WGNE report to WCRP JSC

Andy Brown and **Christian Jakob**
WGNE co-chairs

WGNE TORs

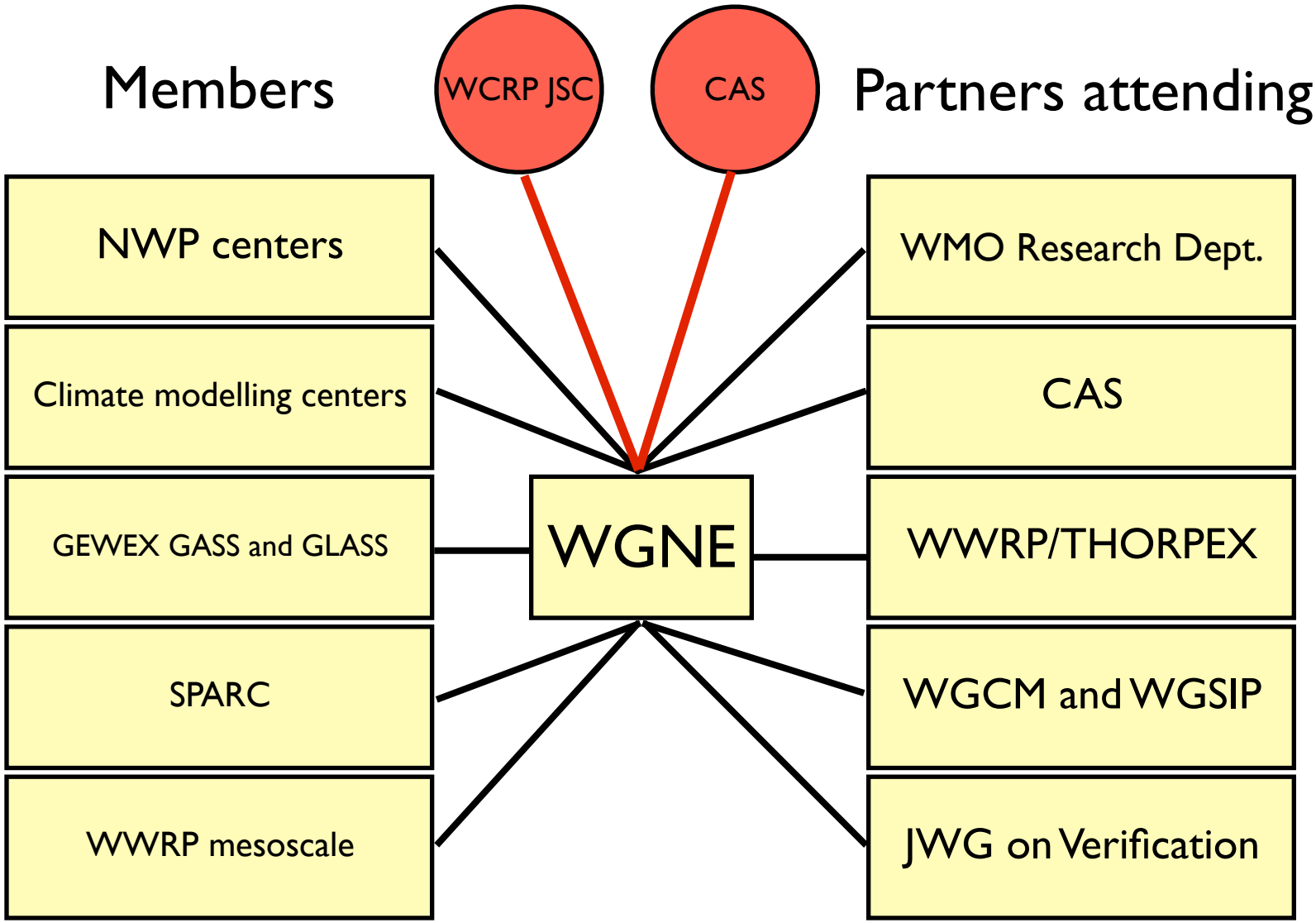
- Advise the JSC and CAS on progress in atmospheric modelling.
- Review the development of atmospheric models for use in weather prediction and climate studies on all scales, including the diagnosis of shortcomings.
- Propose numerical experiments aiming to refine numerical techniques and the formulation 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 timescales.
- 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.

