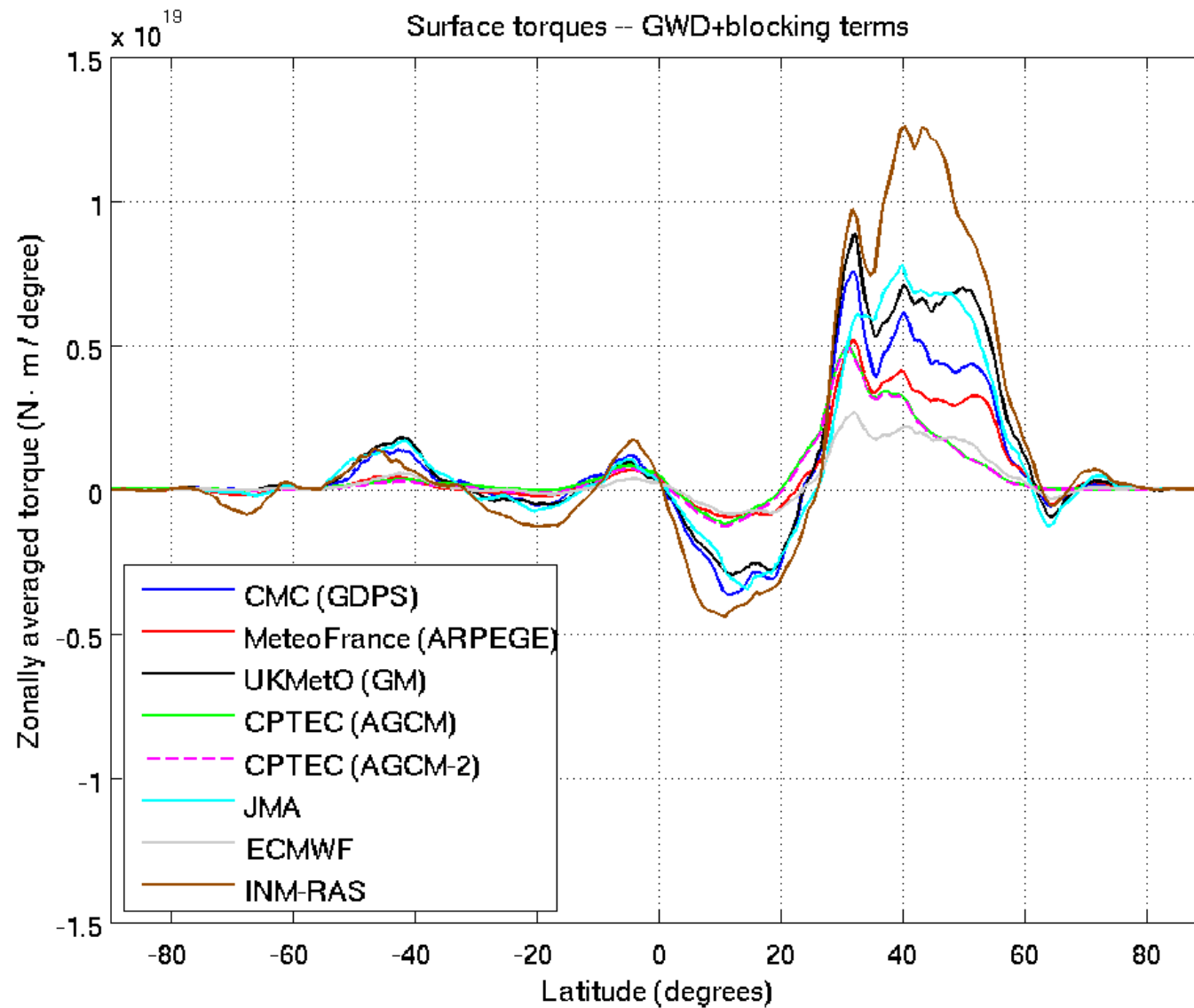
Khamisn in Tahrir square "Kolena Khaled Said"

Palestinian men cross a main road as a sand storm envelops the town of Rafah along the border with Egypt in southern Gaza Strip, on April18, 2012. (SAID KHATIB/AFP/Getty Images)

