



Interactive
Comment

Interactive comment on “Assessing remote polarimetric measurements sensitivities to aerosol emissions using the GEOS-Chem adjoint model” by B. S. Meland et al.

Anonymous Referee #2

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Meland et al. present a method that applying forward and adjoint chemical transport models combined with a radiative transfer model to assess the feasibility of using satellite polarimetric measurements to constrain aerosol precursor emissions. The method is tested using model simulations along the satellite paths. They showed the sensitivity of the polarized reflectance at the top of the atmosphere to aerosol emissions is much higher than that for the radiant reflectance. The authors further examined the limits on the uncertainties in aerosol microphysical properties required for detecting a 50% change in aerosol emissions, which is useful for testing current and future satellite instruments. The method is a sound idea, and the manuscript fits the scope of AMT. But

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I have some comments that suggest the authors address to improve the manuscript.

Specific Comments

(1) Page 5460, Line 25-27: What do the normalized sensitivities represent? Percentage change of reflectance given some percent changes in aerosol concentrations or precursor emissions?

(2) Page 5461, Line 14-16: In Fig. 5, how many data points on average in each 4x5 model grid? As seen from Fig. 6 it appears that not all simulated satellite pixels during the two-week period were used in the study. Are they filtered out and why? Since the study used model simulated satellite observations, it is not clear to me why not use more data points to have a better spatial coverage. As seen from the right panel of Fig. 6, the data used for polarized reflectance calculation are very limited in the east US. This would make the results less statistically robust.

(3) Page 5462, Line 21-24: Can you explain why radiance observations from large azimuthal angles have higher sensitivities to the aerosol concentrations? This is not clear to me. Looking at Fig. 6, it seems to me the reason why the measurements from the Wide-Swath grid have larger sensitivities than those from the Narrow-Swath grid is due to more data points and high values over Mexico.

(4) Page 5463, Line 18: The sensitivity of TOA radiant reflectance to ammonia (NH₃) emissions as illustrated in Fig. 8 also shows large values over Africa. Can you explain why? The values over Asia may be explained as intercontinental influences, but the feature over Africa is not shown for other aerosol species, as well as in Fig. 9.

(5) Page 5464, Line 25-30: In Fig.10 the sensitivity ratio values are lower than one over the eastern US, different from those over other areas. Can you explain why?

Technical Comments

(1) Page 5453, Line 12: Should it be "GFED v2", not "GFED v1.2"?

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(2) Page 5456, Line 11: Should " R_I " here be " $r_{eff,i}$ "? What does " σ_i " represent here?

(3) Page 5488, Fig. 5: In the first panel "SO2" should be "SO4".

(4) Fig. 6 and Fig. 7: Please describe in the caption what the values inset are? Are they scaled by the factors?

(5) Fig. 8-Fig.9: I suggest use grey color for areas with no data points so that they can be separated from areas with zero values.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 5447, 2013.

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