***Response to Anonymous Referee #1 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**

Review of "Intercomparison of shortwave radiative transfer schemes in global aerosol modeling: results from the AeroCom Radiative Transfer Experiment" by C. A. Randles et al. submitted to Atmos. Chem. Phys. Discussion (acp-2012-613).

In this study radiative transfer schemes which are incorporated into general circulation models are inter-compared under the AeroCom initiative. This manuscript is well complied on uncertainties in the radiative transfer schemes to estimate the aerosol radiative forcing. I suggest that this manuscript will be able to be published if the authors address minor revisions indicted below.

We thank the reviewer for their recommendation and we address the suggested revisions below in bold.

1. page 32634, line 24: The address of the AeroCom website should change to http://aerocom.met.no/

Done.

2. page 32636, line 11-12: "at specific sun elevation". Please indicate the values of the specific sun elevations.

Boucher et al. (1998) examined global average conditions as well as the following SZAs: 7.8, 71.6 and 83.4 degrees. We have noted these specific angles considered in the text:

"Even higher diversity was found for radiative forcing calculated at specific solar zenith angles (specifically, 7.8°, 71.6°, and 83.4°)."

3. page 32636, line 25: "sun elevation or solar zenith angle (SZA)". I recommend to use either terminology throughout the manuscript.

Reviewer J. Wang made the same suggestion. We have chosen to use SZA throughout the text. All mentions of "sun elevation" have been removed.

4. page 32638, line 5-7: How large is the bias of the TOA downward UV-VIS irradiance among models? This may be a useful information for the radiation budget.

The mean, standard deviation, and bias relative to LBL values for each TOA flux are given below:

	Broadband TOA Down	Broadband TOA Down	UV-VIS TOA Down	UV-VIS TOA Down
	SZA 30	SZA 75	SZA 30	SZA 75
Non-LBL Mean [W m^{-2}]	1190.78	355.87	564.28	168.64
Non-LBL STDEV [W m^{-2}]	22.74	7.21	29.87	9.00
Mean Bias Relative to LBL [W m^{-2}]	23.36	6.97	13.01	3.89
Mean Bias Relative to LBL [%]	2.00	2.00	2.36	2.36

Note: Mean bias = non-LBL – LBL. Expressed as %: Mean bias = 100 × (non-LBL-LBL)/LBL.

As shown in the table above, for the downwards flux at the top-of-the atmosphere, the mean bias of the non-LBL models is small (approximately +2%). The bias in the downwards irradiance at TOA should not matter much, however, as results from each model are first normalized by their own downwards flux, in either the broadband or UV-VIS, and all results are then scaled to a common downwards flux in the appropriate band. Nevertheless, we note this small bias in the caption of Figure 2 where we have previously noted the scaling factors.

5. page 32639, line 2-4: Explain how to interpolate the vertical profiles of ozone and water vapor in the models which do not have the 1-km vertical resolution.

Eight of the 31 models did not use the vertical resolution of the given AFGL atmospheres. For each of these models, listed in Table 1 (by the omission of "AFGL"), we describe their interpolation method within the Appendix.

6. page 32640, line 1: I would like to recommend to change the title of this section to "Aerosol direct radiative forcing".

Done.

7. page 32643, line 4-5: Is it a monotonically change with the sun elevation?

With only two data points (SZA 30° and 75°), we of course cannot know if the change in the bias in monotonic. As pointed out by reviewer J. Wang, the aerosol RF itself is not monotonic (e.g. Russell et al. 1997), peaking around SZA 60°. Two-stream models do tend to compare better to multi-stream models near 60°; however, without having done the calculations at additional angles it would be difficult to state that the bias relative to the LBL codes is monotonic or not.

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.

8. page 32645, line 1: Typo ("witha" to "with a")

Done

9. page 32646, line 13-14: I would like to give the same question as Comment 5.

Again, it is not possible to know in the context of this study. We were limited in the number of SZA we could consider because we needed to keep the number of calculations manageable for the large number of models considered.

10. page 32648, line 15-19: Confirm these numbers in the latest manuscript of Stier et al. (2012).

We have updated the text in Section 3.4 Comparison to other AeroCom Phase II Experiments as well as Figure 8 to reflect the latest (as of 2/12/2013) revisions from both Stier et al. (2013) and Myhre et al. (2013).

11. page 32649, line 8-10: Confirm these numbers in the latest manuscript of Stier et al. (2012).

As above. The revised Figure 8 is below:

