

WGCM and CMIP6

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CMIP panel chair

WCRP JSC meeting, Heidelberg July 1st, 2014

WGCM activities: 2013-2014

- CMIP6: its new structure and organization
 - Science focus
 - Distributed Organisation
- The WGCM Infrastructure Panel (WIP)
- Workshops/Meetings
 - CMIP6 preparation and new scenarios (Aspen Aug 2013)
 - WGCM-17 (Victoria Oct 2013) and jointly with AIMES
 - Definition meeting of GC on clouds, circulation and climate sensitivity (Ringberg March 2014)
 - Supporting the definition of CMIP6 (pattern scaling NCAR Apr 2014, obs4MIPs Washington May 2014)
 - PMIP meeting (Belgium, May 2014)
 - CFMIP meeting (Netherland, July 2014)
- Co-chairs have presented CMP6 plans to a number of WGs (CLiC, WGSIP, WGRC)
- Organisational issues
 - Membership
 - Expertise

Preparing for Phase 6 of the Coupled Model Intercomparison Project (CMIP6)

see updates on the CMIP Panel website

<http://www.wcrp-climate.org/index.php/wgcm-cmip/about-cmip>

- Initial proposal for the design of CMIP6 to inform interested research communities and to encourage discussion and feedback for consideration in the evolving experiment design.



- This proposal is based on

Meehl, G. A., R. Moss, K. E. Taylor, V. Eyring, R. J. Stouffer, S. Bony and B. Stevens, Climate Model Intercomparisons: Preparing for the Next Phase, Eos Trans. AGU, 95(9), 77, 2014.

- Feedback on this initial CMIP6 proposal is being solicited over the next year from modeling groups and model analysts.** Please send comments to CMIP Panel chair, Veronika Eyring, Veronika.Eyring@dlr.de by September 2014. The WGCM and the CMIP Panel will then iterate on the proposed experiment design, with the intention to **finalize it at its meeting in October, 2014.**

Initial CMIP6 Proposal: Scientific Focus

- It is proposed to use as the **scientific backdrop** for CMIP6 the six **WCRP Grand Challenges**, and an additional theme encapsulating questions related to **biospheric forcings and feedbacks**.
 1. Clouds, Circulation and Climate Sensitivity
 2. Changes in Cryosphere
 3. Climate Extremes
 4. Regional Climate Information
 5. Regional Sea-level Rise
 6. Water Availability
 7. AIMES theme for collaboration: biospheric forcings and feedbacks
- The specific experimental design would be focused on **three broad scientific questions**:
 1. How does the Earth System respond to forcing?
 2. What are the origins and consequences of systematic model biases?
 3. How can we assess future climate changes given climate variability, predictability and uncertainties in scenarios?

Initial CMIP6 Proposal: A Distributed Organization under the oversight of the CMIP Panel

CMIP would be comprised of two elements:

- 1. Ongoing CMIP Diagnostic, Evaluation and Characterization of Klima (DECK) experiments:** a small set of standardized experiments that would be performed whenever a new model is developed.

The DECK experiments are chosen to provide **continuity across past and future phases of CMIP**, to evolve only slowly with time, and to take advantage of what is already **common practice in many modeling centers**:

- i. an AMIP simulation (~1979-2010);
- ii. a multi-hundred year pre-industrial control simulation;
- iii. a 1%/yr CO₂ increase simulation to quadrupling to derive the transient climate response;
- iv. an instantaneous 4xCO₂ run to derive the equilibrium climate sensitivity;
- v. a simulation starting in the 19th century and running through the 21st century using an existing scenario (RCP8.5).

- 2. Standardization, coordination, infrastructure, and documentation functions** that make the simulations and their main characteristics performed under CMIP available to the broader community.

Initial CMIP6 Proposal: A Distributed Organization under the oversight of the CMIP Panel

CMIP Phase 6 (CMIP6):

- **CMIP6-Endorsed MIPs** would propose additional experiments, and modeling groups could choose a subset of these to run according to their interest, computing and/or human resources and funding constraints.
- The MIPs would also likely have additional experiments that would not be part of CMIP6 but would be of interest and relevant to their respective communities.

Participation

- The ongoing nature of the proposed CMIP/CMIP6 structure means that anyone at any time could download model data for analysis.
- A scientist or group of scientists could send a 'Request for a **CMIP6-Endorsed MIP**' at any time to the CMIP Panel Chair (see template on CMIP webpage).

