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PROJECT REPORT

Report of the 14th Session of the CLIVAR/WCRP Working Group on Coupled Modelling (WGCM)

4- 6 October 2010, UK Met Office, Exeter, UK

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1. Recommend that all decadal exp groups also run AMIP experiments (Expt. 3.3 of Taylor et al., 2011)

2. Remind groups that an important part of the core long term experiments are the pair of fixed SST simulations (Expts. 6.2a and 6.2b) needed to diagnose CO2 radiative forcing. An alternative method of diagnosing CO2 radiative forcing is to perform an ensemble of 5-year abrupt 4xCO2 simulations (Tier 1, Expt. 6.3-E), along with the Core Expt. 6.3. Recommend that if Expts. 6.2a and 6.2b cannot be performed, that at least 6.3 and 6.3-E be run (see of Taylor et al., 2011).

3. Recommend that all should run 1% CO2 increase (Expt 6.1 or 6.1-S of Taylor et al., 2011).

4. Link to gridded CO2 emissions; centralize data access (K. Taylor)

Representative Concentration Pathways (RCPs) Update

5. Ensure consistency in how the IAM community refers to the RCP2.6/3 scenario. The scenario is referred to as RCP2.6 in the CMIP5 documentation. The Climatic Change 2011 special issue should make clear that both conventions refer to the same scenario (N. Nakicenovic)

6. The IIASA database is recommended as the starting point to download RCP data.

7. The default for aerosol concentrations post 2100 should be to continue the same aerosol concentrations in 2100 out to 2300

Publishing CMIP5 Data

8. CMIP panel to query METAFOR on its plans to publish information on the metadata questionnaire (R. Stouffer)

9. The CMIP5 model output should be referred to as "the CMIP5 multi-model ensemble [archive/output/results/of simulations/dataset/ ...]".

Decadal Prediction Panel

10. WGCM-WGSIP Decadal Climate Prediction Panel membership: G. Boer (lead), B. Kirtman, R. Stouffer, G. Meehl, K. Taylor, M. Latif, D. Smith and S. Power

11. Encourage panel support the organization of the 2011 Aspen Global Change Institute workshop on decadal prediction.

12. WGSIP and the Decadal Climate Prediction Panel should consider providing recommendations/guidance on bias corrections and what decadal prediction data (bias corrected or raw) should be submitted to the CMIP5 archive. The recommendations should be circulated to WGCM soon so that they can be passed on to modeling groups as soon as possible (G. Boer, D. Smith)

CMIP5 Coordinated Analysis

13. CMIP3 participants continue to keep their information up-to-date with PCMDI (C. Covey)

14. Prepare guidance to help users navigate the CMIP5 database. This may involve a road map summary of the Taylor et al CMIP5 document, a categorisation of the experiments, and links to additional recommendations for analysts (R. Stouffer, K. Taylor, CMIP panel).

15. Analysts accessing CMIP5 output should be asked to:
    a) Record (at registration) how they intend to use the data (e.g., what science issues they plan to address, register subproject outlines).
    b) Be ready to respond to requests from the WGCM for feedback about model errors or deficiencies they discover, CMIP5 publications, etc.

16. Recommend to SPARC DynVar to synthesize impact of high top models running in CMIP as compared to low-top version (V. Eyring)

17. Recommend that WGOMD compare CORE-II results to CMIP coupled simulations (H. Drange)

Metrics Panel

18. The Metrics Panel should strengthen its links to other groups that are developing metrics. Help compile an email list of PIs of MIPs for the Metrics Panel (A. Pirani, V. Eyring)

19. Post the Meeting Report of the Intergovernmental Panel on Climate Change Expert Meeting on Assessing and Combining Multi Model Climate Projections on the PCMDI and WGCM web pages, alerting users to these guidelines (A. Pirani, K. Taylor)

WGCM-endorsed community coordinated experiments

20. "WGCM-endorsed community coordinated experiments" (formerly referred to as "CMIP Coordinated Experiments) are those modeling activities encouraged by the WGCM and synergistically built on the CMIP5 experiment framework. The PCMDI website will direct analysts to additional CMIP-coordinated project datasets. Details of the WGCM-endorsed community coordinated experiments and the previous CMIP-coordinated experiments will be added to the WGCM website (K. Taylor and A. Pirani)

1. Introduction

The UK Met Office in Exeter, UK hosted the 14th Session of the CLIVAR/WCRP WORKING GROUP on Coupled Modelling (WGCM) on 4-6 October 2010. WGCM was extremely grateful for the welcome and organization provided by C. Senior and L. Challenger. The meeting agenda is in Appendix 1 and the list of participants is in Appendix 2.

The two main topics of this meeting were progress of the Coupled Model Intercomparison Project: Phase 5 (CMIP5) and model evaluation and development. WGCM's partners (including CLIVAR, GEWEX, SPARC, CliC, WGNE, WOAP, IDAG) and the global modelling centres reported on their activities of relevance to CMIP5, including associated coordinated experiments, and progress in model development. The CMIP5 discussion included the prospects and coordination of analyses across the different CMIP5 components and recommendations for analysts. WGCM encouraged the CMIP5 partners to pledge introductory/overview papers on the components of CMIP5 that they are leading in an effort to facilitate the assessment process by IPCC author teams in AR5. Discussions also addressed how to promote and facilitate model development, how to benefit from CMIP5 analyses and implications for WCRP coordination.

2. CMIP5

2.1. Status and Update

Over 20 groups are participating in CMIP5, contributing about 40 models. 2.3 Petabytes of data are expected, about 100 times more data than was produced for CMIP3. A preliminary survey of what experiments groups are planning on running has shown that the number of groups planning the decadal prediction AMIP time slice experiments is low, surprisingly since these runs are relatively inexpensive but extremely useful. All groups that are running the decadal prediction runs are encouraged to also consider including the AMIP experiments. Of the groups running the 20th and 21st century (centennial) simulations, most are doing the RCP, AMIP and 1% CO2 increase simulations. Groups should also be encouraged to do either the fixed SST experiments to diagnose the CO2 forcing, an ensemble of abrupt 4xCO2 simulations to diagnose the forcing and climate sensitivity from the evolution of the top of the atmosphere radiation compared to surface radiation, or both. An aerosols-only run is also included in Tier 3 of the centennial experiment design for detection and attribution studies.

ACTION: Recommend that all decadal exp groups also run AMIP experiments (Expt. 3.3 of Taylor et al., 2011)

ACTION: Remind groups that an important part of the core long term experiments are the pair of fixed SST simulations (Expts. 6.2a and 6.2b) needed to diagnose CO2 radiative forcing. An alternative method of diagnosing CO2 radiative forcing is to perform an ensemble of 5-year abrupt 4xCO2 simulations (Tier 1, Expt. 6.3-E), along with the Core Expt. 6.3. Recommend that if Expts. 6.2a and 6.2b cannot be performed, that at least 6.3 and 6.3-E be run (see of Taylor et al., 2011).

