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High resolution meteorological modelling of the Inntal valley atmosphere, Part II: applications to dispersion modelling

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Orography and local meteorology play a major role in Alpine valleys, as they are linked with valley and slope wind systems, stagnation and recirculation, temperature inversions and turbulence. Thus, they have a strong influence of transport and dilution of pollutants in the valley, affecting human health, and sound propagation.

Shallow stable layers at the valley floor and low wind speed conditions, especially in autumn and winter, trap pollutants and thus cause unfavourable dispersion conditions , possibly leading to exceedances of air pollution limits. Moreover, under certain synoptic conditions such as persistent high-pressure systems inversion conditions prevail for days. Emissions may accumulate in the valley from day to day and thus critical levels of pollutants may be reached.

With the current computer capabilities, numerical meteorological models and particle dispersion models are powerful tools to investigate such situations and their impact on emission-side measures. Output from the limited area meteorological model MM5 for selected synoptic periods of special interest regarding air quality conditions (see contribution by Schicker et al., this session) will be used as input to the Lagrangian particle dispersion model FLEXPARTv6.2. Currently two specific versions of FLEXPART exist to work in the meso and local scale, WRF-FLEXPARTv6.2 and MM5v3-7.FLEXPARTv6.2, which use WRF and MM5 fields as meteorological input, respectively. Extensive tests will be performed with the MM5-driven version and additional preliminary ones with the WRF version.

Dispersion calculations for CO and NOx will be performed in a receptor-oriented approach for three stations and with different meteorological input resolutions. The target stations will be Innsbruck, located at the bottom of the Inn valley, and Nordkette, located on the northern slopes of the valley. Source-receptor sensitivities (SRS) will be obtained to see the major sources which contribute to the measurements for those specific episodes, and the differences existing between locations, heights and input resolutions will be evaluated. Comparison of the modelled ambient concentrations with the measured ones will also be performed by folding the SRSs with an emission inventory. Quantitative evaluation will be provided through parameters such as RMSE, BIAS and correlation.