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Observations of an elevated rotor and precipitation processes decoupled during a mountain wave event in the Eastern Pyrenees (Cerdanya-2017 Field Experiment)

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The study documents the formation of a rotor underneath the mountain waves generated the 15 January 2017 over the eastern Pyrenees (near the border between France, Spain and Andorra) during the Cerdanya-2017 field campaign. The event was characterized by strong winds, mountain waves and relevant snow accumulation over the Cerdanya valley and the eastern Pyrenees. The evolution and location of the mountain waves and precipitation structure were studied using high temporal resolution data from a UHF wind-profiler and a vertically pointing K-band Doppler radar, separated a few kilometres in horizontal distance.

A mountain wave was detected in the morning and shortened slightly in the afternoon when a transient rotor was formed disconnected from the surface flow (Udina et al. 2020). A strong turbulence zone was identified at the upper edge of the mountain wave, above the rotor, a feature observed in previous studies. The mountain wave and rotor induced circulation was favoured by the valley shape and the second mountain ridge location, in addition to the weak and variable winds, established during the sunset close to the valley surface. In addition, we find decoupling between precipitation processes and mountain wave induced circulations. During the studied event, mountain wave wind circulations and low-level turbulence do not affect neither the snow crystal riming or aggregation along the vertical column nor the surface particle size distribution of the snow. This study illustrates that precipitation profiles and mountain induced circulations may be decoupled which can be very relevant for either ground-based or spaceborne remote sensing of precipitation (Gonzalez et al 2019). This research is supported by CGL2015-65627-C3-1-R, CGL2015-65627-C3-2-R (MINECO/FEDER), CGL2016-81828-REDT and RTI2018- 098693-B-C32 (AEI/FEDER).

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