ACTION: Recommend that all should run 1% CO2 increase (Expt 6.1 or 6.1-S of Taylor et al., 2011).

ACTION: Link to gridded CO2 emissions; centralize data access (K. Taylor)

2.2 Representative Concentration Pathways (RCPs) Update

The Integrated Assessment Modeling (IAM) Consortium has produced the four mitigation scenarios for use by the global coupled modelling groups. The scenarios are called Representative Concentration Pathways (RCPs), consist of forcing data from 2006 to 2100, and include the extensions for each to 2300. While the CMIP5 multi model ensemble is being run, in a parallel process the IAM

community will produce new scenarios, some replicating the emissions and other will use different socio-economic assumptions. Similar future GHG emissions can result from very different socio-economic developments, and similar developments of driving forces can result in different future emissions. For example, one could explore to what extent the socio-economic footprint shows up in land-use patterns and emissions of short-lived species. This "parallel" phase will address:

- Alternative socio-economic assumptions,
- Alternative technology availability regimes,
- Alternative realizations of Earth system science research,
- Alternative stabilization scenario pathways including traditional, "not-to-exceed" scenario pathways, societies, economies and policies.
- "Overshoot" scenario pathways, and
- Alternative representations of regionally heterogeneous mitigation policies and measures, as well as regional societies, economies and policies.

The subsequent phase will work towards the development of socio-economic storylines and then Representative Socio-Economic Pathways (RSPs). The IAM community is discussing different proposals for storylines using mitigation and adaptive capacity.

Anthropogenic and biomass burning emissions (ozone precursors and aerosols) are available for 1850-2000 and 2000-2100 for all RCPs. Emissions are available every 10 years (with the addition of 2005 for recent trends). Only 2000 is the same between RCPs. Concentrations (tropospheric ozone and aerosols) are available every 10 years as decadal averages for 1850-2000 and 2000-2100 for all RCPs (Cionni *et al.*, 2010, Lamarque *et al.*, 2010a, 2010b). The emissions and concentrations can be obtained from the International Institute for Applied Systems Analysis (IIASA) RCP database (http://www.iiasa.ac.at/web-apps/tnt/RcpDb/dsd?Action=htmlpage&page=welcome).

RCP extensions from 2100-2300 are generated without running the IAMs so no emission information for air pollutants and precursors is available. Constant concentrations (set to 2100 values) are therefore assumed.

ACTION: Ensure consistency in how the IAM community refers to the RCP2.6/3 scenario. The scenario is referred to as RCP2.6 in the CMIP5 documentation. The Climatic Change 2011 special issue should make clear that both conventions refer to the same scenario (N. Nakicenovic)

ACTION: The IIASA database is recommended as the starting point to download RCP data.

ACTION: The default for aerosol concentrations post 2100 should be to continue the same aerosol concentrations in 2100 out to 2300

2.3 Publishing CMIP5 Data

A data submission procedure is in place to publish CMIP5 data to the Earth System Grid (ESG) including multiple quality control tests. The European project METAFOR has prepared a questionnaire that is mandatory for modeling groups to complete before their data is published that will document the models and simulations. Modeling groups will have to respond if inconsistencies are found between the documentation and the metadata stored in the output files. METAFOR and the Earth System (ES) Curator project have integrated the model documentation effort with the data collection effort. METAFOR has developed the schema and controlled vocabulary that will be used and has received exclusive endorsement from the CMIP panel to gather documentation. ES Curator provides the tools for ingesting the information in the questionnaire, is designing web-based "discovery" tools for interrogating the documentation and integrating these tools into the ESG

framework. To avoid model documentation from going into the grey literature, METAFOR is encouraged to publish its metadata questionnaire.

ACTION: CMIP panel to query METAFOR on its plans to publish information on the metadata questionnaire (R. Stouffer)

Some outstanding issues have to be resolved by modeling groups. A key issue is consistency in the choice of official model name. Some groups have, for example, different names for their coupled and AMIP model versions and this will lead to confusion. The model name is important as it dictates the naming of the output directory structure and for consistency in how the model is referenced in publications.

Once the data is published, groups will select one out of two terms of reference, either unrestricted access or for non-commercial and academic use only. Importantly, the UK Met Office has recently agreed to lift its restriction on commercial use of its model output in recognition of the development of climate services for decision makers and in recognition of the commercial component of such services.

Under both options, users have to agree to six additional terms, including the following two that will ensure credit is given to the modeling groups in subsequent publications:

- In publications that rely on the CMIP5 model output, I will appropriately credit the data providers by an acknowledgment similar to the following: "For their roles in producing, coordinating, and making available the CMIP5 model output, we acknowledge the climate modeling groups (listed in Table XX of this paper), the World Climate Research Programme's (WCRP) Working Group on Coupled Modelling (WGCM), and the Global Organization for Earth System Science Portals (GO-ESSP)." Table XX would also be included in the publication and would list the models and modeling groups that provided data that were analyzed.

- I understand that Digital Object Identifiers (DOI's used, for example, in journal citations) will be assigned to various subsets of the CMIP5 multi-model dataset, and when available and as appropriate, I will cite these references in my publications. I will consult the CMIP5 website (http://cmip-pcmdi.llnl.gov/cmip5/) to learn how to do this.

When errors in the data or inconsistencies are detected in the metadata, the data will have to be withdrawn and replaced. There is an improved mechanism in place since CMIP3 by which users can query PCMDI whether any runs have been withdrawn and replaced. Users will also be able to sign up for email updates. A problematic issue is that changing the model data will change the automated DOI assignation. This new process will certainly encounter problems and growing pains but the assignment of DOIs to model data will be of huge benefit for modeling centres, as their model development effort will be citable for the first time.

WGCM and the CMIP panel have agreed that the CMIP5 model output should be referred to as "***the CMIP5 multi-model ensemble [archive/output/results/of simulations/dataset/ ...]***".

ACTION: The CMIP5 model output should be referred to as "the CMIP5 multi-model ensemble [archive/output/results/of simulations/dataset/ ...]".

CMIP5 model output could start entering the archive early as October 2010. PCMDI anticipates advertising the archive in spring 2011 when a sufficient number of groups have published their data. Though CMIP5 model data will continue to be accepted into the archive over the next few years, model data that is not already in the CMIP5 archive by December 2011 will probably not be included in publications cited by the AR5 according to its timeframe:

- Journal articles submitted – 31 July 2012
- Journal articles accepted – 15 March 2013
- Late 2013: IPCC AR5 published

However, there is no deadline for submitting data to the CMIP5 database, and the analysis of CMIP5 model output will continue well beyond the AR5 deadlines.

3. CMIP5 Coordinated Analysis

3.1 CMIP5 Archive

First of all, interest in CMIP3 results continues unabated, and will continue to be made available in parallel with the newer CMIP5 data. More than 1 Pbyte has been downloaded so far and the current download rate is of around 500 Gbytes per day. There are more than 3000 registered users and 550 publications. WGCM and the CMIP panel recommend that CMIP3 participants maintain updated information, such as contact details, with PCMDI.

