

Interactive comment on “A review of measurement-based assessment of aerosol direct radiative effect and forcing” by H. Yu et al.

H. Yu et al.

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We appreciate the reviewers' insightful and detail comments on the work and have fully incorporated those comments in our revision. Our point-by-point responses to the reviewers' comments have been included in two previously published Author Comments. Below is a brief description of major changes we have made in the revision.

1. To improve the readability of this comprehensive review paper, we have modified the paper in a number of ways. Such modifications include: (1) adding a “Table of contents” and several sub-sections in sections 2 and 3; (2) adding specific goals to the abstract and defining the focus of this assessment more clearly; (3) simplifying the description of non-AERONET ground-based measurements (section 2.2.1); (4) adding a new sub-section (section 3.1.4) that discusses the uncertainties more quantitatively and in more

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detail; (5) generating several short bullets about “Future Research” in section 5; (6) Figures 2, 4, 9, and 10 have been remade to give a clearer demonstration; among others.

2. We have enhanced uncertainty analysis and attribution of the discrepancies observed among methods in the revision. For example, we now discuss, in a new sub-section 3.1.4, the uncertainties associated with individual methods more quantitatively and in more detail. This new sub-section facilitates the later interpretation and discussion of discrepancies among different approaches and datasets. To support our assertion that differences in aerosol types should be one of major reasons for the observed east-west contrast in the radiative efficiency in region 7 (North Indian Ocean and Arabian Sea), we have carried out additional analysis of anthropogenic fraction of aerosols for MODIS, MODIS_A, and GOCART. In section 3.2, we use GOCART aerosols to do some new sensitivity tests by (1) replacing model surface albedo with a more detailed description; and (2) using low-humidity single-scattering albedo and asymmetry factor to approximate clear-sky conditions. The results suggest that such modifications would raise the TOA DRE efficiency and hence reduce the model-satellite discrepancy.

3. We have rephrased section 2.3 (Characterization of surface albedo and clouds) to include discussion of problems with satellite retrievals and clarify some issues. We describe the surface reflectance and albedo in more detail, which facilitates later discussion on how various simplifications could influence the estimate of aerosol direct radiative forcing. We now discuss some issues associated with cloud retrievals (e.g., overestimate of cloud effective radius resulting from a plane-parallel approximation, uncertainties and biases in cloud optical depth and effective radius due to a presence of aerosol above cloud layer, current lack of cloud-base observations).

4. Other major additions and modifications: (1) sub-section 4.6 is added to discuss issues related to a detection of long-term trends of aerosols and their radiative effect; (2) standard deviations separately for measurements and models are added in Tables 7, 8, and 9; (3) a new table (Table 12) is added to show more clearly how satellite and

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model estimates of aerosol direct effect compare with the AERONET measurements; (4) MODIS_A related figures, tables, and texts have been updated and modified, based on the final version of Bellouin et al. (2005) accepted by Nature; (5) section 3.4 of anthropogenic forcing has been rephrased to better summarize recent assessments and show more clearly how the uncertainty analysis (Table 19) has been carried out; (6) problems associated with measurement and modeling of aerosol single-scattering albedo have also been discussed briefly.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 7647, 2005.

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