CMIP6-Endorsed MIPs

- Request for **CMIP6-Endorsed MIPs** should be sent to the CMIP Panel Chair.
- **CMIP6-Endorsed MIPs**
 - can make full use of the ESGF infrastructure.
 - They can propose that part or all of their experiments be included in CMIP6.

The main criteria for MIPs to be endorsed for CMIP6 are

- The MIP addresses at least one of the key science questions of CMIP6;
- The MIP follows CMIP standards in terms of experimental design, data format and documentation;
- A sufficient number of modeling groups have agreed to participate in the MIP;
- The MIP builds on the shared CMIP DECK experiments;
- A commitment to contribute to the creation of the CMIP6 data request and to analyze the data.
- A commitment to identify or contribute possible observations/reanalysis to obs4MIPs/ana4MIPs for model evaluation and improved process understanding.

See <http://www.wcrp-climate.org/index.php/wgcm-cmip/about-cmip>

CMIP6 Organization

Communication

WGCM and the CMIP Panel facilitate communication between MIP co-chairs and model group contacts to help with coordination between MIPs and model groups.

CMIP Panel (chaired by Veronika Eyring)

- Coordinate diagnosis and evaluation simulations with the community
- Approve experiment and variable lists etc. that are part of CMIP6
- Coordinate with WCRP Grand Challenges and the additional theme on “biospheric forcings and feedbacks”

WGCM Infrastructure Panel (WIP, chaired by V. Balaji and Karl Taylor)

- Standard governance for MIPs and use of the Earth System Infrastructure Federation (ESGF)
- File formats, structures, and metadata, description of models and simulations etc.

MIPs

- Suggest model experiments to address the CMIP6 science questions and supply rationalization for relevance of experiments
- Work with CMIP Panel for output list for CMIP6 data request
- MIPs determine which experiments are run when

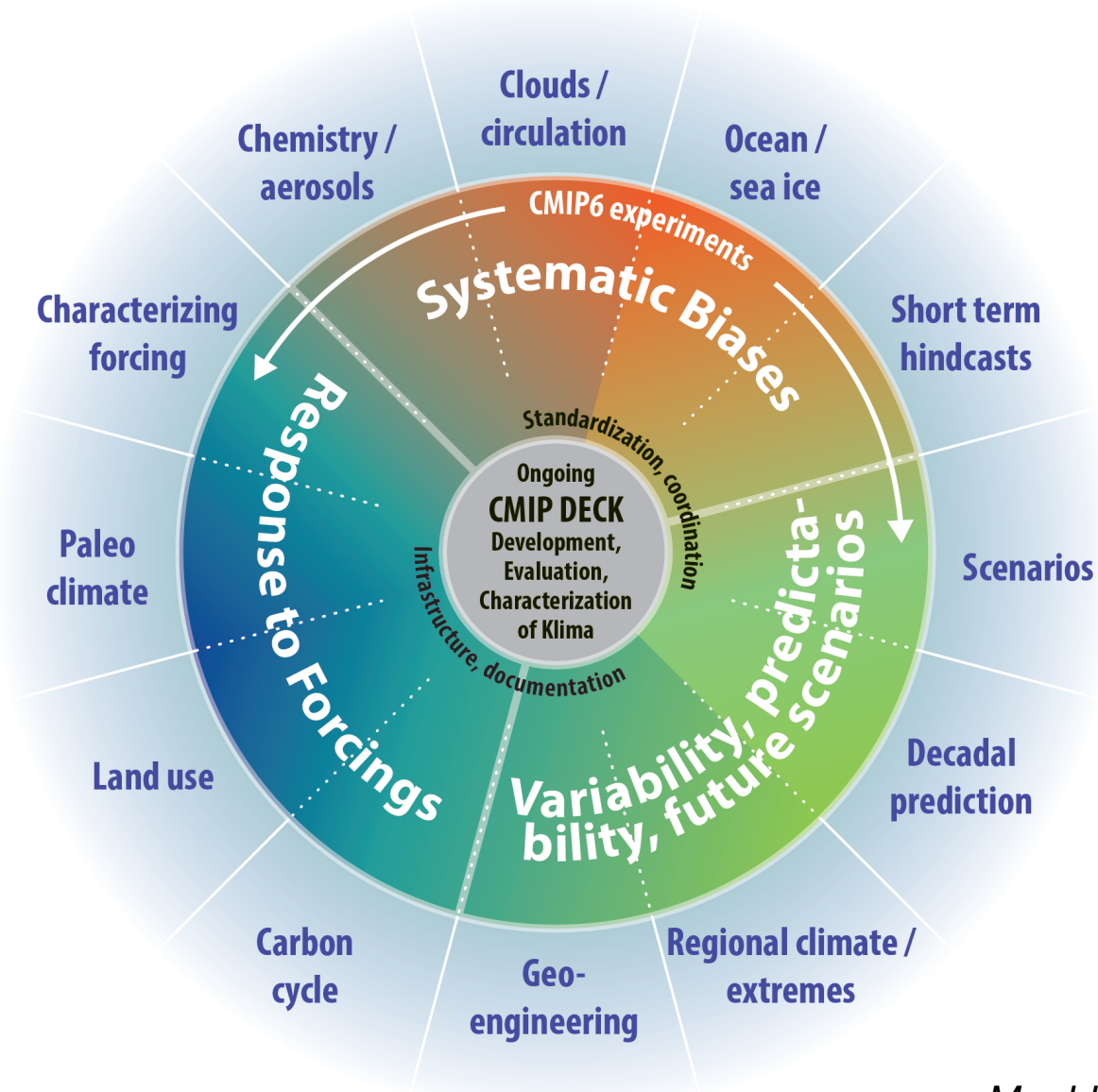
WGCM Infrastructure Panel (WIP) – Charge

