DIAPASON: an user-oriented EC-LIFE+ Project to quantify the role of Saharan dust on European PM10 levels

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PM10 is a widely-employed to assess air quality. The current European Union Air Quality Directive 2008/50/EC allows no more than 35 exceedances per year of the daily-average threshold of 50 µg/m^3 while the PM10 yearly average should not exceed 40 µg/m^3. Considering the high levels of PM10 observed over a large part of Europe, these limits might result as rather stringent. The Directive 2008/50/EC also allows for subtraction of the natural contributions to the PM10 concentrations, after assessing the natural origin and relevant amount. In Mediterranean Europe the natural phenomenon which mostly affects PM10 concentrations is the transport of mineral dust from the nearby Sahara desert. In the central and western Mediterranean, such outflow of mineral dust reaches its maximum between Spring and Autumn, while minimizing in winter.

Under the Directive 2008/50/EC, the European Commission has recently released specific 'Guidelines' to quantify the contribution of natural sources to PM10 (EC, 2011). For Saharan dust, these Guidelines rely on back-trajectories, dust model forecasts and satellite observations coupled to ground PM10 concentration monitoring. The EC LIFE+2010 DIAPASON Project (*Desert dust Impact on Air quality through model-Predictions and Advanced Sensors ObservatioNs*, 2011-2015), intends to build on the capabilities of the current 'Guidelines' and explore possible improvements from the use of remote sensing devices. In this respect, at the core of DIAPASON is the prototyping of affordable Polarization Lidar-Ceilometers (PLCs) able to 'observe' the presence of dust plumes and thus 'certify' their loading in the lowermost atmosphere. Within DIAPASON PLC measurements will be used to define and validate an upgraded Saharan dust detection Methodology. The Project is implemented in the Pilot Region of Rome, in Central Italy, where three networked PLCs will monitor the altitude-resolved advections of Saharan dust for one year.

As the observational phase of DIAPASON has not started yet, an initial phase of the Project was devoted to the development of an effective, user-oriented tool to implement the current EC-Guidelines. To this purpose, DIAPASON has implemented a Graphic User Interface (GUI) (Fig.1) to allow an easy evaluation of the Saharan dust contribution to the PM10 records in a given area. This tool, adaptable to any European site/region/area and freely available upon request, is currently routinely used by the Italian Regional Agency in charge of Air Quality monitoring in the Lazio region (ARPA-Lazio).

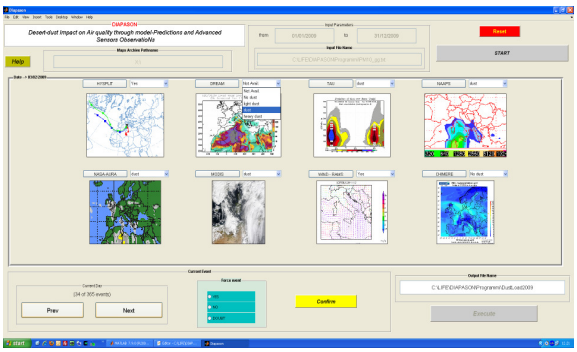

Figure 1. DIAPASON GUI to apply the EC Guidelines

Potential improvements of the current EC-Guidelines are also under evaluation. These include overcoming the selection of a Regional Background site (RB), as prescribed by the EC Guidelines. In fact, in Italy, PM10 monitoring sites "purely" representative of rural background conditions are difficult to find and the choice of the RB was found to be critical in the EC-Methodology outcome. DIAPASON is therefore investigating the use of the out-of-dust record in each single PM10 monitoring site as a 'background reference' for the evaluation of a Saharan dust load at the same site (self-calibration method, Gobbi et al. 2013). An example of the outcome of such a modified approach is given in Fig. 2. Major pro and cons of the new approaches under investigations will be discussed.

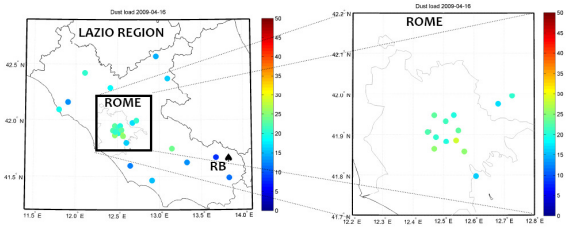

Figure 2. Example of dust load (µg/m^3) derived from a modified version of the EC Guidelines.

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EC (2011) *Establishing guidelines for demonstration and subtraction of exceedances attributable to natural sources under the Directive 2008/50/EC on ambient air quality and cleaner air for Europe,* SEC(2011), 208, 2011.

Gobbi et al. (2013), *Atm. Chem. Phys. Disc.*, 13, 4963-88