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TEAMx: A coordinated effort to investigate transport and exchange processes in the atmosphere over mountains

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Mountains have a profound impact on synoptic- and meso-scale atmospheric processes. They also shape the transfer of heat, momentum and mass (water or trace gases) between the ground, planetary boundary layer and the free atmosphere. An integral part of past international research programmes that focused on the impact of mountains on the atmosphere (e.g., ALPEX, PYREX and MAP) was a deployment of special observing facilities in large-scale field campaigns. Significant progress in understanding and prediction of processes in and around complex terrain ensued, for instance in relation to gravity-wave-induced phenomena and orographic precipitation. In the two decades since MAP, technological and scientific progress has extended the range of phenomena that can be accurately observed and modelled towards smaller spatial scales. This forms the basis for an internationally coordinated program to study exchange processes over mountains, their interaction with mesoscale processes and their role in the climate system.

From the experimental perspective, terrain heterogeneity creates challenges in practical use and interpretation of observations. Among others, these include limited representativeness of point measurements, special requirements for data post-processing (e.g., for turbulence measurements), and limited validation of satellite remote-sensing retrieval algorithms over regions of complex terrain. From the modelling perspective, sub-grid-scale orographically-induced processes are typically not accounted for in parameterizations of land-surface exchange, planetary-boundary-layer turbulence and convection. Both numerical weather prediction and climate change simulations suffer from model errors caused by imperfect representation of the flow over mountains. These errors remain one of the major sources of uncertainty for the Earth System models despite the ever-increasing model resolution.

This contribution offers an overview of TEAMx (Multi-scale Transport and Exchange Processes in the Atmosphere over Mountains –programme and experiment), a recently initiated programme focusing on the investigation, field observations, and numerical modelling of exchange processes between mountainous terrain and the free atmosphere.

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