MACC-II/ECMWF forecasts for April 18 2012

Graphycs by Miha Razinger

Saturday 14 April 2012 00UTC MACC Forecast t+108 VT: Wednesday 18 April 2012 12UTC
Dust Aerosols Optical Depth at 550 nm — **Day 4**

Sunday 15 April 2012 00UTC MACC Forecast t+084 VT: Wednesday 18 April 2012 12UTC
Dust Aerosols Optical Depth at 550 nm — **Day 3**

Monday 16 April 2012 00UTC MACC Forecast t+060 VT: Wednesday 18 April 2012 12UTC
Dust Aerosols Optical Depth at 550 nm — **Day 2**

Tuesday 17 April 2012 00UTC MACC Forecast t+036 VT: Wednesday 18 April 2012 12UTC
Dust Aerosols Optical Depth at 550 nm — **Day 1**

Wednesday 18 April 2012 00UTC MACC Forecast t+012 VT: Wednesday 18 April 2012 12UTC
Dust Aerosols Optical Depth at 550 nm — **Day 0**

• Good skill of the model at the synoptic scale: storm predicted with 4 days of lead time!

MACC AOD + AERONET L0 Sede Boker (30.8, 34.75)

AERONET verification at Sde Boker, Israel

macc
Monitoring atmospheric
composition & climate - II

WGNE DRAG-project, torque inter-comparison Step0-24 January 2012

subgrid orography

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Thanks to: Ayrton Zadra

WGNE DRAG-project, torque inter-comparison Step0-24 January 2012

Boundary layer

Surface torques -- PBL term, contribution from land

Legend:
- CMC (GDPS)
- MeteoFrance (ARPEGE)
- UKMetO (GM)
- CPTEC (AGCM)
- CPTEC (AGCM-2)
- JMA
- ECMWF
- INM-RAS

X-axis: Latitude (degrees)
Y-axis: Zonally averaged torque (N · m / degree)

