

Coupled Model Intercomparison Project Phase 6 (CMIP6): Design and Organization

Veronika Eyring, Jerry Meehl, Bjorn Stevens, Ron Stouffer, Karl Taylor
(CMIP Panel)

Sandrine Bony and Cath Senior (WGCM Co-chairs)

V. Balaji (WGCM Infrastructure Panel co-chair with K. Taylor)

16 January 2015 (*updates to CMIP6 Data Request Timeline on Slide 9*)

Please see the CMIP Panel website for additional information and updates:

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

Contact for questions: CMIP Panel Chair Veronika Eyring (email: Veronika.Eyring@dlr.de)

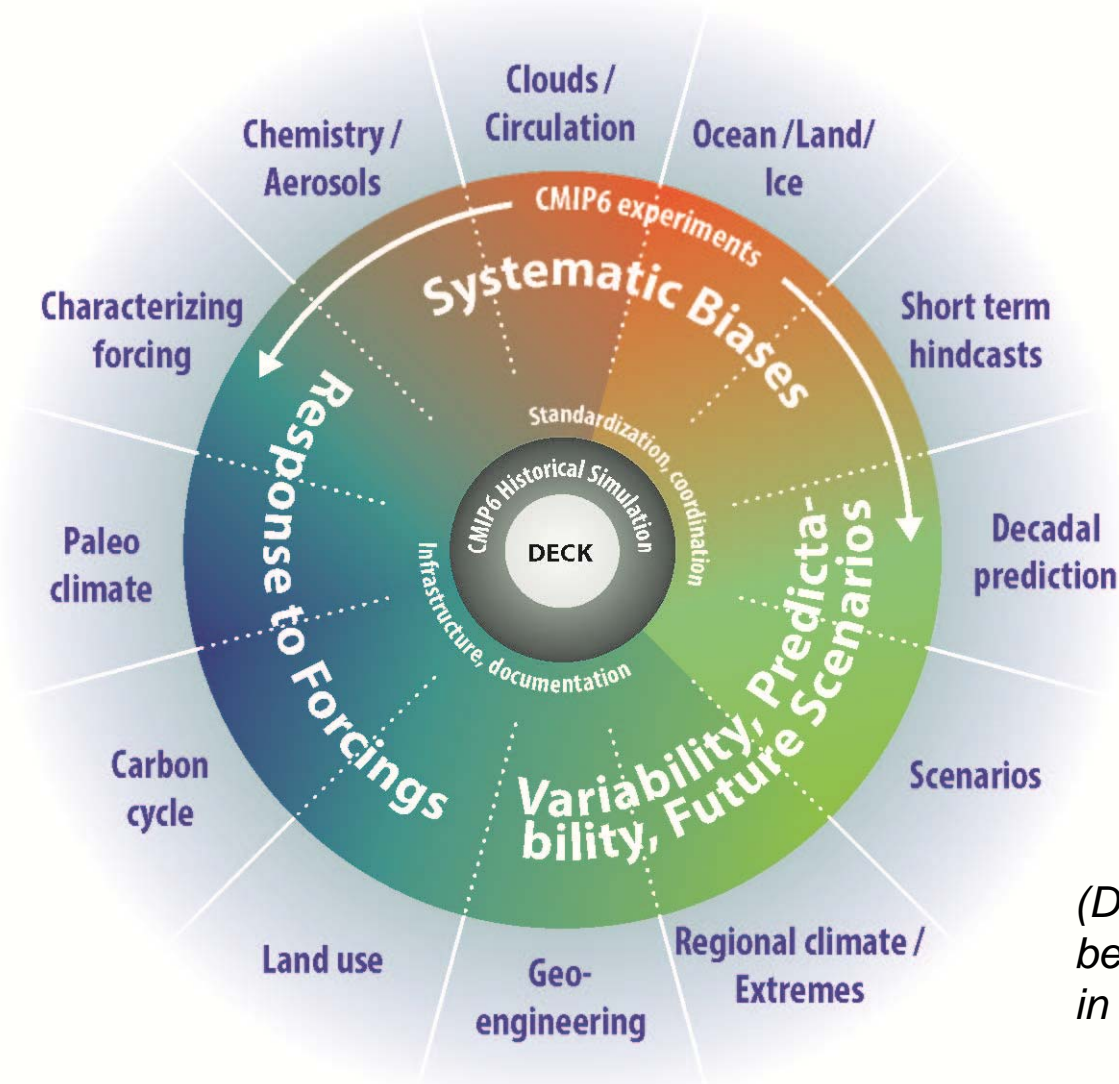
The final CMIP6 Design, possibly with small modifications to the here presented figures and wording, will be published in a GMD Special Issue together with a description of the CMIP6-Endorsed MIPs and the forcing datasets. This Special Issue will open 30 April 2015.