- Establish standards and policies for sharing climate model output and ensure consistency across WGCM activities
- Extend standards as needed to meet evolving needs
- Review and provide guidance on requirements of the infrastructure (e.g. level of service, accessibility, level of security)
- **Oversee**
 - file formats, structure and metadata
 - controlled vocabularies, name spaces, and naming conventions
 - protocols for interfacing components of the infrastructure
 - URL and catalog standards making data accessible regardless of local storage format
 - protocols for data publication (including version identification), node management and data harvesting
 - standardized descriptions of models and simulations
 - security protocol for authentication and authorization
 - query formats.

WGCM Infrastructure Panel (WIP) – 1st Meeting

- Chaired by V. Balaji and K. Taylor
- Will meet at least quarterly. First meeting - very lively and enthusiastic!
- Strategy to develop a series of "position papers" on global data infrastructure and its interaction with the scientific design of experiments. These will be presented to WGCM annual meeting. Likely topics include;
 - projected data volumes for CMIP6, strategies for managing the growth path
 - data access policies: would open access simplify the technical design of the infrastructure?
 - data citations. Developing and promoting a path to data citations using DOIs and the emerging data journals, such as ESSD, Nature Scientific Data.
 - protocol document for the "endorsed MIPs".
- Infrastructure issues that impinge on science design for CMIP6 will be handled through close involvement of the WIP and CMIP panel (e.g. joint papers)

WCRP Grand Challenges: (1) Clouds, circulation and climate sensitivity, (2) Changes in cryosphere, (3) Climate extremes, (4) Regional climate information, (5) Regional sea-level rise, and (6) Water availability, plus an additional theme on “biospheric forcings and feedbacks”



CMIP6 Timeline

2014

2015

2016

2017

2018

2019

2020

...

Diagnostic, Evaluation and Characterization

with standardized metrics & assessment

CMIP
DECK

Model
Version 1

Model
Version 2

Model
Version 3

Model
Version 4

CMIP6
Endorsed
MIPs

MIP1

MIP2

MIP3

MIP1

MIP4

MIP2

Future
projection
runs

Finalize experiment
design (WGCM)

Scenario MIP studies,
MIP matrix, pattern
scaling, scenario pairs

Community input
on CMIP6 design

Formulate scenarios
to be run by AOGCMs
and ESMs

Forcing data:
harmonization,
emissions to
concentrations

Preliminary ESM/AOGCM
runs with new scenarios

Run and analyze scenario simulations from matrix

Possible IPCC AR6

Nominal Simulation Period of CMIP6

Pattern Scaling Workshop, NCAR 23-25 April 2014.

