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# Evaluation of global AEROCOM aerosol optical properties against satellite MODIS aerosol products

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Lack of dense worldwide ground-based monitoring network has lead to other solutions for creating a climatology of aerosol optical properties. AEROCOM data set is a mixture of ground-based aerosol observations and global modeling output at 1° by 1° latitude-longitude resolution. In order to evaluate such a 'constructed' data set, a validation against MODIS aerosol data (collection 4 and 5) is performed here. Since AEROCOM incorporates observations from 1998 to 2007 and are provided as a climatological set and not as a specific year, we have used from MODIS the mean value of the years 2000 to 2007.

The global value of AEROCOM aerosol optical depth (AOD) at 550 nm is 0.13, while the corresponding value for MODIS is 0.155. The hemispherical mean AODs for N. Hemisphere are 0.16 for AEROCOM and 0.18 for MODIS, and those for S. Hemisphere are equal to 0.097 and 0.125 for AEROCOM and MODIS, respectively, indicating thus an underestimation by AEROCOM. AEROCOM seems to overestimate AOD over land and underestimate over oceanic areas. From a temporal point of view, AEROCOM underestimates the global average AOD with respect to MODIS in boreal spring months (March, April and May) presenting a summer maximum, whilst MODIS maximum is observed in spring. However, the largest differences between AEROCOM and MODIS AOD are found in autumn and winter, mostly in October, November and December. The correlation coefficient for the monthly values of AEROCOM and MODIS is 0.72. The planetary mean value for fine (anthropogenic plus pre-industrial for AEROCOM) aerosols was found to be 0.061 for AEROCOM and 0.069 for MODIS, while the hemispherical values are 0.084 (0.081) for AEROCOM (MODIS) for North Hemisphere and 0.038 (0.055) for South Hemisphere.

On a global annual mean basis, AEROCOM is found to overestimate asymmetry parameter and aerosol single scattering albedo with respect to MODIS, by 16.6% and 4.1%, respectively. The spectral variability of aerosol optical properties (aerosol optical depth, single scattering albedo and asymmetry parameter) has also been investigated. Four (4) sites have been selected which are characteristic of certain type of aerosols (pollutants, sea salt spray, biomass and dust). The comparison is made for the wavelengths ranges between 400 nm and 700 nm over land and between 400 nm and 2320 nm over ocean, due to limitations set by MODIS data. For the range of wavelength that was used, AEROCOM single scattering albedo values are quite close to those from MODIS, with the mean difference from all wavelengths being smaller than 9.1%. An interesting feature is the fact that for aerosols with SSA values larger/smaller than 0.95, AEROCOM values are larger/smaller than MODIS. The spectral dependence of AEROCOM asymmetry parameter shows a decrease from 400 nm to 550 nm and an increase to larger wavelengths, same with MODIS.

A thorough comparison has been attempted between aerosol optical properties taken from AEROCOM and MODIS datasets. According to the results, AEROCOM is a valuable tool for studies using aerosol optical properties, given the relatively small differences in magnitude and spectral profiles. The encountered differences have to be further assessed, so that improvements can be made to both datasets. The good performance of AEROCOM maximizes its usefulness based on advantages like the separation between natural and anthropogenic aerosols and the high spectral resolution of climatically relevant aerosol optical properties.