CMIP6 Design: Scientific Focus

- The **scientific backdrop** for CMIP6 is the six **WCRP Grand Challenges**, and an additional theme encapsulating questions related to **biogeochemical 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. Biogeochemical forcings and feedbacks (AIMES & WGCM)
- The specific experimental design is 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?

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 “Biogeochemical forcings and feedbacks”



Note: The themes in the outer circle of the figure might be slightly revised at the end of the MIP endorsement process

DECK (entry card for CMIP)

- i. AMIP simulation (~1979-2014)
- ii. Pre-industrial control simulation
- iii. 1%/yr CO₂ increase
- iv. Abrupt 4xCO₂ run

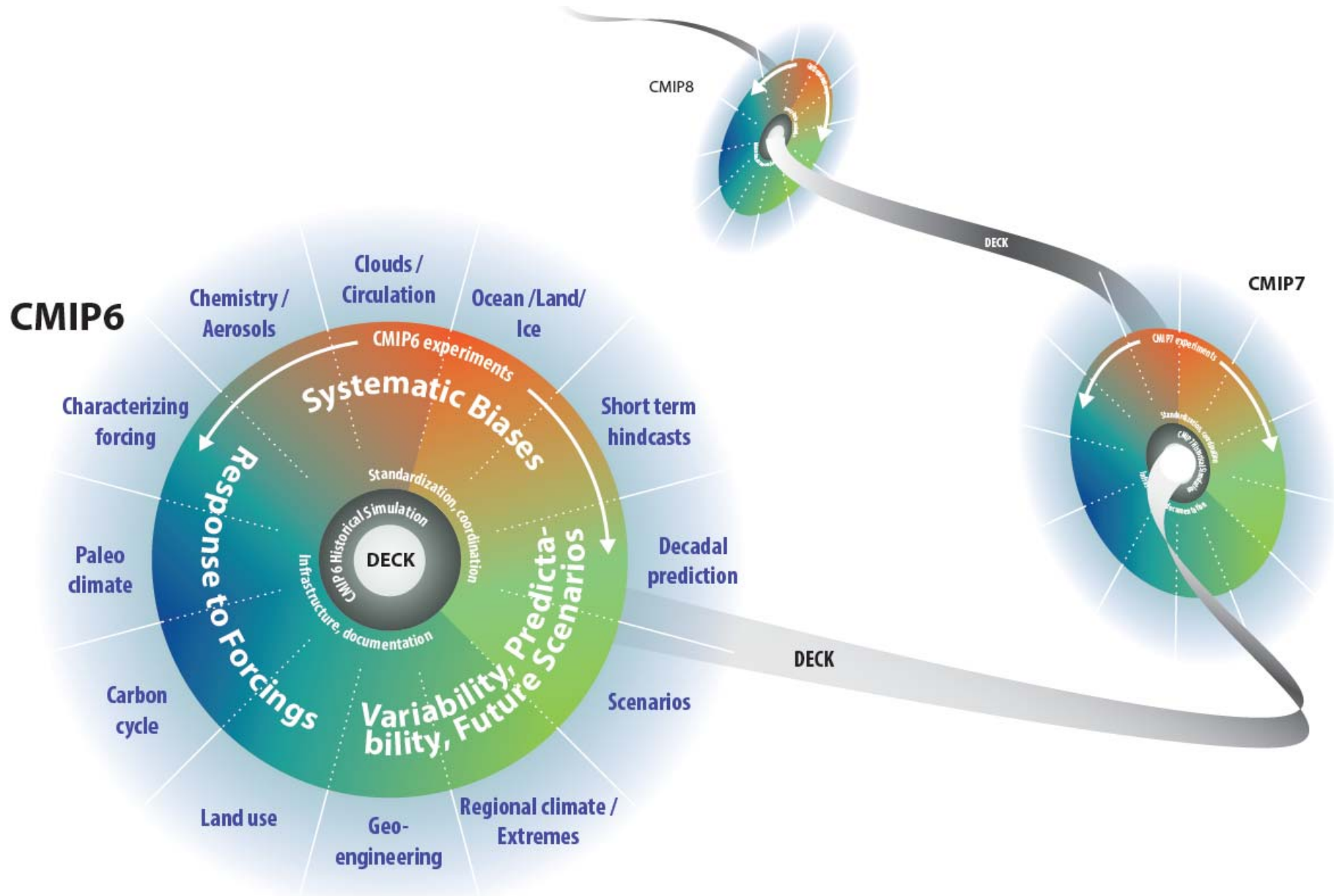
CMIP6 Historical Simulation (entry card for CMIP6)

