Geoscientific
Model Development
Discussions

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Interactive comment on "An efficient method for discerning climate-relevant sensitivities in atmospheric general circulation models" *by* H. Wan et al.
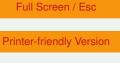
Anonymous Referee #1

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Review comments on "An efficient method for discerning climate-relevant sensitivities in atmospheric general circulation models" by Wan H. et al.

General comments:

The authors have proposed a method for tuning climate models, viz. replace the traditional serial-in-time long-term climate integration by representative ensembles of shorter simulations. The advantage of the new method lies in its efficiency, which is evidenced in its less computational cost, the dramatic reduction of the turnaround time in benchmark tests, sensitivity studies and model tuning exercises. The effectiveness of the new method is demonstrated by performing two experiments using CAM5. The

first experiment focuses on the model cloud and precipitation sensitivity to the time step sensitivity, the second experiment focuses on the sensitivity of radiation balance to empirical parameters that are related to cloud microphysics and aerosols. The manuscript is technically well written and easy to follow. The authors show clear evidences that the efficiency of the ensemble method is useful for the development of high resolution, computationally expensive and complex climate models. I believe that the manuscript can be accepted for publication after only minor revisions.

Specific comments:

1. Better to revise the title as "Ensemble of shorter simulations: An efficient method for discerning climate-relevant sensitivities in atmospheric general circulation models"

2. P2175, L8-11: Another example is the sensitivity of monsoon precipitation to convection schemes. The traditional numerical experiments need several sets of computationally-expensive long-term integrations:

Chen, H. et al., 2010: Performance of the New NCAR CAM3.5 in East Asian Summer Monsoon Simulations: Sensitivity to Modifications of the Convection Scheme. Journal of Climate, 23, 3657-3675

Zhou T., and Z. Li, 2002, Simulation of the east Asian summer monsoon by using a variable resolution atmospheric GCM, Climate Dynamics,19:167-180

3. For Example-1, viz. the comparison of 30 and 4 minutes time steps, it would be better to add some comparisons to the observations. As a climate modeler, I am interested to the skills of two simulations: which one is more close to the observation? I understand that the satellite measurement may not be enough in time interval to provide the observational evidences, at least a discussion is needed. Or at least the results of reference simulation can be compared to the satellite cloud, as what has been done in previous papers of CAM5 evaluation.

4. Similar as Figure 2 and Figure 6, could you please add a figure of precipitation and

examine the well-known double ITCZ bias? Nearly all climate modelers should have interests to this.

5. The ensemble size of shorter simulation should be highlighted in both abstract and summary part. This may provide a useful guide for climate modelers who may follow your method in their studies.

6. P2195, L23-28: Yes, the simulation of aerosol impacts on Asian monsoon traditionally takes long-time of integration and the integration should cover at least the whole monsoon season:

Song,F. et al. (2014),Responses of East Asian summer monsoon to natural and anthropogenic forcings in the 17 latest CMIP5 models,Geophys.Res.Lett.,41,doi:10.1002/2013GL058705

Interactive comment on Geosci. Model Dev. Discuss., 7, 2173, 2014.