IRS2012-69
International Radiation Symposium 2012
Dahlem Cube, Berlin, Germany, 06 – 10 August 2012

Columnar aerosol absorption retrieval and effects on solar UV radiation

S. Kazadzis (1), V. Amiridis (2), N. Kouremeti (3), V. Gerasopoulos (1), and D. Kopania (1)

(1) National Observatory of Athens, Institute of Environmental Research ans Ssustainable Development, Athens, Greece (kazadzis@meteo.noa.gr), (2) National Observatory of Athens, ISARS, Greece, (3) Laboratory of Atmospheric Physics, Aristotle University of Thessaloniki, Greece

The role of aerosols, both natural and anthropogenic, is recognized as extremely important for radiative forcing related research. While a number of studies related with aerosol effects on solar radiation deal with the aerosol optical depth (AOD) as a major aerosol parameter, only few tend to include changes in other aerosol properties such as single scattering albedo (SSA). For the visible (VIS) range, advanced retrieval algorithms for microphysical aerosol properties have been developed in the framework of the Aerosol Robotic Network (AERONET). The weakness to retrieve SSA applies more for the ultraviolet (UV) part of the spectrum. Compared to the visible spectral region, a little is known about aerosol absorption in the UV wavelength range.

In this work we present estimates of SSA at two independently retrieved wavelengths 332 and 368 nm for the urban ground-based Atmospheric Remote Sensing Station (ARSS), situated at Athens city area, Greece. We have used measurements of a CIMEL (AERONET) sun-photometer and a UV multifilter radiometer (UVMFR) in order to retrieve SSA in the UV. For that purpose model calculations together with the global/diffuse UV ratios (DGR) from the UVMFR, AOD at UV wavelengths from the CIMEL and also total ozone and solar elevation, were used. More specific, the direct irradiances at 332nm and 368nm from the UVMFR have been inter-calibrated based on CIMEL /AOD retrievals and then look up tables of DGR's have been constructed as a function of solar zenith angle, AOD, SSA, asymmetry parameter and ozone. A combination of synchronous measurements from the two instruments under cloudless conditions, were used in order to calculate SSA.

We found that SSA decreases with decreases in extinction optical thickness. We believe that this behavior reflects the changes from summer to winter months in the average aerosol composition at Athens. Indeed, the annual cycle of SSA is the same to AOD annual cycle: with a maximum in summer and a minimum in winter. The variability of SSA during a one year period was found to be quite high ranging from 0.55 to 0.93 with mean values of 0.83, 0.77 and 0.74 for 440nm, 368nm and 332nm respectively.

Finally, we have used aerosol measurement data for Athens area and for year 2010 together with the LibRadTran radiative transfer code, in order to calculate the effect of different SSA retrievals to the calculated UVB (305-325nm) and UVA (325-380nm) solar irradiance. For such calculations we have used monthly mean AODs at 340nm and Ångström coefficients (CIMEL) and SSA retrievals from various sources (CIMEL(VIS), our method, satellite-retrieved). Results for UVB wavelengths show that compared with the CIMEL derived SSA (at 440nm) UVMFR calculated SSAs for local noon, lead to lower UVB values from 2-7% depending on the aerosol load. For UVA wavelengths the effect of using different SSAs was in the order of 2 to 5%, for the local noon UVMFR related retrievals compared with the CIMEL ones, and 4-8% for a constant (61 degrees) solar zenith angle.