

## ***Interactive comment on “The Cloud Feedback Model Intercomparison Project (CFMIP) contribution to CMIP6” by Mark J. Webb et al.***

### **Anonymous Referee #1**

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In this paper, the authors state the goals and motivation of CFMIP, review the major accomplishments of previous CFMIPs, and describe the proposed experiments and diagnostics for CFMIP3. The coordinated experiments proposed for CFMIP3 will target a number of outstanding questions for which previous model intercomparisons were not equipped to address, in addition to sustaining a number of highly useful experiments from earlier MIPs that will help to characterize and understand the response of the CMIP6-generation of models to external forcing (in addition to help quantify the forcing itself). Advanced diagnostics (e.g., satellite simulators and high frequency tendency terms) will aid in dissecting model results, and the authors have proposed that they be used more broadly (e.g., COSP turned on for longer durations and in more experiments). The emphasis on (mostly) atmosphere-only simulations in CFMIP3 should hopefully make it appealing for modeling centers to take part in several of the experi-

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ments despite the high volume of requested diagnostics.

The scientific questions to be addressed by CFMIP3 are well articulated and the various proposed experiments seem well designed to address these questions, and will advance the community's knowledge. The presentation of the paper is not particularly concise, nor are the figures particularly insightful, but the writing is clear and overall the presentation seems appropriate for a paper proposing a model intercomparison project. Thus, in my opinion the manuscript represents a substantial contribution to modelling science within the scope of Geoscientific Model Development, and I recommend publication following consideration of some minor comments detailed below.

Specific Comments:

\*piSST and a4SST: It is not clear to me whether (a) monthly- and annually-varying SSTs from the relevant 30 years in the piControl run, or (b) a monthly-resolved climatology of SSTs over the relevant 30 years in the piControl run are prescribed in piSST. Same question for a4SST.

\*amip-piForcing: I'm curious whether there was any interest in performing a similar experiment, but with present-day (rather than preindustrial) forcing held fixed. An example application that occurs to me is that a model with large aerosol-cloud interactions would presumably have brighter clouds with smaller droplets downwind of aerosol sources if the forcing were fixed at present-day, and its temperature-mediated changes in clouds might therefore be different than that occurring in an atmosphere with fewer aerosols. Having these two experiments would allow one to explore this effect (and others related to other forcing agents).

\*Given its implications for understanding apparent state- or time-dependent changes in effective climate sensitivity, I was a little surprised to see no experiments designed to explore causes of nonlinearity in the Gregory plot, perhaps using warming experiments in which the SST pattern is fixed in time (with various patterns), similar to those conducted in Andrews et al, J. Climate (2015). Is there a reason for not proposing these,

or are these effects already captured in other proposed experiments?

\*Line 126: should be "...meetings AND international..."

\*Line 426: "a4SST-4xCO2-all" should be "a4SSTice-4xCO2-all". There may be other instances of this; please verify that they are also changed.

\*Line 512: What is the reason for dispensing with the cloud tendency terms in CFMIP3?

\*Lines 597-608: it is not clear to me why some of these have a CMIP5 prefix, a CFMIP prefix, or no prefix at all (cfDay-3d). Why would a CMIP5 prefix be appropriate at all?

\*Line 611: should be "...for 140 years OF the piControl..."

\*Appendix A: I don't understand what is meant by "Lead coordinator". Is this the person who has "first dibs" on writing papers based on these experiments? Are interested investigators expected to contact this person to avoid duplicating work that others are doing with output from these experiments?

\*Figure 1: I think "CMIP6" should be deleted before "historical". If it is supposed to be there, I don't understand why it is only there. It is also unclear to me why the "Clouds" arrow only extends as far as abrupt-0p5xCO2. I think both the clouds arrow and the circulation and precipitation arrows should include all experiments, but in that case, what is the point of showing them?

\*Table 1: should be "This IS a single..."

\*Table 3: Several of the observational datasets end many years ago despite the fact that these satellites are still in orbit. Are there plans to extend these records, especially since the AMIP runs end in 2015?

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