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**Geoscientific
Model Development
Discussions**

# *Interactive comment on* "The Atmospheric Chemistry and Climate Model Intercomparison Project (ACCMIP): overview and description of models, simulations and climate diagnostics" *by* J.-F. Lamarque et al.

**Anonymous Referee #1**

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This manuscript describes the considerable and vital work of the atmospheric chemistry and composition community in assessing the interactions between climate change and the atmosphere. It is the culmination of a semi-voluntary 'atmospheric chemistry & climate' initiative begun in Geneva several years ago and completed in time to contribute to the IPCC's 5th Assessment Report. It represents a large forward step of the community (and the authors) and should be published after some effort is made to clean up the text.

Revisions are needed for language and clarity. In some places it looks as though an



entirely different co-author took over.

2447/5 The order is wrong, this paper documents the composition changes first (that is what ACCMIP calculates as a primary variable) and then the associated RF. /10 'lead to' is odd, you mean 'have', drop the second 'in emissions' as redundant, but replace with 'across models': " natural emissions have a significant range across models, mostly. . ." /15-16 This is totally obtuse, I am not sure what is meant here, or if it is 'abstract' material.

2448/1 Does ACCMIP have that many more models (than 8)? From a look at those for example reporting the hourly data, it was only about 8 out of 15.

2449/5 "ACCMIP takes advantage. . ." verb tense /14 A paper cannot be a repository since it is static, it can be a first point of reference, or the primary documentation defining the simulations and an overview of the inputs and outputs. /29 'physical climate variables'

2450/1 'climate change in response to 21st century forcing' ? is that what is meant

/4 'decadal' is vague and jargon, it could mean every decade the model does a one-week slice. Why not say 'decade-long time slices for specific periods from 19xx to 2100?' /8 The use of letters 'C' and numbers '1' is odd and should be made more consistent if possible after the fact. Note that the additional simulations were designated Tier 2 (not discussed here). It might be better to designate all of these "tiers" as "optional" which makes more sense after reading the discussion below. /11 I would use "prescribed short-live . . . and long-lived concentrations. . ." Were these prescribed? Make this clear that these were the driving factors (Were they complete? What was not specified? Did everyone use these forcing conditions?)

2451/2 'but with an 1850 . . .. climate as specified by sea surface temperatures(?)' – give a simple explanation of how the other climates were imposed. /5-10 Can you comment on how the multi-year average SSTs reduced the inherent variability in circulation

and chemistry? /? What did the models do about solar cycle and volcanoes in the future? CMIP5 chose some very odd formulae.

2455/11 Comment: Even with convective mass flux diagnosed/fixed, most models implement this in such different ways that the effective tracer transports are not equivalent. /20 What is not important is whether the entrain/detrainment is specified (air mass) but that it is used to remove soluble/sticky species – please clarify this sentence.

2456/22 'to reach a preset VALUE (by each ...' ?? /25 'erroneously' is an odd word here, did the MIROC modelers make a mistake or just pick a higher value? "anomalously" describe the range relative to the rest of the models – is that what is meant? I am not sure we really know what is in 'error' here.

2458/1-15 Is it worth pointing to CCMVal's Photocomp as providing a bit more information on the different photolysis schemes ? making this section more parallel with the convection discussion that seems more instructive and useful.

2462/9 Typo: "6 unitK" /12-18 Any comments on how this would affect the chemistry? Specific humidity controls the O(1D)+H2O pathway, and relative, the aerosol size and OD. /18-29 Some confusion about sub-tropical jet vs. polar jet. Clearly the former is vital as it determines the extent of the tropics and trop OH, but the latter may have less impact except in the stratosphere. Can you separate the discussion of the different jets more clearly and maybe motivate why ACCMIP cares?

2463/ff It may be beyond the scope here, but it might be useful to document change from 1960-2000 or 1980-2000 as some of the 2000-climate differences appear to be due to changes in that recent epoch, rather than an overall pre-industrial to present.

Overall, this is an excellent and clearly written manuscript.

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Interactive comment on Geosci. Model Dev. Discuss., 5, 2445, 2012.