An integrated view of Saharan Dust advections: The DIAPASON (LIFE+) experience

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The "DIAPASON" Project (Desert dust Impact on Air quality through model Predictions and Advanced Sensors ObservatioNs, www.diapason-life.eu) funded by the EC LIFE+2010 program, aims at improving current methodologies for assessing the PM10 share due to Saharan dust advections in Europe (e.g., Directive 2008/50/EC and relevant Guidelines). To this goal, automated Polarization Lidar-Ceilometers (PLCs) were prototyped within DIAPASON and deployed at three sites, some 20 km apart from each other, across the Rome area. These systems were collocated with meteorological and air quality monitoring stations. PLCs had to demonstrate their capability at operationally "certifying" the presence, the horizontal coherence and the altitude extent of Saharan dust plumes.

Starting October 2013, a year-round, continuous monitoring of the aerosol profiles and of their physical properties at the ground has been carried-out detecting some thirty Saharan dust advections. Two intensive observation periods (IOPs) involving detailed chemical analysis and physical characterization of aerosol samples have also been carried out in collaboration with "networking" groups from various European research organizations. These IOPs took place during Saharan dust advections in Autumn 2013 and Spring 2014.

In conjunction with model forecasts, the wealth of data collected allowed to associate physical, chemical and mineralogical properties of Saharan dust to specific markers to be used routinely in the recognition and quantification of trans-boundary dust advections. These markers have been tested to provide environmental policy-makers with improved methodologies for the operational assessment of the presence and properties of Saharan advections. Figure 1 illustrates some of the variables observed between October 23 and November 2, 2013, that is during the Autumn 2013 IOP, at the Rome Tor Vergata site (see caption for details).

The presentation will address capabilities of the employed PLCs at identifying the presence and timing of Saharan dust advections, and of elevated aerosol layers in general (e.g., Fig 1d); capabilities and limits of some chemical and physical techniques at detecting and measuring properties of mineral dust aerosols in the real environment, and some new tools developed within DIAPASON to improve and simplify the evaluation of the PM10 mass share of Saharan dust advections.

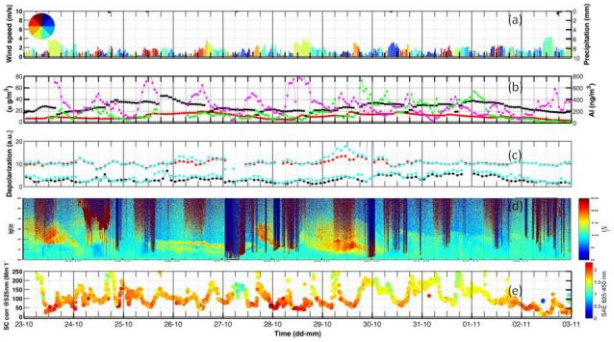

Figure 1. Time evolution of some of the physical and chemical variables observed between October 23 and November 2, 2013, at Rome Tor Vergata: a) wind speed and direction (colour code); b) Aluminum (green line) and Sodium (magenta line) hourly concentrations measured by PIXE analysis (right scale), plus ground PM10 (black line) and dust PM10 loads (red line) expected by the BSC-DREAM 8b model simulations; c) linear depolarization ratio at 500 m recorded by the Tor Vergata (red dots) and Castel di Guido (black dots) PLCs; d) contour plot of the Rome Tor Vergata PLC depolarization ratio between 0 and 6 km; e) record of the aerosol scattering coefficient (550 nm) and Angstrom exponent (colour code) as observed by the three-wavelength nephelometer at Tor Vergata.

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