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# Tracing transfer processes of metal pollutants from soils to surface water using environmental magnetic techniques – results from Paris suburbia (France)

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Major river systems in Europe are potential sinks for environmental pollutions and therefore reflect the consequences of European industrialization and urbanization. Surface water pollution is a major concern for the health of the population and its related ecosystems as well as for the water quality. Within the variety of different typical pollutants in a river watershed, the metallic fraction embraces many toxic/dangerous contaminants. Each of these elements comprises different sources and follows specific processes throughout its pathways from its origin to and within the river system. But the detection, estimation and follow up of the different contaminants is highly complex.

Physico-chemical techniques such as environmental and rock magnetics are powerful complementary tools to traditional methods because they comprise the possibility to trace the entire metal fraction and do offer the possibility to perform spatio-temporal analyze campaigns directly in the field and on a relative high number of samples from both the river and the adjacent areas (suspended particular matter, soils, dust, sediments, etc).

In this study, we took advantages of the recent results on the Seine river (France) that have shown the high potential of environmental magnetic methods to estimate the metal fraction in suspended particular matter samples, and to allow the discrimination of its natural detrital, biogenic or anthropogenic origin (see parallel EGU abstract of Kayvantash et al. in this session). We focused on a suburban agricultural area west of Paris (Pierrelaye-Bessancourt) adjacent to the Seine river, which suffers from a high accumulation of heavy metal pollutants caused by long-term historical irrigation with urban waste waters. For the time being, these heavy metals seem to be geochemically fixed in the surface layer mainly by the soil organic matter. Future land use planning, however, arises questions on the fate of these pollutants and their potential remobilization by acidification (forestation, lixiviation by rain water, etc). Such anthropogenic metal phases were found in the suspended particular matter of the Seine river system, but the transfer mechanisms and pathways from the polluted soils to the surface waters are not yet fully understood and lack high resolution quantitative methods.

In this work we aime at calibrating the environmental magnetic measurements that are tested as complementary tracer tools in combination with more classical geochemical analyses. We performed a magnetic cartography using susceptibility along a topographic profile from the different types of polluted soils (agricultural soil, forest deposits, waste land, flooding plains, etc) towards the surface waters (sediment traps of suspended particular matter) draining this area. The results were compared with laboratory susceptibility and elementary composition (XRF) analyses on the freeze dried bulk samples to evaluate the field work approach. Detailed magnetic hysteresis analyses were used to obtain additional information on the magneto-mineralogy and grain-size distribution in order to deconvolute the magnetic bulk signal in terms of the different “natural” and “anthropogenic” ferruginous phases present in the samples and therefore allowing a better tracking of the pathways of the metallic pollutants.