Geophysical Research Abstracts
Vol. 20, EGU2018-13812, 2018
EGU General Assembly 2018


# A coordinated effort to investigate Transport and Exchange Processes in the Atmosphere over Mountains-Experiment (TEAMx)

Mathias Rotach (1), Marco Arpagaus (2), Joan Cuxart (3), Stephan De Wekker (4), Vanda Grubisic (5), Norbert Kalthoff (6), Dan Kirshbaum (7), Manuela Lehner (1), Stephen Mobbs (8), Alexandre Paci (9), Stefano Serafin (10), and Dino Zardi (11)

(1) University of Innsbruck, Innsbruck, Austria, (2) MeteoSwiss, Zurich, Switzerland, (3) University of the Balearic Islands, Palma (Illes Balears), Spain, (4) University of Virginia, Charlottesville, VA, USA, (5) National Center for Atmospheric Research, Boulder, CO, USA, (6) Karlsruhe Institute of Technology, Karlsruhe, Germany, (7) McGill University, Montreal, QC, Canada, (8) National Centre for Atmospheric Science, Leeds, United Kingdom, (9) CNRM, Meteo France, Toulouse, France, (10) University of Vienna, Vienna, Austria, (11) University of Trento, Trento, Italy

Mountainous areas contribute in major ways to synoptic-scale and meso-scale atmospheric flows (e.g., orographic precipitation; gravity wave drag; thermally driven flows). Both weather and climate models need to get these processes right. Indeed, interaction with mountainous terrain constitutes one of the major uncertainties in Earth-system modelling. Important internationally coordinated activities in the past (such as ALPEX, PYREX, MAP) have addressed these issues and have substantially advanced our knowledge with respect to the impact of mountainous terrain on the atmosphere.
Only recently, we begin to be able to model in a physically consistent manner what traditionally is called 'earth-atmosphere exchange', i.e. the coupling between the surface and the atmosphere – even over complex mountainous terrain. While this task over flat terrain essentially corresponds to using concepts of boundary layer meteorology, it includes processes at distinctly different scales (from synoptic and meso-scale to the local boundary layer and near-surface micro-scales), as well as their interactions over mountainous terrain.
Output of numerical weather prediction models is nowadays used to provide point-specific weather information (e.g., weather apps) - what is extremely challenging in mountainous terrain. Increasingly, it is also used as input for applied models for, e.g., hydrology, health-related forecasts, energy smart-net regulations and potential assessment, economic decision models or ecological budgeting. Similarly, climate services in relation to climate change call for our ability to correctly model scenarios for future climate states. Mountainous areas not only seem to exhibit a stronger climate sensitivity (e.g., stronger presently observed temperature increase over mountains than in the global average) and are thought to be particularly vulnerable, but also pose a particularly challenging task to the climate modelling community due to unresolved processes, terrain representation and scale interactions. Due to longer integration times, possible errors in surface-atmosphere exchange will likely have even stronger impact for the assessment of input data for climate services modelling (the entire range of energy, agriculture, health, hydrology applications) than for Earth System services in the weather prediction time-range.
Atmospheric composition is not only relevant with respect to climate forcing, but also – on shorter time scales – in view of air pollution. Mountainous terrain does not only trigger its characteristic pollution threats (such as smog episodes in a stably stratified valley), but also largely increases the complexity by introducing air chemistry as another process that needs to be taken into account. The interactions between chemical transformations and turbulent diffusion are complicated by additional length and timescales related to meso-scale processes in complex terrain.
All these developments make it highly timely to plan and execute – some twenty years after the last major international project on mountain meteorology, MAP - a new internationally coordinated project focusing on the investigation, experimental assessment and numerical modelling of the exchange of energy, mass, and momentum between 'mountainous terrain' and the free atmosphere at all scales and especially their interactions. This contribution summarizes the state of affairs for 'TEAMx' – i.e. the experiment on Transport and Exchange processes in the Atmosphere over Mountains.