**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Estimation of ECHAM5 climate model closure parameters with adaptive MCMC" *by* H. Järvinen et al.

Anonymous Referee #1

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Overview: This manuscript describes parameter estimation using the adaptive Markov Chain Monte Carlo method in a general circulation model. The method is presented and five different objective functions are tested, all related to the net ToA radiative flux, for the estimation of four cloud and precipitation related parameters. The authors come to the conclusion, that the method is applicable, but dependent on the choice of the objective function.

The manuscript is generally clear and well-presented, also the conclusion are kept very general. The findings are of interesting to the ACP readers, therefore I make some comments and recommend that the manuscript is accepted after some revisions.

1.) The discussion section states that this method is applied for the first time to a GCM. Jackson et al., Error reduction and convergence in climate prediction (Journal

of Climate, 2008) chose a comparable approach to estimate parameters in a general circulation model (CAM3.1) in order to select an ensemble of plausible climate model configurations to narrow the range of simulated climate sensitivities. Jackson et al. include a relativly large number of observed variables in their cost function. In the here presented manuscript, the importance of the choice of the cost function is one of the main results. It would be great if the results of Jackson et al. could be discussed here and also be mentioned in the introduction.

2.) In the discussion, the authors mention the general problem of compensating errors in climate models. Fig. 4 shows that the model improved according to the net ToA radiative fluxes. This was likely achieved by reducing the skill in other climate variables related to the chosen parameters, e.g cloud cover or precipitation. This could be tested and quantified very easy.

3.) The conclusions remain very vague. I suggest to elaborate more on the importance of choice of the objective function, also in dependence of the choice of climate variables depending on the parameters to estimate. I assume that the influence of the two parameters related to precipitation (CPRCON/CAULOC) have a very small influence on the net ToA radiation budget. Here an objective function including precipitation would more probably lead to convergence. The choice of the objective function probably will depend on the parameter which should be estimated. The net ToA radiation only put constraints, depending on the chosen cost function, on one of the four parameters, which indicates that the objective function needs to be revised for future experiments.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 11951, 2010.