Atmos. Chem. Phys. Discuss., 14, C6449–C6452, 2014
www.atmos-chem-phys-discuss.net/14/C6449/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Analysis of the ozone profile specifications in the WRF-ARW model and their impact on the simulation of direct solar radiation" *by* A. Montornès et al.

Anonymous Referee #1

Received and published: 3 September 2014

General Comments In this paper, the authors aim at analyzing i) the ozone representation in the shortwave (SW) radiative transfer schemes of WRF, and ii) the impact of the biases in this representation on the predicted direct solar radiation. Three different ozone representations have been analyzed: one which is shared by the Goddard, New-Goddard and Fu-Gu-Liou SW schemes, and two more used in the CAM and RRTMG SW schemes, respectively. The two objectives are clearly set out at the beginning of the paper but, to my view, the interest of the study is not sufficiently well motivated. The methods used are appropriate to achieve the proposed objectives. However, I have concerns regarding how the second objective was addressed. In my opinion, the

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

interest of the paper has not been clearly set out. This work deals with stratospheric ozone. Thus, in principle, it has high interest for WRF's applications in the stratosphere. However, only total ozone has been verified and nothing is said regarding how the vertical profile of ozone is represented in WRF. This limits the interest of the study for "stratospheric" applications. In any case, authors should add comments on how important is a correct vertical distribution for the vertical distribution of heating rate, and the coincidences and differences in this respect in the analyzed data bases. It is claimed that this study has interest for solar energy, more specifically, for solar energy forecasting. However, in my opinion, this importance should be better contextualized. I miss some comments on the average absorption due to ozone in typical conditions, so that the reader receives a clearer message on the importance of ozone for solar energy. Since it is claimed that "high spatial and temporal variability" of ozone occurs in the stratosphere, it would be helpful if some figures were given of the expected range of seasonal variability in a point and spatial variability for a fixed season and how they translate to solar radiation extinction. These simple numbers would help to advance the reader the order of magnitude of the corrections that could be achieved with an improved representation of ozone. This could be compared with the typical errors of WRF in solar energy forecasting applications. One application that is not even mentioned is the modeling of shortwave irradiance in the UV part of the spectrum. The SW schemes analyzed make spectral computations. Could have been this analyzed somehow? Moreover, the latest WRF versions provide broadband direct and diffuse irradiance with RRTMG and New-Goddard. Could they be used to investigate the impact of ozone misrepresentation on irradiance fluxes? To my view, the study of the impact of the ozone misrepresentation on the computed direct irradiance has not been totally addressed. This analysis has been done showing maps and numbers of absorption biases, instead of the expected irradiance biases. However, the irradiance biases can be very easily computed by including the effect of solar geometry. Unless these maps are included in the paper and the results analyzed in terms of irradiance biases I don't agree that this paper addresses the impact of ozone errors on the direct solar

ACPD
14, C6449–C6452, 2014

irradiance. I would encourage the authors to address these issues and the specific comments detailed below. I would also suggest the authors to use the knowledge acquired in this work to improve the current representation of ozone in WRF (for instance, by including the MSR dataset in WRF and making it available for the SW schemes). WRF is public and freely available for anyone and I am sure that the WRF's community would be thankful.

Specific Comments Title: I don't see the title appropriate for a threefold reason: i) only the total ozone amount has been analyzed, but not the "ozone profile" (i.e., the vertical distribution of ozone); ii) the impact of the ozone misrepresentation is analyzed, and not the impact of the ozone profile "specifications"; and iii) the impact on the solar radiation absorption is analyzed, and not the "impact on the direct solar radiation". Section 2.1: I don't think you have necessarily to distinguish always between the Goddard and New-Goddard SW schemes. The new SW Goddard is essentially the Goddard scheme (Chou and Suarez, 1999) with only few minor modifications (http://www.atmos.umd.edu/∼martini/wrfchem/ppt/WRF_Toshi.ppt). You can mention you are using the new version implemented in WRF and from there on just talk about Goddard SW scheme. One more thing is that the reference Chou et al. (2001) is not appropriate because it is for the longwave Goddard scheme only. Could you provide details and/or references on the origin of the ozone profiles used in each SW scheme? I don't understand: "The RRTMG scheme includes two ozone profiles as a function of the season (winter and summer). Nevertheless, this granularity is useless due to the fact that the final used profile is computed as a composition of both, without considering the day of the year. Therefore, only one profile is considered for any latitude and season." Could you please explain better? Why is it useless? Is it not used in RRTMG? Section 2.2: How did you re-grid the datasets to 1°x1°? Section 3: Why can you validate the RRTMG's ozone amount but not the impact of its misrepresentation on direct solar irradiance? Why do you only validate the impact using the Goddard and CAM ozones? I don't understand this point. Split both Fig. 1 and Fig. 3 in two figures. It would be interesting to add annual results, not only monthly. As mentioned earlier,

ACPD
14, C6449–C6452, 2014

direct solar irradiance biases (in W/m2, and in % would be also interesting) should be shown instead of absorption biases.

Technical Corrections Needs careful proof-reading for English grammar and style.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 20231, 2014.