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Estimation of debris flow velocity based on infrasound and seismic data

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The velocity of processes like debris flows or debris floods is an important parameter to know for early warning since the time domain is a crucial parameter for setting appropriate warning and evacuation action. Further, the infrasound and seismic signal spectrum are also significant affected by the process velocity, therefore an accurate estimation of the velocity will be necessary for a process identification and an estimation of the process magnitude based on infrasound or seismic signals.
So this work presents different approaches to estimate the process velocity on infrasound or seismic data recorded on two spatial separated stations along the Lattenbach channel. The Lattenbach is a very active torrent located in a geologic fault zone in the western part of Austria with a catchment area of 5,3 km^2, feeding the river Sanna, which is a tributary of the river Inn. Due to the frequent debris flow and debris flood events the torrent is monitored by the Institute of Mountain Risk Engineering since several years. The parameters that are currently measured during an event includes meteorological data (rainfall, temperature, etc.) in the upper part of the catchment (station Dawinalpe), run-off data from the middle and lower reach of the torrent at the villages Grins and Pians, the surface velocity measured by a Debris Flow Radar (Pulse Doppler radar (IBTP Koschuch e.U.)) and the cross sectional wetted area measured by the 2D Laser scanner. Two station of a warning system based on infrasound and seismic data are installed along this channel with a distance from 90 m. This systems are based on one infrasound sensor and one geophone which are placed co-located and a microcontroller where a specially designed detection algorithm is executed which can detect mass movements in real time directly at the sensor site. The seismic and infrasound data recorded at this stations for several debris flows in the last years has bee used to analyse different methods for an estimation of the process velocity based on this data. This methods has been compared with velocities measured by the Debris Flow Radar and several sensors for flow height.