PCMDI will work with the CMIP panel to develop guidance material for the PCMDI archive website that will help analysts navigate the CMIP5 archive. This will help explain what the different experiments address, summarizing the Taylor *et al.* (2011) protocol document, and what is available in the database, by means of a categorization of the types of models participating in the experiments. For example by selecting a category of model users will get to a list of available experiments.

Table 1: Candidate categories for climate models from CMIP5 to be assessed as part of the IPCC AR5

A. 20th century and future climate change model configurations - Concentration-driven AOGCMs (control, 1% CO2, 20th century, and RCPs) - Emission-driven ESMs (control, 20th century, and RCPs) - Concentration-driven ESMs (carbon cycle feedback, calculate emissions) - High resolution AOGCMs (~50km, concentration-driven control, 20th century, and RCPs, AMIP and aquaplanet experiments, cloud feedback experiments) - High-resolution time slice (atmospheric models) - High-top AOGCMs (concentration-driven control, 20th century, and RCPs) B. Feedback and other model experiments - Paleoclimate experiments - Cloud feedback experiments - Fast and slow feedback experiments - Single forcing experiments (D&A)

As part of the process of accessing the archive, analysts will be asked to provide some non-binding information on the type of analysis they will be working on and analysts will be encouraged to provide feedback to modeling groups on model errors and deficiencies that their work sheds light on.

ACTION: CMIP3 participants continue to keep their information up-to-date with PCMDI (C. Covey)

ACTION: Prepare guidance and finding aids to help users navigate the CMIP5 database. This may involve a road map summary of the Taylor et al CMIP5 document, a categorisation of the experiments, and links to additional recommendations for analysts (K. Taylor, CMIP panel).

ACTION: Analysts accessing CMIP5 output should be asked to:

a) Record (at registration) how they intend to use the data (e.g., what science issues they plan to address, register subproject outlines).
b) Be ready to respond to requests from the WGCM for feedback about model errors or deficiencies they discover, CMIP5 publications, etc.

3.2 CMIP5 Analyses

A key goal of the 14th WGCM session was to launch a 'pledge drive' from the partner communities participating in CMIP5 to lead the coordinated analysis of CMIP5 results and pledge to write introduction/overview papers in an effort to facilitate the review process that IPCC lead authors will carry out for the Fifth Assessment Report (AR5). This was intended to get the ball rolling on analysis so, at minimum, someone at least looks at each experiment. This is not intended to exclude or pre-empt others from analyzing the model data, but is meant to encourage the communities who advocated including certain experiments in CMIP5 to step up and write overview papers that could be assessed in the IPCC AR5 and also referred to by other analysts.

Table 2: CMIP5 introduction/overview papers (including possible contacts/leads)

- CMIP5 User guide/Experimental design paper (Taylor, Stouffer Meehl)
- CMIP5 decadal experiments: paper from June 2011 Aspen workshop, coordinated by WGCM/WGSIP decadal panel (leads: Boer, Kirtman, Meehl)
- CFMIP CMIP5 experiments: at least one paper (leads: Bony, Webb)
- Paleo CMIP5 experiments: at least one paper (leads: Otto-Bliesner, Bracannot)
- CMIP5 ESM carbon cycle feedback experiments with concentration-driven ESMs as well as emission-driven ESMs: paper organized by AIMES (leads: Cox, Friedlingstein, Hibbard)
- SPARC: possible paper analyzing the new high top AOGCMs (lead: Charlton-Perez, Manzini, Scaife)
- WGOMD: paper analyzing CMIP5 ocean output WGOMD requested, possibly comparing to CORE-forced experiments (lead: Drange, Danabasaglu)
- CLIC: paper analyzing sea ice and high latitude CMIP5 results; subproject "ARCHIMEDES" has already been organized (lead: Steffen)
- IDAG: paper analyzing single forcing experiments (lead: Karoly)
- Fast and slow feedback experiments: paper (lead: Taylor, Webb, Gregory)
- MJO Task force: paper on MJO in CMIP5 simulations (lead: Waliser, Lin, Sperber)
- Metrics panel paper (lead: Gleckler)

ACTION: Recommend to SPARC DynVar to synthesize impact of high top models running in CMIP as compared to low-top versions (V. Eyring)

ACTION: Recommend that WGOMD compare CORE-II results to CMIP coupled simulations (H. Drange)

3.3 WGNE/WGCM Climate Model Metrics Panel

The NWP community routinely uses metrics with results openly published by the WMO. To date there is no analogue in the climate modeling community, and to address this several years ago the WGNE established a metrics panel. This activity was introduced at the 2008 12th Session of WGCM, and more recently it was concluded that the metrics panel was ideally suited for a joint WGNE/WGCM activity which is now reflected in the panel membership. The panel has been active over the past year developing a proposal to start applying a set of metrics to climate model results. The members have been selected by their relevance and diverse experience and potential to liaise with key WCRP activities.

P. Gleckler (PCMDI), Chair – WGNE
B. Ebert (BMRC) – JWGV WWRP/WGNE
V. Eyring (DLR) – WGCM/SPARC/AC&C

P. Friedlingstein (Uni. Exeter) – IGBP
R. Pincus (NOAA) – GEWEX/GCSS
K. Taylor (PCMDI) – CMIP5/WGCM
H. Hewitt (Met Office) – WGOMD

The main questions that are motivating the use of routine climate metrics is to see whether climate models are improving, if so how rapidly, and which are more realistic. Additionally, it is hoped that a diversity of routine metrics will provide useful summaries of overall model performance. The panel has already decided that is will promote quantitative performance metrics, but not advocate methods of model weighting for any purposes. A performance metric is a statistical measure of agreement between a simulated and observed field (or co-variability between fields) that can be used to assign a quantitative measure of performance ("grade") to individual models. Diagnostic information, observations and code will be made readily available by the panel. Perhaps as importantly as the results themselves, the panels aims to clarify the value and limitations of performance metrics. Other research drivers for climate model metrics are:

- How does skill in simulating observed (past and present) climate relate to the credibility of projections?
- Can we justify weighting models, based on metrics of skill, to optimize use of multi-model ensembles in making projections of climate change (mindful of the conclusions of the IPCC Workshop in January 2010 that advocated against weighting or ranking, see section 3.4 below)?

The objectives of the panel are to identify and promote a limited set of standard metrics in an attempt to establish routine community benchmarks for climate models. This would start with a base or standard set (which is nearing a beta-version) that is based on comparison with carefully selected observations, is easy to calculate, reproduce and interpret, is well established in the peer-reviewed literature, covers a diverse suite of climate characteristics, and emphasizes large- to global-scale measures of mean climate (and a limited number of measures of variability) for the atmosphere, oceans, land surface, and sea-ice. The next phase, or expanded set of metrics, would aim to facilitate research and development of increasingly in-depth, more process-based, metrics via coordination with other WCRP activities. The panel will collaborate with different activities and model intercomparison projects (MIPs) that are also developing metrics (e.g. the US CLIVAR Decadal Prediction Working Group).

