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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Towards a better representation of the solar cycle in general circulation models" *by* K. M. Nissen et al.

K. M. Nissen et al.

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Reply to Referee #2:

General comments:

We have rephrased the text referring to the necessary spectral resolution for solar cycle studies and include a rough estimate on the number of intervals necessary. (see also author's comment "general comment")

Specific comments:

46-5: The distribution of the FB SW bands is explained in more detail in the text.

46-11: This has been changed.

48-12: See our general comment above.

50-15: libRadtran was actually run in line-by-line mode. The reviewer is correct that this is usually not necessary below about 500nm where water absorption starts, but for the Schumann-Runge bands of O2 (175-205) it is necessary to get an accurate result. Outside the Schumann-Runge bands a moderate resolution was chosen which properly resolves all structures of the ozone absorption cross section etc but in the Schumann-Runge bands individual lines have to be resolved unless one would introduce a correlated-k distribution. The chosen resolution was already described in the original manuscript.

50-25: Thanks for the comment. We have relabeled the figure.

51-5: For the intercomparison we used identical extraterrestrial irradiances for both models as described now in the revised manuscript.

51-6: Rayleigh scattering and surface reflection was included. For Rayleigh scattering we used the well-accepted cross section of Bodhaine et al., Journal of Atmospheric and Oceanic Technology, 1999. Identical surface albedo was used for both models in the intercomparison (0.07 for 45°S, 0.09 for Equator, and 0.8 for 85°S). This information has been added to the manuscript.

52-15: We assume that the shape of the heating rate profile in FB is similar to that in FUBRad as it is determined largely by the prescribed vertical ozone profile and the solar zenith angle which were identical in both simulations. Adding 1-2 extra bands to ECHAM5 would not improve the performance of ECHAM5. The Fouquart and Bonnel radiation scheme only allows altering the solar constant. The total flux is distributed to the resolved bands using a prescribed percentage. This approach would continue to smear out the solar variation even if extra bands are added.

53-21: Mentioning of climatological SSTs has been added.

54-19: The statistically significant feature seems to be a robust signal as it appeared in a second set of experiments (with improved coupling of the FUBRad and FB schemes.

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We are therefore quite confident that it represents a significant change. A significant temperature change does not necessarily require a significant change in SW heating rates, as it could be due to an indirect dynamical effect (Kodera and Kuroda, 2002).

55-18: The Conclusions have been reformulated according to the results of the newly included resolution tests.

56-1: Text has been reworded.

Technical comments

47-9: "Solar forcing" has been explained.

54-15: Old version is the version described by Matthes et al. (2004). It does not include Lyman-alpha and the efficiency factors of Mlynczak and Solomon.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 45, 2007.