- v. Historical simulation using CMIP6 forcings (1850-2014)

(DECK & CMIP6 Historical Simulation to be run for each model configuration used in the subsequent CMIP6-Endorsed MIPs)

With proto-DECK experiments (LMIP, OMIP etc.) in CMIP6 Tier1

CMIP Continuity



Note: The themes in the outer circle of the figure might be slightly revised at the end of the MIP endorsement process

Criteria for DECK and CMIP6 Historical Simulation

(1) What are the criteria for the DECK?

The DECK experiments are chosen

1. to provide continuity across past and future phases of CMIP,
2. to evolve as little as possible over time,
3. to be well-established,
4. to be part of the model development cycle.

(2) What are the criteria for the CMIP Phase X Historical Simulation?

The CMIP Phase X Historical Simulation is chosen

1. to serve as a benchmark for CMIP6-Endorsed MIPs
2. to use the specific forcings consistent with Phase X of CMIP
3. to be decoupled from model development cycle if needed.

CMIP6-Endorsed MIPs

Main Criteria for Endorsement

1. The MIP and its experiments address at least one of the key science questions of CMIP6.
2. The MIP demonstrates connectivity to the DECK experiments and the CMIP6 Historical Simulation.
3. The MIP adopts the CMIP modeling infrastructure standards and conventions.
4. All experiments are tiered, well-defined, and useful in a multi-model context and don't overlap with other CMIP6 experiments.
5. Unless a Tier 1 experiment differs only slightly from another well-established experiment, it must already have been performed by more than one modeling group.
6. A sufficient number of modelling centers (~8) are committed to performing all of the MIP's Tier 1 experiments and providing all the requested diagnostics needed to answer at least one of its science questions.
7. The MIP presents an analysis plan describing how it will use all proposed experiments, any relevant observations, and specially requested model output to evaluate the models and address its science questions.
8. The MIP has completed the MIP template questionnaire.
9. The MIP contributes a paper on its experimental design to the CMIP6 Special Issue.
10. The MIP considers reporting on the results by co-authoring a paper with the modelling groups.

* For "Diagnostic-MIPs" only non-experimental criteria apply

Timeline MIP-Endorsement Process

- First feedback from WGCM and modelling groups on the September proposal sent to MIP co-chairs (CMIP Panel, October 2014)
- MIP Proposal (except for information of the data request) scientifically revised and harmonized with other MIPs (MIP co-chairs, 29 November 2014)
- Revised proposals sent to WGCM, WCRP GCs, biogeochemical forcing theme & projects (WGCM co-chairs), MIP co-chairs and modelling groups for review (CMIP Panel, 30 November 2014)
- Review Process Finished (15 January 2015)
- Synthesis of comments and recommendations for each MIP finished and sent to MIP co-chairs (WGCM members organized by WGCM co-chairs, 15 February 2015)
- Final MIP proposals with all information (including final experiment list for all Tiers) sent to CMIP Panel and WIP co-chairs (MIP co-chairs, 31 March 2015)
- MIP Endorsement (CMIP Panel and WGCM co-chairs, 30 April 2015)
- GMD Special Issue on the CMIP6 experimental design opens (30 April 2015) with envisaged submission of the April-Endorsed MIPs and the CMIP6 forcings by December 2015.

WGCM Infrastructure Panel (WIP)

Co-Chairs and Contacts: V. Balaji and K. Taylor

<https://www.earthsystemcog.org/signal/list/wip/>

- Agreed actions-

- Consensus on open access, two choices of embedded license
- Data citation requirement to acknowledge modeling groups
- CMIP6 data request template available mid-December 2014
- An ES-DOC template available to fill at the same time that groups are writing "documentation papers"
- Recommendation of a common calendar
- A small subset of high-value variables (especially for downstream science) to be made available on a common grid
- PCMDI to report on which variables were most used in peer-reviewed literature
- MIPs to recommend a tiered variable list (ocean groups have already done this)
- "Freeze" DRS and CMOR conventions to enable centres to embed them in their own post processing/analysis workflows
- "One-stop" website where CMIP6/WIP issues are all described in detail (resources?)