The panel has focused on the analysis of benchmark WGNE/WGCM experiments, in other words, the CMIP historical runs and the AMIP runs. Discussions are starting to also address metrics for historical ESM experiments and initial condition experiments (eg Transpose AMIP) that could be evaluated in 'NWP-mode'.

The metrics panel proposal generated considerable discussion on how public the assessment should be. There are various concerns on the misinterpretation of results and the consequences of certain models appearing to under perform. While this would help identify model deficiencies and hopefully lead to progress, there could be a risk that funding may be cut or models could be excluded from multi-model analyses. In some cases the model climate may be poor, while the representation of the core processes is realistic. There is no way to determine what is more realistic in terms of modeling future climate. A model that correctly resolves the processes may be more realistic than a model with a better historical or present-day climate. The metrics panel is very well aware of these concerns and will work with both working groups to ensure they are properly addressed.

It is expected that these concerns will begin to diminish as the community builds on this initial development of the metrics based assessment. The panel envisages a pyramid of metrics, starting at metrics for baseline quantities or processes, such as those being initially proposed by the panel, that will then determined by various other processes and associated metrics such as those developed by specialized groups (MJO, ENSO, etc).

The metics panel is in the process of constructing its website which will carefully explain the purpose of the panel. This website will not be made public until it has been reviewed by the co-chairs of the WGNE and WGCM. After a review from the panel co-chairs modeling groups will be given the opportunity to comment on the first results posted, which will be limited to CMIP3 simulations.

ACTION: The Metrics Panel should strengthen its links to other groups that are developing metrics. Help compile an email list of PIs of MIPs for the Metrics Panel (A. Pirani, V. Eyring)

3.4 Assessing and Combining Multi-Model Climate Projections

The IPCC Expert Meeting on Assessing and Combining Multi Model Climate Projections was held at NCAR on 25-27 January 2010. The aims of the meeting were to stimulate a discussion on metrics to evaluate climate models, discuss and assess the potential for model weighting and discuss the potential and implications for minimum standards. The meeting report (Knutti *et al.*, 2010) provides recommendations on the analysis of ensembles, performance metrics, model selection, averaging and weighting, and reproducibility. Extensive research is needed to develop justifiable methods for constructing indices that can be used for weighting model projections for a particular purpose. Studies should employ formal statistical frameworks rather than using ad hoc techniques.

There was no consensus at the workshop on whether there is justification for weighting since how this is done best has not been defined. However, there was agreement that there is value for users to have a measure of performance. Consideration needs to be given to cases where the number of ensemble members or simulations differs between contributing models. There is no real guidance on working with same-model ensembles and more guidance or documentation is needed that explains differences in different model versions submitted by individual groups and how to construct the multi-model ensemble.

ACTION: Post the Meeting Report of the Intergovernmental Panel on Climate Change Expert Meeting on Assessing and Combining Multi Model Climate Projections on the PCMDI and WGCM webpages, alerting users to these guidelines (A. Pirani, K. Taylor)

4. Decadal Climate Prediction

The CLIVAR Working Group on Seasonal to Interannual Prediction (WGSIP) and WGCM share a common interest in the decadal prediction problem. A panel was set up with representatives from both working groups (R. Stouffer, M. Latif, G. Meehl, T. Stockdale, G. Boer) at the 2008 WGCM meeting to oversee the CMIP5 decadal prediction experiments. The group original group guided the establishment of the CMIP5 decadal prediction experiments protocol and has given advice on aspects of the protocol such as the treatment of volcanoes. This year's WGCM meeting has endorsed the group to be called the WGCM-WGSIP Decadal Climate Prediction Panel (DCPP) and its members have been revised. They now are: G. Boer (lead), B. Kirtman, R. Stouffer, G. Meehl, K. Taylor, M. Latif, D. Smith and S. Power.

The DCPP will act as a point of contact for CMIP5 decadal climate prediction (DCP) for questions on methods, validation, evaluation, scores etc and to distribute recommendations from WGCM and WGSIP. It will aid the coordination of meetings and workshops, including the 2011 Aspen Global Change Institute workshop on decadal prediction, the analysis of the CMIP5 decadal climate prediction results by fostering the analysis of DCP results by CLIVAR Working Groups and Panels. It will provide input to the IPCC Chapter 11 on Near-term Climate Change: Projections and Predictability.

The DCPP has initiated a survey of DCP participation within the climate modeling and seasonal to interannual prediction communities. It will develop the WCRP website on DCP (http://www.wcrp-

climate.org/decadal/index.shtml) to provide a summary of participation and information, with links to the PCMDI, WGCM and WGSIP websites.

ACTION: WGCM-WGSIP Decadal Climate Prediction Panel membership: G. Boer (lead), B. Kirtman, R. Stouffer, G. Meehl, K. Taylor, M. Latif, D. Smith and S. Power

ACTION: Encourage panel support the organization of the 2011 Aspen Global Change Institute workshop on decadal prediction.

4.1 Bias Correction and Decadal Climate Prediction

Bias correction is routinely applied to initialized seasonal to interannual forecasts to remove model drift. The drift is treated as a forcing, in the same way as climate is forced by an external component on top of internal variability. The drift is calculated at each hindcast time since it evolves over the hindcast. By averaging over enough hindcasts, the drift can be isolated and removed linearly, typically removing the ensemble average. Removing the drift in this way when a model or variable is highly non linear becomes a problem. Anomaly prediction models attempt to remove or prevent the drift that occurs (because model climates are different from observed climate) by adding only the anomalies of observed climate to the model. This approach has not been shown yet to be better than full field initialization in decadal and seasonal prediction experiments.

For CMIP5, there is concern on whether groups should make their raw decadal prediction experiments available, the bias corrected data, or both. Each group will use a different technique for dealing with model bias and this should be well documented. The bias correction is essentially a climatology of the model bias and it would be like adding an additional ensemble member to the archive. The bias correction is also only done for selected variables, in general only for surface temperature and precipitation. WGSIP and the DCPP have been charged with providing a recommendation on the treatment of bias corrections and the data that should be archived for CMIP5 decadal climate prediction experiments.

