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Turbulence influence on urban air pollution in a hot spot in Madrid: comparison of winter and summer field campaigns

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Air pollution is a major problem in the city of Madrid during weak synoptic forcing, since the presence of atmospheric stability conditions often develops night surface-based thermal inversions and subsidence inversions during daytime for several consecutive days, reaching high levels of NO_x and Particulate Matter (PM) concentration. In this context, the TECNAIRE-CM (Innovative technologies for the assessment and improvement of urban air quality) research project has developed two field campaigns along 2015 (winter and summer) in a hot spot in the city of Madrid (Fernández Ladreda square). This hot spot includes one important intersection of different streets and also the start of the A42 motorway, which crosses down the square through a tunnel of about 150 m length. Besides, the location has numerous traffic lights and a lot of pedestrians walking in the vicinity.

In addition to direct measurements related to air quality, data from different meteorological variables were recorded in order to characterize the atmospheric conditions. Moreover, two sonic anemometers where deployed to carry out a micrometeorological assessment of physical processes that take place in the urban atmospheric surface layer (TKE, friction velocity and sensible heat flux were evaluated).

The evolution of the turbulence will be analyzed and compared for both campaigns (winter and summer), searching for the key seasonal differences as well as the importance of the different scales influencing the diffusion of pollutants (from multi resolution flux decomposition –MRFD- analysis). Specific case studies corresponding to high levels of pollution will be studied in detailed, to understand local pollution dynamics under the influence of both high traffic density and low turbulence situations.

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