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Video-Seismic coupling for lahar study at Merapi Volcano, Indonesia

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Lahar disasters caused 44.252 deaths worldwide from 1600 to 2010. At least 52 % of this death toll was due to a single event in the late 20th century. In order to reduce the fatality, decision makers need a better understanding of lahar flow behavior. Moreover, the fact that general public is always attracted to see lahars directly is contradictory to lahar risk reduction. This research presents debris-flow-type lahar on February 28, 2014 at Merapi volcano in Indonesia. The lahar dynamics was studied in the frame of the SEDIMER Project (Sediment-related Disasters following the 2010 centennial eruption of Merapi Volcano, Java, Indonesia) based on video-seismic coupling approach. We installed an independent seismic station at Gendol River (4.6 km south from the summit). It consisted of two geophones placed 76 meters apart parallel to the channel and 10 m from the edge of 30 m deep channel; a high definition camera; and two raingauges at east and west side of the river. The results showed that the behavior of this lahar changed continuously during the event. The lahar front moved at an average speed of 4.1 m/s at the observation site. Its maximum velocity reached 14.5 m/s with a peak discharge of 473 m3/s. The maximum depth of the flow reached 7 m. Almost 600 blocks of more than 1 m main axis were identified on the surface of the lahar during 36 minutes, which represented an average block discharge of 17 blocks per minute. Seismic frequency ranged from 10 to 150 Hz. However, there was a clear difference between upstream and downstream seismic characteristics. The interpretation related to this seismic characteristic could be improved by video analysis, especially to differentiate the debris flow and hyperconcentrated flow phase. Our lahar video is accessible online to the broader community (https://www.youtube.com/watch?v=wlVssRoaPbw).