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Observations of Radiation Divergence and Stability Driven Slope Flows during the Field Experiment KASCADE

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During the winter of 2013 the intensive field measurement campaign KASCADE (KAtabatic winds and Stability over CAdarache for Dispersion of Effluents) has been carried out at Cadarache, a research centre of CEA, located in South-Eastern France. The stability of the lower atmospheric boundary layer caused by radiative cooling at night, combined with the local orography, strongly affects the conditions for the dispersion of potential pollutants. Understanding the complex patterns of drainage flow and cold pool build up in the smaller valleys confluent to the Durance river is thus a major issue for refining the models used to assess the sanitary and environmental impact of Cadarache. Stability is easily formed in the region and in combination with the orographic complexity, there is a need to study the Stable Boundary Layer (SBL), which potentially can have a large impact on the dispersion of gaseous emissions released by the various facilities of Cadarache. KASCADE was designed to characterize the local SBL in order to feed future planned numerical simulations with WRF and impact studies involving numerical models coping with dispersion.

With a focus on night time, a combination of continuous observations (SODAR and a flux-measurement tower of 30 meter [M30]) and 23 Intensive Observational Periods (IOPs) (Tethered Balloon [TB] profiling and radio-soundings) allows to study the relevant phenomena for SBL-formation. M30 was equipped with sonic anemometers at 3 levels for turbulence measurements and net radiometers at 2 levels to capture radiation divergence. TB-profiles up to 300 m allow to describe the SBL-formation and local wind patterns. In addition to the IOPs, year-round SODAR measurements are available to catch the influence of the Durance valley on wind patterns.

During the desired conditions (clear sky and calm wind), the set-up of the experiment has proven successful in observing the main drivers for SBL-formation and its effects on local orography. Minimal longwave heating (cooling) values of -1 to -1.5 K h¬-1 are measured regularly and resulting slope flows are observed. The presentation focusses on the comparison of several contrasting nights.