Simulation of the boundary layer over topography: The valley wind system

Thermally driven valley and slope winds are a key component of the atmospheric boundary layer over the complex terrains. While these diurnal wind systems are well understood for simple situations, this is not the case for complex real-world situations. The complex shapes of mountains and the interaction of these flows with the larger environment (e.g. upper-level regional winds) has so far prevented the development of a general theory. The valley and slope winds strongly influence the exchange of heat, momentum, moisture, and other constituents between the land surface and the free troposphere. The corresponding exchange fluxes can be much larger than the near-surface turbulent fluxes in flat terrain and thus directly influence the characteristics of local weather and climate such as near-surface temperatures, wind speeds, cloudiness, and precipitation.

Among the many factors which influence the diurnal valley and slope winds, the impact of upper-level winds on their evolution has so far received little attention. We thus propose to study the impact of upper-level winds on the structure and evolution of the slope wind system and exchange over complex terrain. The work will consist of performing and analyzing high-resolution simulations using the NWP model COSMO. Thus a strong interest in numerical modeling of the atmosphere is desired.

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