

Atmospheric Circulation Types Related to Dust Transport Episodes over Crete in the Eastern Mediterranean

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Abstract : The Mediterranean basin is an area where different aerosol types coexist, including urban/industrial, desert dust, biomass burning and marine particles. Particularly, mineral dust aerosols, mostly originated from North African deserts, significantly contribute to high aerosol loads above the Mediterranean. Dust transport, controlled by the variation of the atmospheric circulation throughout the year, results in a strong spatial and temporal variability of aerosol properties. In this study, the synoptic conditions which favor dust transport over the Eastern Mediterranean are thoroughly investigated. For this reason, three datasets are employed. Firstly, ground-based daily data of aerosol properties, namely Aerosol Optical Thickness (AOT), Ångström exponent ($\alpha_{440-870}$) and fine fraction from the FORTH-AERONET (Aerosol Robotic Network) station along with measurements of PM₁₀ concentrations from Finokalia station, for the period 2003-2011, are used to identify days with high coarse aerosol load (episodes) over Crete. Then, geopotential height at 1000, 850 and 700 hPa levels obtained from the NCEP/NCAR Reanalysis Project, are utilized to depict the atmospheric circulation during the identified episodes. Additionally, air-mass back trajectories, calculated by HYSPLIT, are used to verify the origin of aerosols from neighbouring deserts. For the 227 identified dust episodes, the statistical methods of Factor and Cluster Analysis are applied on the corresponding atmospheric circulation data to reveal the main types of the synoptic conditions favouring dust transport towards Crete (Eastern Mediterranean). The 227 cases are classified into 11 distinct types (clusters). Dust episodes in Eastern Mediterranean, are found to be more frequent (52%) in spring with a secondary maximum in autumn. The main characteristic of the atmospheric circulation associated with dust episodes, is the presence of a low-pressure system at surface, either in southwestern Europe or western/central Mediterranean, which induces a southerly air flow favouring dust transport from African deserts. The exact position and the intensity of the low-pressure system vary notably among clusters. More rarely dust may originate from deserts of Arabian Peninsula.

Keywords : aerosols, atmospheric circulation, dust particles, Eastern Mediterranean

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