Thanks to: Ayrton Zadra
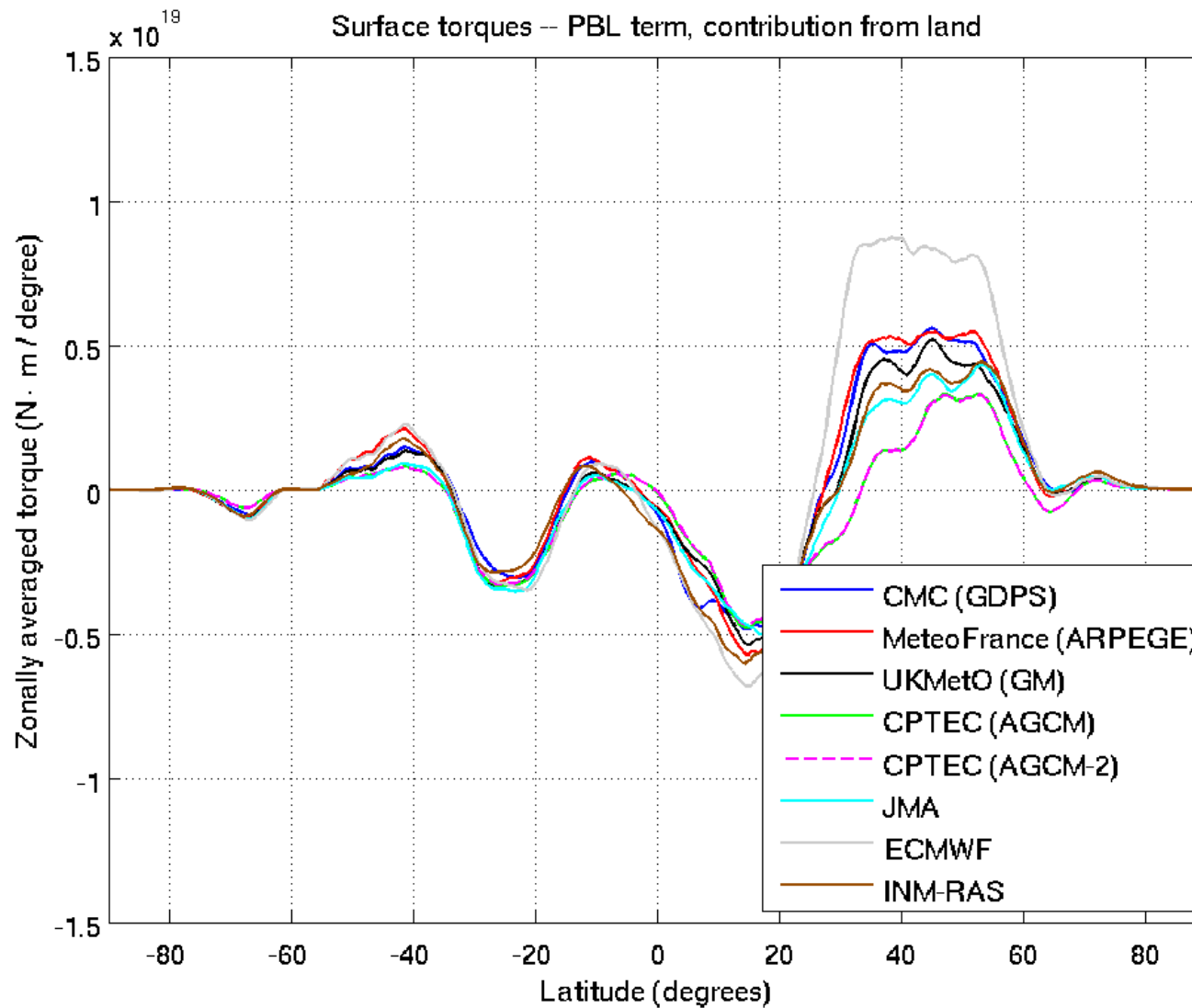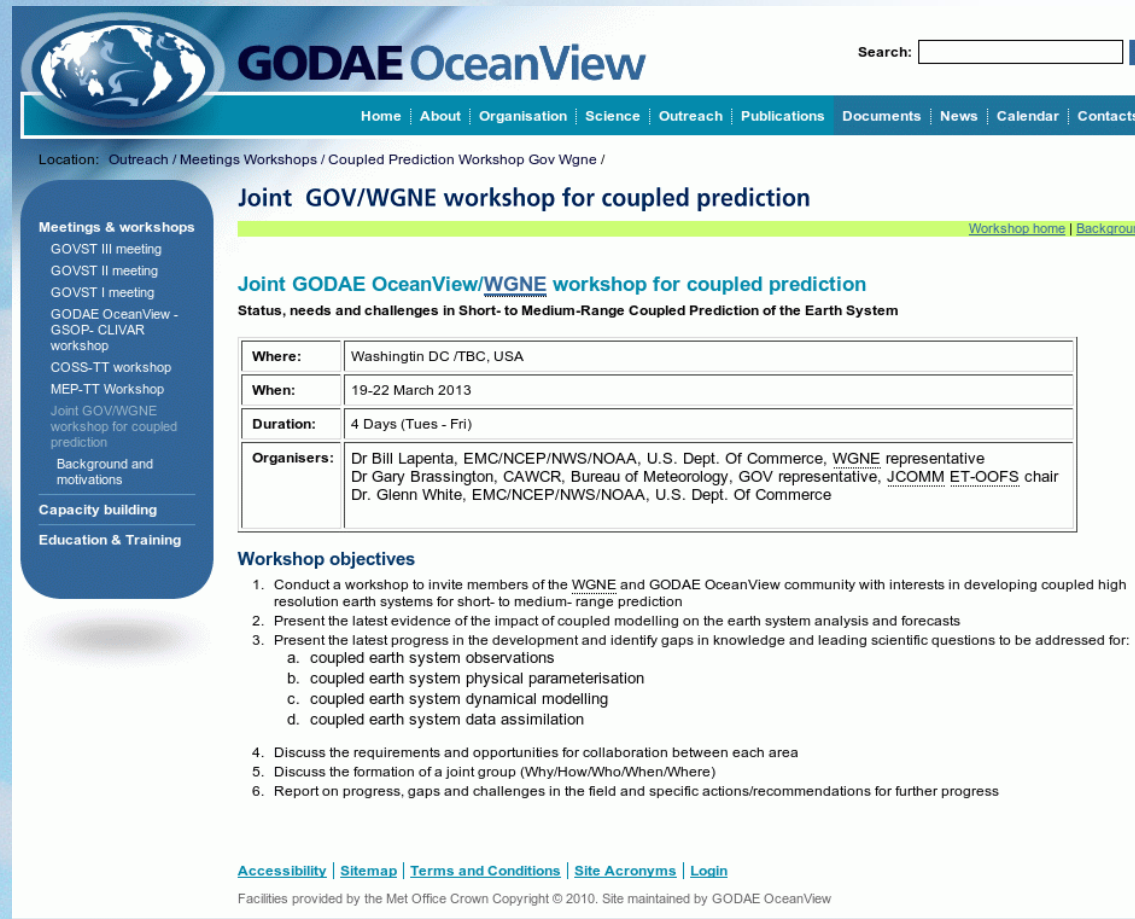
WGNE DRAG-project, torque inter-comparison Step0-24 January 2012

