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Using operational active remote sensing devices to detect Saharan dust advections and evaluate their contribution to the PM10 levels: The EU LIFE+ "DIAPASON" project

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The contribution of Saharan-dust advections to both daily and annual PM average mass concentrations can be significant all over Southern Europe. The Directive 2008/50/EC allows subtraction of PM10 exceedances caused by natural contributions from the statistic used to determine air-quality levels in Europe. To this purpose, the Commission Staff Working Paper 6771/11 (EC, 2011) provides specific Guidelines on methods to quantify and subtract the contribution of these sources in the framework of the Air Quality Directive. For Saharan dust, the EC methodology is largely based on a thorough analysis performed over the Iberian Peninsula (Escudero et al, 2007), although revision of the current methodology is in progress. In line with the EC Guidelines, the DIAPASON project ("Desert-dust Impact on Air quality through model-Predictions and Advanced Sensors ObservatioNs"), funded under the EC LIFE+ program, has been formulated to provide a robust, user-oriented, and demonstrated method to assess the presence of desert dust and evaluate its contribution to PM10 levels at the monitoring sites. To this end, in addition to satellite-based data and model forecasts already included in the EC Guidelines, DIAPASON will take advantage, in both the Project implementation and demonstration phase, of innovative and affordable technologies (partly prototyped within the project itself), namely operational Polarization Lidar-Ceilometers (PLC) capable of detecting and profiling dust clouds from the ground up to 10 km altitude. The PLC prototypes have been already finalized during the initial phase of the Project. Three of them will be networked in relevant air quality monitoring stations located in the Rome metropolitan area (Italy) during the DIAPASON observational phase (one-year long field campaign) starting in March 2013. The Rome region was chosen as the DIAPASON pilot scale area since highly impacted by urban pollution and frequently affected by Saharan dust transport events. In fact, a preliminary assessment of the role of Saharan dust in this area, based on a four-year dataset (2001-2004) has shown average increases of PM10 levels of the order of 11.9 μg/m3 when Saharan dust presence is either predicted by models or observed by a depolarization lidar. Conversely, PM10 increases computed relying only on the Lidar detections (i.e. presence of dust layers actually observed) were of the order of 15.6 μg/m3. Both analyses indicate the annual average contribution of dust advections to the city PM10 mass concentrations to be of the order of 2.3 μg/m3 (Gobbi et al., 2013). These results confirm Saharan advections in the central Mediterranean as important modulators of PM10 loads and exceedances.
After the demonstrative pilot scale study, the DIAPASON results will be spatially generalised to a wider area. The final DIAPASON methodology to detect/quantify the Saharan dust contribution to PM10 will be tailored for a national scale application, and easily transferable to other air-quality and meteorological agencies in Europe.
In this work, preliminary results from the combined analysis of Saharan dust model predictions, PM10 data and lidar records performed within DIAPASON will be shown, with particular focus on the added–value provided by continuous polarization lidar data in integrating the present EC Methodology.

- EC, Commission Staff Working Paper 6771/11 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, European Commission, 2011.
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