The Role of Dry Layers and Cold Pools in the Activation of Mesoscale Convective Systems: A Characterization Study based on the Combined Use of Raman Lidar and DIAL Measurements and MESO-NH Model Simulations

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As part of the Cevennes-Vivarais site, the University of Basilicata Raman lidar system BASIL (Di Girolamo et al., 2009, 2012, 2916) was deployed in Candillargues (Cévennes-Vivarais Southern France Lat: 43°37′ N; Long: 04°04′ E; Elev: 1 m) and operated throughout the duration of HyMeX-SOP 1 (September-November 2012), providing high-resolution and accurate measurements, both in daytime and night-time, of atmospheric temperature, water vapour mixing ratio and particle backscattering and extinction coefficient at three wavelengths.

Measurements carried out by BASIL on 28-29 September 2012 reveal a water vapour field characterized by a quite complex vertical structure. Reported measurements were run in the time interval between two consecutive heavy precipitation events, from 15:30 UTC on 28 September to 03:30 UTC on 29 September 2012. Throughout most of this observation period, lidar measurements reveal the presence of four distinct humidity layers.

This research effort aims at assessing the origin and transport path of the different humidity filaments observed by BASIL on this day. In the research work we also try to identify the presence of dry layers and cold pools and assess their role in the genesis of the mesoscale convective systems and the heavy precipitation events (HPEs) observed on 28-29 September 2012. Virtual potential temperature and equivalent potential temperature are considered as prognostic variables to identify cold pools, with the considered threshold value for virtual potential temperature and equivalent potential temperature being 23 °C and 52 °C, respectively. The study is based on the combined use of water vapour mixing ratio and temperature profile measurements from BASIL and water vapour mixing ratio profile measurements from the water vapour differential absorption lidar LEANDRE 2, supported by simulations from the mesoscale non-hydrostatic model MESO-NH.