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Reconciliation of the rotor concept

A. Dörnbrack, C. Kühnlein, and M. Weissmann

DLR Oberpfaffenhofen, Institu für Physik der Atmosphäre, D- 82230 WESSLING, Germany

During the Terrain-Induced Rotor Experiment 2006 (T-REX), we performed ground-based high-resolution Doppler lidar wind observations to explore the wind field in the lee of the Sierra Nevada. During several periods, the wind measurements reveal atmospheric phenomena as hydraulic jumps and internal gravity waves. Occasionally, mountain waves forced by the long quasi-two-dimensional ridge of the Sierra Nevada were accompanied by low-level vortices. The actual turbulence and the large vertical accelerations in thesse flow pose severe hazards for the traffic in the vicinity of mountains.

Since the early fifties of the last century, this kind of flow has been sketched as a rotor: a large coherent valley filling roll with a horizontal axis parallel to the ridgeline under the crest of an smooth gravity wave. Recently, this schematic has been repeated and reproduced several times in the literature and even became the generic base for designing the instrumentation during T-REX. We contrast our observations with this classical concept of atmospheric rotors. High-resolution numerical simualtions are applied to identify processes which were only partly resolved by our observations. The combination of observational and numerical methods helps to understand the Doppler lidar wind observations. At the end, we discuss implications for modelling and forecasting atmospheric rotors.