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# A study of dispersion in complex terrain under winter conditions using high-resolution mesoscale and Lagrangian particle models

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Abstract. A mesoscale model (MM5), a dispersive Langrangian particle model (FLEXPART), and intensive meteorological and COrrelation SPECtrometer (COSPEC) measurements from a field campaign are used to examine the advection and turbulent diffusion patterns associated with interactions and forcings between topography, synoptic atmospheric flows and thermally-driven circulations. This study describes the atmospheric dispersion of emissions from a power plant with a 343-m tall chimney, situated on very complex terrain in the North-East of Spain, under winter conditions. During the field campaign, the plume was transported with low transversal dispersion and deformed essentially due to the effect of mechanical turbulence. The main surface impacts appeared at long distances from the emission source (more than 30 km). The results show that the coupled models (MM5 and FLEXPART) are able to predict the plume integral advection from the power plant on very complex terrain. Integral advection and turbulent dispersion are derived from the dispersive Lagrangian model output for three consecutive days so that a direct quantitative comparison has been made between the temporal evolution of the predicted three-dimensional dispersive conditions and the COSPEC measurements. 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 MM5.

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