EMS Annual Meeting Abstracts
Vol. 10, EMS2013-128, 2013
13th EMS / 11th ECAM

Seasonal variations, synoptic background and possible source areas of Saharan dust outbreaks over the Mediterranean Basin

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The global annual input of mineral dust deflated from arid-semiarid areas can be set in the range between 1 and 3 billion of tons. Most important sources are situated in Saharan and Sahel regions, which are responsible for 50–70% of the global emission. From these dust hotspots, several hundred thousand tons of mineral dust is transported into the atmosphere of the Mediterranean Basin, often exceeding the PM10 standards of the European Union in Spain, in Italy and in Greece.
For this study the daily Total Ozone Mapping Spectrometer's aerosol data (from 1979 to 2012) were employed to estimate atmospheric dust amount in the investigation area (31°–43.5°N, 9°W–35°E). Daily geopotential height (at 700 mb), wind vector and meridional flow data of the distinguished dust events were obtained from the NCEP/NCAR Reanalysis project to compile mean synoptic composite maps. In order to identify the typical dust transportation routes and possible source areas, the backward trajectories were plotted on multiple trajectory maps, using the NOAA HYSPLIT model.
The main period of the dust transportation is in spring and summer, when the thermal convective activity forces the injection of particles to higher atmospheric levels. However, seasonality patterns of the different Mediterranean sub-basins show quite large differences. In western sub-basins (Alboran, Balearic and partly the Tyrrhenian Sea), the maxima of Saharan dust outbreaks is in summer, related SW flow between a southward emanating trough and the northward migrating subtropical high-pressure centre. In the eastern basin, dust storms occur typically in spring, generated by the warm sector winds on foreside of eastward moving Mediterranean and Sharav cyclones. The seasonal distribution of dust events in the central sub-basins (southern part of the Tyrrhenian Sea, Sea of Sicily and Ionian Sea) show typical bimodal characteristic with a spring and summer peak, indicating a transitional position.