Temporal variability of mineral dust in southern Tunisia: analysis of 2 years of PM_{10} concentration, aerosol optical depth, and meteorology monitoring

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The south of Tunisia is a region very prone to wind erosion. During the last decades, changes in soil management have led to an increase in wind erosion. In February 2014, a ground-based station dedicated to the monitoring of mineral dust (that can be seen in this region as a proxy of the erosion of soils by wind) was installed at the Institut des Régions Arides (IRA) of Médenine (Tunisia) to document the temporal variability of mineral dust concentrations. This station allows continuous measurements of surface PM_{10} concentration (TEOM™), aerosol optical depth (CIMEL sunphotometer), and total atmospheric deposition of insoluble dust (CARAGA automatic sampler). The simultaneous monitoring of meteorological parameters (wind speed and direction, relative humidity, air temperature, atmospheric pressure, and precipitations) allows to analyse the factors controlling the variations of mineral dust concentration from the sub-daily to the annual scale.

The results from the two first years of measurements of PM_{10} concentration are presented and discussed. In average on year 2014, PM_{10} concentration is 56 µg m^{-3}. However, mineral dust concentration highly varies throughout the year: very high PM_{10} concentrations (up to 800 µg m^{-3} in daily mean) are frequently observed during wintertime and springtime, hardly ever in summer. These episodes of high PM_{10} concentration (when daily average PM_{10} concentration is higher than 240 µg m^{-3}) sometimes last several days (Fig. 1).

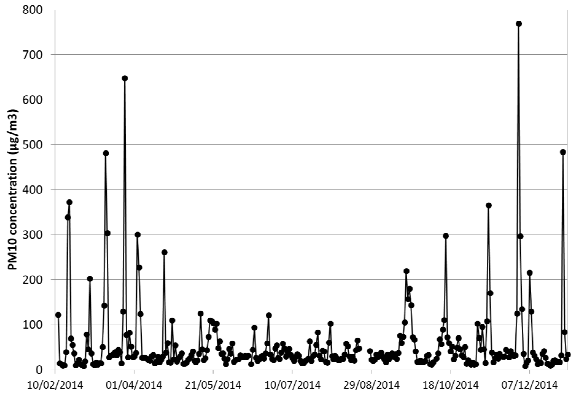

Figure 1. Daily mean of PM_{10} concentration (in µg m^{-3}) from 10 February to 31 December 2014.

By combining local meteorological data, air-masses trajectories, sunphotometer measurements, and satellite imagery, the part of the high PM_{10} concentration due to local emissions and those linked to an advection of dusty air masses by medium and long range transport from the Sahara desert is quantified.