ACTION: WGSIP and the Decadal Climate Prediction Panel should consider providing recommendations/guidance on bias corrections and what decadal prediction data (bias corrected or raw) should be submitted to the CMIP5 archive. The recommendations should be circulated to WGCM soon so that they can be passed on to modeling groups as soon as possible (G. Boer, D. Smith)

4.2 WGOMD CORE-II and EasyINIT

The CLIVAR Working Group on Ocean Model Development (WGOMD) is coordinating the second phase of the Coordinated Ocean-ice Reference Experiment (CORE-II - http://www.clivar.org/organization/wgomd/core/core.php). These are hindcast simulations forced by interannually varying CORE IAF.v2 forcing (Large and Yeager, 2009) that covers the period 1948-2007. The baseline experiments will be complemented by studies on the sensitivity to model numerics, physics and forcing. The CORE-II analysis will focus on the robust results in the period of interannual variability in all forcing variables from 1984 onwards as compared to ocean state estimates and observations. The analysis will be relevant for the evaluation of the ocean component of CMIP5 participating models as well as for the initialization of decadal predictions. The analysis will cover time-mean diagnostics over the 1988-2007 period, variability defined with respect to the 1988-2007 mean, and trends and changes over this period. Regional case studies will contribute understanding of observed variability, such as changes in the strength of the Atlantic sub-polar gyre. The CORE-II simulations can also explore sensitivity in the climate system, for example due to changes to precipitation at high latitudes, changes in zonal wind trend in Southern Ocean and the role of buoyancy and mechanical forcing for abrupt shifts.

At the CLIVAR meeting on decadal predictions, hosted by the KNMI last year, the modeling community had suggested and requested that ocean reanalysis are being provided in an “EasyInit” project that can support the coupled modeling community to ease the initialization of decadal

prediction runs using ocean reanalyses. The KlimaCampus of the University of Hamburg had volunteered to host such a project and started the preparation of the infrastructure. First pilot application can be found and viewed at http://icdc.zmaw.de/easy_init.html, where also a more in-depth description and explanation of the goals of the project can be found. As described there, the idea is, that all reanalyses currently referred to at the CLIVAR GSOP website are being physically collected and provided in a uniform format with sufficient explanation, that the modeling community can get all reanalysis in a "one-stop" fashion and with a uniform format.

5. WGCM-endorsed community coordinated experiments

WGCM-endorsed community coordinated experiments are modeling activities endorsed by WGCM and synergistically built on the CMIP5 experiment framework. These are:

- Atmospheric Chemistry and Climate MIP (ACC-MIP)
- Climate-system Historical Forecast Project (CHFP)
- Cloud Feedback Model Intercomparison Project (CFMIP)
- Coordinated Regional climate Downscaling Experiment (CORDEX)
- Coupled Carbon Cycle Climate Model Intercomparison Project (C4MIP)
- Geoengineering Model Intercomparison Project (GeoMIP)
- Paleoclimate Modelling Intercomparison Project (PMIP)
- Transpose Atmposphere Model Intercomparison Project (Transpose-AMIP)

PCMDI hosts some of these datasets and all will be clearly indicated on the PCMDI website so analysts can access their datasets in parallel to the CMIP5 dataset.

ACTION: WGCM-endorsed community coordinated experiments are those modeling activities encouraged by the WGCM and synergistically built on the CMIP5 experiment framework. The PCMDI website will direct analysts to additional coordinated experiment datasets. Details of the coordinated experiments will be added to the WGCM website (K. Taylor and A. Pirani)

5.1 Cloud Feedback Intercomparison Project (CFMIP)

The aim of this project is to better characterize cloud feedbacks in current and future climate by means of three research approaches: GCM analysis through a hierarchy of models, process studies (in-situ obs, LES/CRMs) and satellite observations and simulators (COSP). The project is in its second phase (CFMIP2 - http://www.cfmip.net) and has contributes process diagnostics and several idealized experiments to CMIP5 to better understand climate sensitivity. Since last year, the CFMIP observational simulator package (COSP) is available as a single software package that has been distributed to climate and NWP groups. Currently, 28 models participating in CMIP5 are planning to use COSP. The project has compiled an observations website to use with COSP. CFMIP is in discussions with PCMDI on how this resource could be merged with the NASA-PCMDI satellite observations initiative (see Section 8.2 for more details). For process understanding, 119 locations of detailed, high-frequency CMIP5 output have been selected for comparison to observations and the intercomparison of clouds and cloud feedbacks continues by means of the CFMIP-GCSS Intercomparison of Large Eddy Simulation Model with Single Column Models (CGILS). The objectives of CGILS are to understand the physical mechanisms of subtropical low cloud feedbacks in GCMs by using Single-Column Models (SCMs) and to assess the physical credibility of model physics/cloud feedbacks by comparing SCM results with equivalently forced Large Eddy Simulation Models.

5.2 Paleoclimate Model Intercomparison Project (PMIP)

The PMIP objectives are to:

- Understand mechanisms of past climate change
- Evaluate roles of feedbacks from the different climate subsystems (atmosphere, ocean, land-surface, sea-ice …)

- Evaluate the ability of climate models to simulate a climate different from that of today

The PMIP project is in its third phase (PMIP3) and has contributed experiments to CMIP5 to test climate sensitivity over three time periods: Mid-Holocene, last glacial maximum (LGM), and the last millennium (LM). Groups should use the same model version as the one used for climate projections. Over the past year, PMIP has finalized the PMIP3/CMIP5 boundary conditions, mainly for the LGM and LM. The difficulty in agreeing on the correct forcing for the LM means that PMIP3 is proposing two options. One is the PMIP3 recommended forcing set and the other is an alternative solution for ozone, tropospheric aerosols, and vegetation. Running both options allows for a wider sampling in the model solution variance and is important for detection and attribution studies. Three papers have been coordinated to present the boundary conditions and paleoclimate experiment objectives in CMIP5:

- Schmidt et al., GMD submitted: LM
- Abe-Ouchi et al., GMD, in progress: LGM
- Braconnot et al., BAMS? In preparation: A multimodel ensemble of past simulations for the Last Glacial maximum, the mid-Holocene and the last millennium (still under discussion)

The PMIP community is also discussing boundary conditions for other PMIP topics
(for example deglaciation and transient Eemian simulations).

The PMIP3 database will follow the CMIP5 distributed database guidelines (making use of the IPSL data node), together with a copy of a subset of files at IPSL/LSCE for direct access to the PMIP3 community that is not necessarily familiar with CMIP5.

5.3 Coupled Carbon Cycle Climate Model Intercomparison Project (C4MIP)

C4MIP and AIMES have contributed to the CMIP5 experiment design in the context of Climate-Carbon analysis. Earth System Models (ESMs) with interactive carbon cycles will run emissions-driven experiments. The emission-driven (RCP 8.5) will focus on simulated atmospheric CO2 and climate, calculating concentrations that will be compared with the RCP 8.5 concentrations scenario. The concentration-driven runs will focus on changes in land-use, land and ocean carbon and re-estimate compatible emissions for fossil fuels to compare with those issued by the Integrated Assessment Models (IAMs). The HadGEM2-ES model has calculated the compatible (permissible) emissions for the Historical, RCP 2.5 and 4.5 runs and these compare well with the historical and RCP CO2 emissions, therefore validating the IAMs that created the scenarios.

