WGNE activities and future directions

Jean-Noël Thépaut & Andy Brown (WGNE co-chairs)

JSC-35
June 2014

Role of WGNE

- Working Group on Numerical Experimentation
  - Jointly established by the WCRP and the WMO Commission for Atmospheric Sciences (CAS)
  - Responsibility of fostering the development of atmospheric circulation models for use in weather prediction and climate studies on all time scales and diagnosing and resolving shortcomings.

- A distillation of the Terms of Reference…..
  - Advice, liaison
  - Co-ordinated experiments
  - Workshops, publications, meetings

Co-ordinated projects and experiments

- Transpose-AMIP - testing climate models in weather mode
- Cloudy-radiance - comparing methods used in data assimilation
- Grey-zone - representation of cold-air outbreaks at different resolutions
- Verification
  - NWP performance (eg TCs, precipitation)
  - Polar (CBS-style; ConcordIASI intercomparison) ➡ PPP
  - Climate metrics
  - Issues with verification against own analysis
  - MJO / Boreal Summer Intraseasonal Oscillation intercomparisons and forecast metrics (with MJO-TF)

- Comparison of model momentum budgets - how do they differ? What is right?
- Importance of aerosols for weather and climate - assessing the level of complexity required

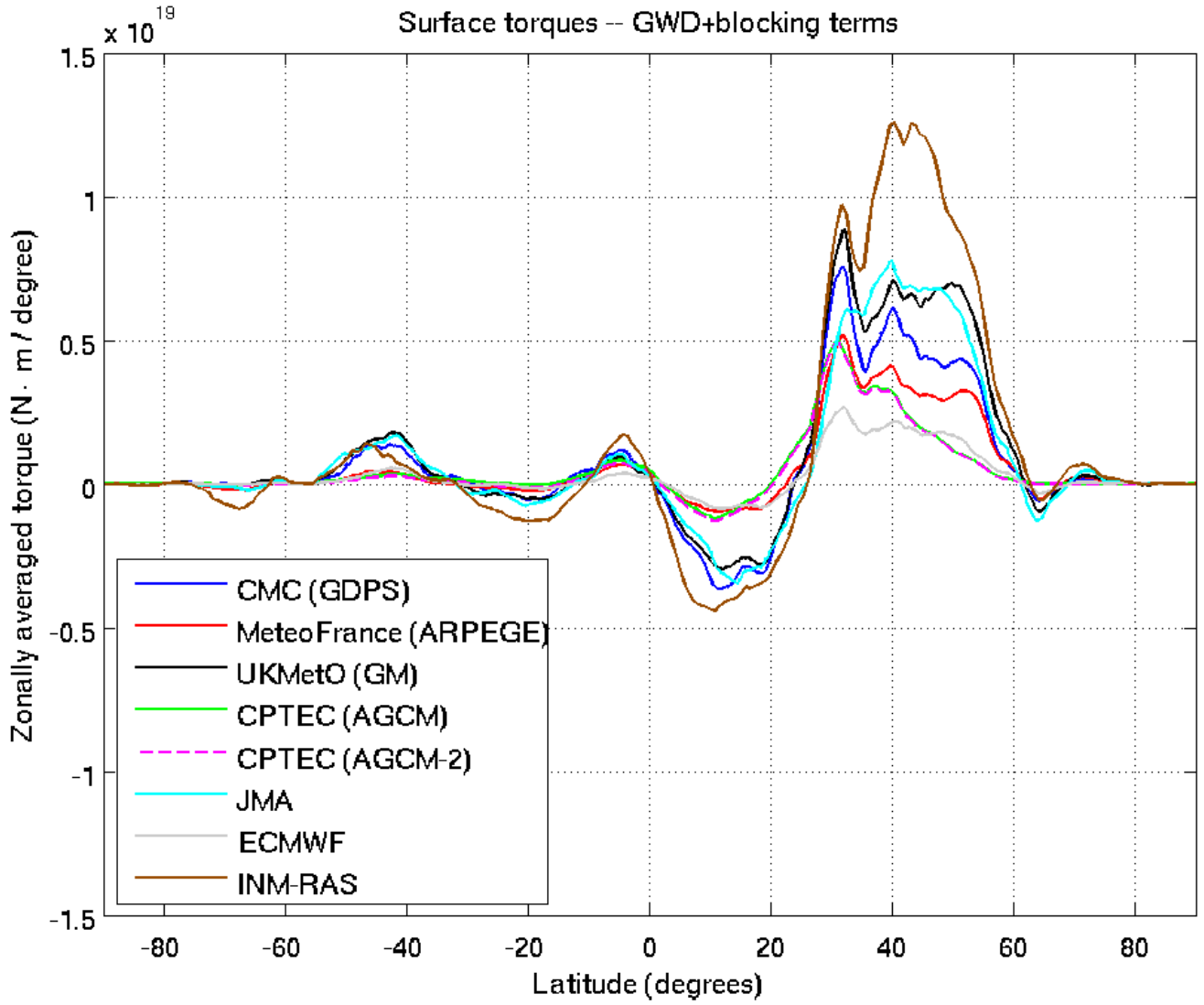
MJO Task Force

- Joined WGNE a little over 1 year ago,
- Continues to make progress towards its overall goal to facilitate improvements of the MJO in weather and climate models.

- 6 current subprojects:
  1. Process-oriented diagnostics/metrics for MJO simulation
  2. Boreal summer monsoon ISV monitoring and forecast metrics
  3. Assessment of CMIP5 model capability to simulate realistic intraseasonal variability
  4. MJO TF + GASS Multi-Model Diabatic Processes Experiment
  5. MJO air-sea interaction
  6. The MJO and the Maritime Continent (with S2S).

