Abstract

A physically based aerosol climatology is essential to address the questions of global climate changes. The previous comparisons of the GISS ModelE aerosol with satellite and ground-based measurements (Liu et al., 2006) showed that the agreement in the distributions of global optical depth between GCM aerosols and satellite data is qualitatively reasonable. However, the Angstrom exponent of the GCM aerosol is clearly biased low compared to satellite data, implying that the GCM aerosol sizes are overestimated. Consequently, the aerosol size distributions specified in the latest ModelE aerosol fields provided by Koch (2006, personal communications) are reduced. In this study we compare the newly available MODIS AQUA Collection 5 Level 3 quality assured monthly averaged data available from July 2002 to July 2006 with both the old that we used in Liu et al. [2006] and the new aerosol fields (Koch, 2006, personal communication). Compared to MODIS AQUA Collection 4 data, the aerosol optical depth distributions are improved, particularly over land. The Angstrom exponent values are significantly smaller both over land and over ocean. We also present in the study preliminary results of the improved GCM aerosol climatology using the MODIS AQUA Collection 5 retrievals as constraints.

Results and Analyses

Figure 1. Time series of the global mean values of the aerosol optical depth (top two panels) and Angstrom exponent (bottom two panels) for MODIS AQUA Collection 5 (black curves) and Collection 4 (red curves) data.

Figure 2. Seasonal dependence of area weighted overall monthly mean aerosol optical depth from different data sources. Data over land (left panel) and over ocean (right panel) have been constrained between the 45 degree south and north latitudinal band.

Figure 3. Same as Fig. 2, but for the Angstrom exponent in the atmosphere.

Figure 4. Regressions selected for comparison of GCM aerosol climatology with MODIS AQUA data.

Conclusions and Discussions

The GISS ModelE [Schmidt et al., 2006] aerosol optical depth reasonably agree with the newly released MODIS AQUA Collection 6/5 data, but the Angstrom exponent is clearly biased low, implying that the aerosol size specified in the GCM are overestimated.

The new aerosol climatology [Koch, 2006] shows some improvements, particularly in terms of the seasonality of aerosol optical depth. But the Angstrom exponent is now too large. Increasing organic carbon size would be appropriate to start with since the bias is greatest in biomass burning regions like South Africa, South America and Sahel.

We present preliminary results of the improved aerosol optical depth distributions using the newly available MODIS AQUA Collection 5 data as constraints.

References