Timeline CMIP6 Data Request *(updated since 10 Nov)*

See additional information at <https://earthsystemcog.org/projects/wip/CMIP6DataRequest>

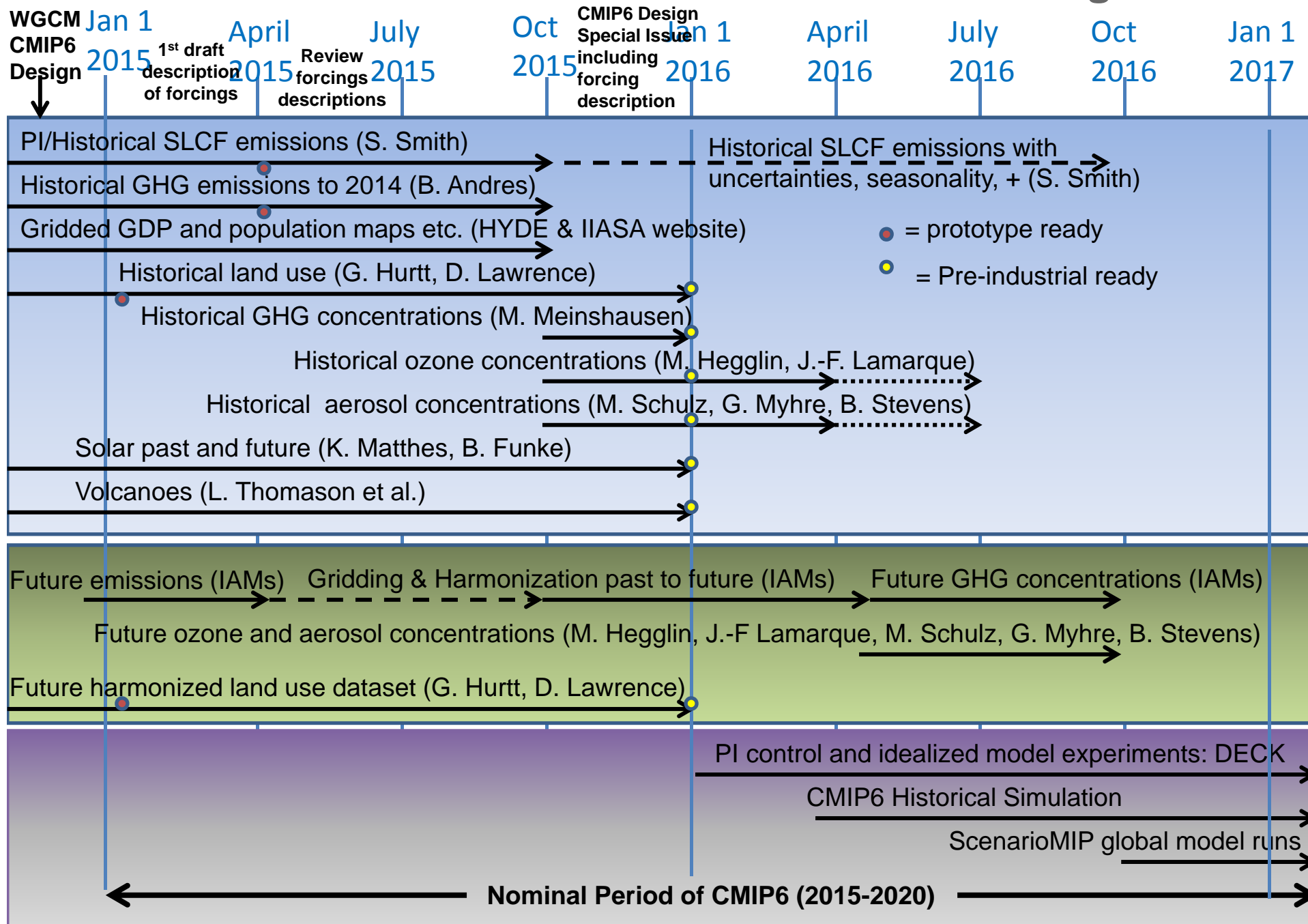
- Online registration and CMIP5 variables which will be used again [see instructions in Section 2 and 4, respectively, of the **CMIP6 Data Request Compilation Guidance Note**] returned to WIP co-chairs and CMIP Panel Chair, c/o Martin Jukes (*MIP co-chairs*, 31 January 2015)
- Full information except the final experiment list (spreadsheet 2) for **CMIP6 Data Request Compilation Template** returned to WIP co-chairs and CMIP Panel Chair, c/o Martin Jukes (*MIP co-chairs*, 28 February 2015)
- Synthesized responses (i.e., 1st Draft of **CMIP6 Data Request**) sent to MIP co-chairs (copied to modelling groups) with request for additional information that can be aligned only after the final experiment list is received (*Martin Jukes, WIP co-chairs and CMIP Panel*, 15 April 2015)
- 1st Draft of **CMIP6 Data Request** reviewed and returned, with additional information as requested, to WIP co-chairs and CMIP Panel Chair, c/o Martin Jukes (*MIP co-chairs*, 15 June 2015)
- 1st Draft of **CMIP6 Data Request** reviewed and returned to WIP co-chairs and CMIP Panel Chair, c/o Martin Jukes (*Model groups*, 15 June 2015)
- Near-final version of **CMIP6 Data Request** published (*Martin Jukes, WIP co-chairs and CMIP Panel*, 31 July 2015)
- Feedback from modelling group on the actual implementation of the *CMIP6 Data Request* returned (*Model groups*, 15 October 2015)
- Final **CMIP6 Data Request** approved at WGCM meeting (*WIP co-chairs and CMIP Panel*, 31 October 2015)