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

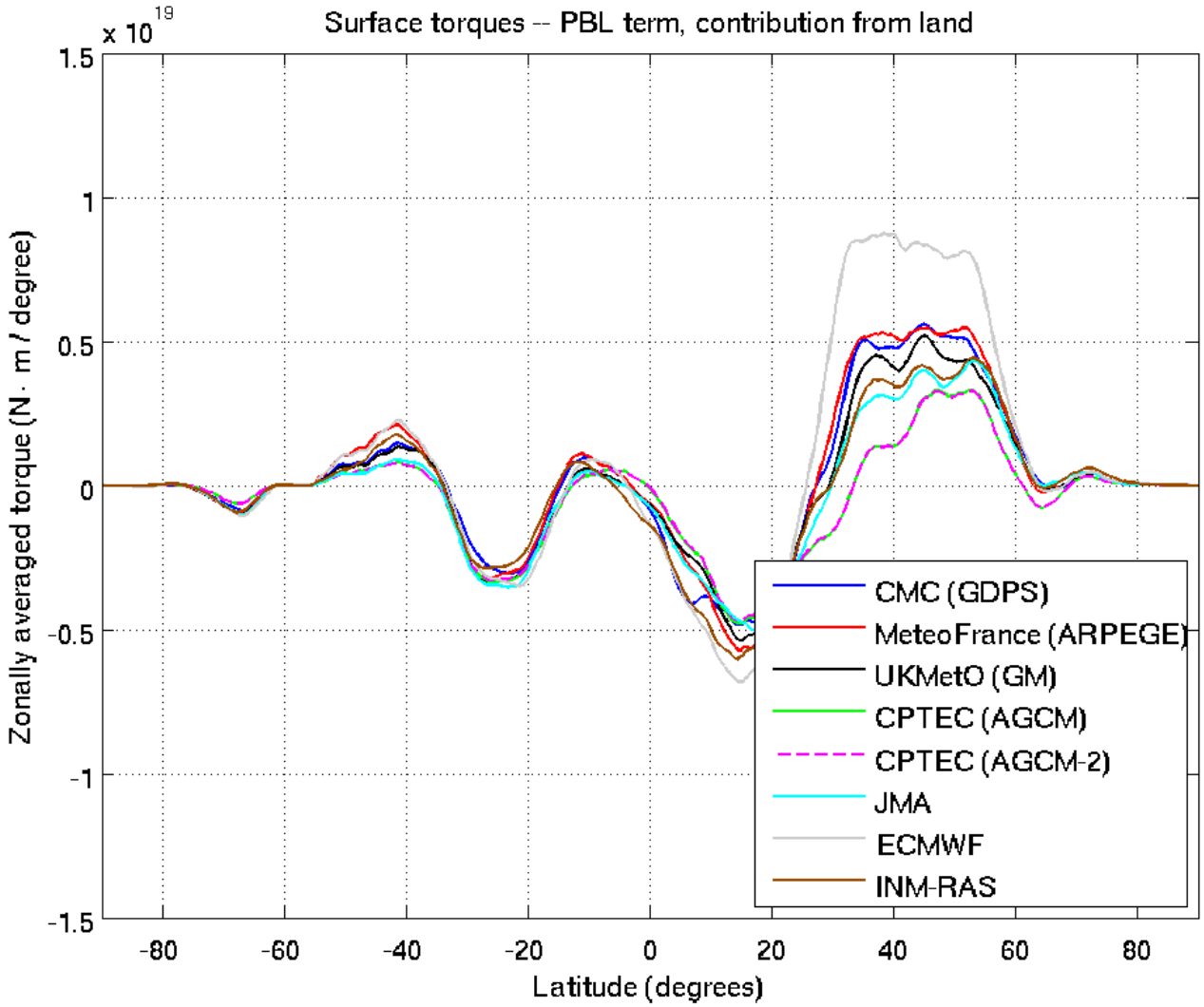
subgrid orography



Thanks to:
Ayrton Zadra

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

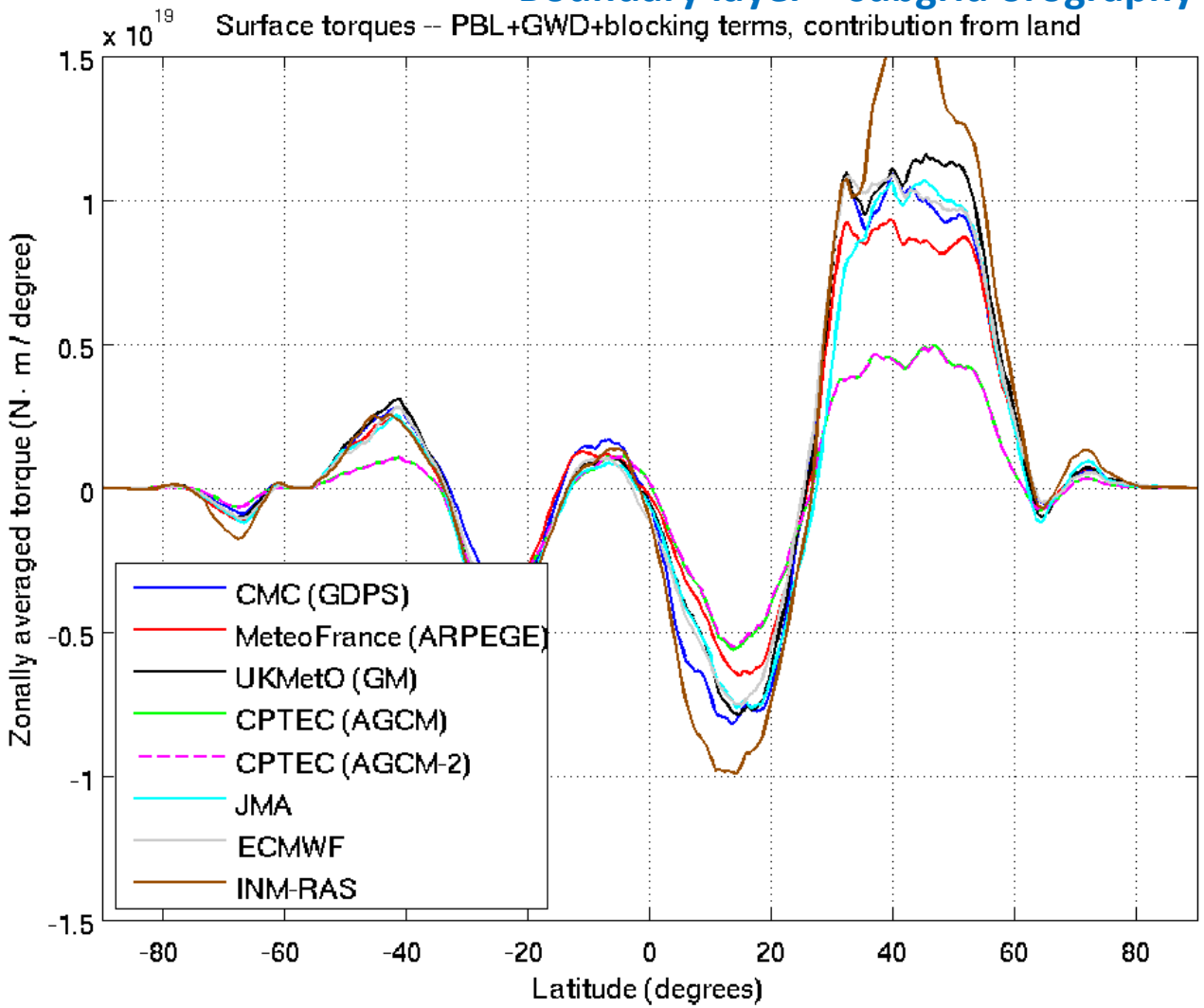
Boundary layer



Thanks to: Ayrton Zadra

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

Boundary layer + subgrid orography



Thanks to: Ayrton Zadra

Evaluating aerosols impacts on Numerical Weather Prediction (NWP)

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

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.

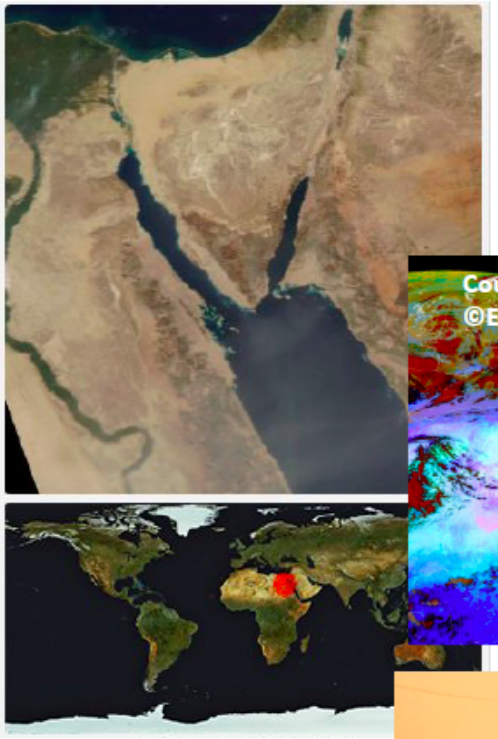
