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Generation of highly resolved wind climatologies in the Alpine region at the 100 m scale

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To foster the investigation of climate change effects in the Alpine region, wind fields of the ERA-40 re-analysis dataset are downscaled with a hybrid dynamical/diagnostic approach from ˜100 km horizontal grid spacing to the micro scale (200 m). The work is part of the Austrian project Research for Climate Protection: Model Run Evaluation (reclip:more).

The first step of the wind-downscaling method is based on dynamical downscaling by applying the PSU/NCAR model MM5 to create atmospheric fields at 5 km horizontal grid spacing. Since further dynamical downscaling of long periods (e.g., decades) would exceed current computing resources, hourly time slices from MM5 are used to initialize a modified version of the mass-consistent flow-model CALMET, which approximates the 3-dimensional air-flow within the planetary boundary layer under consideration of kinematic terrain effects, thermo-dynamical blocking effects, and slope flows at the targeted horizontal grid spacing of 200 m.

The wind-downscaling system has been applied to the Hohe Tauern region in the Eastern Alps during 7 August to 15 November 1999. Comparisons with observational data from the Mesoscale Alpine Programme point out that the downscaling systematically reduces biases when compared to the mesoscale driving data: at wind speeds above 5 m/s the bias of speed is reduced by about 0.7 m/s (20 % of the total bias), below 5 m/s a bias reduction of about 1.2 m/s is achieved (50 % of the total bias). Directional biases virtually disappear up to speeds of 15 m/s. Furthermore, results from inspecting wind-climatologic aspects are presented and next steps of advancing the wind-downscaling system are outlined.