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KASCADE2017 – An experimental study of thermal circulations and turbulence in complex terrain

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The KASCADE (KAtabatic winds and Stability over CAdarache for Dispersion of Effluents) 2017 experiment was conducted during winter 2017 with the overarching objective of improving prediction of dispersion in complex terrain during stable atmospheric conditions. The experiment builds on knowledge gathered during the first KASCADE experiment conducted in 2013 (Duine et al., 2016), which provided detailed observations of the vertical structure of the atmosphere during stable conditions. In spite of this improved understanding, considerable uncertainty remains regarding the near-surface horizontal spatial and temporal variability of winds and thermodynamic variables. For this specific campaign, the general aim has been to use a large number of sensors to improve our understanding of the spatial and temporal development, evolution and breakdown of topographically driven flows.

KASCADE 2017 consisted of continuous observations, which were broadened during ten Intensive Observation Periods (IOPs) conducted in the Cadarache Valley located in south-eastern France from January through March 2017. The Cadarache Valley is a relatively small valley (6 km x 1 km) with modest slopes and elevation differences between the valley floor and nearby peaks ($\sim$100 m). The valley is embedded in the larger Durance Valley drainage system leading to multi-scale flow interactions. During the winter, winds are light and stably stratified leading to thermal circulations as well as complex near-surface atmospheric layering that impacts dispersion of contaminants. The continuously operating instrumentation deployed included mean near surface (2-m) and sub-surface observations from 12 low-cost Local Energy-budget Measurement Stations (LEMS), four sonic anemometer masts, one full surface flux station, sodar measurements at two locations, wind and temperature measurements from a tall 110 m tower, and two additional met stations. During IOPs, additional deployments included a low-cost tethered balloon temperature profiler as well as regular (every 3 hours) radiosoundings (including recoverable and reusable probes). The presentation will provide an overview of the experiment and several interesting "first-results." First results will include data characterizing highly-regular nocturnal horizontal wind meandering and associated turbulence statistics. In addition, we present data on the development of strong near surface stable stratification hours before sunset.