

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

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This paper summarizes the objectives of CFMIP and the contribution of CFMIP-3 to CMIP6. CFMIP helps to explain the spread of cloud feedbacks, adjustments and processes across climate models. This updated contribution goes a step forward and suggests additional experiments to allow the community to tackle in more detail the physical reasons underlying dynamical and regional biases seen in climate models. By proposing experiments that test especially the atmospheric components of climate models, CFMIP provides a relevant framework to understand and improve cloud parameterizations and processes which remain the principal sources of surface and atmospheric model biases.

First, the authors summarised well how former CFMIP/CMIP5 experiments helped to

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improve our scientific understanding of climate feedbacks. It thus provides a relevant background supporting the additional experiments that they advise the modelling groups to perform. I particularly appreciated (1) the will to promote the analysis of experiments when cloud radiative effects are switched off, (2) the pertinent time slice experiments aiming to understand regional climate responses and (3) the encouragement of a more extensive distribution and use of physical tendencies which are a signature of the atmospheric components of climate models.

Below, I have listed a number of minor points which might be addressed to clarify the text (if the authors find them useful):

- Some acronyms are not defined : AOGCM (l.83), GCM (l.92), RFMIP (l.378), TOA (l.637), PMC (l.777)

L. 196 : I have trouble understanding the meaning of “known answer”.

L. 217: The amip-future4K experiments used the CMIP3 pattern of SST increase. Is this pattern consistent with the one derived from CMIP5 models?

L. 222-225 and L. 419-422: I'm a little bit confused about all 4xCO₂ experiments. The amip4xCO₂ experiment involves the CO₂ effect on the atmospheric component and land warming without the vegetation feedback. It is thus “equivalent” to the piSST-4xCO₂-rad experiment listed in section 2.7 (but not to piSST-4xCO₂). I guess abrupt4xCO₂ takes into account the vegetation feedback. So, the amip4xCO₂ experiment should be named amip4xCO₂-rad, doesn't it?

L.257-264: You could also add the reference “Block and Mauristen (13) JAMES - Forcing and Feedback in the MPI-ESM-LR coupled model under abruptly quadrupled CO₂”, which highlights the utility of diverse amip-pXk and abrupt2xCO₂ experiments.

L. 288-299:

(1) It is thus right that LW effects are the most important contributor to cloud atmospheric radiative effects, and SW effects play a minor role (e.g. Takahashi 09). Never-

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theless, local SW cloud effects exist (Pendergrass and Hartmann, 14). It might thus be interesting to point this fact out in the text and leave the discussion about SW effects sufficiently open.

(2) Since only LW radiative effects are removed, does it mean that models still have a SW cloud feedback but no LW cloud feedback?

(3) “and the radiation code only”. Does this mean that, for instance, a boundary-layer parameterization based on LW cloud-top radiative cooling continues to see LW effects?

L.326-328: Contrary to CO2 effects, the radiative forcing of solar insolation depends on latitude. Is this dependency taken into account when the authors state that a 4% change results in a “radiative forcing of a similar magnitude to that due to CO2 quadrupling”?

L. 482: Single Column Model already defined line 91-92.

L. 600-601: Is it normal that “cfDay-2d” is named by CMIP5 and not CFMIP? Why is there no CMIP5 or CFMIP prefix for “cfDay-3d”?

Fig.1 : The DECK is written in the caption but not highlighted in the graph.

Fig.1: I consider Iwoff experiments as part of the “Clouds” analysis. You may consider making the arrow longer.

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