Role of WGNE

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

Advice and Liaison

The WGNE cohort



Co-ordinated experiments and projects

Project overview

- Transpose-AMIP with WGCM GOOD PROGRESS
- SURFA SLOW PROGRESS
- Grey-zone (with GASS) GOOD PROGRESS
- Verification
  - NWP performance (with JWGV) (eg TCs, precipitation) ONGOING
  - Polar (CBS-style; ConcordIASI intercomparsion) NEW
  - Climate metrics (with WGCM) GOOD PROGRESS
  - Issues with verifcation against own analysis (with JWGV) NEW

Transpose-AMIP:
testing climate models in NWP mode

- Core experiment is to run 64 hindcasts, each 5 days long, initialised from ECMWF YOTC analysis.
- Optional experiment to repeat the same set of hindcasts with NASA MERRA re-analysis or own analysis.
- The hindcasts spread through the annual and diurnal cycles and chosen to tie in with YOTC and coincide with some of the IOPs in:
  - VOCALS (SE Pacific stratocumulus)
  - AMY (Asian monsoon)
  - T-PARC (mid-latitude Pacific)
- 9 centres committed to submit data
- **MIROC5, HADGEM2, CNRM-CM5 now available to download**

Correspondence between Forecast Errors and Climate Errors in Tropical Precipitation Simulated by Transpose-AMIP and CMIP5-AMIP Models

Shaocheng Xie[1], His-Yen Ma[1], James Boyle[1], Stephen Klein[2], Keith Williams[2], Michel Deque[3], and Masahiro Watanabe[4]

[1]Lawrence Livermore National Laboratory, USA [2]Met Office, United Kingdom [3]Meteo-France, France

[4]Center for Climate System Research/The University of Tokyo, Kashiwa, Japan

Introduction

Transpose-AMIP - The Transpose - Atmospheric Model Intercomparison Project is to run climate models in weather-forecast mode for selected periods during the Year Of Tropical Convection (YOTC) (May 2008 to April 2010). The atmospheric models used in the transpose-AMIP are the same as those used for the CMIP5. The goal of the transpose-AMIP project is to better understand and yield significant insights into the cause of errors in the CMIP5 models.

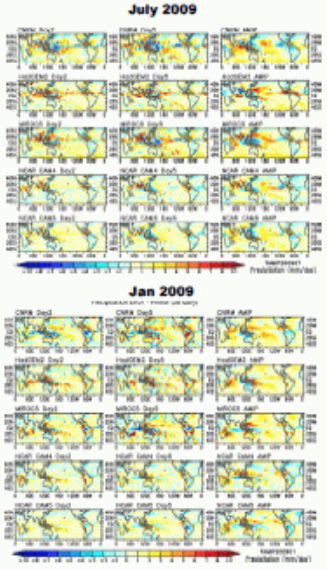
Experiments – total 64 5-day hindcasts initialized with the ECMWF analysis; 4 sets of 16 hindcasts are run, the first in each set starting at 00Z on the 15th of the following months and then subsequently at 30 hour intervals: October 2008, January 2009, April 2009 and July 2009. This ensures sampling throughout the annual and diurnal cycles for each grid-point for a given lead times.

Objective – Systematically examine the relationship between the composite biases in the short-range forecasts and long-term climate simulations with a focus on tropical convection:

- *Which climate errors develop on short time scales? Which on long time scales?*

Observation – TRMM precipitation

Forecast Errors vs. Climate Errors



- Major model errors are similar between forecasts and climate for all the five examined models.
- HadGEM2-A shows quite different errors over the a broad stretch of the Indian Ocean, Maritime Continent, and western Pacific, the vicinity of Central America, the Eastern Pacific Warm Pool, and the Central South America.

