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Density and granulometric structure of wet and dry-snow avalanches

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We present several measurements of avalanche density, which were carried out in naturally and artificially released dry, and wet-snow avalanches at the Vallée de la Sionne test site in Switzerland. Measurements were performed using capacitance probes developed by M. Louge (Louge et al. 1997), which are installed at two heights along the instrumented pylon. The high frequency response of the sensor (7.5 kHz) allows capturing significantly different density variations, which can also be correlated to avalanche granulometry.

We show that in dry-snow avalanches average density increases from head to tail presumably due to the actions of forces and temperature variations within the avalanche body. At the avalanche tail the density is the largest and it remains constant up to deposition. In the avalanche head and body, density is characterized by large fluctuations around the average, which decrease their frequency toward the tail. The granular structure changes accordingly from a more dilute flow at the avalanche head, to the high density, well-rounded granules of various sizes that dominate the avalanche tail.

In contrast to the large density variations that characterize dry-snow avalanches, wet-snow avalanches exhibit a more constant density throughout the whole avalanche and a homogeneous structure constituted by well-sorted granules, with a predominance of large particles moving on the avalanche surface.

These measurements show the avalanche structure of both wet and dry-snow avalanches, which has been inaccessible to measurements up to now and will lead to new and improved physical models of avalanche dynamics.