Evaluate model performance in terms of AOD simulation compared to observations (e.g. AERONET/MODIS data) or any other related aerosol observation available.

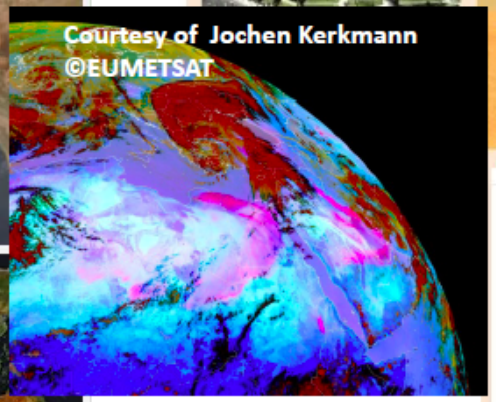
Evaluate aerosol impacts on the model results regarding 2-metter temperature, wind, rainfall, surface energy budget, …

3 cases:

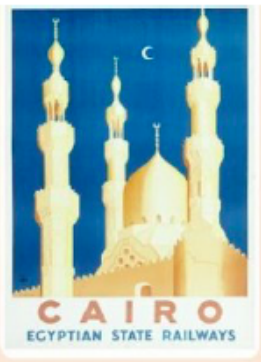
- **Egyptian dust storm – 18 April 2012**
- **Air pollution event, Beijing – 14 January 2013**
- **Biomass burning over South America**

Dust Storm on April 18 2012





Dust over the Nile delta from satellite imagery.
Image courtesy of Chelys.



