



Cold-to-warm flow regime transition in snow avalanches

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Over the last four years, the high-resolution radar system GEODAR has revealed new insights into the motion of snow avalanches. As the radar signal penetrates through the powder cloud and is reflected by the denser flow underneath, we can directly image flow structures that have hereto been unobserved.

GEODAR has measured more than 100 avalanches at Vallée de la Sionne and this large dataset has enabled a characterization of avalanche flow regimes by highly distinctive radar signatures. These signatures can be used to identify different flow regimes in an avalanche, and, in particular, to characterize the evolution of these flow regime as the avalanche moves down the slope.

Remarkably, we show clearly that cold and warm flow regimes can co-exist in a single avalanche and that the balance between warm and cold flow regimes correlates with the snow pack temperature along the avalanche path. Indeed, at the Vallée de la Sionne, we could observe complete flow transitions, from cold to warm flow regime, when the temperature of the snow-cover exceeds -1°C in the lowest 500 m altitude of the avalanche path. Such knowledge is of great importance since avalanche pressure and the effectiveness of protection measures are greatly dependent on the flow regime.