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A synoptic characterization of the dust transport in the Mediterranean basin

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In this work the daily dust transport over the Mediterranean basin is characterized through circulation type classification (CTC) methods. The dust loads are estimated through the aerosol optical depth (AOD) simulated by the GOCART model in the period 2000-2007 and remote-sensed by the MODIS in the period 2001–2010. The dust transport from the Sahara is identified linking the AOD anomalies to the thermal anomalies into the Mediterranean, studying the covariance modes of AOD and air temperature at 850 hPa from the MERRA dataset. The time series of the expansion coefficients associated to the first two covariance modes allow to describe the dust transport in the eastern, western and central Mediterranean sub-basins.

The circulation types are classified using the MERRA geopotential height at 700 hPa in the period 1979–2010, the performance of the CTC methods in the characterization of the dust anomalies is evaluated and the best method is selected. Results show that a T-mode PCA method with 14 classes allows the characterization of dust transport and thermal anomalies in the eastern and western Mediterranean, while the variability in the central Mediterranean is well characterized by a S-mode PCA method with 10 classes.

Moreover, extreme dust events over the western, central and eastern Mediterranean are identified, and the associated synoptic circulation patterns evolution is studied. Extreme dust events in the western Mediterranean are associated with high-pressure conditions limiting the development of lows to the western North Africa, while the eastward evolution of cyclones over the central Mediterranean and Northern Africa accompanies dust events in the central and eastern Mediterranean.