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Interactive comment on "Designing and Documenting Experiments in CMIP6" *by* Charlotte Pascoe et al.

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Comments from CMIP Panel and RFMIP members

General Comments

The paper by Pascoe et al. on "Designing and Documenting Experiments in CMIP6" outlines a concept for the documentation of the experiment description in CMIP6. The authors describe ES-DOC as the place where the experiments are designed and documented, yet the original source of the experiment design and descriptions are the papers from the CMIP Panel (for the DECK and historical simulations) and the

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Discussion paper

CMIP6-Endorsed MIPs (for the CMIP6 experiments) in the GMD CMIP6 Special Issue and possibly new papers (version controlled) in case the experiment design changes or bugs are found. The paper should be changed to reflect that.

Until now a formal procedure has not been established for clarifying, modifying, and updating the CMIP6 experiment design as originally documented in the GMD paper descriptions. Furthermore, the narrative describing experiments in the GMD articles may not provide a comprehensive recipe for setting up and performing the experiments. The effort of the ES-DOC author team has been very helpful in identifying unclear details in experiments and between MIP projects, and they have a system which supports version control and traceability. However, ideally, the authority and responsibility to make changes lies with the MIP chairs, but this needs to be consistent with infrastructure requirements, and validated to minimize the introduction of ambiguity and/or further errors in specification. This requires software which can be used by the MIP teams to construct standardized descriptions which can enter the ES-DOC tool chain for presentation, validation and comparison, but as it stands there are no easy to use templates and software to do this.

Therefore, the following approach of experiment documentation has been agreed by the CMIP Panel and the WGCM Infrastructure Panel (WIP) in collaboration with the ES-DOC team (i.e. the authors of this paper):

- There will be a single authoritative source for the experiment design information that is version controlled with a DOI assigned (with content in a Github repository for each CMIP6-Endorsed MIP that holds this information).

- The MIP co-chairs will have the responsibility and authority to document the experiments and all changes in this central version controlled location.

- This documentation will conform in content with the ES-DOC specification and be formatted using a new template system to be constructed by a small working group, working under the joint auspices of the CMIP Panel and the WIP, which will use existing documentation as exemplars.

- When new documentation is produced or existing documentation updated, before any release and DOI assignment, there will be a review of the content by the WIP in consultation with the CMIP Panel in order to ensure that the information can smoothly and automatically propagate from the authorized source into the Data Request and the Controlled Vocabulary.

- The CMIP Panel will make it an Endorsement Criterion for MIPs to fill the experiment design in this single version controlled repository and to take responsibility and authority to maintain it up to date.

- The MIPs are also asked to keep the description of their experiment design up-to-date in the CMIP6 Special Issue at GMD. Corrigenda should only be used for mistakes in the description of the experimental protocol. Any changes in the experimental protocol itself, including bug fixes, require a new short paper of the Experiment Description paper type. New experiments or updates in the protocol also require a new paper. Such papers should highlight what has been changed compared to the previous version, give the reasoning behind the changes, with version numbering assigned so it is clearly traceable.

In CMIP6 a more distributed structure has been put in place (Eyring et al., doi:10.5194/gmd-9-1937-2016, 2016). As we move forward, we envisage making enhanced use of the distributed structure which includes the responsibility and authority of the experiment design description by the CMIP6-Endorsed MIPs supported by a central endeavor as proposed here. The value of ES-DOC lies in helping this process by defining templates and reviewing the experiment design and by bringing

information from different CMIP6-Endorsed MIPs together similar to what the authors present in Section 4. However, we need to work to avoid a data-user rather than data-provider imposed definition of the norms and standards on the community that the community cannot support.

The paper should be rewritten to reflect this agreed approach for CMIP. As it stands, the paper would be misleading to all those involved in CMIP.

Specific Comments

- The title needs changing. ES-DOC has not designed experiments in CMIP6. The experiments are designed by the CMIP Panel (DECK and historical simulation) and by the CMIP6-Endorsed MIPs. The paper is about the **taxonomy** or **nomenclature** of terms for more clearly defining experiments. Please change the title to reflect that.

