WGNE activities and future directions

Jean-Noël Thépaut & Andy Brown

ECMWF & UK MetOffice
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**.
Co-ordinated experiments and projects
- 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
AEROSOL impact on NWP

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-metre 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.

Egyptian Chronicles

Courtesy of Jochen Kerkmann @EUMETSAT

#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.

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 April 18, 2012. (SAID KHATIB/AFP/Getty Images)
MACC-II/ECMWF forecasts for April 18 2012

Day 4

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

Day 3

Day 2

Day 1

Day 0

AERONET verification at Sde Boker, Israel
subgrid orography

Surface torques -- GWD+blocking terms

Zonally averaged torque (N. m / degree)

Latitude (degrees)

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

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

Boundary layer

Surface torques -- PBL term, contribution from land

Zonally averaged torque (N m/degree)

Latitude (degrees)

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

Thanks to: Ayrton Zadra
Boundary layer + subgrid orography

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

Zonally averaged torque (N m/degree)

Latitude (degrees)

-80 -60 -40 -20 0 20 40 60 80

-1.5 -1 -0.5 0 0.5 1 1.5

x 10^10

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

Thanks to Ayrton Zadra
Workshops and meetings
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)

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

The JSC/CAS Working Group on Numerical Experimentation (WGNE) is organizing a workshop on systematic errors in weather and climate models to be hosted at the Met Office, Exeter, UK, during 15-19 April 2013.

The principal goal will be to increase understanding of the nature and cause of errors in models used for weather and climate prediction, including intra-seasonal to inter-annual. It is anticipated that the focus will be on General Circulation Models (GCMs) such as those used in CMIP5, THASSOS, etc., including atmosphere-only, coupled atmosphere-ocean and earth system models. Bases in the atmosphere, land surface, ocean and cryosphere are all of interest. A wide variety of diagnostic techniques will be discussed, including traditional analysis methods applied to global models, process studies, the use of diagnostic and process models (e.g., single-column, cloud-resolving), and simplified experiments (e.g., aqua-planet). Of special interest will be studies that consider errors found in multiple models and errors which are present across timescales. Diagnostics and metrics that utilize novel or multi-variable observational resources and constraints to identify and characterize systematic errors are welcomed, together with studies which infer the amount of systematic error in predicted extremes from systematic errors in non-extreme simulations.

Alongside WGCM, the following groups will contribute to the coordination of the workshop: The Working Group on Coupled Models (WGCM), the Working Group on Seasonal to Inter-Annual Prediction (WGSAIP), the Working Group on Ocean Model Development (WGOMD), Ecological Processes And Their Role In Climate (WGECAR), Global Energy and Water Cycle Experiment (GEOEX), and the Year Of Tropical Convection (YOTC) project.

More details will appear here as planning progresses.

Systematic errors workshop scientific steering committee:
- Keith Williams (chair and local organiser)
- Christian Jakob and Andy Brown (WGNE co-chairs)
- Sondre Bony (representing WGCM)
- Adam Soulie (representing WGCM and WSGM)
- Glebhat Daskalov (representing WGCM)
- Peter Gleckler (representing Climate Metrics Panel)
- Ruth Flint (representing WGCM)
- Jon Politz (representing GEWEX)
- Darin Wibber (representing the observational community and YOTC)

Questions can be addressed to Keith Williams.

http://www.metoffice.gov.uk/conference/wgne2013
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).
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?
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 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)
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
Thank You