IRS2012-553
International Radiation Symposium 2012
Dahlem Cube, Berlin, Germany, 06 – 10 August 2012

Analyzing the influence of aerosol particles on UVB irradiance reaching the surface in Sao Paulo city

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Surface measurements of UVB irradiance data are compared with modeled calculations with and without aerosol particles influence. Analyzed data were collected from years 2005 up to 2007 at Sao Paulo city, in Brazil (latitude -23.55 degrees, longitude -46.64 degrees) using a UVB biometer from Solar Light, model 501. Measurements were registered every 10 minutes. Numerical simulations were performed with SBDART radiative transfer code using as input daily atmospheric column ozone retrievals from OMI (Ozone Monitoring Instrument). When simulations included the aerosol effect, its optical properties such as single scattering albedo (ssa), asymmetry factor (g) and optical depth (AOD) data were obtained from AERONET (Aerosol Robotic Network). Results showed that neglecting the presence of aerosol particles in the numerical simulations, the ratio between measured and calculated instantaneous irradiance data, around noon (local time), decreased with increasing AOD at 500 nm, reaching a ratio of about 0.5 for AOD approximately 1.0. Including aerosol optical properties in the numerical simulations, the difference between measured and calculated downward UVB irradiance decreased significantly. For instance, on 9 September 2007, AOD at 500 nm was about 0.5 and column ozone was 297DU. Difference between measured and calculated UVB irradiance at local noon was about 4%. In order to obtain numerical results presenting minimum difference with measured irradiances, three distinct average aerosol optical models, based on aerosol ssa, had to be taken into account, one more absorbing, one intermediate and one more scattering aerosol. For the previous example, the minimum difference was obtained using the intermediate model. Running the radiative transfer code using the more absorbing aerosol model, the difference was of about -14% while using the more scattering one, the difference reached 22%. On other days, the use of the more absorbing or the more scattering models resulted in better comparisons. In conclusion, due to the spectral dependence of aerosol interaction with solar radiation, which in general is higher for shorter wavelength, its effect must be taken in account in the UV spectral region even when low AOD values are observed in the visible region. Moreover, other analyses still need to be conducted to define the meteorological or atmospheric conditions contributing to identify which aerosol optical model must be considered in each situation.