Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2020-428

Anonymous Referee #1

Referee comment on "The SMHI Large Ensemble (SMHI-LENS) with EC-Earth3.3.1" by Klaus Wyser et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2020-428-RC1, 2021

This paper describes a new large ensemble with the climate model EC-Earth3 and a relatively unique combination of emissions scenarios. The analysis examples are largely uncontroversial/unsurprising, which is perhaps intentional and adequate for a description paper. The paper is written very clearly, with sound methods and results that support the conclusions. I only have a few small comments that could be considered in a revised version, after which I can recommend publication. I want to express my thanks to the authors for making this data available to the community; it is very valuable.

Three requests as a curious reader:
Could the authors make a few intuitive comparisons with CMIP6? In particular, I was under the impression that EC-Earth3 has among the largest decadal global temperature variability of any CMIP6 model (at least in the piControl). How does this affect its signal/noise ratio in comparison to other CMIP6 models and other available large ensembles?

It would be interesting to divide the change patterns from the different emissions scenario by global mean temperature, so the pattern become comparable. I actually think that would be a more interesting analysis (and easy to do) than the absolute change maps that are shown here. The authors kind of have to show the absolute change patterns for the description paper, I get that, but we already knew how they would look. I think a comparison of the normalized patterns would be very interesting for the overshoot vs non-overshoot path.

I encourage a comparison with or at least discussion of Sanderson et al. (2017) and several references therein, which investigate what might have been the first “large” (n=10) ensemble of overshoot simulations, albeit with CMIP5 forcing and not CMIP6 forcing.

Other comments:
There have been some concerns with the transition of biomass burning (BB) forcing from the satellite period to the future emissions scenarios in the CMIP6 forcing files. The forcing file has high variability during the satellite era and abruptly lower variability thereafter, at least in certain regions of prominent BB. A large ensemble is perfect to investigate whether this has an appreciable effect on the simulated climate during that transition period. It's not a priori clear whether it affects each model, as aerosol forcing is implemented quite differently across models. It would be valuable information for the community whether there's any sensitivity to this issue in EC-Earth.

Fig. 2: Please add some observations (at least for tas, pr, and sic) as a minimal model validation and to illustrate how the ensemble range compares to real-world variability.

Some map colorbars are a bit unintuitive, as they have a color switch offset from zero (e.g., Fig 3c-j). Also, rainbow or rainbow-like colorbars aren't encouraged.

L188: "mainly due to reduced variability of the change across members" sounds confusing to me. Do the authors just mean "due to the larger signal under stronger forcing"?

L218: "highly relevant" rather than "highly important"

L151: that's actually quite interesting. Could the authors speculate what could cause this?

L100: "There are differences"

L116: "tell us"

References:
Sanderson, B. M., et al., 2017: Community climate simulations to assess avoided impacts in 1.5 and 2°C futures. Earth Syst. Dyn., 8, 827–847.