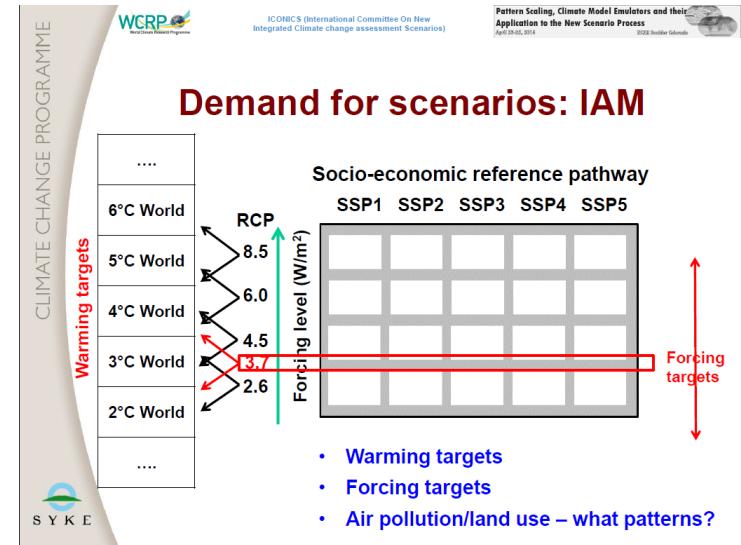
Goals

- Assess the current state of pattern scaling science
- To what extent can current approaches meet the needs of integrated assessment and impact modellers for climate change information ?
- Identify and prioritise research directions so that pattern scaling can better meet the needs of future applied research

Outcomes

- Coordinated evaluation of current approaches (Danny Williamson, Exeter)
- Two planned papers: meeting conclusions / review of current state of pattern scaling/emulation science
- Assemble information on user needs and tools
- Input into CMIP6 plans (design of ScenarioMIP, AerChemMIP, LUMIP, DetAttMIP; seek single-forcing expts to help support pattern scaling)
- Interactions with the scenario process (Breckenridge, Snowmass, Aspen)

There is a *hierarchy of needs*; for some, PS may suffice, but it is clear that *they cannot satisfy the whole gamut of user needs* and therefore cannot be relied upon as substitutes for climate model runs.



WGCM Organisational Issues

Membership

Many Thanks to Jerry Meehl for outstanding service over many years!

Extensions: Veronika Eyring (new CMIP panel chair, SPARC link), Bin Wang

Retiring/leaving: Nathalie Mahowald (NCAR), Tony Hirst (CSIRO), Colin Jones (SMHI)

Proposed new members: Pierre Friedlingstein (U. Exeter UK), Simon Marsland (CSIRO) , Bart Van den Hurk (KNMI)

Ex-Officio: CLIC co-chairs

Balance of Expertise

Balancing membership across modelling centres and maintaining a good blend of scientific interests is very challenging. Some current issues include;

- Maintaining links to the WGRC
- Increased need for expertise from wider communities (carbon cycle, chemistry, IAMs, land-surface processes)
- Need to pay attention to core atmospheric and ocean expertise otherwise will become a minority within WGCM. e.g. losing expertise in climate variability

Plans for 2014-15

- WGCM co-chairs involved in the organizing committee of the IPCC-WCRP workshop to be held on 8-10 sept 2014 in Bern
- Workshop on "Model tuning" on 8-10 oct 2014 (Germany); initially proposed by WGCM, with the support of WMAC
- WGCM meeting on 9-11 Oct 2014 (Germany) – Reps from all major modelling groups invited. Final decision on CMIP6 design
- Further GC workshops (previously described)
- Other meetings planned to help the preparation of forcings for CMIP6

ScenarioMIP

A **pair of two new scenarios** (high/low) run by all models with new 20th century (to 2015) and 21st century forcings



Scenario MIP matrix, modeling groups that subscribe run a **pair of two additional new scenarios** (Sample different combinations of scenario pairs and AOGCMs/ESMs (sampled in an appropriate way, e.g. climate sensitivity, enough realizations))

Paired non-mitigation/mitigation scenarios

Scenario Pair 1 Scenario Pair 2 Scenario Pair 3 Scenario Pair 4 Scenario Pair 1 →

↑ AOGCMs and ESMs

Model 1	x				
Model 2		x			
3			x		
4	x				
.					
.					

IAM and climate modeling community decides which scenario pairs make most sense:

1. baseline/mitigation scenario pairs for research on benefits of mitigation related to land use change, short lived climate forcers, etc.
2. An overshoot scenario

Obs4MIPs workshop,