IDENTIFICATION OF SAHARAN DUST EPISODES OVER ITALY IN 2003-2005

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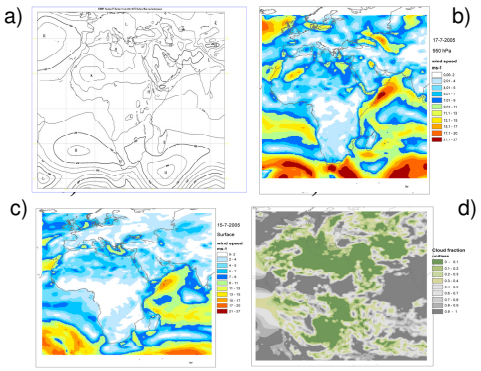
1. Summary

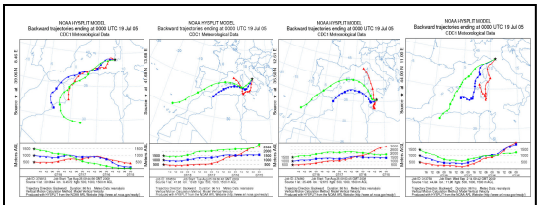
This study presents a monthly distribution of the main Saharan dust outbreaks registered in the period 2003-2005 at seven Italian locations. The identification has been carried out by looking at several sources of information such as monitoring network observations, satellite images, ground measurements of aerosol optical properties, dust model simulations and air mass backward trajectory analysis. Dust intrusions are mainly focused in spring (40%-45%) and summer (35%-55%). In winter and autumn the sites in Northern Italy registered a significant number of episodes in January and February (between 7% and 10%) whereas the stations in Central Italy and in the islands were not affected by any dust intrusion. The highest number of episodes was identified at the Mediterranean island of Lampedusa in summer (57% of the total). A specific dust event in 2005 (17th-20th July) identified by using this methodology is also described.

2. Meteorological conditions



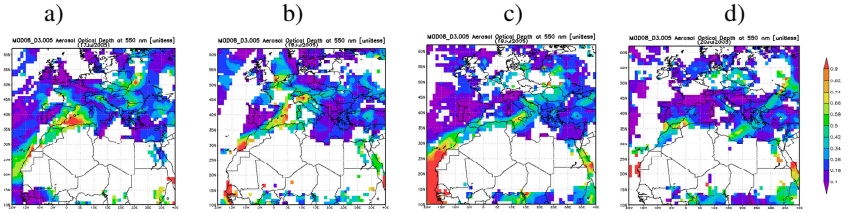
Source: ECMWF forecast re-analysis over Europe
a) Synoptic chart, 17th July at 1200 UTC. Between the low pressure located over North Western Africa and the high pressure area over Italy a pressure gradient produces air masses moving towards Italy.
b) Wind speed chart at 950 hPa, 17th July at 1800 UTC. Winds between 15 ms^{-1} and 17 ms^{-1} developing in the low pressure region.
(**c**) surface winds less than 6 ms^{-1} on 15th July over Northern Africa
(**d**) cloudy sky on 15th July over Northern Algeria and Morocco. Source: MODIS

3. Back trajectories



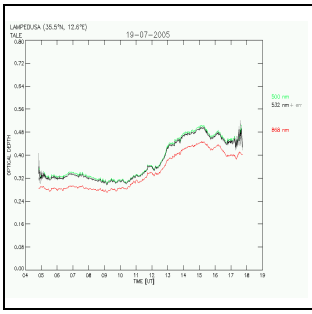
Three particle pathways originating at the same site from different heights above ground: 500m (red), 1000m (blue), 1500m (green).
Source: atmospheric Lagrangian model HYSPLIT (http://ready.arl.noaa.gov/HYSPLIT.php)
Target: S.Antioco (39.06°N, 8.46°E), Fontechiari (41.68°N, 13.68°E), Lampedusa (35.52°N, 12.63°E), Gherardi (44.84°N, 11.96°E) ,.
Starting time: 00 UTC on 19th July 2005
Ending time: 00 UTC on 15th July 2005.
The computation of the trajectories at 1000 m and 1500 m supports the North African origin of the dust, mainly from Morocco and North Algeria.

