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***Interactive comment on* “Emulating IPCC AR4
atmosphere-ocean and carbon cycle models for
projecting global-mean, hemispheric and
land/ocean temperatures: MAGICC 6.0” by
M. Meinshausen et al.**

Anonymous Referee #2

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General comments: The full documentation of the updated MAGICC 6.0 model is important since this model will likely be relied on in future IPCC assessments to interpolate and extrapolate results obtained from more complex atmosphere-ocean general circulation models (AOGCMs) and earth system models (ESMs, e.g., AOGCMs coupled to carbon cycle models) to cover a wider range of emission scenarios. MAGICC has been modified in a number of ways to account more realistically for processes represented in ESMs. These improvements enable MAGICC to better emulate the time-evolving global-mean, hemispheric and land/ocean temperatures and well as car-

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bon fluxes and reservoirs simulated by the CMIP3 and C4MIP models. These days one can only rarely find full documentation of any model in the published literature, so this article is a welcome addition, even though most readers will find it rather dense. As far as planning for future model intercomparisons, it is clear from this article that there is considerable value in obtaining more accurate estimates of radiative forcing from the AOGCMs, in order that better estimates of climate sensitivity can be obtained.

Specific Comments: Three options for tuning MAGICC to emulate the AOGCM results are provided, starting with one that adjusts only three parameters. Although tuning the additional parameters as specified in the second and third options improves the emulation for a few of the models, in others there is only marginal improvement. Given the large uncertainties in the forcing pointed out by the authors, one wonders whether the discrepancies found in the simply tuned case might be explainable by other factors. One such factor might be the recently discussed "tropospheric adjustment" (Gregory and Webb, 2008, cited by the authors), which accounts for fast tropospheric responses to forcing that are seemingly unrelated to the slower changes of temperature governed primarily by the ocean surface layers. In a subsequent article (published after submission of the article under review here), Williams, Ingram, and Gregory (2008; J. Clim., doi:10.1175/2008JCLI2371.1) suggest that "much of the apparent variation in effective climate sensitivity identified in previous studies is actually due to the comparatively fast forcing adjustment." Thus, a redefinition of the forcing may mean that at least two of the additional parameters would not need to be adjusted, since they only were considered to account for apparent changes in climate sensitivity. This highlights the importance of obtaining accurate estimates of properly adjusted radiative forcing.

Technical corrections/suggestions:

page 6164: "allows to a better" should read "allows a better"

page 6231 (Acknowledgements): "B. Santers" should read "B. Santer".

figures: several figures cannot be read unless they are zoomed in on (by a factor of 4).

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It would be nice if several of these were enlarged, so that when they are printed out normally, they would be clear.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 6153, 2008.

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