Wednesday, April 18, 2012

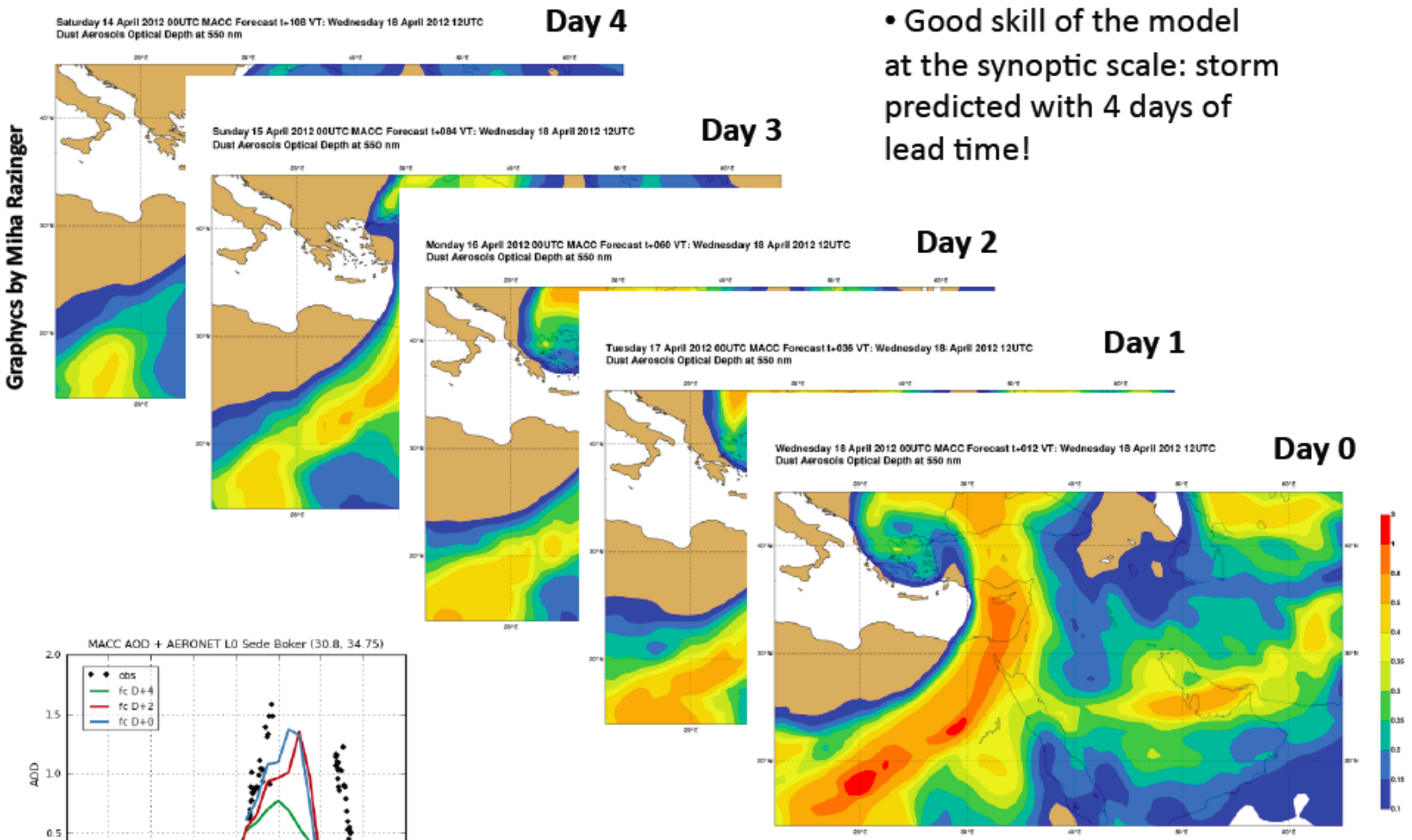
#Sandstorm in #Cairo

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



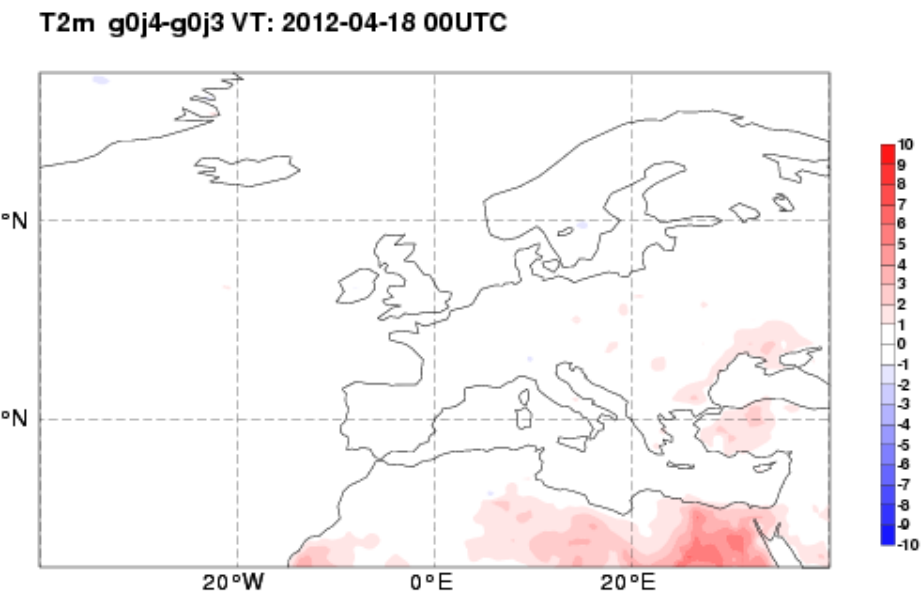
- Good skill of the model at the synoptic scale: storm predicted with 4 days of lead time!