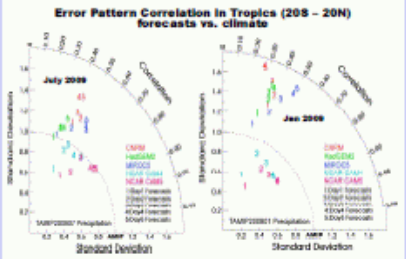
Examined Models

CMIP5 Model Name	Modeling Group(s)	AGCM Resolution: (Lonxlat, Lev)	Contact
HadGEM2-A	Met Office Hadley Centre	192x145, L38	Keith Williams
CNRM-CM5	Centre National de Recherches Meteorologiques / Centre Europeen de Recherche et Formation Avancee en Calcul Scientifique	256x128, L17	Michel Deque
MIROC5	Atmosphere and Ocean Research Institute (The University of Tokyo), National Institute for Environmental Studies, and Japan Agency for Marine-Earth Science and Technology	256x128, L40	Masahiro Watanabe
NCAR-CAM4*	National Center for Atmospheric Research	0.9 x 1.25 (deg), L26	James Boyle
NCAR-CAM5*	National Center for Atmospheric Research	0.9 x 1.25 (deg), L30	James Boyle

*CAM4 and CAM5 were initialized with the ECMWF analysis every day at 00Z for the entire YOTC period. This is slightly different from the standard transpose-AMIP runs. These special runs were done at PCMDI/LLNL. Therefore, they have more samplings for obtaining the monthly mean than the other three CMIP5 models.

* Standard CAM4 and CAM5 transpose-AMIP runs are not available and will be done by Dave Williamson of NCAR.

How Are Climate Errors Approached in Forecasts?

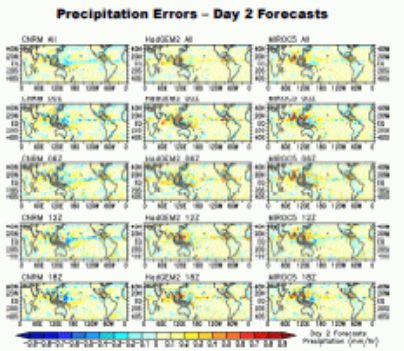


The CAM4/5 clearly show the gradual evolution of forecast errors toward their climate errors. This is also true for MIROC5 in Winter. HadGEM2-A day 2 ~ day 6 forecasts are similar; while the pattern correlation with climate errors decreases with the forecast lead time in CNRM.

Summary

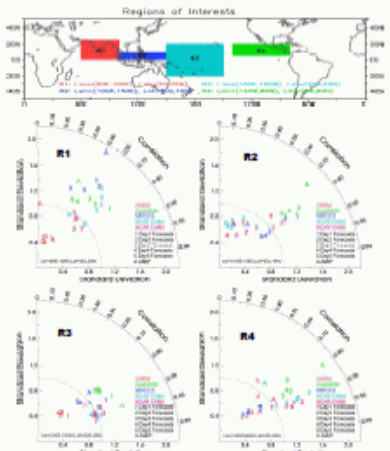
- Most tropical precipitation errors develop fast and are apparent in day 2 forecasts for all the five examined models. These include excessive precipitation over much of the tropics, particularly over the areas adjacent the Indian peninsula and the Central and Eastern Pacific for all the models, as well as the precipitation deficits over Central South America for most of the models except for HadGEM2-A, in which the errors are small and not clear.
- The precipitation deficits in the areas adjacent the Maritime Continent exhibited by all the CMIP5 models are apparent in their day 5 forecasts, but not in their day 2 forecasts. This suggests some feedbacks with the large-scale circulation need to be involved and they take longer timescale to develop.
- These errors steadily grow with the forecast lead time in CAM4 and CAM5, as well as MIROC5 in Winter while this error growth is not clear for HadGEM2-A, CNRM, and MIROC5 (Summer)
- These errors are not sensitive to model initialization time and are statistically significant (seems not sensitive to the number of samplings).
- Other relevant fields will be analyzed and a more in-depth analysis will be performed to understand the cause of these errors.

Sensitivity to Model Starting Time



Major model errors are not sensitive to the slightly different starting time or the number of samplings.

