



An assessment of Biomass Burning Aerosol Optical Properties over the Mediterranean Basin based on Satellite Data

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The Mediterranean basin is characterized by the coexistence of various aerosol types such as anthropogenic, desert dust, biomass burning (BB) and background marine particles, with relatively high aerosol load affecting the regional radiative budget. This diversity results in complex aerosol properties with high temporal and spatial variability, which is enhanced by the sporadic character of dust transport and wildfire events. The impact of aerosol load on the regional or local radiative budget is intensified during the summer cloud-free period due to the intense solar radiation. During the warm period the Mediterranean experiences the impact of BB emissions when forest and shrubland fires occur due to favorable meteorological conditions. BB aerosols consisting of two major components, black carbon which is the most absorbing aerosol species and organic aerosols that scatter solar radiation, can have a strong impact on the solar radiation budget, altering atmospheric temperature lapse rates and dynamics over a region.

In this work an assessment of temporal variability and spatial distribution of biomass burning aerosol optical properties over the broader Mediterranean basin for the period 2002-2016 is conducted. To that end satellite databases are used. At first, wildfire events are identified in terms of ignition date and geographical location based on MODIS (MODerate resolution Imaging Spectroradiometer) collection 006 data. For our analysis wildfires with a burned area of at least 500ha are considered. Then, for each event aerosol optical properties namely spectral AOD, Ångström Exponent (AE), Fine Fraction (FF) and Aerosol Index (AI), that describe the atmospheric load and size of BB aerosols, are assessed. The relevant data are derived from Collection 006 MODIS-Terra database, except for AI which is taken from TOMS (Total Ozone Mapping Spectrometer) and OMI-Aura (Ozone Monitoring Instrument) databases for the periods 2002-2004 and 2005-2016, respectively. The spatial distribution and the inter-annual variability of BB aerosol optical properties are analyzed. The AI values are greater than 2 with maxima attaining 4.3. Ångström Exponent presents a mean value around 1.5 with maxima exceeding 2.5, whereas mean value of FF is about 0.84. AOD (AOD550) can reach values up to 3.3. For selected large wildfire events (mega-fires) the spatial expansion of smoke plume is estimated through forward-trajectories using the HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory Model) model and then BB aerosol properties are calculated over areas affected by the smoke.