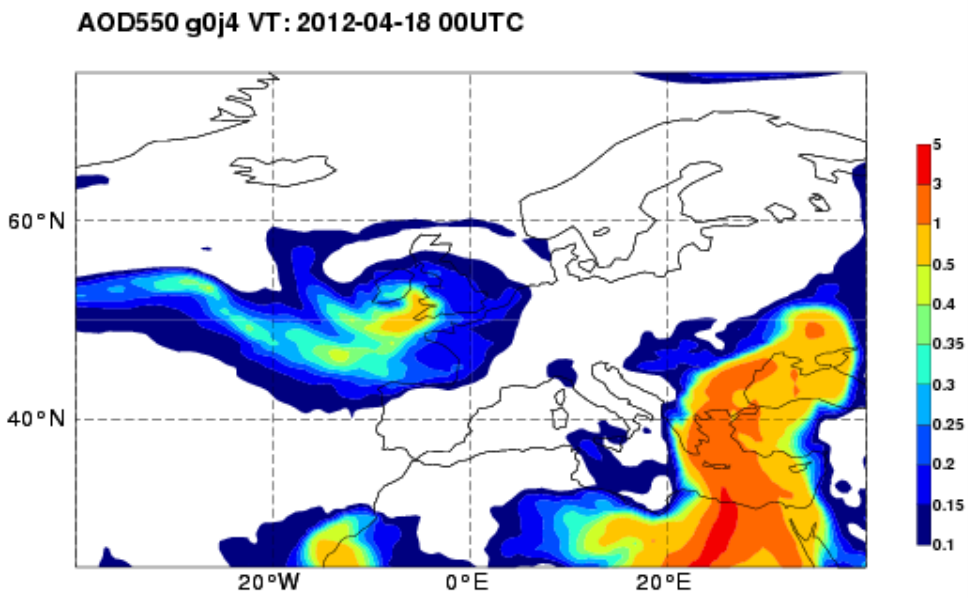
AERONET verification at Sde Boker, Israel

macc
Monitoring atmospheric composition & climate – II

Impact of aerosols direct effect on minimum temperatures

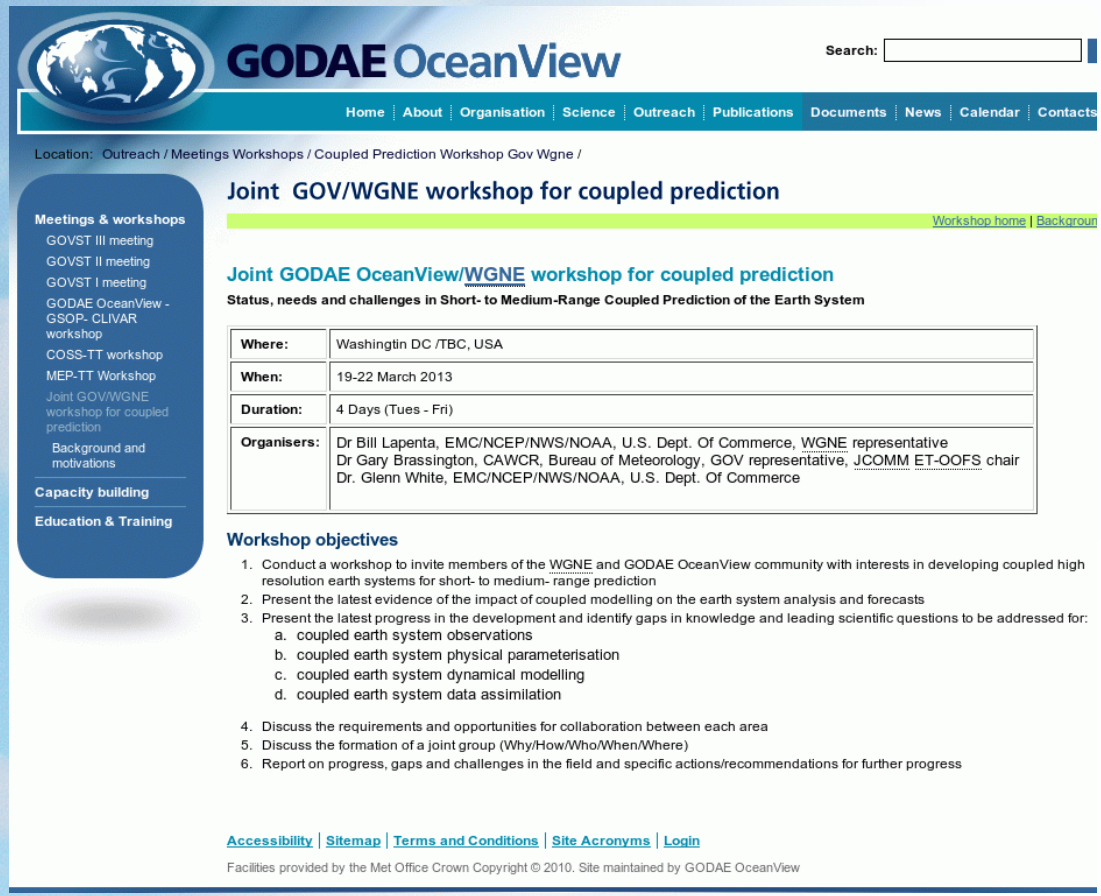
- Taking into account the direct effect brings warmer night-time temperatures over land, by up to 4 degrees
- Near-perfect collocation with AOD patterns
- For most stations in desertic area, it reduces a cold bias at night
- Creates a local heat low
- Generates stronger local wind
- Lifts more aerosols (in agreement with observations)





Workshops and meetings

GOV/WGNE Ocean coupling workshop



GODAE OceanView

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Location: Outreach / Meetings Workshops / Coupled Prediction Workshop Gov Wgne /

Meetings & workshops
- GOVST III meeting
- GOVST II meeting
- GOVST I meeting
- GODAE OceanView - GSOP- CLIVAR workshop
- COSS-TT workshop
- MEP-TT Workshop
- Joint GOV/WGNE workshop for coupled prediction
  - Background and motivations