Timeline CMIP6 Forcing Datasets

- Initial description of each forcing dataset sent to CMIP Panel chair (Forcing Group, 31 January 2015)
- Initial description reviewed (Model groups, 31 March 2015)
- Description of forcing datasets in CMIP6 Special Issue (Forcing Group, preferably by 31 December 2015)
- Forcing datasets available (Forcing group, see next slide)

Finalize scenario choice, March 2015 (O'Neill, Tebaldi, van Vuuren)

CMIP6 Forcing Timeline



CMIP and CMIP6 Cycle

CMIP Cycle

1. **Coordination of Data Request DECK** (coordinated and technically overseen by WIP, scientifically overseen by CMIP Panel, in close collaboration with modelling groups)
2. **ESGF Data Archive and Related Functionality** (overseen by WIP)
3. **Register Model for CMIP and Run and Submit DECK Experiments** (model groups)
4. **Documentation of Models and Simulations** (WIP in collaboration with model groups)

CMIP6 Cycle

1. **Defining the MIP set:** open call for MIP proposals
2. **Harmonization Phase:** WGCM reviews and harmonizes experiments across the MIPs for synergies and similar experimental design in collaboration with MIP co-chairs
3. **Endorsement of MIPs by CMIP Panel + WGCM co-chairs**
4. **Coordination of CMIP6 Data Request (DECK+)** (coordinated and technically overseen by WIP, scientifically overseen by CMIP Panel, in close collaboration with modelling groups)
5. **Preparation of Forcings** (“Forcing Group” and overseen by CMIP Panel)
6. **Documentation of CMIP6 Experimental Design in a Special Issue Overview** (CMIP Panel + WGCM Co-chairs) + Papers from CMIP6-Endorsed MIPs + Papers on Forcing Datasets)
7. **Model Execution CMIP6 Historical Simulation** (DECK & CMIP6 Historical Simulation to be run for each model configuration used in the subsequent CMIP6-Endorsed MIPs)
8. **Routine Model Evaluation:** as soon as output from CMIP6 Historical Simulation is submitted
9. **Model Execution MIP experiments and submission to ESGF** (model groups)
10. **Additional Model Analysis:** by wider community

CMIP Organization and Governance

WGCM (co-chaired by S. Bony and C. Senior)

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

- Ensures good communication between the modelling groups and the WGCM panels (CMIP Panel, WIP)
- Facilitates communication between the CMIP Panel and WCRP Grand Challenges + Theme of collaboration on “Biogeochemical forcings and feedbacks”, and WCRP core projects
- Organizes the review of MIP proposals for CMIP6 endorsement

CMIP Panel (V. Eyring (chair), J. Meehl, B. Stevens, R. Stouffer, K. Taylor)

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

- Sub-committee of the WGCM which is responsible for direct coordination of CMIP
- Oversees the whole CMIP process
- Coordinates the DECK activity and the CMIP Phase X Historical Simulation
- Coordinates and approves endorsement of CMIP6 MIPs
- Oversees and approves scientific content of the CMIP data request
- Facilitates communication between the MIPs, modeling groups and the WIP

WGCM Infrastructure Panel (WIP, co-chaired by V. Balaji & K. Taylor)

<https://www.earthsystemcog.org/signal/list/wip/>

- Establishes standards and policies for sharing climate model output and ensure consistency across WGCM activities
- Extends standards as needed to meet evolving needs.
- Reviews and provides guidance on requirements of the infrastructure (e.g. level of service, accessibility, level of security)
- Oversees technical part of the CMIP6 data request and puts it together (**M. Juckes**)