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The regime of biomass burning aerosols over the Mediterranean basin based on satellite observations

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Biomass burning (BB) aerosol particles have significant effects on global and regional climate, as well as on regional air quality, visibility, cloud processes and human health.Biomass burning contributes by about 40% to the global emission of black carbonBC, and BB aerosols can exert a significant positive radiative forcing. The BB aerosols can originate from natural fires and human induced burning, such as wood or agricultural waste. However, the magnitude, but also the sign of the radiative forcing of BB aerosols is still uncertain, according to the third assessment report of IPCC (2013). Moreover, there are significant differences between different models as to their representation (inventories) of BB aerosols, more than for others, e.g. of fossil fuel origin. Therefore, it is important to better understand the spatial and temporal regime of BB aerosols. This is attempted here for the broader Mediterranean basin, which is a very interesting study area for aerosols, also being one of the most climaticallysensitive world regions.

The determination of spatial and temporal regime of Mediterranean BB aerosols premises the identification of these particles at a complete spatial and long temporal coverage. Such a complete coverage is only ensured by contemporary satellite observations, which offer a challenging ability to characterize the existence of BB aerosols. This is possible thanks to the current availability of derived satellite products offering information on the size and absorption/scattering ability of aerosol particles. A synergistic use of such satellite aerosol data is made here, in conjunction with a developed algorithm, in order to identify the existence of BB aerosols over the Mediterranean basin over the 11-year period from 2005 to 2015. The algorithm operates, on a daily basis and at $1^{o}\times 1^{o}$latitude-longitude resolution, setting threshold values (criteria) for specific physical and optical properties, which are representative of BB aerosols. More specifically, the algorithm examines the fulfillment of these criteria for Ångström Exponent (AE), Fine Fraction (FF) and Aerosol Index (AI). The AE and FF data, which are characteristic of the aerosol size, are derived from multispectralCollection 006 MODIS-AquaAerosol Optical Depth (AOD) data, whereas the AI data, that characterize the absorption ability of aerosols, are taken from the OMI-Aura database.

The algorithm enables the identification of BB aerosols over specific geographical cells (pixels) throughout the study region, over both sea and land surfaces, during days of the 2005-2015 period. The results make possible the construction of a climatological-like database of Mediterranean BB aerosols, permitting to perceive the geographical patterns of their regime, namely the areas in which they occur, in relation to their timing, i.e. the months and seasons of their occurrence. This regime is quantified, which means that the frequency (absolute and percent) of occurrence of BB aerosols is calculated, along with the associated computed AOD values. The year by year variability of BB aerosols is also investigated over the period 2005-2015, with emphasis to inter-annual and seasonal tendencies.