6.22 CHARACTERISATION OF THE DISPERSION OF A POWER PLANT PLUME ON COMPLEX TERRAIN UNDER WINTER CONDITIONS

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The characterisation of atmospheric pollutant dispersion (advection+turbulent diffusion) requires a detailed description of the wind and turbulence fields, especially on complex terrain. The objective of this study is to describe the atmospheric dispersion of the emissions from a power plant with a 343-meter-tall chimney, situated on very complex terrain in the North-East of Spain, under winter conditions.

In this region during winter, advective conditions are associated with North-Westerly moderate-to-strong winds with low to moderate temperatures. Under these conditions, the plume is transported with low transversal dispersion and it is deformed essentially due to the effect of mechanical turbulence. Under this dispersion scenario, the main surface impacts appear at long distances from the emission source (more than 30 km).

By experimentation and modelling, the study attempts to characterise both the advection (through the reconstruction of 3 D wind fields) and the turbulent dispersion present during the period of analysis. Systematic SO2 plume tracking was carried out for 3 days, by means of a vehicle equipped with a COSPEC (COrrelation SPECtrometer). This passive remote sensor utilises solar radiation to obtain SO2 concentration distribution measurements aloft and around the emission source [1]. In addition, the study used a non-hydrostatic mesoscale meteorological model MM5 [2]coupled to a Lagrangian Particle Dispersion (LPD) Model FLEXPART [3].

The results show that the coupled models are able to predict the plume integral advection from the power plant on very complex terrain. Comparison between experimental and simulated transversal dispersion shows an index of agreement between 80% and 90%, within distance ranges from 6 to 33 Km from the stack. Linked to the orographic features, the simulated plume impacts on the ground more than 30 km away from the stack, because of the lee waves simulated by the FLEXPART.

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[2] Grell, G.A.; Dudhia, J. and Stauffer, D.R.; 1994: A description of the fifth-generation Penn State/NCAR mesoscale model (MM5). NCAR/TN-398+STR (1994), 138 pp.
[3] Stohl, A. ; 1999: The FLEXPART particle dispersion model. User Guide.