

Response to reviewer comments

Reviewer 1

This paper describes the protocols and reasoning for the experiments requested as part of CFMIP4, which is in turn part of CMIP7. Given the importance of cloud feedbacks in climate system and their role in the structural diversity across models, this is an important initiative to get right. This paper is timely, given that CMIP7 simulations are now beginning and is publishable with only a few minor revisions.

We thank the reviewer for their positive and thoughtful comments on our paper.

l.85-90 The variation in ECS between 2xCO₂ and 4xCo₂ is not that large (except for a few models, like CESM2, which already have too high an ECS), and so I am unsure how important this will turn out to be in the real world. It is worth looking into more (as suggested here). I note that some papers referenced use 8xCO₂ runs as well, and I start to get a little nervous since most models are starting to push their basic assumptions at such high forcing levels (high water vapor effects on the equation of state or radiative transfer, mis-match of the ozone layer location and the rising troposphere etc.)

Thanks. We will change “remarkable inter-model spread” to “substantial inter-model spread”. We agree with the reviewer regarding the interpretation of 8xCO₂ results.

l. 141. The amip-piForcing experiment seems to be basically the same as the amip-sst experiment in CERESMIP in CMIP6Plus. Probably better to have the same name.

Yes, agreed. Given that amip-piForcing predates amip-sst, and that CMIP naming conventions require us to avoid changing experiment names unless necessary, we will stick to amip-piForcing here, but will encourage the CERESMIP community to adopt the amip-piForcing name.

l. 141. The choice of SST/SIC driving file is problematic (for reasons acknowledged in the text). It's possible that there will be an update to HadISST2.x relatively soon which would be better - and so maybe leave this ambiguous for now? Or allow for an update?

Our understanding is that there is no timeline yet for the publication of HadISST2.x; only HadISST1.1 is operational. We will therefore stick with the choice of HadISST1.1 for the alternative amip-piForcing variant, but will note in the text that we will endeavour to publish an additional dataset based on HadISST2.x when that becomes available; this could be run as a third amip-piForcing variant (with forcing index “f3”).

Table 1. Can the authors ask for simulations up to Dec 2025 for all historical runs? CMIP is endeavoring to update forcing fields by the fall of the following year. So Dec 2025 forcing (not just for SST) should be available by the end of this calendar year. (Hewitt et al, 2025; <https://doi.org/10.1371/journal.pclm.0000708>). Data to the end of 2024

should already be available (though it probably isn't). We should at least be aspiring to keep things as up-to-date as possible.

While we agree this would be desirable from a science standpoint, it is outside the scope of CFMIP to request extensions to the historical coupled runs (or even amip, which isn't a CFMIP experiment). We support community initiatives such as CERESMIP to extend model simulations closer to present-day. Our extended amip-piForcing variant with HadISST boundary conditions was also proposed in this spirit.

l. 168. The "true" value of ECS? I think this is a little optimistic. The longer-term model-specific ECS is more achievable!

By "true" we meant in model world rather than in reality, but we acknowledge this was a poor choice of words. We will remove "true" from this sentence.