

Abstract:

Aerosol absorption, quantified by single scattering albedo (SSA), is an important parameter for assessing the climatic impact of aerosols. While there are several satellites providing aerosol optical depth (AOD), the availability of SSA data is very limited. New and better satellite data retrievals are vital in filling this gap, offering a broad view of aerosol properties. A novel CERES-MODIS algorithm was developed for the first time to generate global SSA maps over visible wavelength. It builds on the critical optical depth concept using top-of-atmosphere fluxes from CERES and AOD data from MODIS sensors on Aqua and Terra satellites. Comparison and validation studies were conducted using CERES-MODIS and OMI SSA, along with ground-based and aircraft measurements. The uncertainty in CERES-MODIS SSA retrieval was estimated at ± 0.044 with surface albedo contributing to the highest uncertainty. Results show that CERES-MODIS offers broader spatial coverage and captures the seasonal variations and absorbing aerosols more effectively, especially over biomass burning and polluted regions. CERES-MODIS SSA shows a clear negative correlation with the MODIS fire count. Whereas, existing SSA dataset fails to show any correlation with increasing fire activity. Overall, this thesis develops a new algorithm to retrieve SSA globally, thus addressed the current data gaps. In doing so, the thesis presents both the method and a critical evaluation of its performance, thus contributing to the remote sensing of aerosol absorption. These global maps of SSA with improved accuracy provide an important input to climate models for the assessment of aerosol-climate impacts on both regional and global scales.