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Infrasound monitoring of gravity driven mass movements: avalanches and debris flow

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The detection of avalanches and debris flows as they occur, no matter what weather conditions, is essential for every natural hazard mitigation program. Recent studies indicated already that snow avalanches and debris flows generate acoustic noise in the low frequency infrasound spectrum (2-15Hz). These infrasound signals have the ability to propagate kilometres from the source thus monitoring is possible from a location unaffected by the mass movement.

This study presents infrasound produced by a 3 days debris flow event in July 2007, in the Jiangjia Gully, Yunnan, China. The debris flow had a big variety in terms of the amount of discharge and furthermore they differ from very fluid surges up to more solid surges with a density of 2000kg/m^3. The data was monitored with two different microphones, a custom made Chinese sensor and a standard infrasound measuring microphone from a German company. Contemporary video recording and photographing took place for visual validation of the acoustic signals. On the other hand for snow avalanches the biggest problem is the wind noise in the mountainous regions. Therefore this study focuses on a spatial wind noise reduction filter made of porous garden hoses in a star configuration covered by snow. Moreover in comparison to this system data is monitored with an infrasound sensor sheltered by a weather-housing. This arrangement is located in a ski resort (Lech am Arlberg, Austria) where naturally and artificially released avalanches occur. In addition avalanche signals are monitored in France and Switzerland. The aim is to specify the avalanche/debris flow signal out of interferences to provide a basis for automated signal processing through the use of digital filtering, frequency analysis, and weighted threshold decision-making. As the

infrasonic mass movement signals are nonlinear and non-stationary they are analysed by adopting the HHT approach and in comparison the conventional FFT method. The final goal is the development of an automatic infrasound warning system for natural hazards such as debris flow and snow avalanches.