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Aerosol events in the Mediterranean basin during the 7-year period 2000-2007 based on MODIS-Terra data

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The Mediterranean basin is one of the most climatically sensitive regions of the planet according to future climate change scenarios. Aerosol particles are a major climatic change agent in this region, being consisted of a large variety of natural plus anthropogenic particles such as desert dust, sea-salt, or fine particles from biomass burning or industrial activities. Several studies have been performed in the past either to build aerosol climatologies or to study specific aerosol transport events in this region. Nowadays, the availability of quality 7-year satellite-based aerosol data from MODIS (MODerate resolution Imaging Spectroradiometer) offer the unique opportunity to study in detail the aerosol events/episodes over the study region and to identify accurately their characteristics.

In the present work, we attempt to identify and characterize the aerosols events that take place over the Mediterranean basin, using geographical cell level aerosol data at 1^o x 1^o latitude-longitude resolution and on a daily basis. The data are taken from the MODIS – Terra platform and cover the period from March 2000 to February 2007. The aerosol burden in the atmosphere is best represented by the aerosol optical depth (AOD), which is available by MODIS at different wavelengths. Our analysis, based on an objective methodology, determines the temporal and spatial features of aerosol events, specifically their frequency, timing, duration and intensity, for the whole study region, and also for three major sub-regions (West Mediterranean, Central Mediterranean and East Mediterranean).

The frequency of aerosol events shows a seasonal variability, with more events in summer and spring than in the rest of year. Geographical distributions provide insight into what specific areas undergo aerosol events, depending on time (season). A greater number of episodes it is found in the western and central parts, against a small number in the eastern and northern parts of the Mediterranean basin. It is also found that more numerous weak and moderate aerosol episodes occur over land than sea areas, and vice-versa for strong episodes associated mainly with dust transport from northern Africa. The intensity of aerosol events, by means of AOD at 550nm, varies from 0.49 to 1.07, and it is found that the strongest episodes take place over the eastern and central Mediterranean Sea. As for the duration of events, it is shown that most episodes last one or two days, whereas very long episodes (up to 17 days) can also take place but very rarely. Finally, the inter-annual variability of events is also investigated with an emphasis on possible tendencies, which is important in view of possible climate change of the region.