

Manuscript Number: MWR-D-11-00132

Title: Sensitivity and Interpretation of Zonal Mean Climate from Two Atmospheric General Circulation Models with Different Dynamical Cores

Recommendation: This manuscript should be rejected, however incase the editor wants to consider the manuscript the reviewer would suggest the following major revisions before acceptance.

Major Comments:

1. The introduction is irrelevant to the results presented in the manuscript.

- It describes the evolution of the IAP AGCM, which has nothing to do in this manuscript. (Since it is not on the release of a new model version).
- Introduction is so vague that it is meaningless. For instance in page 3 line 13-16, what do the authors want to say?
- The model uses the whole physics package from CAM3.1 (stated in line 19 of page 3), so why it is called IAP AGCM. It seems that IAP AGCM is just a tag put on the NCAR's CAM.
- The authors claim that they developed a diagnostics package, however so far I see it is identical to NCAR-AMWG diagnostic package. The authors need to explain the differences between the two. Also the reviewer would like to see the code of the diagnostics package, so the code should be made available at a web link at least till the manuscript is under evaluation. If there is no significant difference between the two packages, please give the credit to the people who developed the package originally.
- The authors say that, there are many differences between the current version and its predecessor but never mentioned the differences.
- The introduction is written in such a way that the authors have developed a new model version, which is not true.

Suggestions: Be specific about what you have done and do not try to over reach and oversell the work; highlight the importance and need of the work; mention the previous relevant work.

2. Model description section does not have relevant information.

- Page 5. Line 1: Mention the vertical levels from both the models (it is experienced that position of vertical levels are important, so some of the differences reported in the paper might be attributable to that; it can only be understood after knowing the positions of those levels).
- Page 5. Paragraph 2: Since the paper is on the sensitivity to dynamical cores, differentiate the two dycores quantitatively i.e. from a numerical perspective (Qualitative differentiation of the dycores would have been enough if the paper were on the sensitivity to a parameterization scheme).

3. Results are not thoughtful and would not be useful

- Since the authors have ported a different physics package (from CAM3), it is desirable to make sure that the model is configured and tuned correctly for the top of the model (TOM) energy balance and noise free solution. Therefore, mention the top of the model residual energy in the IAP AGCM. Also show the kinetic energy spectra and 200 hPa instantaneous vertical pressure velocity for the two models from the three frameworks.
- Mention the aspects in which the two dycores are different. For example do the two models use different diffusion/viscosity coefficients? Do they use same time step size?
- Demonstrate the impact attributable to the differences in the time step and diffusion coefficient of the two models?
- Zhang (2009) is in Chinese; it would be better if the authors do not cite literature, which are not in international language. The reviewer would like to see the diagnostics package (its code). If it is identical to the NCAR-AMWG diagnostics package give the credit to the mentioned package.
- Fig.1 show the statistical significance of the differences (also in other figures).
- Page 11, last paragraph: Why would the IAP dynamical core more diffusive (which aspect of the dynamical core made so)?
- Pages 12 and 13: Since the authors do not derive anything new in these equations, just refer to the literatures.

Remarks: The manuscript does not convey any useful information. In this present form it neither has any science nor would be useful to the model development. The authors should look into the different aspects of the two dynamical cores (i.e. how the horizontal dynamics is different? How the horizontal diffusion is different? How the vertical dynamics is different? How the time stepping is different? How the tracer advection is different? And should

show the contributions from these differences on the net impact? In that case one can get some useful information after reading the manuscript/paper.

The authors are not serious about its publication, even did not write and read the manuscript carefully. For instance, in the title page, “submit to Journal of Climate” is written.

Minor Comments: There are several minor issues but before the authors perform the major revisions there is no point in focusing on the minor issues, which may be implicitly resolved in the revised version.