

NUMERICAL AND EXPERIMENTAL STUDY OF AIR QUALITY IN THE PAMPLONA DOWNTOWN (NAVARRA, SPAIN)

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Abstract: Nowadays, the improvement of urban air quality is one of the most important environmental challenges. A significant part of the emissions are released inside cities and here is where people live. Hence, it is important to study pollutant dispersion inside urban canopy, where there are complex patterns of airflow affecting pollutant concentration fields.

In this aspect, Computational Fluid Dynamics (CFD) models are attractive tools, which solve explicitly the airflow and pollutant dispersion around the buildings. However, these models should be compared to experimental measurements to understand the physical processes and to validate their simulations. In this study, the effects of upper-scale wind direction on airflow and pollutant dispersion over a real urban area (downtown of Pamplona) are studied by means of numerical simulations and experimental measurements. Pamplona is a town of about 200 000 inhabitants located in Navarra, in the northern area of Spain.

A set of 16 different inlet wind directions are simulated using a CFD model based on the steady state Reynolds Averaged Navier-Stokes equations (RANS) and the standard k-turbulence model. Using these simulations and taking into account other factors for pollutant emissions such as the number of cars inside each street, the length of the streets, etc, the computed concentrations are compared against mean experimental concentrations recorded in selected points within the studied area. The selected period chosen for the comparison with model simulations was January and February 2007, because in winter periods pollutants are expected to be less affected by atmospheric chemistry. Temporal series of NO_x and PM_{10} and spatial differences in pollutant concentrations of NO_2 are analysed. A high influence of urban boundary layer dynamics (wind flow features) inside the streets on concentration of pollutant is observed.