



Dispersion modelling over complex terrain in the Bolzano basin in the Alps: comparison of CALPUFF results with diagnostic and prognostic input fields.

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Air quality assessments over complex terrain, performed with coupled meteorological and dispersion models, still pose many challenges, due to the inherent difficulties in accurately modelling both atmospheric and dispersion processes. An example is offered by the incinerator of the city of Bolzano, in the Central Italian Alps, which became operative in July 2013. This new plant required policy makers to improve the forecast of dispersion processes within the Bolzano basin, especially when weather conditions lead to critical air quality episodes, such as during wintertime ground-based thermal inversions under calm conditions. Accurately reproducing meteorological fields is essential prerequisite to obtain reliable dispersion patterns but, over such a complex terrain, it is a challenging goal due to the development of local specific features as up- and down-valley winds, flowing in each valley tributary into the basin. Dispersion modelling is conducted with the CALPUFF model, simulating an hypothetical release of a tracer from the incinerator chimney, and two different methods for the simulation of input meteorological fields are tested: a diagnostic reconstruction by means of the CALMET pre-processor, and a prognostic reconstruction, obtained with the Weather Research and Forecasting (WRF) model ran in data assimilation mode. Both approaches use a rich dataset of in-situ observations: surface temperature and wind speed and direction from eight surface weather stations; a vertical wind profile, up to 400m, from a SODAR; and a vertical temperature profile, up to 1000m, from a thermal profiler. While the diagnostic approach is easier to implement and more likely to use in regulatory applications, it is obviously limited in catching specific features of such complex fields. On the other hand, the prognostic approach allows more detailed results but still represents a research application and requires demanding efforts to apply. Comparing results of these methods allows to identify main deficiencies in the diagnostic approach and to develop some strategies in order to improve its results.