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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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General reply:

Some issues have been addressed by several reviewers. These are discussed here.

It was suggested to give an estimate on the number of spectral intervals to be considered in realistic solar cycle experiments. We have included a paragraph in Section 4, in which we describe two test cases we have performed. In both cases the number of spectral intervals in FUBRad was effectively reduced to 6. In one of the cases the spectral resolution of the solar irradiance only was reduced, while in the other also the spectral resolution of the ozone absorption cross sections was reduced. We found that in both tests, the SW heating rate differences in the 6-band scheme are reduced up to 23% at the stratopause in January. The heating rate difference profiles of the tests

have been included in Figure 3.

We included two new tables, Table 1 describing the spectral intervals of FUBRad, as suggested by one of the Referees, and Table 2, a comparison of SW heating rates from different GCM calculations for validation of the FUBRad scheme.

The reviewers recommended not to reduce the heating rates in the Schumann-Runge continuum and bands by the amount of energy stored as chemical energy, as we do not release it later on. We agree because in the current chemistry module the release of chemical energy is not yet implemented. The results in the revised version show total heating rates now. The option to calculate net heating rates instead of total heating rates is still available and can easily be switched on if the model is coupled to a chemical module, which parameterizes the release of chemical energy.

As suggested we included additional profiles in the validation section of the paper. We have chosen a high-latitude, a mid-latitude and low-latitude trace gas profile and calculated heating rates at 3 different zenith angles for each latitude. The calculations where performed using solar maximum and solar minimum irradiances, leading to a total of 18 profiles. As we had to select the results to include in the paper, we show only daily mean values for solar minimum conditions in the paper and make two additional profiles available online as complementary material.

We had to recalculate the fit of the Chappuis band to the WMO spectral fluxes to avoid overlap with the Near-Infrared wavelength region in the Fouquart and Bonnel scheme. This improved the results of FUBRad between 20 and 30 km.

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