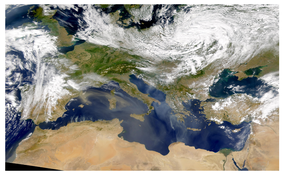
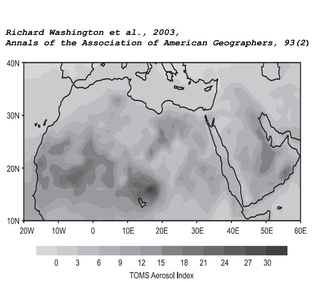
Geophysical Research Abstracts Vol. 13, EGU2011-7547, 2011 EGU General Assembly

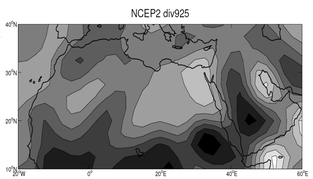
Summer Mediterranean SST impact on circulation mechanisms responsible for Saharan dust transport

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



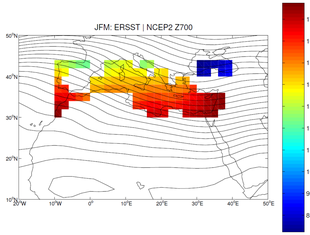


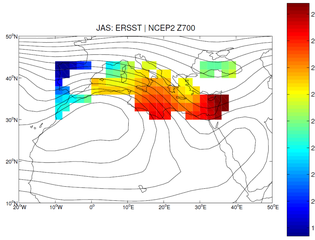


Introduction

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.





Objective

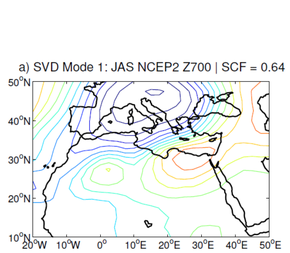
To highlight the relationship between the Mediterranean SST variability and the Saharan dust transport in summer, through the investigation of the changes in the atmospheric dynamics over Europe and northern Africa.

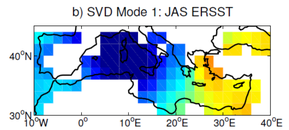
Data and Method

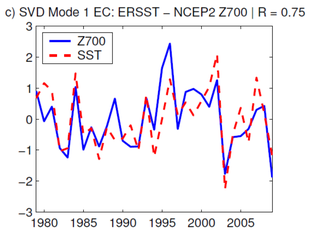
> NOAA Extended Reconstructed SST (ERSST)
> NCEP Reanalysis 2 (R2) atmospheric variables (1979-2009)
> NASA Total Ozone Mapping Spectrometer aerosol index (TOMS AI) (1979-1992; 1996-2005)

Singular Value Decomposition (SVD) > covariance between Mediterranean SST and atmospheric circulation over Europe and northern Africa.

Mediterranean SST gradient index = standardized difference between the eastern and western sub-basins = SST(EMB-WMB) > correlation with dust load; low troposphere divergence (extraction); mid troposphere wind field (transport).



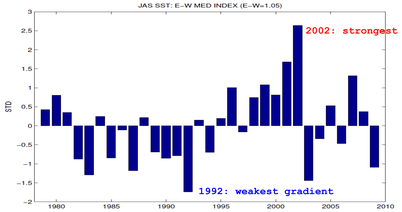


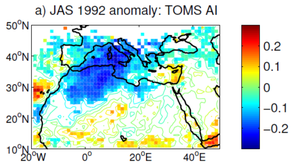


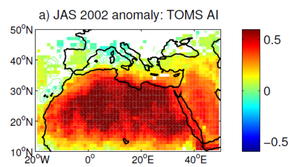
Results

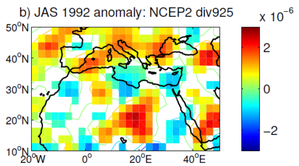
SST-hgt700: 1st SVD mode > enhanced SST gradient in the west-east direction <-> low pressure anomalies over Europe and Maghreb and high pressure anomalies over eastern Mediterranean and Sahara.

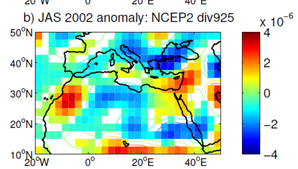
Correlation:
Mediterranean SST gradient vs dust load; div925; wind700 > enhanced SST gradient <-> positive dust load anomalies over southern Mediterranean <-> positive convergence anomalies over Sahara <-> southwesterly flow across the Sahara and the Mediterranean.

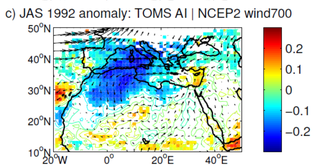


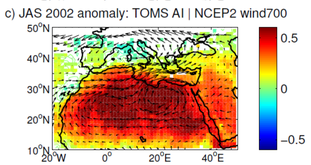


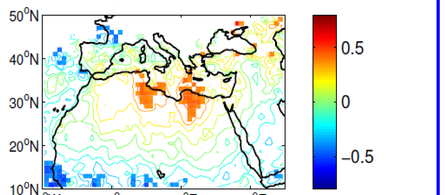


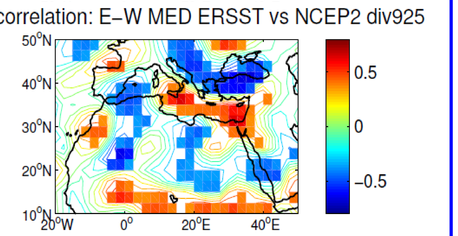


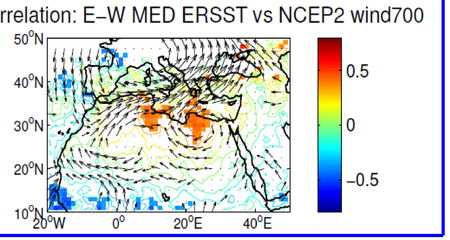












Conclusions

> Active role of the Mediterranean SST gradient in modulating the atmospheric circulation favourable for dust extraction and transport in the Mediterranean.
> Strong (weak) gradient <-> efficient (inefficient) dust extraction and transport across the Mediterranean.
> Further analysis with regional models are planned to address the limitations of R2 in resolving the atmospheric circulation.