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To what extent does the environmental magnetism technique acts as a way of assessing the uptake of atmospheric particles by plants?

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Numerous studies have already shown the possibility of tracing the sources, the compositions, and the concentration of atmospheric pollutants deposited on plant leaves. In environmental geochemistry, inter-element and isotope ratios from chemical element assays have been used for these purposes. Alternatively, environmental magnetism represents a quick and inexpensive asset that is increasingly used as a relative indicator for concentrations of air pollutant on bio accumulator surfaces such as plants. However, a fundamental issue is still pending: Do plants in urban areas represent a sink for fine particles that is sufficiently effective to improve air quality? This is a very topical issue because some studies have shown that the foliage can trap fine particles by different dry deposition processes, while other studies based on CFD models indicate that plant hedges in cities can hinder the atmospheric dispersion of pollutants and therefore increase pollution at the level of emission sources such as traffic. To date, no consensus was made because several factors not necessary well known must be taken into account, such as, PM concentration and size, prevailing wind, surface structures, epicuticular wax, to mention just a few examples. A first step toward the understanding of the impact of urban greens on air quality is the precise determination of the deposition velocity (Vd) parameter. This latter is specific for each species and it is most of the time underestimated in modeling-based studies by taking standard values.
In that perspective, we built a wind tunnel (6 m long, 86 cm wide and 86 cm high) to perform analogical experiments on different endemic species. All parameters are controlled, i.e, the wind speed, the nature and the injection time of pollutants (Gasoline or Diesel exhausts, brakes or tires dust, etc...). We can provide the PM concentrations upwind and downwind of natural reconstituted hedges by two dustmeters (LOACs - MétéoModem). Beforehand, parameters such as the hedge resistance (%) or the leaf area index (LAI) have been estimated for each studied specie to allow comparability between plants removal potential. The interest would ultimately combine PM concentration measured by size bins from the LOACs with magnetic measurements (ARM, IRM100mT, IRM300mT and SIRM) of plant leaves. The idea is to check whether it would be possible to precisely determine in situ the dust removal rate by urban greens with environmental magnetism measurements. Up to now, we have carried out on different endemic species such as Elaeagnus x ebbingei leaves and Mediterranean

pine needles, the results of which will be presented.