4. Satellite retrievals



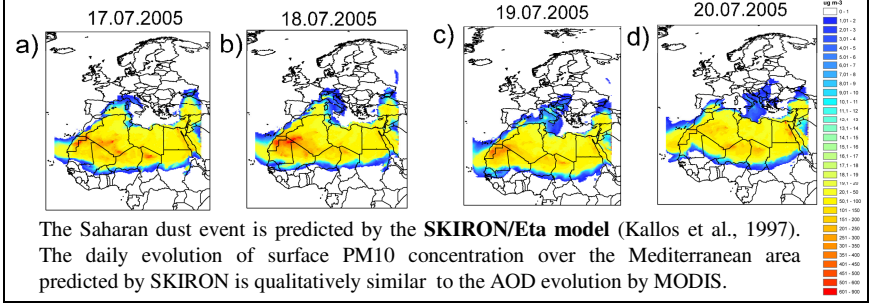
Daily Maps of Aerosol Optical Depth (AOD) at 550 nm. **Source**: MODIS.
Grid resolution: 1 degree x 1 degree.
a) Dust (AOD > 0.6) moves from Northern Africa across the Mediterranean sea towards Sardinia on 17th July.
b) The dust reaches Northern Italy on day 18th July.
c) The day after (19th July) dust is advected, with lower AOD values, towards Centre and Southern Italy.
d) It leaves the peninsula and moves to Greece (20th July).

5. Ground measurements



Hourly series of AOD as derived from observations by a Multi Filter Rotating Shadow band Radiometer (MFRSR) over Lampedusa (Meloni et al. 2007) on 19th July.

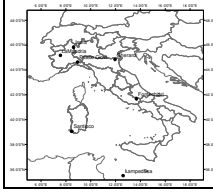
6. Model simulations



The Saharan dust event is predicted by the **SKIRON/Eta model** (Kallos et al., 1997). The daily evolution of surface PM10 concentration over the Mediterranean area predicted by SKIRON is qualitatively similar to the AOD evolution by MODIS.

7. Monthly distribution (%) of dust events in 2003-2005

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fontechiari	0.0	1.5	10.3	7.4	7.4	7.4	30.9	13.2	17.6	4.4	0.0	0,0
Gherardi	1.8	5.3	22.8	14.0	7.0	14.0	8.8	7.0	15.8	3.5	0.0	0.0
Ispra	3.2	7.5	30.1	11.8	4.3	6.5	15.1	6.5	11.8	3.2	0.0	0.0
Lampedusa	0.0	1.8	10.7	5.4	9.8	7.1	27.7	12.5	9.8	12.5	0.0	2.7
La Mandria	3.0	6.0	24.0	12.0	8.0	13.0	14.0	6.0	12.0	2.0	0.0	0.0
Passo Giovi	0.0	0.0	35.9	12.8	2.6	17.9	17.9	5.1	7.7	0.0	0.0	0.0
S.Antioco	0.0	0.0	15.4	3.8	15.4	15.4	23.1	15.4	11.5	0.0	0.0	0.0



Remote rural background monitoring sites used for the identification of daily dust events in the period 2003-2005. The ENEA station for Climate Observations in the Mediterranean island of Lampedusa is also included.

References:
Meloni D. et al. (2007) Seasonal behavior of Saharan dust events at the Mediterranean island of Lampedusa in the period 1999-2005, Atmos. Environ., 41, 3041-3056.
Kallos G. et al.(1997) The Regional Weather Forecasting System SKIRON and its capability for forecasting dust uptake and transport. Proc. Of the WMO conference on dust storms, 1-6 November 1997, Damascus, Syria, pp 9.
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