Geophysical Research Abstracts
Vol. 16, EGU2014-7189, 2014
EGU General Assembly 2014

Infrasound array observations of snow avalanches: support to controlled activity and implications to risk assessment

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Snow avalanches can radiate infrasound (low frequency <20 Hz sound) as the front moves downhill and accelerates. An highly variable efficiency in the infrasound radiation, related to the coupling of the front with the atmosphere, is documented for different kinds of events, being maximum for powder snow avalanches. Here, once infrasound is radiated from the avalanche front, it can propagate far away (> several km), thus representing a valuable monitoring system. However, snow avalanche infrasound did not develop significantly after the first pioneer studies, and attempts to use infrasound as a monitoring/alert systems are sparse and often abandoned, given the high uncertainty of the results and the large numbers of false alarms.

The main source of difficulty is the strong ambiguity in the waveform, with the infrasound radiated from avalanches being emergent, of long duration, and low amplitude (typically < few Pa) making identification from noise or infrasound from additional sources not trivial. Significant advances in the infrasound analysis of snow avalanches result from the use of arrays, rather then single sensors, as they allow to robustly retrieve wave parameters (etc. back-azimuth/slowness) that support the identification of the possible source mechanism.

We presents results from observations performed during the last 4 years in Italy (Champoluc, Valtournenche and Gressoney, AO), Austria (Ischgl) and Swiss (Goms) and discuss them in terms of real-time monitoring of avalanche activity, spanning from a qualitative analysis of medium-range (> several km) avalanche observations for a general risk assessment, up to detailed, quantitative, short range (1-2 km) observation to support controlled avalanche release.