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Mount Meager landslide flow history

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Gravitational instabilities, such as landslides, avalanches, or debris flows, play a key role in erosional processes and represent one of the major natural hazards in mountainous, coastal, and volcanic regions. Despite the great amount of field, experimental and numerical work devoted to this problem, the understanding of the physical processes at work in gravitational flows is still an open issue, in particular due to the lack of observations relevant to their dynamics.

In this context, the seismic signal generated by gravitational flows is a unique opportunity to obtain information on their dynamics. Indeed, as shown recently by Favreau et al., (2010), simulation of the seismic signal generated by landslides makes it possible to discriminate different flow scenarios and estimate rheological parameters. Global and regional seismic networks continuously record gravitational instabilities, so this new method will help gather new data on landslide behavior, particularly when combined with a landslide numerical modeling.

Using this approach, we focus on the 6 August 2010 Mount Meager landslide: a 48.5 Mm3 rockslide-debris flow occurring in the Mount Meager Volcanic complex in the Southwest British Columbia. This landslide traveled over 12.7 km in just a few minutes time and was recorded by 25 broadband seismic stations. The time history of the forces exerted by the landslide on the ground surface was inverted from the seismic waveforms. The forcing history revealed the occurrence of a complicated initiation and showed features attributable to flow over a complicated path that included two sharp turns and runup at a valley wall barrier. To reliably interpret this signal and thus obtain detailed information about the dynamics of the landslide, we ran simulations for a range of scenarios by varying the coefficient of friction and the number, mass, and timings of subevents and compute the forces generated in each case. By comparing the results of these simulations to the forces obtained from the seismic data, we are able to reconstruct the event and better understand its dynamics in unprecedented detail.