Regional Analysis – July 2009



- Forecast errors are typically smaller than climate errors over these selected regions
- These models show more problems over the areas adjacent the Indian peninsula and Maritime Continent than the Central and eastern Pacific

Acknowledgments

This work is supported by the Global Climate Modeling Program and Atmospheric System Research (ASR) program of the Office of Science at the US Department of Energy. The transpose-AMIP is sponsored by the WMO WGNE and WGCM working groups.

- Data now being used!
- Expect at least some papers to make AR5 deadline

www.transpose-amip.info

Grey zone
Cold air outbreak case

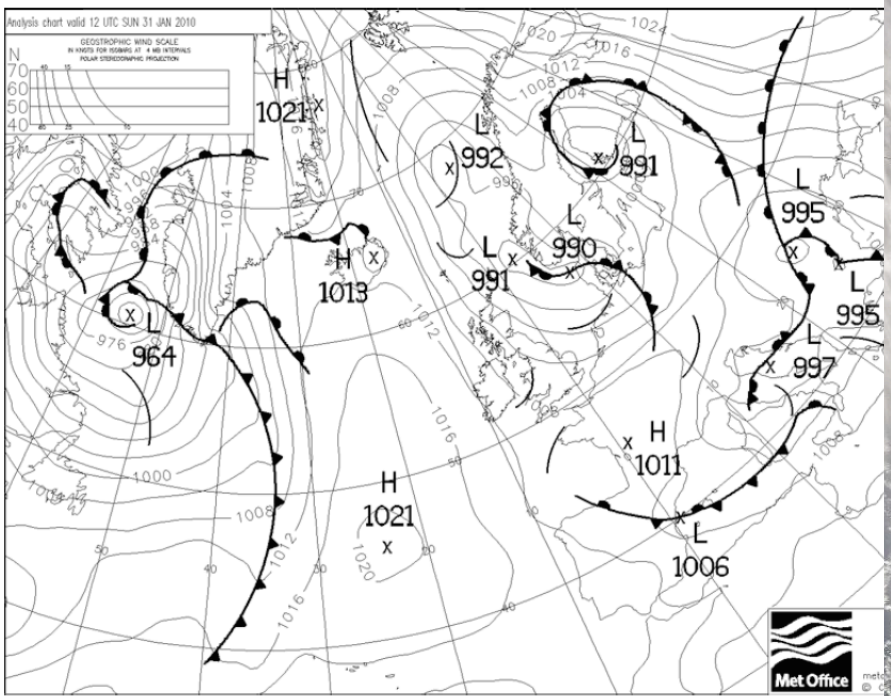
- WGNE and GASS supported project
- Model intercomparison (9+ participating groups)
  - GCM
  - LAM
  - Idealized LAM / CRM.
- How well do models represent convection and the evolution of the boundary layer in a cold air outbreak?
- Use of high resolution 'truth' to investigate parametrization issues for coarser resolution models

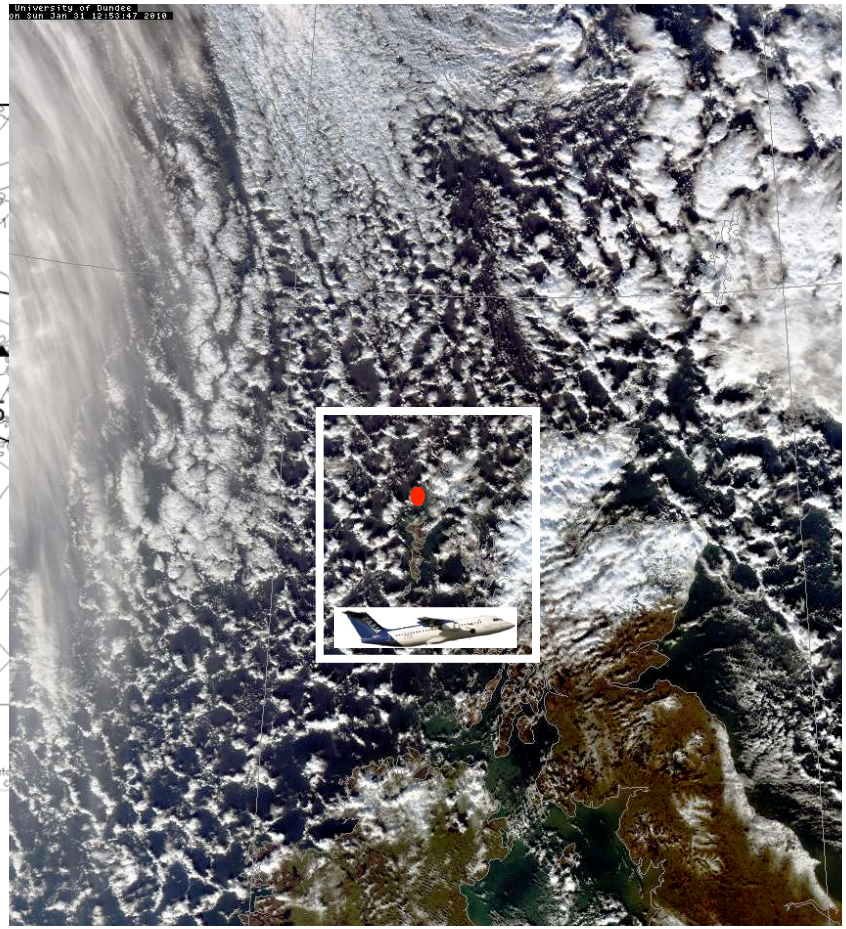
Interest on participation on the Grey Zone Project