Capacity building

Education & Training

Joint GOV/WGNE workshop for coupled prediction

Workshop home | Backgroun

Joint GODAE OceanView/WGNE workshop for coupled prediction

Status, needs and challenges in Short- to Medium-Range Coupled Prediction of the Earth System

Where:	Washingtin DC /TBC, USA
When:	19-22 March 2013
Duration:	4 Days (Tues - Fri)
Organisers:	Dr Bill Lapenta, EMC/NCEP/NWS/NOAA, U.S. Dept. Of Commerce, WGNE representative Dr Gary Brassington, CAWCR, Bureau of Meteorology, GOV representative, JCOMM ET-OOFS chair Dr. Glenn White, EMC/NCEP/NWS/NOAA, U.S. Dept. Of Commerce

Workshop objectives

1. Conduct a workshop to invite members of the WGNE and GODAE OceanView community with interests in developing coupled high resolution earth systems for short- to medium- range prediction
2. Present the latest evidence of the impact of coupled modelling on the earth system analysis and forecasts
3. Present the latest progress in the development and identify gaps in knowledge and leading scientific questions to be addressed for:
   a. coupled earth system observations
   b. coupled earth system physical parameterisation
   c. coupled earth system dynamical modelling
   d. coupled earth system data assimilation
4. Discuss the requirements and opportunities for collaboration between each area
5. Discuss the formation of a joint group (Why/How/Who/When/Where)
6. Report on progress, gaps and challenges in the field and specific actions/recommendations for further progress

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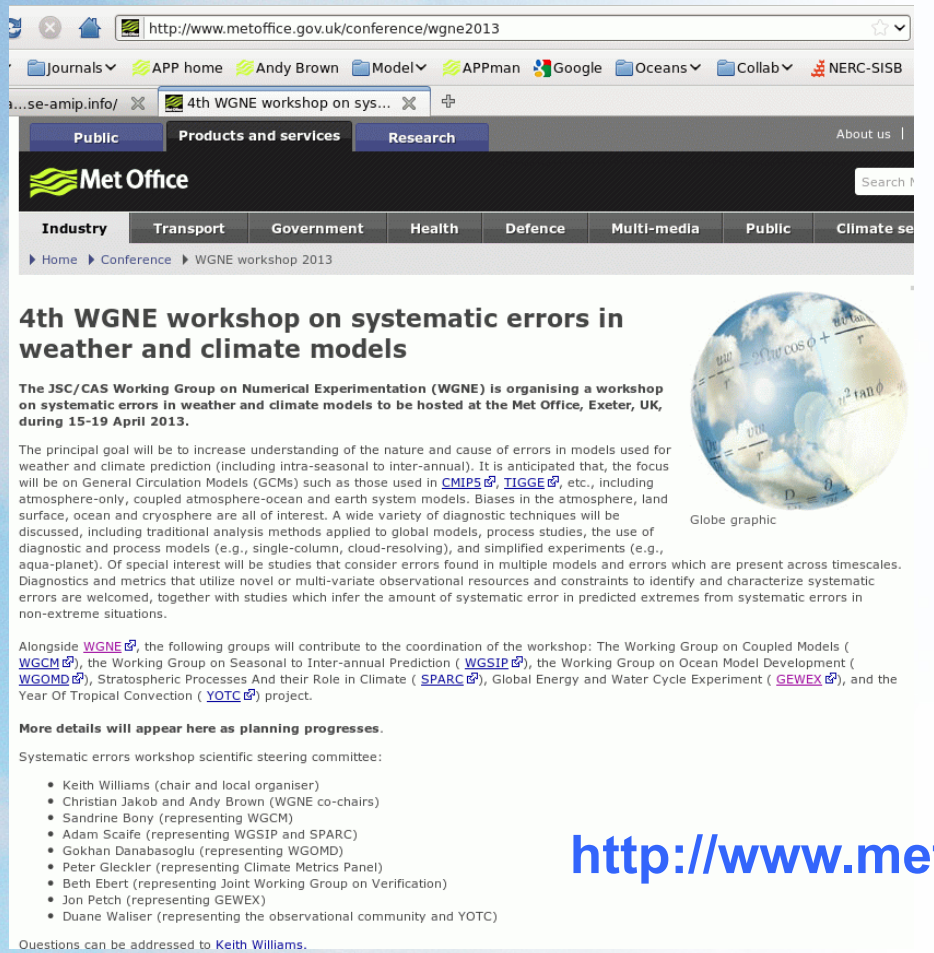
- **Washington, USA. 19th-22nd March 2013**
- Follow on to ECMWF (2008) and Met Office (2009) workshops
- Focus on coupled modelling for short and medium range
- Use of short-range coupled to understand issues for longer range (e.g. subseasonal-seasonal)

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

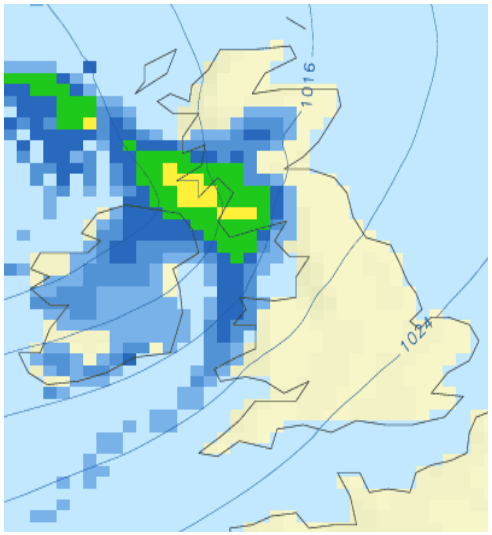


- **Met Office, Exeter, UK. 15th-19th April 2013**
- Weather and climate
- Nature and causes of errors
- Use of diagnostic techniques, observations, process models and simplified experiments to understand errors

