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Magnetic properties of atmospheric particulate matter (PM10) in the Latium region (Italy): an empirical approach to evaluate natural and anthropogenic inputs

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We report the results of a systematic study on the magnetic properties of fine atmospheric particulate matter (PM10) samples collected by six automatic stations operating in the Latium region (Italy) for continuous monitoring of air quality. Two air monitoring stations are within the town of Rome, whereas the other four represent different scenarios through the Latium territory, including provincial towns, industrial and rural environments. The magnetic data span the period July 2004-July 2005. The aim of this study was to set up an experimental protocol for the use of magnetic properties as proxies for the identification of the natural and anthropogenic PM10 sources and to define the magnetic characters of various populations of fine atmospheric particles. For each station, we measured the low-field magnetic susceptibility of all the daily air filters, and derived an empirical linear correlation linking magnetic susceptibility to the concentration of PM10 produced by local sources, in absence of significant exogenous PM10 inputs. An experimental approach was then suggested for estimating the percentage of non-magnetic PM10 transported from natural far-sided sources (i.e., dust from North Africa and marine aerosols). Moreover, we carried out a variety of additional magnetic measurements to investigate the magnetic mineralogy of selected air filters spanning representative periods. The data indicate that the magnetic fraction of PM10 consists of a mixture of low-coercivity, magnetite-like, particles with a wide spectrum of grain sizes related to a variety of natural and anthropogenic sources. The natural PM10 component has a magnetic signature that is indistinguishable from that of eolian dust, while the anthropogenic PM10 fraction, mostly originated from circulating vehicles and similar to the one also found in Zurich (Switzerland), is a mixture of fine superparamagnetic particles and of subordinate large multidomain grains.