Seismo-Acoustic Analysis of Debris Flows at Illgraben, Switzerland

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Infrared and seismic waveforms of debris-flow events occurred at Illgraben respectively in the period 2017-2018 (Figure 3) and in 2019 (Figure 4) typically show an emergent envelope, despite having variable amplitude and duration. In general, seismic signals tend to be clearer than infrasonic ones, with infrasound below the back-ground noise for at least 4 events (Figures 3 and 4, Table 1). It seems thus that debris-flows tend to be more effective as seismic sources than as infrasonic sources, especially for smaller debris-flow events.

Concluding remarks
Illgraben debris-flows events are characterized by a stable infrasonic-to-seismic RMSA ratio time-trend, reflecting a stable elastic energy partition between atmosphere and ground during the event. Both infrasonic and seismic RMSAs increase with increasing flow velocity and flow depth, while no universal relation is observed for density. Unit flow discharge and both infrasonic and seismic RMSAs are related by a linear positive relation. In addition, an increase in flow discharge leads to an increase in infrasonic energy radiation greater than the resulting increase of seismic energy radiation. The role of density (and thus mass flux) on both infrasonic and seismic RMSAs and on their ratio seems secondary. Being infrasound amplitudes intimately bound to flow discharge, infrasonic analysis probably is not the right tool for the study and for the monitoring of smaller debris-flow events.

Results

Infrasonic and seismic waveforms of debris-flow events occurred at Illgraben respectively in the period 2017-2018 (Figure 3) and in 2019 (Figure 4) typically show an emergent envelope, despite having variable amplitude and duration. In general, seismic signals tend to be clearer than infrasonic ones, with infrasound below the background noise for at least 4 events (Figures 3 and 4, Table 1). It seems thus that debris-flows tend to be more effective as seismic sources than as infrasonic sources, especially for smaller debris-flow events.

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