	global	Meso Operational	Meso idealised	LES	contacts
MetO	MetO globa Model	MetO meso model	MetO meso model	MOLEM	Paul Field Adrian Lock Andy Brown
Meteo France	Arpege	AROME MesoNH	AROME MesoNH (p)	MesoNH	Bouysel Eric Bazile Fleur Couvreux
DWD (MPI-H)	ICON	COSMO-EU COSMO-DE	COSMO-EU COSMO-DE	UCLA-LES	Martin Kohler Axel Seifert Verena Grutzun
Met Service Canada		Canadian LAM		Canadian LES	Vaillancourt Jason Milbrandt Aytron Zadra Stephan Belair
NCAR		WRF	WRF (p)	WRF(p)	Jim Dudhia
ECMWF	IFS (p)				Anton Beljaars
KNMI		HARMONIE	HARMONIE (p)		Wim de Rooy
TU Delft		Harmonie		DALES	Stephan de Roode Ramon Mendez
		Alaro	Alaro		J-F Geleyn
JMA Univ. of Tokyo	NICAM	JMA model	JMA model	LES	Kazuo Saito Niino Kimoto

31st January 2010

- Aircraft obs
- Radar obs





Next steps

- Iterating setup for CRM case between Met Office and KNMI
- Release case setup Summer 2012.
- Grey zone session at Pan-GASS meeting (Boulder Sept 2012). Show first results.

Workshops and meetings

WGNE-THORPEX PDP

- Joint expert meeting on "Diagnosis of Forecast Errors" held in Zurich, July 2010
- WGNE/PDP/ECMWF Workshop on Representing Model Uncertainty and Error in Numerical Weather and Climate Prediction Models, ECMWF, June 2011
    - Brought together data assimilation, model physics and ensemble/stochastic physics communities
    - Stochastic parametrisation paradigm needs further development at the process level and to be incorporated as part of general parametrization development ⇒ WGNE/GASS efforts
    - http://www.ecmwf.int/publications/library/do/references/list/201106

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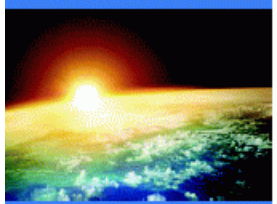


climatesciences.jpl.nasa.gov

NASA JET PROPULSION LABORATORY CENTER FOR CLIMATE SCIENCES

Workshop: The Physics of Weather and Climate Models

March 20-23, 2012

Beckman Institute, California Institute of Technology
Pasadena, California

Organized by J. Teixeira (JPL), C. Jakob (Monash), P. Siebesma (KNMI)

Co-organized by
Working Group on Numerical Experimentation (WGNE)
Keck Institute for Space Studies (KISS), Caltech

Workshop Goal
To focus on key problems in the representation of physical processes in weather and climate models, and to develop scientific and programmatic strategies for their solution.

