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Seismo-acoustic energy partitioning of snow avalanches

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While flowing downhill a snow avalanche radiates seismic waves in the ground and infrasonic waves in the atmosphere. It is generally accepted that infrasound is mostly generated by the powder cloud of the avalanche, while seismic waves are believed to be exited by the frictional force exerted by the dense flowing snow mass on the ground. This results into different energy partitioning between seismic and infrasound for different kinds of avalanches, with infrasound more efficiently radiated by powder snow avalanches rather than for wet avalanches. This complex behavior has to be accounted for when infrasound and seismic observations are used for the study of avalanche dynamics of real time avalanche detection and monitoring.
We present infrasonic and seismic array data collected during the winter of 2015- 2016 in the Dischma valley south of Davos, Switzerland, where a five element infrasound array and a 7 element seismic array had been deployed at short distance (<500 m) from each other and with several avalanche paths nearby.
For a selected event, documented with camera observation, the modeling of flow evolution and dynamics was performed with RAMMS and compared with seismic and infrasound array processing results, with detections back projected to topography to identify the areas of seismic and infrasound energy release.
Comparison shows that while seismic energy is produced during the whole evolution of the flow, infrasound is produced only after the flow has reached its maximum flow velocity and is confined in a narrow channel. Moreover, phase velocity detected by the seismic array points to a strong coupling of infrasound to elastic energy in the ground during the phase of peak infrasound radiation. This prevents the use of the duration of infrasound signal or the amplitude of the seismic signal to estimate the magnitude of the event.
Eventually, results of seismic and infrasound array processing are compared for the whole 2015-2016 winter season in order to investigate the ability of the two monitoring systems to identify and characterize snow avalanches.