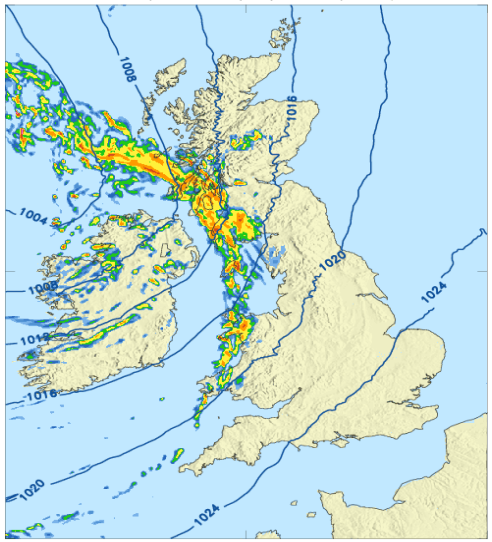
http://www.metoffice.gov.uk/conference/wgne2013

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

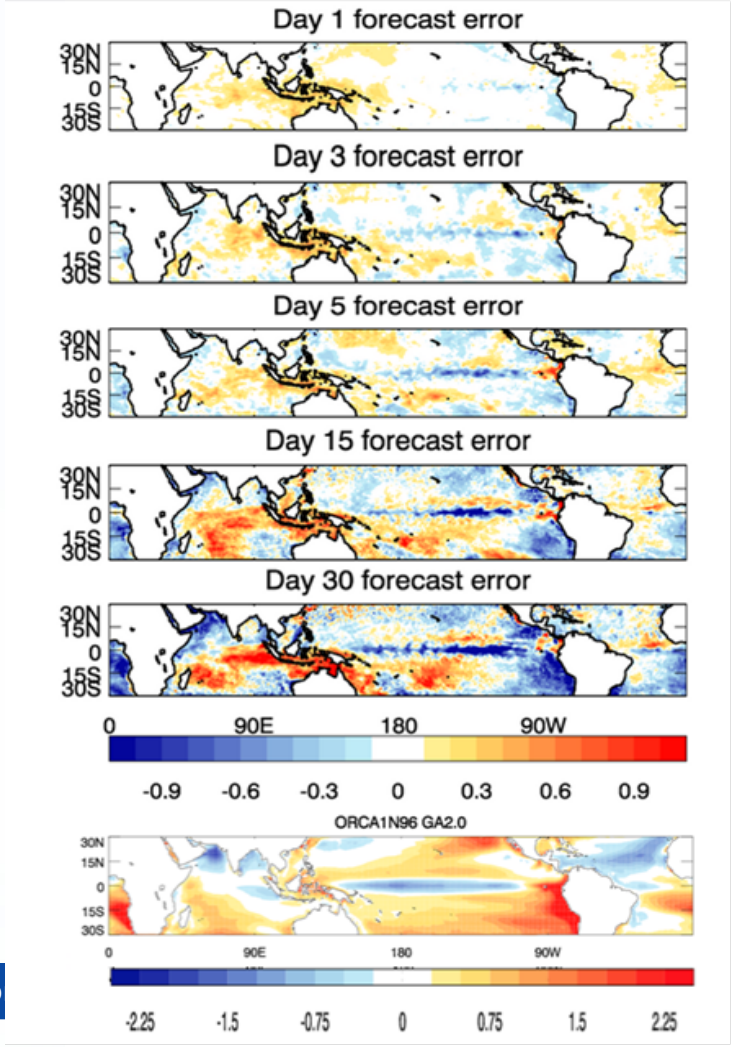


1.5km

Future directions

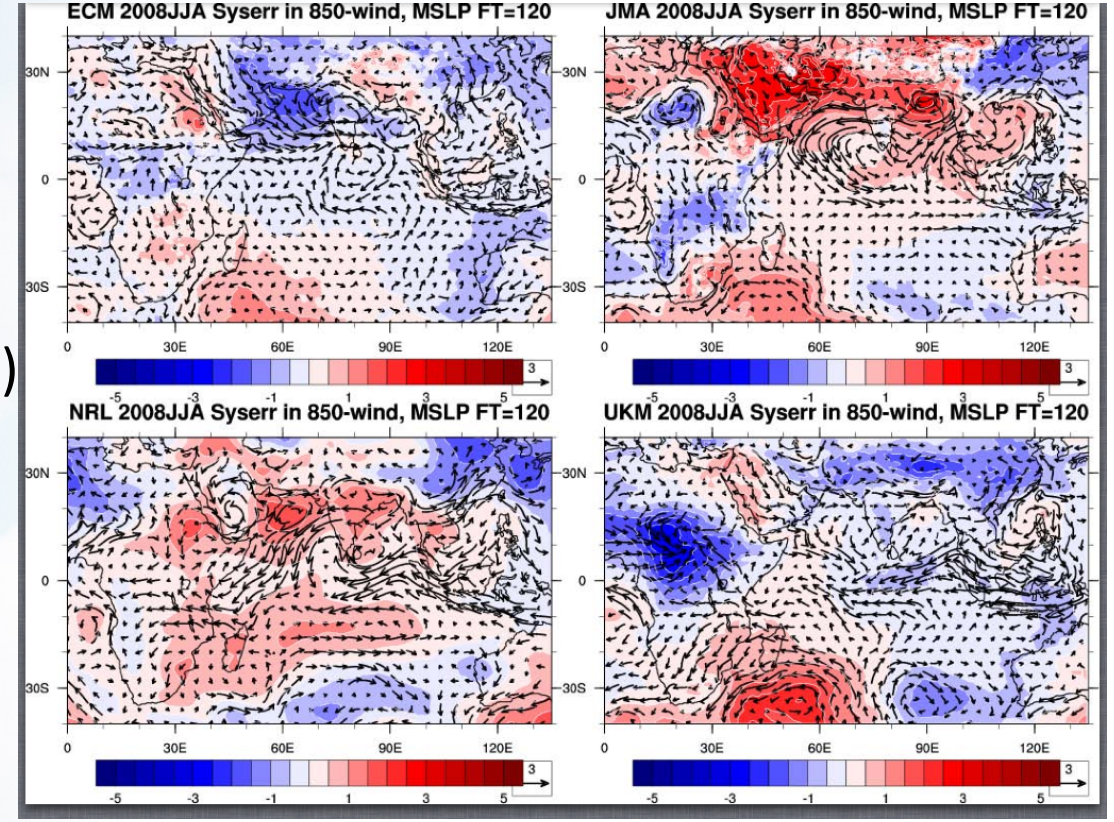
- Earth system prediction
  - (Ensemble) atmospheric weather prediction models coupled to ocean, composition, air quality, hydrology, ice.....
    - Bringing together communities (GODAE coupling workshop; systematic errors meeting)
    - Importance of aerosol for NWP: review and test cases
    - **TRANSPOSE-CMIP?**

