

Foehn-cold pool interactions in the Inn Valley during PIANO IOP2

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Foehn in Alpine valleys is characterized by rapid changes in wind speed and direction. This poses hazard to aviation and has an impact on the pollutant concentration in the valleys. Therefore, an accurate forecast of foehn breakthrough and its interruption in valleys is crucial. In order to improve the forecast, the main mechanisms controlling these transient phases have to be better understood. Often the initial stage is characterized by a stably stratified cold air pool (CAP) in valley and a foehn flow aloft. This CAP has to be removed prior to the foehn breakthrough at the valley floor. Various processes are discussed in literature, however, no systematic study exists capturing the different mechanisms explicitly. For this reason, a measurement campaign was conducted in autumn and early winter 2017. The campaign is part of the research project “Penetration and Interruption of Alpine Foehn (PIANO)” and took place in the Wipp Valley and Inn Valley (Austria), with a special focus on the region of Innsbruck.

In this presentation a case of the second Intensive Observation Period (IOP2) from 3 to 5 November 2017 is presented. The analysis is based on data from temperature and humidity loggers, automatic weather stations, radio soundings, eddy-covariance stations and four Doppler wind lidars. From the latter, spatio-temporal information about the three-dimensional wind field was retrieved. During IOP2, foehn prevailed above the CAP for more than 30 hours until it finally broke through at the valley bottom. Within this period different phases of foehn-CAP interaction could be identified, including shear flow instabilities forming in the layer between the CAP and the foehn flow. Their influence on the CAP’s heat budget is assessed by estimating profiles of the vertical turbulent heat flux. The most prominent phase of the foehn event is the final breakthrough: foehn air was first detected in a localized area in the northeast part of the city, from which it spread over the whole city within about two hours. A few hours later, the CAP pushed back and lifted the foehn flow from the ground. Finally, the event was terminated by the passage of a cold front.