Workshop Format
Three multidisciplinary thematic sessions, one per day

Day 1-3: Mornings: Three invited one-hour presentations
Afternoons: Break-out and Poster Sessions

Day 4: Break-out Presentations, Plenary Session, Recommendations

March 20, Tuesday: **High-Latitude Physics**
March 21, Wednesday: **Tropical Weather and Climate**
March 22, Thursday: **Clouds and Climate Physics**
March 23, Friday: **Plenary Session and Recommendations**

Register Online starting November 20, 2011 at:
climatesciences.jpl.nasa.gov/workshop/model-physics-2012

WCRP World Climate Research Programme

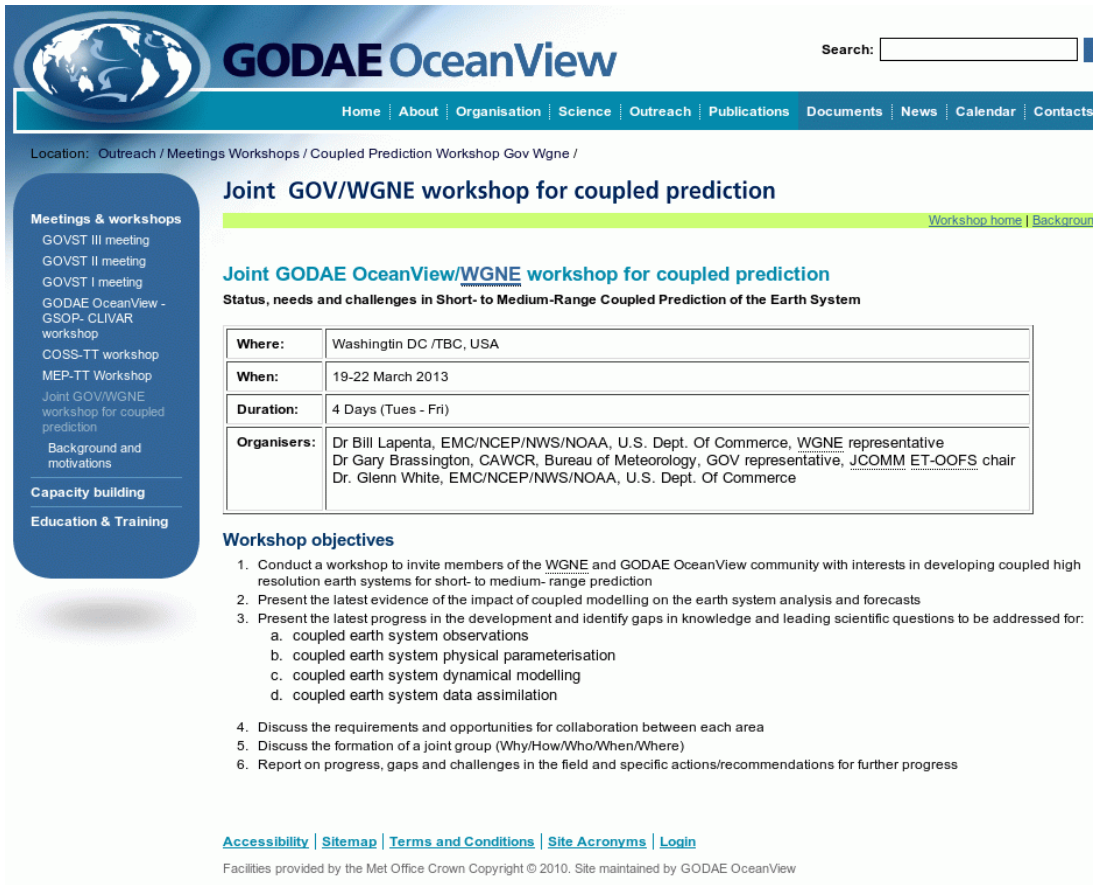
Keck

WWRP

Some recommendations

- Improve funding around model physics development, in particular increase length and target key issues
- Focus on addressing long-standing issues, in particular some of the old model biases
- Grow the model developer species
  - Links to academia using complementing strengths of both communities
  - Improve Recognition including prizes
  - Targeted programs including summer schools and scholarships
- Communicate better, especially, be more positive

