



Evolution of the nocturnal stratification and vertical ozone concentrations of the lower troposphere in an industrialized coastal environment of the North Sea

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The structure of the lower troposphere and vertical ozone concentrations have been studied during sea breeze event in an industrialized coastal area of the North Sea. During this campaign, ground-based remote sensing systems (lidar and sodar) were deployed over the Dunkerque area (51 N, 2.20 E), in the North of France, together with surface meteorology and air quality network stations. Dynamics and dispersion of pollutants in the lower troposphere have been analysed by experimental results associated with 3D non hydrostatic model Meso-NH data. We present here the effects of the sea breeze and the synoptic wind on the nocturnal lower troposphere stratification and on the vertical ozone concentrations. The structure of the lower troposphere observed by the lidar during the sea breeze episode changed at the beginning of the evening. Above the gravity current, an air mass consisting of a horizontal multilayer structure was observed at an altitude between 300 m and 600 m. The study of this structure, by the lidar and the model Meso-NH, suggests a relationship between this multilayer structure and meteorological parameters vertical profiles (wind speed, water vapour mixing ratio and the potential temperature). Moreover, high ozone concentrations (up to 200 $\mu\text{g}/\text{m}^3$) were measured inside this multilayer structure and correspond to the maximum ozone concentration obtained during this day in the lower troposphere (up to 1400 m). In the middle of the night, the change of the synoptic wind direction implies a ramification of the lower troposphere between 200 m and 1000 m

characterised by the presence of two different residual layers. Simultaneously, near the ground, a double stable layer structure has been detected by the lidar up to 200 m which is persisted during the morning and inhibits the development of the mixing layer. This phenomenon can potentially increase the concentrations of pollutant in this industrialized coastal area.