Time evolution of coupled model SST errors



Future directions

- "Traditional model evaluation and development"
  - Still important – and importance under-recognized
  - Champion (with partners) e.g. Conferences
  - Specific projects to engage community and tackle key issues



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
- Maintain strong links to many other groups and projects e.g. WWRP, DAOS, GASS, PPP, S2S, WGCM, SPARC, WMAC, WDAC, GODAE, WCRP GCs and CPs,..
- Maintaining active portfolio of focused projects and workshops/conferences

Future directions: short-term focus and immediate actions

- Comparison of model momentum budgets
  - Consolidate results, engage with more participants, expand to climate (SPARC)
- Importance of aerosols for weather and climate
  - Expand cases, refine protocols, expand beyond NWP angle, etc.
- Support to S2S
  - Systematic error workshop, special focus on teleconnections
- Support to PPP (PCPI)
  - Verification (quality of (re-)analyses), observational system design, etc.
- Support to CMIP
  - High resolution time slice intercomparisons

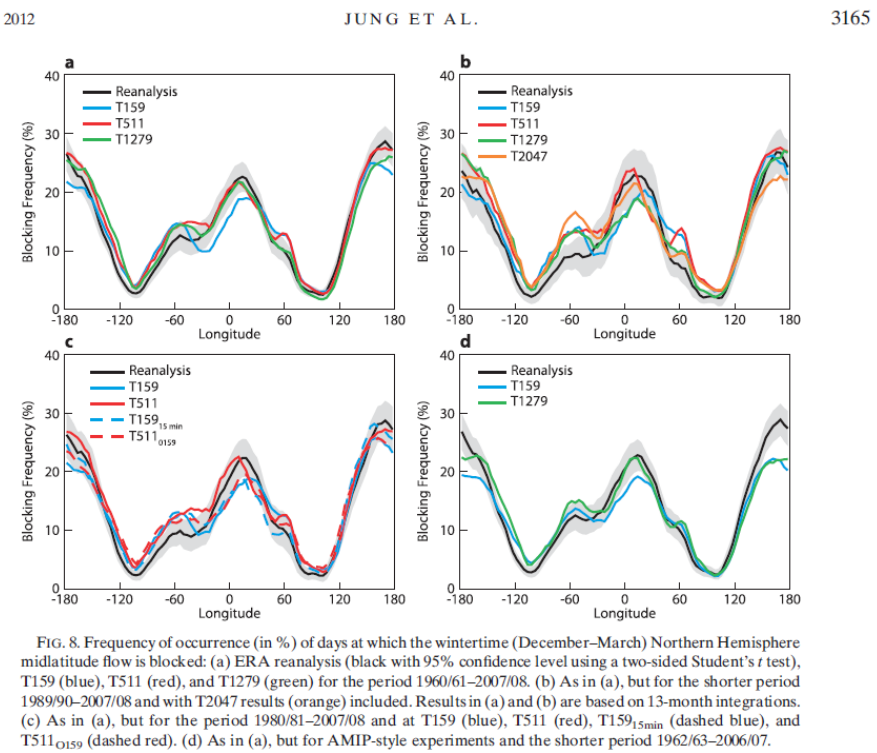


FIG. 8. Frequency of occurrence (in %) of days at which the wintertime (December–March) Northern Hemisphere midlatitude flow is blocked: (a) ERA reanalysis (black with 95% confidence level using a two-sided Student's *t* test), T159 (blue), T511 (red), and T1279 (green) for the period 1960/61–2007/08. (b) As in (a), but for the shorter period 1989/90–2007/08 and with T2047 results (orange) included. Results in (a) and (b) are based on 13-month integrations. (c) As in (a), but for the period 1980/81–2007/08 and at T159 (blue), T511 (red), $T159_{15min}$ (dashed blue), and $T511_{O159}$ (dashed red). (d) As in (a), but for AMIP-style experiments and the shorter period 1962/63–2006/07.

Thank You

WGCM/WGNE links

- Several modeling groups contributed high-resolution (~25km) AMIP experiments to CMIP5 with companion "time-slice" AGCM simulations that used mid-21st century SSTs from a coupled model configuration as boundary forcing.

- Given the need to further explore the added value of higher resolution in climate change experiments, there is considerable interest to increase the opportunities for high-resolution intercomparison in CMIP6.

- It is expected that a formal "MIP" will be organized, and WGNE will be available to provide some guidance given WGNE's experiences with high resolution NWP, the Grey Zone, and other projects.

- Julio Bacmeister will provide this link.