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Influence of the Aure valley on the boundary-layer features observed during the BLLAST experimental field campaign

Maria A. Jimenez, Joan Cuxart, and Daniel Martinez-Villagrasa

Universitat de les Illes Balears, Physics Department, Meteorology group, Palma de Mallorca, Spain (mantonia.jimenez@uib.es)

Under clear-skies and weak-synoptic pressure gradients, the organization of the flow at lower levels is mainly controlled by the local effects, such as terrain or surface heterogeneities. This is the case of the thermal differences between the air adjacent to the slopes, within a valley and over the nearby plains that generate slope, valley and mountain winds with an opposite direction between day and night. The Aure valley, located at the north of the Pyrenees with the main axis pointing to North, and the surrounding foothills are selected to study the temporal and spatial scales of the thermally-driven flows during the BLLAST experimental field campaign (June-July 2011). A combined inspection of the observations in Lannemezan (located over a plateau at about 5 km from the exit of the Aure valley) and high-resolution mesoscale simulations is used to evaluate the effect of the Aure valley on the boundary-layer characteristics over Lannemezan.

The inspection of some selected IOPs (clear-skies, no rain) show that the interaction between the Aure valley and the Lannemezan plateau takes place depending on the direction and intensity of the large-scale wind, enhancing or diminishing the thermally-driven flow. During day, a convective boundary layer is formed with associated strong turbulence at the foothills, valleys and plain. However, during the night-time turbulence is in general weaker with some episodes of strong turbulence associated to wind shear related to the presence of the exit valley jet of the drainage winds. It is found that when large-scale winds are weak the exit valley jet reach Lannemezan close to midnight and interacts with the locally-generated downslope winds already present. It is found that IOP11 shows a Foehn effect in the valley, that is warmer than the plain, resulting in up-valley flows during the night. The BLLAST dataset is an useful tool to evaluate the performance of the mesoscale model in a complex region, such as the valleys and foothills of the Pyrenees. Therefore, this study can contribute to point out the weakest parameterizations/options in the model.