The 1%/yr CO2 and RCP 4.5 runs are designed to test the sensitivity of carbon cycle feedbacks. While RCP 4.5 is more policy-relevant, it is recommended that all groups at least run the 1% run since the sensitivity analysis is shorter and easier to run and simpler to understand (see Action Item in Section 2.1). It will also facilitate interactions with other MIPs, such as CFMIP, and feedbacks studies. The historical and RCP 4.5 runs include changes in all climate forcings (GHG, aerosol, Natural) and other carbon forcings (land-use) so the impact of climate is harder to understand. However, those experiments are useful to compare back to the IAM models' emissions, and also produce results comparable to the other RCP simulations.

5.4 Coordinated Regional Climate Downscaling Experiment (CORDEX)

The Task Force on Regional Climate Downscaling (TFRCD) was formed and endorsed by WGCM in 2008 with a one-year mandate that was renewed for an additional year in 2009. It has been responsible for designing the CORDEX project to evaluate and improve RCD techniques, provide a coordinated set of RCD-based projections for regions worldwide and to facilitate communication with the IAV community and involvement of the developing country research community. CORDEX has two frameworks: one for model evaluation and one on climate projection. It is organized regionally with a priority focus on Africa.

The TFRCD last met in June 2010 and there was agreement that the panel is unwilling to continue serving in its current mandate. A proposal will be presented to the 2011 WCRP JSC for the TF to evolve into a formal group to represent regional climate science including observational, impacts and global as well as RCD communities. Regional climate information is produced by both GCMs and regional climate modeling/RCD. International coordination is sought for regional climate science, not just regional climate modeling.

5.5 Transpose Atmosphere Model Intercomparison Project (Transpose-AMIP)

Climate models are run in numerical weather prediction (NWP) mode to test model parameterizations while the circulation is still close to observed, to evaluate processes operating in the model against observations for particular events (e.g. ARM/Cloudnet sites, actual A-train passes, etc.) and to be able to comment on the ability of models taking part in CMIP5 to accurately represent fast processes. The core experiment is to run 64 hindcasts, each 5 days long, initialized from the ECMWF Year of Tropical Convection (YOTC) analysis. Groups can also repeat the same set of hindcasts with NASA MERRA reanalysis or their own analysis. The hindcasts are spread through the annual and diurnal cycles during 2008-9 and were chosen to tie in with YOTC and coincide with some of the intense observing periods (IOPs) in VOCALS (SE Pacific stratocumulus), AMY (Asian monsoon) and T-PARC (mid-latitude Pacific).

Any global modelling centre (NWP or climate) can submit data. Those taking part in CMIP5 should use the same model as is being used for their AMIP simulation. The project is jointly endorsed by WGNE and WGCM. Although not formally part of CMIP5, data formats and the process for downloading will be the same. The transpose-AMIP II diagnostic lists are largely based on the CFMIP component of the CMIP5 lists (including COSP output, etc.). Data will be saved globally every 3 hours and the CFMIP sites diagnostic list will be saved every 30 minutes.

5.6 Geoengineering Model Intercomparison Project (GeoMIP)

There are two geoengineering categories: one to remove GHGs from the atmosphere and one to manage solar radiation. A. Robock and others have proposed an intercomparison protocol to address the second that balances simplicity and policy relevance and leverages what is being done for CMIP5 (see Kravitz *et al.*, 2010), based on two sets of experiments. In the first (G1, G2), a reduction in the solar constant is applied to generate the opposite forcing to the CMIP5 4xCO2 and 1%/yr CO2 sensitivity experiments. The second set (G3, G4) consists of more realistic simulations. In G3 aerosols are injected or prescribed in the stratosphere to offset the RCP 4.5 forcing for 50 years. G4 has the same objective but is for interactive stratospheric chemistry models, chemistry transport models and for high-top stratosphere-resolving models.

6. Updates

6.1 SPARC Chemistry-Climate Model Validation Activity (CCMVal) and IGAC-SPARC Atmospheric Chemistry and Climate (AC&C)

The goal of CCMVal is to improve understanding of Chemistry Climate Models (CCMs) through process-oriented evaluation and to provide reliable projections of stratospheric ozone and its impact on climate. The extensively peer-reviewed SPARC CCMVal Report (SPARC CCMVal, 2010) is a key contribution to the WMO/UNEP Scientific Assessments of Ozone Depletion that are produced every four years in support of the 1987 Montreal Protocol on Substances That Deplete the Ozone Layer. The report, produced by over 100 authors, provides a detailed evaluation of past reference simulations (REF-B1) and of projections of stratospheric ozone and impact on climate (REF-B2). The report will also make a prominent contribution to the IPCC AR5. Some initial work (Eyring *et al.,* 2010) of ozone evolution under different GHG scenarios has shown the importance of publishing a range of ozone projections.

A number of groups that participated in CCMVal are also contributing simulations for CMIP5. Models participating in CCMVal generally use prescribed SSTs, but future simulations will use coupled AOGCMs. Around 10 modeling groups are also contributing high-top (stratosphere-resolving) AOGCM simulations to CMIP5.

The following are some (selected) recommendations from the CCMVal Report that are relevant for WGCM:

- Models should routinely undergo tests concerning their implementation of physical processes where benchmark comparisons are available.
- Performance metrics on a wide suite of diagnostics need to be made as standard practice and calculated routinely by individual model groups and through multi-model comparisons.
- More analysis is needed of the robustness of the metrics, and their possible use to assign relative weights to ozone projections.
- More attention needs to be paid to model development to address major persistent deficiencies, e.g. the late-spring breakdown of the Antarctic vortex.
- Development should continue towards comprehensive troposphere-stratosphere chemistry climate models (CCMs), which include an interactive ocean, tropospheric chemistry, a naturally occurring QBO, spectrally resolved solar irradiance, and a fully resolved stratosphere.
- The CCMVal assessment and projection process should be synchronized with that of CMIP to make the maximum use of human and computer resources, and to allow time for model improvements.
- The current set of GCOS Essential Climate Variables is not sufficient for process-oriented validation of CCMs.
- Provision of a more accurate assessment of measurement uncertainties is required for a systematic comparison of existing observations.

The IGAG-SPARC AC&C initiative is addressing some key scientific questions in support of the IPCC AR5:

- Diagnostic and analysis of radiative forcings
- Climate penalty of air quality
- Understanding long-term trends in tropospheric chemistry
- Climate impact of reducing ship emissions

The Atmospheric Chemistry and Climate MIP (ACC-MIP) timeslice experiments complement the CMIP5 climate simulations with input and special simulation studies related to atmospheric chemistry in the troposphere and stratosphere and evaluating the radiative forcing for radiatively active gases and aerosols. ACC-MIP will also include sensitivity studies of emissions (for isoprene, CH4, …), IAM modeling of emissions for each RCP and the spread resulting from using climatology. Close links have been established with the CCMVal activity and AEROCOM, which is an assessment of the state-of-the-art in modeling tropospheric aerosol distribution and composition.

