

Review

An extensible perturbed parameter ensemble (PPE) for Community Atmosphere Model version 6.
Trude Eidhammer and Co-Authors.

This paper presents a clear description of the generation of a perturbed parameter ensemble (PPE) for a widely used global atmospheric model. Model sensitivity to key parameters is described. The use of the PPE to develop emulators characterizing the model's parametric dependencies is presented, and the emulators are applied to tuning. The paper is important in establishing new methods for model analysis and development, as well for its characterization of often poorly documented parametric dependencies. Only minor revisions are suggested.

Minor Revisions

1. The tuning results summarized in Figs. 9 and 10 point towards the possibility of using objective methods for model tuning going forward. Could the authors comment briefly on the possibilities of tuning towards a weighted function of a range of outputs, as would typically arise subjectively during a model development process? Have any experiments along these lines been undertaken?
2. In Eq. (1), as the Euclidean distance d characterizes each ensemble member m , would it be useful to denote as d_m rather than simply d ?
3. ll. 139-142: Instead of as stated in the text, does *clubb_C6thl* refer to liquid water potential temperature flux, while *clubb_C6rt* is total water flux?
4. Longwave and shortwave cloud forcing are now more typically referred to as longwave and shortwave cloud radiative effective effect, to avoid confusion with forcing as a concept related to change in atmospheric composition.
5. Fig. 3H: I was looking for 3 histograms, one each for PD, SST4K, and PI. But there seem to be more. Perhaps this is just a perception issue related to overlapping colors. Perhaps better to outline the histograms rather than shade for clarity?

6. l. 359: Guo et al. (2015) used a GFDL model, not CAM, which could also explain the differing responses to CLUBB tuning. See also the discussion of CLUBB tuning for CAM in Appendix A of Bogenschutz et al. (2013).

l. 121: "aerosol" -> "aerosol effective"

l. 123: "3 and 5" -> "3 and 5 yrs"

l. 413: "relative" -> "relatively"