



## **Measurement of snow particle size and speed in powder snow avalanches**

Yoichi ITO (1,2), Kouichi NISHIMURA (3), Florence NAAIM-BOUVET (1,2), Hervé BELLOT (1,2), Emmanuel THIBERT (1,2), Xavier RAVANAT (1,2), Firmin FONTAINE (1,2)

(1) Irstea, UR ETGR, Centre de Grenoble, F-38402 St-Martin-d'Hères, France, (2) Univ. Grenoble Alpes, F-38041 Grenoble, France, (3) Nagoya Univ., Nagoya 464-8601, Japan

Generally snow avalanches consist a dense-flow layer at the bottom and a powder snow cloud on top. Snow particle size and speed are key parameters to describe the turbulent condition in the powder cloud, however, the information on the particles were not well investigated. In this study, we observed powder snow avalanches using a snow particle counter (SPC) to measure the particle size and speed. The SPC is an optical device consisting a laser diode and photodiode; a pulse signal proportional to its diameter is generated resulting from a snow particle passing through the sensing volume. In general use, the signals are sent to a transducer and divided into 32 size classes based on particle diameter to observe the snow particle size distribution and mass flux at 1-s intervals. In this study, the direct output signal from the transducer was also acquired at a high frequency to obtain the original pulse signal produced by each snow particle. Then the speed of each particle can be calculated using the peak of the pulse, which corresponds to particle diameter and the duration over which the particle passes through the sampling area. We also employed an ultrasonic anemometer to measure air flow speed. Both sensors were installed at the Col du Lautaret Pass in the French Alps. The results of the particle size and speed distribution were then compared with airflow movement in the powder cloud. The ratio of the particle and airflow speeds changed by the particle size distribution and the distance from the dense-flow layer.