Boundary layer + subgrid orography

Surface torques -- PBL+GWD+blocking terms, contribution from land

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Thanks to: Ayrton Zadra

Workshops and meetings

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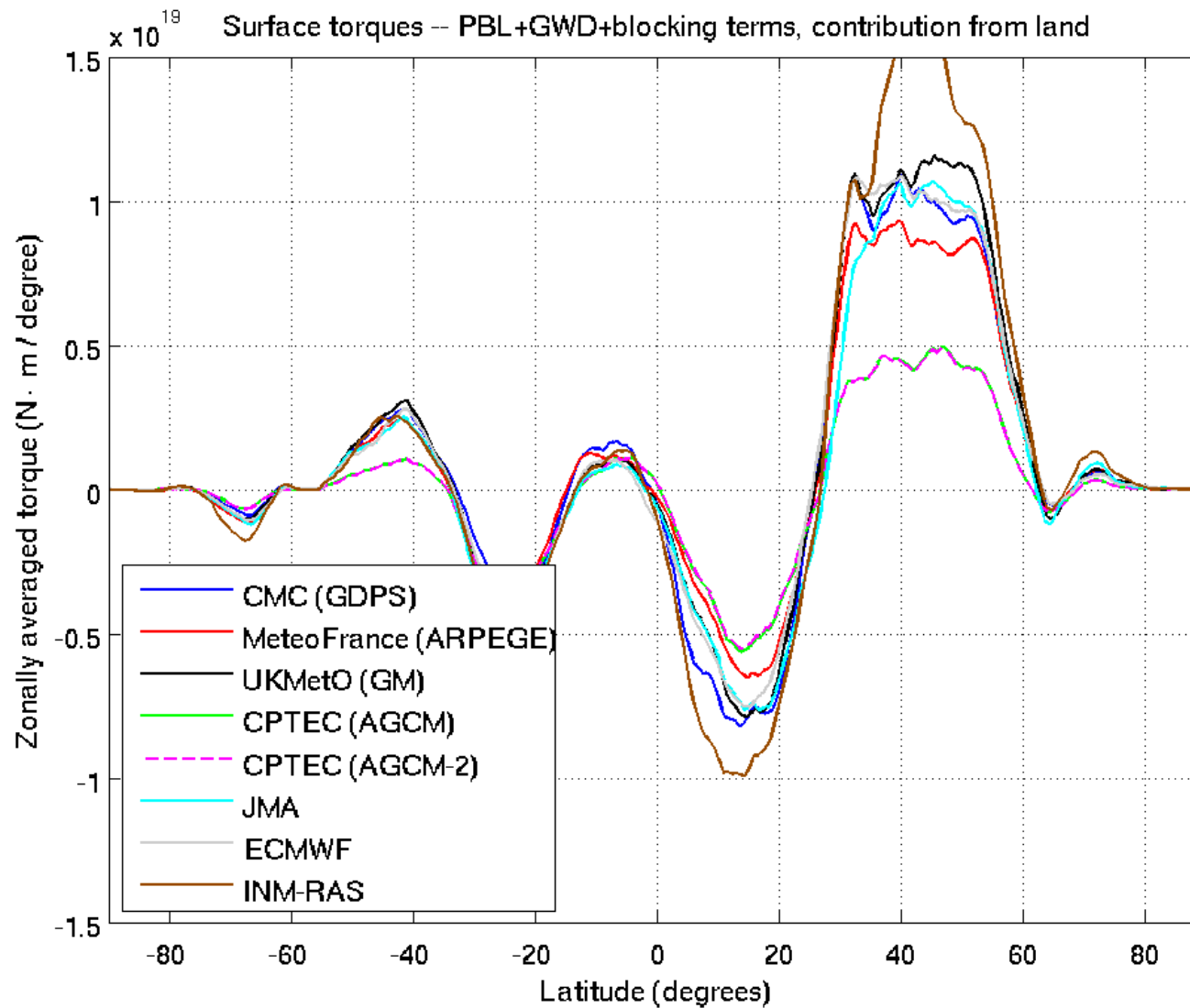
GOV/WGNE Ocean coupling workshop