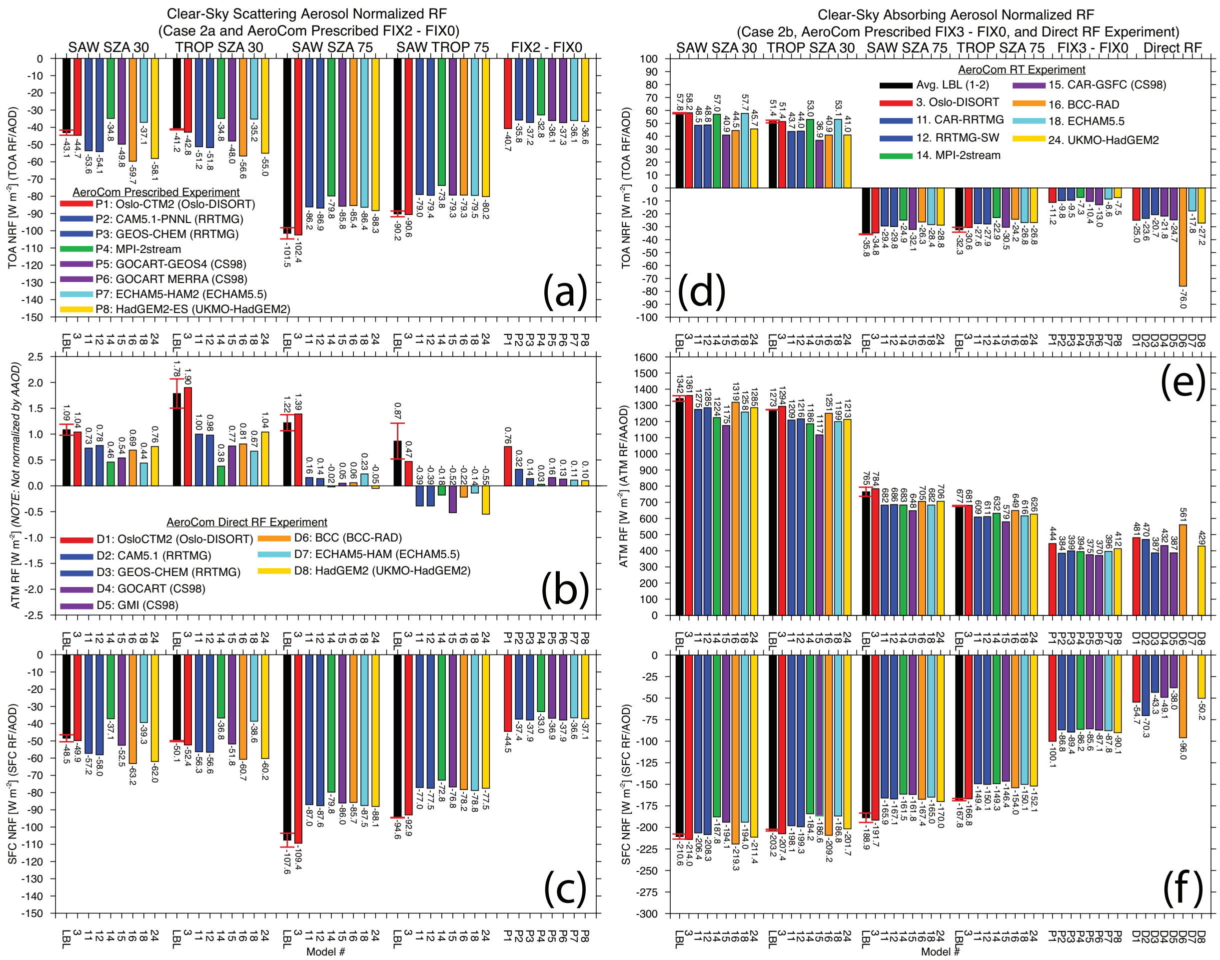

Figure 8: Summary of clear-sky (cloud-free) aerosol direct normalized radiative forcing (NRF) from the present study (AeroCom Radiative Transfer Experiment), the AeroCom Prescribed Experiment (Stier et al., 2013), and the AeroCom Direct Radiative Forcing Experiment (Myhre et al., 2013). NRF is defined as the TOA and SFC RF divided by the AOD and the ATM RF divided by the absorption optical depth (AAOD = (1 - SSA) × AOD). Results from Stier et al. (2013) and Myhre et al. (2013) are from Table 3 of each study. Models which use similar radiative transfer schemes have the same color bar. (a) Comparison of TOA NRF results from Case 2a (Scattering Aerosols) versus the FIX2-FIX0 (Scattering Aerosols) Prescribed experiment; aerosol properties in these two studies are identical (AOD = 0.2, SSA = 1.0) except in the Prescribed experiment host models simulate their own surface albedo and gaseous absorbers. Also, the results for FIX2-FIX0 are global and diurnal average results. (b) Comparison of ATM RF results from Case 2a (Scattering Aerosols) versus FIX2-FIX0. *Note:* We do not show normalized atmospheric radiative forcing because the AAOD is zero. Non-zero ATM RF in the scattering case results from enhanced molecular absorption due to aerosol scattering as described in the text. (c) Comparison of SFC NRF from Case 2a and FIX2-FIX0. (d-f) Comparison of TOA, ATM, and SFC NRF results from Case 2b (Absorbing Aerosols) versus the global average result from the FIX3-FIX0 (Absorbing Aerosols) Prescribed experiment, which also has the same specified aerosol optical properties

(but not the same albedo or gaseous absorbers; AOD = 0.2, AAOD = 0.04). We also include results from the AeroCom Direct Radiative Forcing Experiment (Myhre et al., 2013). Note that in the global and diurnally averaged AeroCom Direct Radiative Forcing Experiment results, models are run in their standard configuration, simulating all included aerosol processes. The mean SSA for the seven models here was 0.941 with a standard deviation of 0.02, and the mean global AOD was 0.0245 with a standard deviation of 0.008 (Myhre et al., 2013, Table 3).