Atmos. Chem. Phys. Discuss., 8, S2565–S2567, 2008
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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The CCCma third generation AGCM and its extension into the middle atmosphere" *by* J. F. Scinocca et al.

Anonymous Referee #4

Received and published: 13 May 2008

Manuscript no. acpd-2008-0085

This study reports on the new AGCM3 that the authors and colleagues have developed. This model is ranked among the best GCM in the world, and one of the most important improvement is the ability to represent realistically the middle atmosphere. Numerous papers have been published, and excellent science has been produced from this model.

This manuscript illustrates the various improvements that were discussed separately in other papers. In fact a large part of the study is a technical report that summarizes previous work. I realize that it is important to document those aspects that at different and crucial stages of the development of a GCM come together to make a new model.

I just wonder if it is necessary to have 2/3 of the material reduced to a summary. I recommend that the authors trim down those 20 pages to something that is more manageable.

After this summary comes the interesting stuff. The authors document very well what happens to the model with respect to gravity wave drag. I think it is a very nice discussion of how both the orographic and non-orographic gravity waves interact with the mean state to alleviate some of the model biases. Are those biases common to other models or are they simply specific to AGCM3? Can the authors show that the conclusions they draw regarding the southern polar bias is not just peculiar to their model? I think it is very important to be more specific on this point, otherwise the discussion is reduced to a commentary on a model's specific biases.

Regarding the QBO, I wouldn't call this a spontaneous QBO, rather a forced QBO. In my mind, a spontaneous QBO could be the one generated in the MPI model and shown in the studies of Giorgetta, which I am sure the authors are aware of. I don't want to get into semantics, however, so if the authors feel to call it is spontaneous I am not going to argue this point any further. I want to argue, instead, on whether the resolved dynamics is a "property of each GCM". What does make the dynamics of a GCM? I think, maybe naively, that if two models have for example the same parameterizations of convection, as far as the wave dynamics generated by convection is concerned, they will share similar resolved features. Obviously, I have oversimplified: in reality many other aspects of the model intervene to muddle this seemingly simple conclusion.However, Ricciardulli and Garcia showed that the resolved dynamics in a GCM can be made closer to reality if one uses a different type of parameterization of convection, one that generates more variability. The authors of the present study, instead, have taken a different approach: they assume that the resolved wave dynamics is correct and they feel that they can only force a QBO with the parameterized momentum drag. Have they verified that the resolved wave dynamics is realistic, at all resolved temporal and spatial scales?

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8, S2565–S2567, 2008

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8, S2565–S2567, 2008

Interactive Comment