

ACC021-P02

Room: Convention Hall

Time: May 27 17:15-18:45

Earthquake-induced snow avalanches: inventory of known world-wide cases for 1899-2010

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Strong ground motions caused by earthquakes can induce catastrophic avalanches. The phenomenon of simultaneous massive snow avalanching from a number of slopes has been observed in natural environments and has been suggested for large quarries and underground mines where strong artificial ground motions are produced by technological explosions. To address a lack of studies regarding seismogenic snow avalanches, an inventory has been compiled to document the limited available cases and related causative mechanisms and to compare these among witnessed and statistically identified events. For the period 1899-2010, 22 individual events are identified world-wide, related to natural or artificial seismicity with magnitudes (M_w) of 1.9-9.2 and source-to-site distances of about 0.2-640 km, with more than several thousand simultaneously released large-scale avalanches in the most extreme case. The obtained distribution and variety of parameters are discussed and compared with earthquake-induced landslides and ice avalanches; the results are similar among these three types of failure events, although all data derived from statistical analyses (i.e. non-witnessed cases) represent outliers, suggesting a significant reduction in the threshold magnitudes proposed for landslides; this proposal could be verified by the collection of additional data.

Keywords: earthquake-induced, snow avalanche, earthquake, mine explosion, world-wide, inventory