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High resolution meteorological modellingof the Inn Valley atmosphere, Part I

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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. However, alpine valleys and other complex topographical areas require very high resolutions to ensure accurate representation of the physical processes. Typically, the highest resolutions used nowadays in episodic simulations with models such as, e.g., RAMS, WRF, or MM5, are around 1 km. This still smooths the orography, cutting the peaks and raising the valley bottoms.

In this work a comparison of the simulation of the valley atmosphere with two meteorological models, MM5 and WRF, with high horizontal (0.6 km to 0.2 km) and vertical resolutions (35 to 39 half-s levels) is carried out for selected scenarios in which levels of pollutants exceeded air pollution limits. For a better representation of the orography SRTM 3" topography data is used in MM5 for resolutions below 1 km ($\sim$ resolution of SRTM 30" data), WRF will be tested only with SRTM 30" due to computational time constraints. The evolution of the valley atmosphere is studied using different PBL schemes available in the models as well as land-use representations. Rawinsonde data of the Innsbruck airport station and observation data of Innsbruck University and Patscherkofel will be used for comparison.

These high-resolution simulations are very demanding in computational terms. Therefore, an evaluation of the computer demands of each of the simulations is also carried out.

In order to asses the influence of this high resolution meteorological modelling on air quality conditions, further work with a dispersion model/chemistry model will be carried out and compared to observations (see contribution by Arnold et al., this session).