

Interactive comment on “Description and Evaluation of the Specified-Dynamics Experiment in the Chemistry-Climate Model Initiative (CCMI)” by Clara Orbe et al.

Anonymous Referee #2

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General Comments

Orbe et al. provide a systematic description of the specified dynamics (SD) model experiments carried out as part of the CCMI exercise. They also evaluate how well the model experiments represent various aspects of the atmospheric state and large scale flow. In some instances, large differences are reported, and are related to differences in the reanalysis products used between the different model experiments, as well as differences in the implementation of the specification of the dynamics, which are themselves further analysed both in terms of inter-model differences in the ways in which the large scale flow was constrained, and biases in the underlying free running

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models. Meridional and vertical winds were found to be quite poorly represented in the SD model experiments.

The manuscript is necessarily quite dense and packed with information, but overall I find it to be well structured and logically organised. A high level of detail is presented in an accessible way, caveats are well explained, and suitable interpretation of the results is usually given. I think this manuscript will be a good resource for the CCMI community (and beyond). I recommend it for publication in ACP, with only a small number of minor revisions.

Specific Comments

Language: In general the manuscript is clear and relatively easy to follow, and written in a concise style. In a few places however, some redundant language seems to have crept in to the text. For example on page 9, line 11 "Moving next to the vertical winds" is absolutely not needed in this sentence at all. Similarly, at the beginning of the following paragraph, the sentence could be rewritten without "Next we compare". There are some other examples of this meta-level discussion of what you do first, then what you do next, which for me are simply not necessary. See also page 13, line 12, and page 15, line 3.

Interannual variability: It would be good to be more specific about what you mean by "interannual variability" in the context of this paper. Clearly you are referring to the correlation of annual average quantities from the model experiments for specific years with the corresponding annual averages from the reanalysis products. This is mostly clear by also referring to this as "covariability". But perhaps some readers might have other ideas about what it means for a model to be representing "interannual variability" well, for example how well periodic variations (eg. ENSO) are represented in a statistical sense (eg. by reproducing probability distributions of their frequency and amplitude), rather than their exact timing. You could avoid this potential confusion by being clearer about what you mean by this term.

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Page 2, line 11: Perhaps be explicit that by "boundary conditions" you mean the SSTs and SICs. The flow fields could also be considered a kind of boundary condition.

Page 2, line 13: "improves transport". What would constitute an improvement of transport exactly? It's not clear what you really mean here.

Section 3.4: Can you go into a little bit more detail about why the different groups chose such different strategies for their choice of nudged fields, domains, and timescales? Can you synthesise relevant parts of earlier work by the respective modelling groups, or even draw on unrelated literature to provide more detail about how and why these choices are made? I think some more context could be useful here.

Section 5.3: I think the lack of dynamical consistency in the SD simulations is as interesting a result of this study as any of the other results you discuss, and could probably be highlighted more in the abstract and conclusions. I would also like to see some discussion here about the implications of this for tracer transport, especially with respect to the use of SD for tropospheric chemistry simulations (especially involving long-range transport), and inverse modelling studies of greenhouse gases.

Page 17, lines 18 and 20: The use of the word "cases" is confusing here. It's not immediately clear what a "case" is. Is it maybe a specific model run? With some effort the reader can see that you actually mean variables or fields (eg. T850hPa), so perhaps use "fields" here to be more consistent with the immediately preceding sentence.

Conclusions: For the benefit of readers who like to read the conclusions section before reading the rest of the paper, it would be good to define all acronyms again in this section. Please consider the following acronyms: SD; TEM; CTM; and CCM. CCMI should be clear enough.

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