Geophysical Research Abstracts
Vol. 13, EGU2011-8265, 2011
EGU General Assembly 2011

The Interruption of Alpine Foehn by a Cold Front: A Modeling Case Study

Erika Dautz (1) and Alexander Gohm (2)

(1) ForWind, University of Oldenburg, Germany (erika.dautz@forwind.de), (2) Institute of Meteorology and Geophysics, University of Innsbruck, Austria

The interaction of Alpine foehn winds with a cold front is investigated by means of numerical simulations conducted with the Weather Research and Forecasting (WRF) Model.

For this purpose a foehn event has been chosen that occurred during the Special Observing Period (SOP) of the Mesoscale Alpine Programme (MAP). On 06 November 1999 a cold front impinged on the Alps and caused the breakdown of the foehn flow. The investigation mainly focuses on the Austrian Inn- and Wipp Valley. The results from the mesoscale model are compaired against the available data set, including observations from surface stations, radiosondes and a Doppler wind lidar.

The nested model runs capture this event on a wide range of temporal and spatial scales. Statistical error measures reveal that near-surface parameters are simulated very well during foehn, however, cold air pools are reproduced rather poorly. Furthermore, the model is able to simulate small-scale flow features such as the formation of a rotor in the Inn Valley. The structure of the cold front which approached the Alps from the northwest is highly modified as it passes the mountain barrier, horizontally and vertically. It enters the Inn Valley in the morning hours of 06 November via Seefeld, the Achen and Brandenberg Valley, via Kufstein and the Fernpass. Mass flux calculations indicate that the major part of the cold air is transported via Brandenberg and that the inflow via Kufstein is a short-time phenomena. From the various tributaries two gust fronts propagate along the Inn Valley against each other and collide east of Innsbruck. As the cold front enters the Wipp Valley and impinges on the opposing foehn flow, it shows at density-current nature. An additional high-resolution simulation shows the main characteristics like an elevated head with a wake behind it, a rear-to-front inflow exceeding the propagation speed and a shallow layer of backflow near the surface. The propagation speed increases to the south of the valley which is in contrast to the observations. Sensitivity tests show that the quality of the simulations depends strongly on the used initial and boundary condition data sets. Particularly, they affect the timing of the cold front.