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# Magnetic properties of atmospheric particulate matter from automatic air sampler stations in Latium (Italy): toward a definition of magnetic fingerprints for natural and anthropogenic $PM_{10}$ sources

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Atmospheric particulate matter with dimensions less than 10 micron ($PM_{10}$) is known to be harmful for human health. Environmental problems linked to the concentration of $PM_{10}$ in urban settings have therefore both attracted the attention of media and stimulated specific scientific researches in recent years.

This study reports a systematic examination of the magnetic properties of $PM_{10}$ samples collected by six automatic stations operating by Regione Lazio for continuous monitoring of air quality. The study was undertaken in the framework of a cooperative Project between INGV, Regione Lazio and ARPA Lazio and it is funded by Regione Lazio. The magnetic data span the period since August 2004. Two of the considered air monitoring stations are within the town of Rome, whereas the other four represent different cases and various scenarios of anthropogenic pollution through the Latium territory.

We measured the low-field magnetic susceptibility of each air filter, representing a daily collection of $PM_{10}$ at each station. Magnetic susceptibility values were then compared to the $PM_{10}$ concentration values. The trends observed in the values of the two properties during the whole period of observation allow the recognition of time intervals characterized by a magnetically uniform source of $PM_{10}$ and time intervals during which the variations in the values of the two properties do not appear directly

related. After selection of properly “quiet” time intervals we derived for each station an empirical correlation factor between magnetic susceptibility and the concentration of $PM_{10}$ from local anthropogenic sources (i.e. combustion exhausts from motor vehicles). An experimental approach is then suggested to calculate the relative percentage of non-magnetic $PM_{10}$ fraction deriving from natural far-sided sources (i.e., dust from North Africa in the specific case).

Moreover, for some selected air filters, spanning representative periods, we carried out a variety of additional magnetic measurements to investigate the details of the magnetic mineralogy. In particular, the coercivity distribution of each sample is calculated from detailed demagnetization curves of anhysteretic remanent magnetization (ARM) and is modelled using a linear combination of appropriate functions which represent the contribution of different sources of magnetic minerals to the total magnetization. The results from this additional magnetic experiments allow to refine the understanding on the nature and sources of magnetic particles in the atmospheric $PM_{10}$. The overall aim of this study is to define a magnetic fingerprint for various populations of fine atmospheric particles and to set up an experimental protocol for the use of magnetic properties as reliable proxies for the identification of the natural and anthropogenic $PM_{10}$sources.