Atmospheric
Chemistry
and Physics
Discussions

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Interactive comment on "Comparison of the CMAM30 data set with ACE-FTS and OSIRIS: polar regions" *by* D. Pendlebury et al.

Anonymous Referee #1

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The authors present an analysis of a 30-year simulation using the CMAM stratospheric chemistry-climate model constrained with ERA-Interim reanalyses, covering the period 1979-2010. The focus of the paper is on the performance of the model in the polar regions, and on chemical species observed by the ACE-FTE and OSIRIS satellite instruments. As is typical for chemistry-climate models, CMAM performs well in some respects but fails in others. The authors find that the treatment of PSCs, particularly the lack of dehydration and denitrification in the model, may play a substantial role in this. Overall, the paper is well written, the language is adequate, and the figures are fine, apart from several annotations which when printed are too small and practically unintelligible. The paper sets a direction for CMAM developers to improve the model. I recommend publication once my minor comments, detailed below, are addressed.

Detailed comments:

P11183 L4: Why do you nudge winds? To my understanding, primary predicted variables by ERAI and CMAM are vorticity and divergence in spectral space. Nudging these quantities for low wave numbers would straightforwardly achieve the scale selection of nudging.

P11184 L10ff: Why does CMAM not account for sedimentation of PSC particles? The presence of this process is well established even though actual sedimentation velocities are subject to substantial uncertainties due to their particle size dependence. Other CCMs that I have heard of all include this process.

P11185L1: What is "nodding"? Please explain or replace with a more common word.

P11187L1ff: Please correct the placement of brackets for the references.

P11188L5: The formula should be $\mathrm{MAD}(x) = \mathrm{median}|x_i - \mathrm{median}(x)|$ (i.e., replace one set of brackets with vertical bars).

P11188L25: Replace "washing out" with "obscuring" or similar.

P11191L23: Remove "the" before "methane".

P11192L8: "Weak" dehydration is not a surprise considering the model does not include dehydration (see above). Please indicate here that this is as expected due to the model's formulation.

P11192L22: In terms of ozone mixing ratio, any transport of ozone-rich air from the mesosphere would not cause a "build-up" of ozone because transport alone cannot change the mixing ratio. If there is too little mass transport out of the bottom of the vortex, continuity suggests there is also too little transport into the vortex from the mesosphere. So I have trouble accepting this dynamical explanation. You would need to assess rates of descent in the vortex to make a statement on this.

P11193L3: "underestimation"

P11193L16: How do you "scale" PV? What is the scaling factor? Please expand or give a reference.

P11193L24: "the diurnal cycle of ozone becomes" (singular). There is just one diurnal cycle, I think.

Figure 1: Areas with missing data for the satellite should be marked as such. Here they are rendered as 0, which sets up artificial gradients along the boundary. Dito also in some other plots.

Figure 9: The caption is imprecise. For temperature, you're actually displaying the absolute difference (in units of K). The annotations are practically unintelligible when printed; please use a larger font. Dito for figures 10, 11, 12, 13, 14.

Figure 13: The phrase "sPV $<>$ ± 1.2 PVU" requires expansion. For "sPV" see above comment. You probably want to write that "sPV < -1.2 PVU in the SH and sPV > 1.2 PVU in the NH".