Geophysical Research Abstracts
Vol. 13, EGU2011-7547, 2011
EGU General Assembly 2011

Summer Mediterranean SST impact on circulation mechanisms responsible for Saharan dust transport

Francesca Guarnieri (1,2), Marco Gaetani (2,3), Caterina Busillo (1,2), Francesca Calastrini (1,2), and Massimiliano Pasqui (2)

(1) LAMMA Consortium, Sesto Fiorentino (FI), Italy, (2) IBIMET-CNR, Roma, Italy (m.gaetani@ibimet.cnr.it), (3) CETEMPS, University of L'Aquila, Italy

The Mediterranean region is interested by aerosol transport of different origins: anthropogenic pollution from Europe, marine and forest fires emissions, desert dust from the Sahara. The Saharan dust intrusion into the Mediterranean is related to specific atmospheric conditions favourable to the extraction from the surface, the lifting above the boundary layer and finally the advection northwards. During summer, the zonally component of mid-latitude tropospheric flow is reduced, favouring coupling between Europe and Northern Africa. The atmospheric dynamics over the Mediterranean is dominated by an anticyclonic circulation to the west, associated to the Azores high, a cyclonic circulation to the east, associated to the Asian monsoon system, and a divergent circulation to the south, associated to the Saharan heat-low. The late summer Mediterranean SST is characterized by a positive gradient toward the Levantine basin. The aim of this work is to highlight the relationship between the Mediterranean SST variability and the Saharan dust transport in summer, through the investigation of the changes in the atmospheric dynamics over Europe and northern Africa. We focus on the low and mid troposphere circulation to study dust extraction and transport, respectively.

Using NOAA Extended Reconstructed SST and NCEP Reanalysis 2 atmospheric variables, the covariance between Mediterranean SST and atmospheric circulation over Europe and northern Africa has been studied, through a Singular Value Decomposition in the period 1979-2009. Considering the circulation close to the surface, the first covariance mode shows an enhanced SST gradient in the west-east direction, related to low pressure anomalies over Europe and Maghreb and high pressure anomalies over eastern Mediterranean. In the mid troposphere, the SST gradient anomaly is related to cyclonic anomalies over western-central Europe and anomalous anticyclonic circulation over eastern Mediterranean and Sahara.

The association between SST gradient in the Mediterranean and dust transport form the Sahara is investigated using the aerosol index measured by the NASA Total Ozone Mapping Spectrometer, in the period 1979-2005. A Mediterranean SST gradient index is defined as the standardized difference between the eastern and western sub-basins, and the high-low gradient differences are computed for the dust load and the low and mid troposphere wind field. Weak anomalies in the near surface wind over the Sahara are related to enhanced Mediterranean SST gradient, with consequent low dust extraction. On the other hand, the dust load associated to high Mediterranean SST gradient shows a strong positive anomaly from western Sahara to central Mediterranean, displaced along a southwesterly flow associated to the low-high pressure dipole between central Europe and North Africa.

These results suggest a possible active role of the Mediterranean SST gradient in modulating the atmospheric circulation favourable for dust transport in the central Mediterranean. While, the role of the Mediterranean SST gradient in the dust extraction appears not to be prominent, but further analysis with high resolution numerical models are planned to address the limitations of Reanalysis 2 in resolving low level atmospheric circulation.