- **Washington, USA. 19th-22nd March 2013**

- Follow on to ECMWF (2008) and Met Office (2009) workshops

- Focus on coupled modelling for short and medium range

- Use of short-range coupled to understand issues for longer range (e.g. subseasonal-seasonal)

https://www.godae-oceanview.org/outreach/meetings-workshops/task-team-meetings/coupled-prediction-workshop-gov-wgne-2013/

4th WGNE Workshop on Systematic Errors in Weather and Climate Models


- **Met Office, Exeter, UK. 15th-19th April 2013**
- Weather and climate
- Nature and causes of errors
- Use of diagnostic techniques, observations, process models and simplified experiments to understand errors

WGNE systematic errors meeting: Key outcomes

- Challenged by lack and/or inaccessibility of observations (& uncertainties)

  - Surface fluxes (e.g. Argo floats)

  - Polar data (clouds, sea-ice volume, etc.)

- Wide range of diagnostic techniques to identify the timescale on which errors develop (**Transpose-CMIP**), supported by well organised data availability in common formats.

- This needs to have good links across the communities (e.g. Climate, seasonal, NWP)

- Develop link between dynamics & physics in diagnostic methods (e.g. PDP work; clouds grand challenge)

- Quality of (re-)analyses (esp. Tropics & Poles).

- Diagnostic packages for centres to run themselves (repository?).

- **Common model configurations to different MIPs. Linked to this, model configurations being analysed need to be more relevant to modelling centres (implication for CMIP6; Uni/ Op centre links).**

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Future directions

- Short-range weather prediction

  – Changing focus – cloud, rain, surface temperature (not Z500!)

  – Increased emphasis on high resolution – especially convection permitting

    - Grey-zone project

    - Appropriate metrics for high resolution models (with JWGVR) and routine use of them

    - Link to climate downscaling?

25km

1.5km

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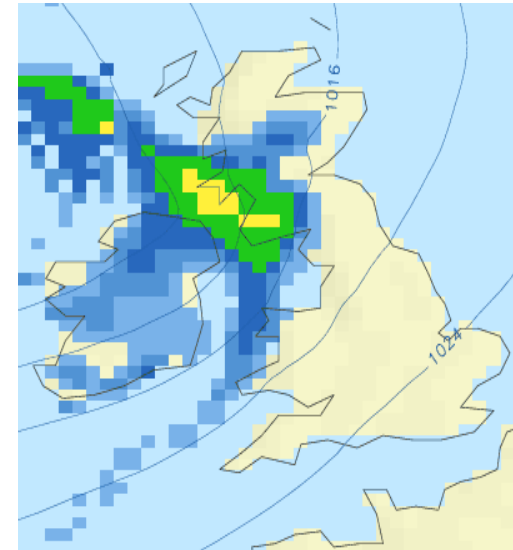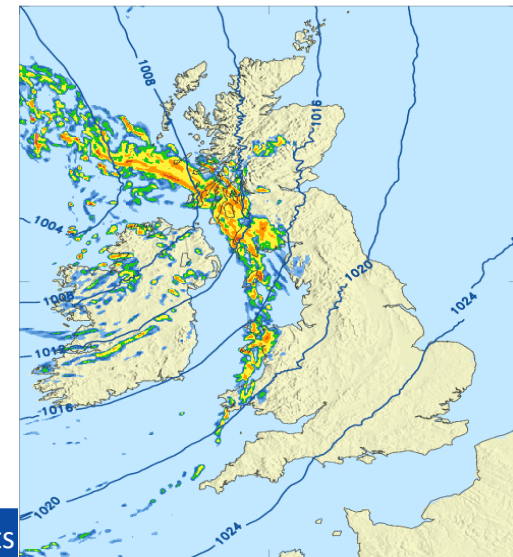
Future directions

