Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 6, 715-727, 2006
www.atmos-chem-phys.net/6/715/2006/

Aerosol optical properties at Lampedusa (Central Mediterranean). 2. Determination of single scattering albedo at two wavelengths for different aerosol types

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Abstract. Aerosol optical properties were retrieved from direct and diffuse spectral irradiance measurements made by a multi-filter rotating shadowband radiometer (MFRSR) at the island of Lampedusa (35.5° N, 12.6° E), in the Central Mediterranean, in the period July 2001–September 2003. In a companion paper (Pace et al., 2006) the aerosol optical depth (AOD) and Ångström exponent were used together with airmass backward trajectories to identify and classify different aerosol types. The MFRSR diffuse-to-direct ratio (DDR) at 415.6 nm and 868.7 nm for aerosol classified as "biomass burning-urban/industrial", originating primarily from the European continent, and desert dust, originating from the Sahara, is used in this study to estimate the aerosol single scattering albedo (SSA). A detailed radiative transfer model is initialised with the measured aerosol optical depth; calculations are performed at the two wavelengths varying the SSA values until the modelled DDR matches the MFRSR observations. Sensitivity studies are performed to estimate how uncertainties on AOD, DDR, asymmetry factor (g), and surface albedo influence the retrieved SSA values. The results show that a 3% variation of AOD or DDR produce a change of about 0.02 in the retrieved SSA value at 415.6 and 868.7 nm; a ±0.06 variation of the asymmetry factor g produces a change of the estimated SSA of <0.04 at 415.6 nm, and <0.06 at 868.7 nm; finally, an increase of the assumed surface albedo of 0.05 causes very small changes (0.01–0.02) in the retrieved SSA. The calculations show that the SSA of desert dust (DD) increases with wavelength, from 0.81±0.05 at 415.6 nm to 0.94±0.05 at 868.7 nm; on the contrary, the SSA of urban/industrial (UN) aerosols decreases from 0.96±0.02 at 415.6 nm to 0.87±0.07 at 868.7 nm; the SSA of biomass burning (BB) particles is 0.82±0.04 at 415.6 nm and 0.80±0.05 at 868.7 nm. Episodes of UN aerosols occur usually in June and July; long lasting BB aerosol episodes with large AOD are observed mainly in July and August, the driest months of the year, when the development of fires is frequent.

Final Revised Paper (PDF, 1013 KB) Discussion Paper (ACPD)

Citation: Meloni, D., di Sarra, A., Pace, G., and Monteleone, F.: Aerosol optical properties at Lampedusa (Central Mediterranean). 2. Determination of single scattering albedo at two wavelengths for different aerosol types, Atmos. Chem. Phys., 6, 715-727, 2006. Bibtex EndNote Reference Manager