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CHARACTERISATION OF THE WET AND DRY ATMOSPHERIC DEPOSITION OVER LEÓN - NW SPAIN

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Aerosol atmospheric deposition is the ultimate path by which particles and trace gases are removed from the atmosphere. This process can occur through precipitation scavenging (wet deposition), or by direct sedimentation during periods without rain (dry deposition) (Seinfeld and Pandis, 2016).

The chemical composition of the wet and dry deposition can offer insights into local pollutant emission sources, and also the effects of emissions transported over long distances (like those from Saharan dust intrusions or forest fires events).

Based on a long monitoring campaign, the goal of this research is to characterise atmospheric particulate matter deposition in León city in terms of aerosol fluxes, chemical composition and sources with a special focus on origin of the air mass.

Sampling was carried out in León city, Spain, at NW of the Iberian Peninsula. Two sampling sites with different characteristics were selected: 1) the top of a public building located in downtown León, at a height of around 20 m above street level (42°35´59.5“N, 5°34´34.3“W), classified as roadside, and 2) the top of the Faculty Veterinary Medicine building at the University of León (42°36'47.4"N 5°33'27.3"W), at a height of around 12 m above street level, located in a suburban area at NE of the city center of León. This second site is characterised by the absence of large emitting industries and classified as an urban background site. The sampling took place simultaneously at the two places (for most of the campaign time). Daily rainwater samples were collected between January 2022 and May 2023 with two Eigenbrodt model UNS130/E automatic collectors, both equipped with an dry sample container unit. The dry deposition samples were collected during the same period, on a weekly basis. The meteorological parameters (temperature, wind and relative humidity) were continuously recorded by an automatic weather station. The physical characteristics of rain (drop size distribution, rain intensity, falling velocity, etc.) were measured with a laser precipitation monitor on a 1-minute basis. Air mass trajectories were also analysed using HYSPLIT-model. To segregate the soluble substances from the insoluble ones, the samples were passed through quartz fiber filters, which was previously calcinated at 600 ˚C for 6 hours. Quartz filters of water insoluble fraction of rain and dry deposition samples were used for the determination of the carbon content (EC, WIOC – water insoluble organic carbon and WITC - water insoluble total carbon), by a thermal-optical method. Whereas the particulate WIOC fraction can be investigated by examining filterable OC of rain, the dominant fraction of particulate OC which is water soluble (WSOC) cannot be directly determined in rain. The ratio between the concentrations of WSOC and WIOC in aerosols (data from other research work) has been used to estimate the contribution of organic particles to the global pool of dissolved organic carbon (DOC) in rainwater. DOC was determined by a total organic carbon analyser. The filtrate was also used for analysing inorganic ions (by ionic chromatography) such as F^-, Cl^-, NO_2^-, Br^-, NO_3^-, PO_4^{3-}, SO_4^{2-}, Na^+, NH_4^+, K^+, Ca^{2+}, Mg^{2+}. Dry deposition fluxes were calculated based on dry deposition velocities found in existing literature and concentration levels observed in our research.

Table 1. Summary with dry and wet days and number of samples collected during the period studied. *until May

			Roadside		Urban background	
			Number samples		Number samples	
Year	Dry days	Wet days	Dry dep.	Wet dep.	Dry dep.	Wet dep.
2022	240	125	48	84	23	96
2023*	102	49	24	31	24	41

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Seinfeld, J.H. et al. (2016) Atmospheric Chemistry and Physics: From Air Pollution to Climate Change, 3rd Ed. John Wiley & Son, NewJersey.