Geophysical Research Abstracts
Vol. 18, EGU2016-11766, 2016
EGU General Assembly 2016

Observations and numerical simulations of downslope flow separation at a valley inversion

Lukas Strauss (1), Stefano Serafin (1), Vanda Grubišić (1,2)

(1) University of Vienna, Department of Meteorology and Geophysics, Vienna, Austria, (2) Earth Observing Laboratory, National Center for Atmospheric Research, Boulder, CO, USA

Severe turbulence downwind of a mountain ridge is often associated with large-amplitude gravity waves that are excited as the air flows over the ridge. Mountain waves can exert an adverse pressure-gradient force on the boundary layer and make it detach from the ground, leading to the formation of atmospheric rotors. However, in a more complex topographic setting, with a second mountain ridge downstream of the first and a valley in between, thermally and dynamically forced processes in the valley (e.g., cold pools or along-valley flow channelling) may be equally important for flow separation.

Observations supporting this idea were made during the Terrain-induced Rotor Experiment in Owens Valley (California, USA) in the nighttime hours of 16 April 2006. In that case, an inversion was present in the valley and resultant buoyancy forces appear to have contributed significantly to flow separation well above the valley floor.

In an attempt to understand better the thermal and dynamic forces determining this case, numerical simulations with the Weather Research and Forecasting (WRF) Model are run in a nested-domain configuration. The innermost model domain exhibits a horizontal grid spacing of 400 m and a vertical spacing of $\sim$25 m at the ground and spans the southern portion of the Sierra Nevada. The sensitivity of model results (e.g. the valley inversion strength) to the chosen boundary-layer parameterization (e.g., Bougeault-Lacarrère, Mellor-Yamada-Janjic, or Shin-Hong 'scale-aware' PBL schemes) is studied. In a next step, the evaluation of the terms in the momentum equations along the trajectories of separated air parcels will help elucidate the relative importance of pressure-gradient forces and buoyancy forces for flow separation.