6.2 International Detection and Attribution Group (IDAG)

IDAG is a group of about 30 members with no parent organization that reviews community progress and produces synthesis papers. The group represents work on detection and attribution of different aspects of climate change such as changes on a regional scale, extremes and the hydrological cycle, and the probabilistic attribution of extremes and climate events, whether unusual events can be attributed to climate change. There is interest in the IDAG community to evaluate CMIP5 decadal simulations with D&A methodologies to separate the forced from the internal signal of variability. The harmonization from historical runs to forced runs is critical for D&A analysis. IDAG encourages modeling groups participating in CMIP5 to contribute to the individual forcing simulations to identify the contribution of each forcing factor to the simulated climate. (about 9 groups have committed so far). Groups are also encouraged to continue the historical simulation out to 2010 to increase the sampling period for D&A analysis with respect to observed change during the 20th Century.

It would be useful for model evaluation and D&A studies to extend the CMIP5 historical runs to near present (as has been done for AMIP), rather than ending them in 2005. In fact since the CMIP5 project is ongoing, it would be useful to have simulations extended to at least the end of 2012 using some estimate of recent and future forcing. There is, however, no community-wide accepted observationally-based concentration/emissions past 2005. Groups are therefore free to use whatever concentrations, solar forcing, SO2 emissions etc. they want to use in extending these runs. It is also acceptable for detection/attribution studies to simply splice one of the RCP runs to the end of the historical simulations.

7. Model Development

7.1 Working Group on Numerical Experimentation (WGNE)

The Working Group on Numerical Experimentation (WGNE), jointly established by the WCRP and the WMO Commission for Atmospheric Sciences (CAS), has the 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. WGNE is activities include improving the model development framework (Jakob, 2010), enhancing routine forecast verification (e.g. through the Metrics Panel in
collaboration with WGCM), coordinating the Transpose-AMIP project in collaboration with WGCM, and strengthening research activities in forecast error diagnostics in support of model development in collaboration with the THORPEX Working Group on Predictability and Dynamical Processes (PDP).

Other WGNE activities on model development and enhancement include coordinating research into parametrization development (with CFMIP and GMPP - GCSS, GLASS, GABLS), high-resolution (km-scale) NWP, coupled ocean-atmosphere NWP, data assimilation and possibly a project on the effects of resolution near convection-resolving scales, which is relevant for regional climate (or global high resolution) modeling.

WGNE, in collaboration with WGCM and WCRP and WWRP more widely, is planning to hold a workshop in 2012 on “Physics in Global and Earth System Models” that will aim to define 4-5 key areas for model development in the next 5 years; for example, building on the results of WGNE/WCRP initiated survey (see Section 7.2). WGNE and WGMD have agreed to hold a joint meeting in 2011 (see Section 9.2).

7.2 WCRP-WWRP-THORPEX Survey on Model Evaluation and Improvement

Model errors and biases are key limitations of the skill of model predictions over a wide range of time and space scales. This is not a new story and increased resolution and the addition of complexity in ESMs have not solved the problem. Identifying these errors and understanding their root cause constitutes a prerequisite for the planning of model improvement activities. For this purpose WGCM and WGNE initiated in 2009 a WCRP, WWRP-THORPEX "bottom-up survey" about the key deficiencies of NWP and climate models. The survey solicited input on problems identified in operational NWP and seasonal prediction centers as well as deficiencies identified for the current generation of climate models by modelers and analysts of CMIP3 simulations. The future restructuring of WCRP is an opportunity to put recommendations from the community into action.

Some general issues that were raised in the responses are the imbalance between visibility and effort between work on hot new topics compared to long-standing errors, that resolution is often portrayed as the solution to everything, while it can lead to new problems, the imbalance in the maturity and size of efforts in evaluating model components (e.g. atmosphere vs. biogeochemistry) and the need for more interdisciplinary interactions. The survey sought to identify what are the key uncertainties and deficiencies of current models, for example in terms of parameterizations and interactions among processes, where the key areas that should be prioritized by the modeling, process study and

observations communities and whether there are resources, such as new observations or results, that should be exploited by the wider community.

The survey received over 120 responses, with about 20 group- or lab-wide responses. The majority of the individual responses came from outside the WCRP panels and working groups; an encouraging result for a survey that aimed to consult the baseline scientific community. The promotion of growth of the model development community was clearly encouraged, as was increased synergy across climate to weather prediction scales and across the modeling, process study and observations communities. The survey is still open to additional contributions, but the results as they currently stand are being synthesized, and will be presented to the WCRP JSC in April 2011 and in a peer-reviewed publication.

7.3 Modeling Center Updates

The global climate modeling centers presented updates on their model development since the previous meeting, with a focus on the model versions participating in CMIP5. The presentations are available on the meeting website. The groups who were represented are the following (direct links to the presentations are included):

USA, GFDL (R. Stouffer)
USA, NCAR (G. Meehl)
Canada, CCCma (G. Flato)
Japan, CCSR/FRGC/U. Tokyo/NIES; MRI (M. Kimoto)
China, LASG; BCC (B. Wang)
Australia, ACCESS (T. Hirst)
U.K., Hadley Centre; Reading (C. Senior)
Italy, ICTP; INGV (F. Giorgi)
Germany, MPI (M. Giorgetta)
France, IPSL; Meteo France (P. Braconnot and S. Bony)
EC-Earth (C. Jones)
NASA GISS and GMAO (D. Waliser)
Norway, NorESM (H. Drange)

8. Observations

8.1 WCRP Observations and Assimilation Panel (WOAP)

WOAP is co-sponsored by the Global Climate Observing System (GCOS) project and consists of panel representatives from all WCRP activities (projects and working groups) and GCOS to deal with cross cutting issues related to global observations, their analysis and assimilation, as well as the resulting products from a research perspective. WOAP is complementary to and includes representatives from the GCOS Panels, the Atmospheric Observation Panel for Climate (AOPC), the Ocean Observation Panel for Climate (OOPC) and the Terrestrial Observation Panel for Climate (TOPC), to establish requirements of climate researchers for *in situ* as well as satellite observation networks and systems.

The key issues being addressed by WOAP since its last meeting in 2010 are:

- Need for datasets for evaluation of CMIP-5 and other model data
- Rigorous error analysis, documentation, product intercomparisons
- Quantification of uncertainties in all data,
- Promotion of inter-comparisons for key climate datasets.
- Provide guidance on:
    - Observational Priorities of the WCRP
    - Requirements for Data Exploitation Tools,
    - Best Practices for “iterative re-processing” of CDRs
    - Data Stewardship Guidelines

- Data Assessment Guidelines

8.2 Satellite observations for CMIP5

The WOAP Workshop on Evaluation of Satellite-Related Global Climate Datasets will be held in Frascati, Italy on 18-20 April 2011. The workshop will address the proliferation of multiple satellite datasets that can vary considerably even if they are derived from the same sources. There is currently little or no guidance available for users on why these differences exist and which product is the best to use. There is a need for documentation of the available products and possibly an intercomparison for non-specialists, such as climate modelers, to understand and use.

