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Experimental study on dispersion and physicochemical temporal evolution of industrialized pollutants in a North Sea costal environment

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During summer 2009, an experimental campaign was realized in an industrialized coastal environment of the North Sea. In this coastal area, pollutant sources generate hazardous pollution episodes in the urban zones which are subject to significant industrial and maritime influences, especially during the sea breeze circulation. The aim of this experiment is to study the emission of pollutants, their transport, their dispersion and the physicochemical temporal evolution of the aerosols phase in the lower troposphere. The observations were carried out using ground-based remote sensing instruments, meteorological and air quality surface stations, over the Dunkerque area, in the north of France. Two angular lidars (aerosols lidar and Differential Absorption Lidar) and a wind profiler (sodar) have been combined to determine the vertical and horizontal dispersion of aerosols and to follow the industrial pollutant plumes. Lidar scanning speeds were adjusted to have a high temporal and spatial resolution to study the pollutant plumes dynamics. Moreover, both lidars have been used to analyse the dynamics and the structure of the Atmospheric Boundary Layer (ABL).
In the surface layer, three wind-velocity components, friction velocity and turbulent heat flux (to deduce the atmosphere dilution capacity) were measured from an ultrasonic anemometer. In order to analyse the aerosols physicochemical evolution (particle number size distribution, particle formation events…), a Scanning Mobility Particle Sizer (SMPS) has been combined to the air quality network and to the surface meteorology ground stations. The results obtained allow us to identify different meteorological events responsible for pollution peaks in this costal area.