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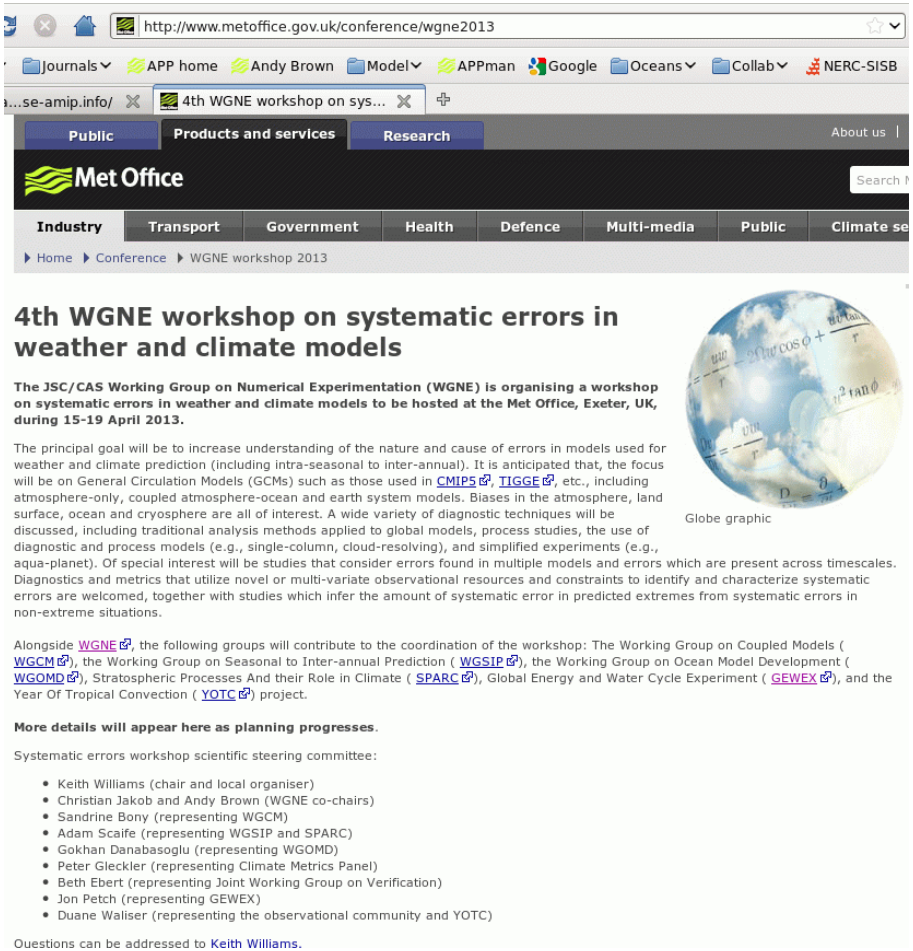
- **Washington, USA. 19th-22nd March 2013**
- Follow on to ECMWF (2008) and Met Office (2009) workshops
- Focus on coupled modelling for short and medium range
- Use of short-range coupled to understand issues for longer range (e.g. subseasonal-seasonal)

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

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

Proposed sessions

- Tropical processes (Convective processes, MJO, ENSO, AEWs, tropical cyclones, etc.)
- Mid-latitude processes (Evolution of synoptic features, storm tracks, blocking, etc.)
- Sea ice and polar processes
- Clouds, aerosols and radiation
- Land surface processes
- Ocean processes and ocean-atmosphere interactions
- Stratospheric processes and stratosphere-troposphere interactions
- Holistic model evaluation and metrics

Some anticipated highlights of WGNE-28

- Polar project(s) presentation and discussions
- Sub-seasonal project presentation and discussion
- Atmospheric chemistry discussions with GAW
- First grey-zone project results
- Finalize Systematic Error workshop planning

Some reflections

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- Climate is the PDF of weather and WGNE has never been more important than today in bringing research in the two areas closer together.
- WGNE will go on strongly and I am looking forward to its crucial contribution to WMAC.

Questions?