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The high-resolution dynamics of a foehn storm

H. Richner (1) and B. Dürr (2)

(1) IACETH, Atmosphere and Climate, Zurich, Switzerland (hans.richner@ethz.ch), (2) Sunergy GmbH, Buchs SG, Switzerland (bruno.duerr@gmail.com)

Foehn storms have repeatedly caused accidents by throwing trains off their track or by derailing cable cars. For some cases, the incidents have been modeled and the local wind speed has been reconstructed. In this context, the question has been raised whether oscillation effects play a role or not, i.e. whether foehn starts to rock the vehicle in question. By doing so, storm damage could be dramatically increased by resonance. While it is known that particularly during the onset of foehn pulsating gusts of foehn air are present, the high-resolution dynamics of this process has never been monitored and documented.

The project WISSA aims at closing this gap. For two years, field measurements were made on a 50-m tower situated in a foehn valley in Liechtenstein. As basic instrumentation, the tower was equipped with sensors for wind, temperature and humidity; data was stored at 1-minute intervals. To this, a microbarograph and two sonic anemometers (measuring 3-dimensional winds) were added, the microbarograph at ground level, one of the sonic anemometer at 5 m height, the other at 49 m height. Data from these sensors was recorded every second.

First results showing the highly turbulent onset of foehn as well as its characteristics once the foehn storm is established are now available. Based on the time delay between first foehn observations at 50 m and its observation at ground level, methods for emergency warnings might be possible. Continuing observations of further foehn cases and at different sites will have to show how representative the available data is.