Atmos. Chem. Phys. Discuss., 12, C11522–C11524, 2013
www.atmos-chem-phys-discuss.net/12/C11522/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Intercomparison of shortwave radiative transfer schemes in global aerosol modeling: results from the AeroCom Radiative Transfer Experiment" *by* C. A. Randles et al.

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Received and published: 14 January 2013

The manuscript presents the intercomparison of ∼30 shortwave radiative transfer models in the context of AeeroCom and aerosol forcing estimate. The results are analyzed in terms of model diversity w.r.t. LBL benchmarks for three cases at two solar zenith angles (30 and 75 degrees): (1) gas + Rayleigh, (2) gas + Rayleigh + scattering-only aerosol, (3) gas + Rayleigh + absorbing aerosol.

The authors find that different RTMs can yield 10-20% difference in forcing estimates,

but those RTMs with two stream scheme generally have larger biases. In addition, the model diversity is found to decrease for absorbing aerosols, further suggesting that multi-scattering should be carefully treated. The biases in RTMs are found to vary with solar zenith angle, which may introduce systematic errors in the estimate of regional and seasonal forcing of aerosols.

The manuscript overall is well written, although I felt more discussions about the implications of the findings from this manuscript are needed. I provide a few comments/suggestions in below. Overall, I am looking forward to seeing this manuscript appear in ACP soon.

1. Radiative forcing varies non-monotonically with solar zenith angle. Russell et al. (1997) showed that forcing may have maxima around solar zenith angle of 60. This non-monotonic feature should be recognized and considered in the interpretation of the analysis here (that is from two angles only). Not sure why solar zenith angle of 75 degrees is selected?

Russell, P. B., S. A. Kinne, and R. W. Bergstrom (1997), Aerosol climate effects: Local radiative forcing and column closure experiments, J. Geophys. Res., 102, 9397–9408.

2. Despite this is a modeling exercise, it might be good to talk about the implications of findings of this paper to what is needed in the observations to constrain the model estimate of forcing. For example, since forcing bias is sensitive to solar angles, will measurements of diurnal variation of aerosol properties and upwelling flux from geostationary satellite be helpful? Such discussion will be valuable for current planning for future satellite missions that need inputs and recommendations from modelers.

3. Trade-offs have to be made between # of the streams used in the RTM (e.g., speed) and the accuracy of the model. In addition, there are use of delta-scaling factor to better treat the phase function and obtain good accuracy that otherwise would need more number of streams in RTM. The speed can be a concern when comes to the global estimate of forcing. Can the manuscript have some discussions in this aspect?

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Other minor comments:

1. Solar zenith angle and solar elevation angle are used in various places in the text. I would recommend using only one of them in the text to avoid inconsistence and inconvenience to the readers.

2. Modeles in the appendix are arranged in alphabetical order, but then it is model # listed in table 1 that are used in the text . I find this is not convenient. When I read the text and find a specific model that I am interested to learn, I have to first go to Table 1, find & write down the name of the model, and then go to the the appendix to find the right model in alphabet. why not just list the models in appendix according to their model #?

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 32631, 2012.

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Interactive Comment