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The synoptics of dust transportation days from Africa toward Italy and central Europe

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The mean synoptic situation associated with dust outbreaks from the Sahara into the Central Mediterranean was examined on daily basis for the month of July from 1979 to 1992. Composite patterns of wind, geopotential heights and temperature for dusty days versus those for all days were analyzed. Dusty days were defined as days with the Total Ozone Mapping Spectrometer Aerosol Index (TOMS-AI) in the area around the Apennine peninsula ($36^oN - 46^oN$, $10^oE - 18^oE$) equal or greater than its monthly average plus one standard deviation. It was found that the strength and position of two essential features of the circulation patterns, such as the trough emanating southward from the Icelandic low and the eastern cell of the subtropical high, are the governing factors in making suitable flows for the Saharan dust transportation toward Italy. The deep, well-developed trough near the Atlantic coasts of Europe and Africa, penetrating well to the south, and the strong eastern cell of the subtropical high situated to the north-east from North Africa near the Mediterranean coast, cause strong south-southwestern flows with the potential to carry dust northward into the Mediterranean. In extreme cases the dust can reach Europe north of the Alps and even northern Europe reaching the shores of the Baltic. This warm flows, accompanied by high dust load cause also considerable warming in the Central Mediterranean region of the order of 6-8 K at 700 hPa. Alternatively, the weak western trough and the weak eastern subtropical cell cause westerlies, which are inconsistent with the Mediterranean dust intrusions. Analysis of the extreme intrusion cases in July 1988, based on TOMS-AI data, and several others in July 2001-2003, based on lidar measurements in Rome, demonstrates the synoptic situation that allows the Saharan dust to reach Italy.