Atmos. Chem. Phys. Discuss., 12, C10892–C10894, 2012
www.atmos-chem-phys-discuss.net/12/C10892/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantitative comparison of the variability in observed and simulated shortwave reflectance" *by* Y. L. Roberts et al.

Anonymous Referee #2

Received and published: 21 December 2012

This manuscript compares hyper spectral solar reflectance spectra simulated from a climate Observation System Simulation Experiments (OSSE) to those observed from the SCIAMACHY satellite instrument. Principal Component Analysis (PCA) is used to study the variability and similarities of these two datasets. In addition to qualitative comparisons using eigenvector shapes and eigenvalue magnitudes (variance distributions), a subspace intersection method is used to quantify the similarities. The study indicates that the OSSE system shares grossly similar spectral features with those from the SCIAMACHY observations. Significant leading eigenvectors for different seasons (or 4 representative months) have been determined by eigenvalues analysis and by total data variance calculations. This paper provides a good method for evaluating the reasonableness of the OSSE simulated solar reflectance data and contributes to the OSSE experiment for future climate observing system such as CLARREO. The

reviewer recommends the publication of the manuscript subject to some minor modifications listed below.

Specific comments:

1). While PCA is very useful tool in finding similarities between various data sets, it is also powerful in identifying differences. The fact that there are significant differences between two sets of eigenvectors derived from OSSE and SCIAMACHY (see figure 4) indicates that the OSSE radiative transfer calculations may have some unrealistic assumptions. The authors have done a good job in handling the spatial and temporal variability of the data to minimize the differences (see figure 2). Some of the differences shown in figure 4 could be due to the cloud properties and surface BRDF used in the radiative transfer calculations. Although the authors have mentioned the possible impact of BRDF as a likely cause for some of the differences in the first eigenvector, a more detailed radiative transfer simulation study is recommended for quantifying the differences in the future. For example, using other sources of high spectral resolution snow BRDFs to calculate the TOA reflectance spectra and compare the results with those obtained using low spectral resolution MODIS snow BRDF. The spectral differences shown in Figure 4 could also be due to the cloud single scattering properties and the number of streams used in the multiple scattering calculations in the OSSE simulations.

2). Page 28320, line 3, “Eq. 7” shoud be “Eq. 6” ?

3). Page 28324, line 15, “reflectance” should be replaced with “Bidirectional Reflectance Distribution Function (BRDF)”.

4). In the conclusion section, there should be some discussions about the effect of using monthly mean CCSM field for OSSE simulation. The gridded monthly mean SCIAMACHY spectra are generated from the average of daily observations, while the OSSE reflectance spectra are computed from monthly mean fields. The monthly mean of daily reflectance spectra are not equivalent to the reflectance spectrum calculated

ACPD

12, C10892–C10894, 2012

using the monthly mean atmospheric and surface properties due to the non-linear nature of the radiative transfer equation.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 28305, 2012.

ACPD

12, C10892–C10894, 2012

Interactive Comment