- ● Earth system prediction
  - – (Ensemble) atmospheric weather
    prediction models coupled to ocean,
    composition, air quality, hydrology, ice.....
    - ● Bringing together communities
      (GODAE coupling workshop;
      systematic errors meeting)
    - ● Importance of aerosol for NWP:
      review and test cases
    - ● **TRANSPOSE-CMIP?**

Time evolution of coupled model SST errors

Day 1 forecast error

Day 3 forecast error

Day 5 forecast error

Day 15 forecast error

Day 30 forecast error

ORCA1N96 GA2.0

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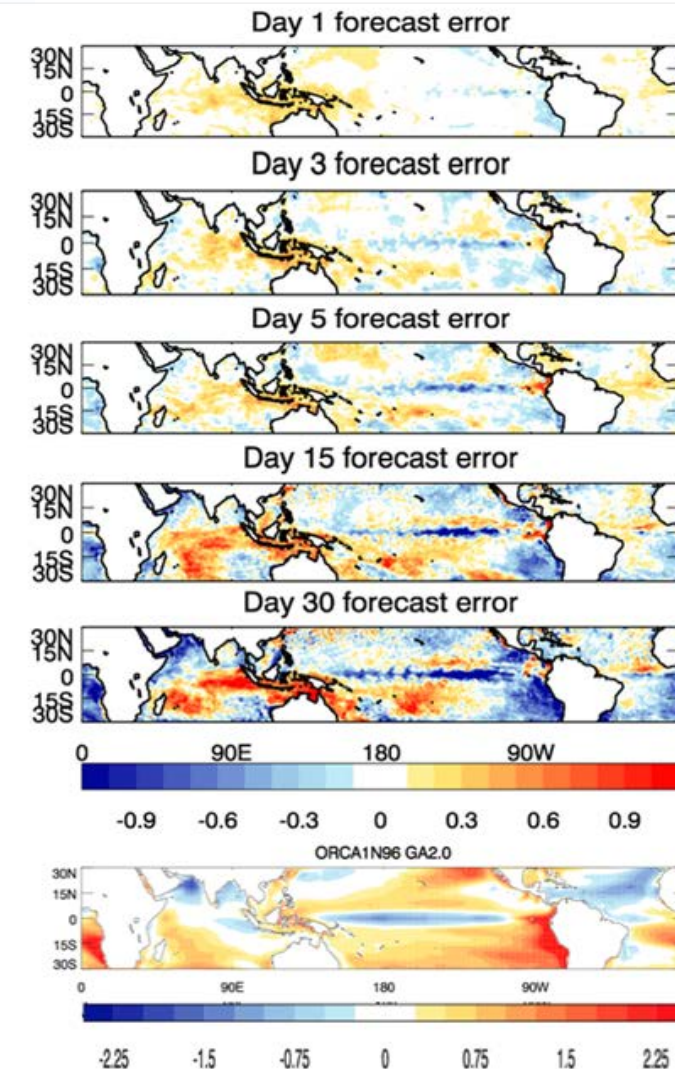
Future directions

- "Traditional model evaluation development"

  - Still important – and importance under-recognized

  - Champion (with partners) e.g. Conferences

- Specific projects to engage community and tackle key issues

  - Boreal ISV, Grey zone, Drag

  - Dynamical cores (Workshops, Review of Centre Plans, Next steps?)

    - Scalability?

  - Stratosphere (resolution, QBO)?

  - Stochastic Physics? (incorporated at the heart of model parameterization developments)

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Future directions

- Continue to look cross-timescale – weather and climate (and air quality/chemistry) communities together

- Need to keep championing the importance of model development

    – Including stochastics, dynamical cores, scalability, etc..

- Maintain strong links to many other groups and projects e.g. WWRP, DAOS, GASS, PPP, S2S, WGCM, SPARC, WMAC, WDAC, GODAE, WCRP Grand Challenges......

- Importance of Maintaining active portfolio of projects and workshops/conferences

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Thank You

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