NASA and ESA have started two initiatives that target the climate modeling community as a user of their earth observation satellite products. The NASA initiative aims to provide access to satellite data sets (e.g., AIRS, MLS, TES, QuikSCAT, CloudSat, Topex/Jason, CERES, TRMM, AMSR-E, TRMM) that are analogous (in terms periods, variables, temporal/spatial frequency, CF-compliant format, dissemination in collaboration with PCMDI) to CMIP5 model output. It will directly engage the observational (e.g. mission and instrument) science teams to facilitate production of the corresponding data sets and documentation and, in the long term, develop future climate-critical satellite missions.

ESA has also recognized that it needs to tailor its products for the climate modeling community and has launched the ESA Climate Change Initiative (CCI), a six-year project that is a new element of the existing European Earth Watch Programme, to generate Essential Climate Variable (ECV) datasets and ensure their regular updating on timescales corresponding to needs of the international climate change community. This demands a major sustained, and coordinated scientific effort to review, improve, and in some cases to develop new underlying processing, retrieval and validation methods. The Essential Climate Variables are those that are required to support the work of the Convention (UNFCCC) and that are technically and economically feasible for systematic observation. ESA has formed the Climate Modeling Users Group (CMUG) as an interface between the climate modeling, analysis and reanalysis communities to tailor the products to the user requirements.

9. WGCM Business

9.1 Membership

P. Giorgi has become a member of the WCRP JSC and so is stepping down from WGCM. C. Jones has been nominated to take his place to represent the regional downscaling community and CORDEX.

9.2 Next Meeting

The 15th Session of WGCM is tentatively planned for the end of the week of 17th October 2011, the week before the WCRP Open Science Conference. WGCM will meet jointly with WGNE and the proposed venueis NCAR, Boulder. The AIMES SSC will also be meeting around the same time and members will be invited to attend the WGCM meeting.

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Appendix 1 – Agenda

Monday 4 October

0900 – 0915

Welcome—G. Meehl and S. Bony
Introduction and welcome from host Hadley Centre, local arrangements (Cath Senior)
Agenda and objectives of meeting (G. Meehl and S. Bony)

0915 – 0945 (10 minutes each)

WCRP restructuring update and WCRP Open Science Conference (G. Flato, on behalf of G Asrar)
Report from JSC-31 (G. Flato)
Report from CLIVAR SSG (G. Meehl)

CMIP5 status and analysis

0945 – 1030

CMIP update, results of questionnaire sent to modelling groups on what runs are being done by which models, tentative completion dates, status of current CMIP5 archive, data distribution and archiving status (R. Stouffer, K. Taylor, P. Gleckler)

1030-1100 Break

1100-1115

RCP update, review RCP issues from past year, post-2100 issues, evaluate process, new "RSPs" and status of scenario parallel process (V. Krey, on behalf of N. Nakicenovic)

1115 – 1230 Working groups closely associated with CMIP5 (15 minutes each)

Decadal prediction: WGCM-WGSIP Contact Group, WGSIP, recent and upcoming workshops, plans for writing a CMIP5 synthesis paper (G. Boer)
CFMIP and cloud feedback experiment status and plans for writing a CMIP5 synthesis paper (S. Bony)
PMIP and paleo experiment status and plans for writing a CMIP5 synthesis paper (P. Braconnot)
C4MIP and plans for writing a CMIP5 synthesis paper (P. Friedlingstein)
SPARC-CCMVal and plans for writing a CMIP5 synthesis paper (V. Eyring)

1230 – 1400 LUNCH

1400 – 1500 Working groups associated with CMIP5 (15 minutes each, continued)

Regional climate and CORDEX (F. Giorgi)
WGOMD and ocean model status, update on EasyInit Project, and plans for writing a CMIP5 synthesis paper (H. Drange)
IDAG : Detection/attribution (D. Karoly)

Model evaluation and development

1500 – 1530 (15 minutes each including questions)

WGNE and Report on WGNE/THORPEX workshop on model systematic errors (A. Brown)
WGNE-WGCM activities : Transpose-AMIP (K. Williams)

1530 – 1600 Break

WGNE-WGCM activities : Metrics panel (V. Eyring)
Update on WCRP Survey on model evaluation and improvement (A. Pirani, S. Bony)

16:45-17:15 Discussion : How to promote and facilitate model development, how to benefit from CMIP5 analyses, publication of the survey, implications for WCRP coordination

1715: re-cap of day

Session ends for the day ~ 1730

Tuesday 5 October

0900 – 0915

Review previous day and outline agenda for the day (G. Meehl and S. Bony)

0915 – 1030 Reports on status of CMIP5 national activities (12 minutes each, 3 minutes for questions)

USA, GFDL (R. Stouffer)
USA, NCAR (G. Meehl)
Canada, CCCMa (G. Flato)
Japan, CCSR/FRGC/U. Tokyo/NIES; MRI (M. Kimoto)
China, LASG; BCC (B. Wang)

1030 - 1100 BREAK

Australia, ACCESS (T. Hirst)
U.K., Hadley Centre; Reading (C. Senior)
Italy, ICTP; INGV (F. Giorgi)
Germany, MPI (M. Giorgetta)
France, IPSL; Meteo France (P. Braconnot and S. Bony)
EC-Earth (C. Jones)
Norway (H. Drange)
GISS, GMAO (D. Waliser)
Other groups, GISS, NGFC, Korea, Denmark (G. Meehl)

1230 – 1400 LUNCH

1400 – 1530 Discussion topics

GeoMIP (O. Boucher)
IPCC AR5 workshop on multi-model projections; implications for CMIP5 analysis (V. Eyring)
Air quality and climate change (V. Eyring)
AIMES, carbon-climate feedbacks (P. Friedlingstien)
Information about COWCLIP (Ocean Wave Climate Projections) (H. Drange)

1530 – 1600 BREAK

1600-1730 Synthesis discussion of CMIP5 status, prospects, coordination of analyses across MIPs, coordination of synthesis papers to be assessed in the IPCC AR5, recommendations to analysts

Adjourn ~1730

Wednesday 6 October

0900 – 0915 Review previous two days and identify topics that warrant further discussion (G. Meehl, S. Bony)

Observations for model evaluation

0915 – 1000 (less than 10 minutes each, questions at the end of the session)

WOAP (K. Taylor)
NASA data initiative status (D. Waliser)
ESA climate initiative (R. Saunders)
YOTC/MJO (D. Waliser)

1000-1030 Synthesis discussion on observations for CMIP5 and other projects of model evaluation: needs? Coordination? Recommendations?

1030 – 1100 BREAK

1100 – 1130 Discussion on the WCRP modelling coordination

1130 - 1230 WGCM business

Spring 2011 CMIP5 model analysis workshop

Membership

Next meeting (joint with WGNE, likely scheduled around WCRP OSC, October, 2011, Boulder)

Adjourn ~1230

Appendix 2 – List of Participants

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