- The manuscript would be stronger as literature, and the ES-DOC effort more compelling to the community, if the benefits to those undertaking the extra efforts (modelling centers, MIP chairs) were more clear. As it is, ES-DOC asks those producing the data to undertake quite a lot of effort. The benefits to those wanting to analyze the data are clear; the benefits to those producing the data are less so. Here is a chance to explain why they should also embrace this effort.

- The authors might also take the chance to explain why undertaking the very significant effort to comply with ES-DOC requests adds value to normal scientific communications. For example by explaining how ES-DOC provides a traceable, documented answer to questions about a simulation or protocol that might otherwise need to be answered multiple times and with potentially different responses

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to email or other questions from analysts.

- In the manuscript and as implemented, the system would be more useful if it were more flexible. One wonders, for example, what value is brought by requiring information in ES-DOC for all the solar particle forcings when the experimental descriptions do not specify them. (This seems to be the root of one of the mistakes with respect to RFMIP experiment documentation in ES-DOC.)

- p2,l11: *"and ES-DOC use is now required for the documentation of CMIP6 simulations."* please reword to *"and the authors now recommended the use of ES-DOC for documentation of CMIP6 simulations."*

- p3,l10: The title of this section is misleading as the experiment are defined by the MIPs. Maybe the definition of the nomenclature?

- p3,l15 *"In the case of CMIP6, the iterative discussion includes input from the ES-DOC community aiming to get a formal experiment description, from the Data Request coordinator, and the CMIP6 central team at the Program for Climate Model Diagnosis and Intercomparison (PCMDI) responsible for cross-experimental common CMIP vocabularies. These extra activities result in additional documentation which can be used by those carrying out the actual experiment (figure 1b) in an attempt to minimize the burden of interpreting and carrying out many experiments."* Inaccurate description of how the experiment design in CMIP6 is established, namely by the CMIP6-Endorsed MIPs. Similarly, Figure 1 should be changed to reflect that the responsibility and authority of defining the CMIP6 experiments is with the CMIP6-Endorsed MIPs. The experiment design and the science comes down to the MIPs as was envisioned from the beginning of the planning for CMIP6 to make it a distributed effort where the MIPs and modeling groups have ownership on the design / models, respectively. ES-DOC should help this envisaged distributed process and could play the role of bringing documentation on different MIPs from the original authorized source together, but

should not request to be the authorized source as seems to be described in this paper.

- p10,l13 *"the CMIP6 team (both the CMIP panel1 and the PCMDI support group2)."* This is a wrong definition of the CMIP6 team, misleading wording, please rephrase. Similarly, please also avoid the use of *co-design between the CMIP Panel and PCMDI* in several places of the paper.

- p10,l11: The title of this section is misleading. The definition of the MIPs is a scientific undertaking by communities involved in specific science questions. Perhaps a better title would be 'Documentation of the experimental design process'.

- Section 6. We appreciate that the underlying code for ES-DOC is made publically available in a Github repository. However, when looking at the code the actual experiment description (i.e. the entries for the various experiments) seems not to be available. For traceability, it would be nice to have this all in an open Github repository as envisaged and described above.

Comments on Figures and Tables

- Figures 1 and 2 need to be changed as the workflow is not accurately representing the workflow in CMIP6.

- Table 4 on the CMIP6-Endorsed MIPs should be removed.

We encourage the authors to take our comments and the general longer-term visions for CMIP experiment description into account when rewriting the paper. If not considered, we recommend that the paper is either rejected, or another example than CMIP6 is taken and the paper gets removed from the GMD CMIP6 Special Issue.

Best regards,

Veronika Eyring, Greg Flato, Jean-Francois Lamarque, Gerald Meehl, Robert Pincus, Cath Senior and Bjorn Stevens (Members of the CMIP Panel and RFMIP)

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