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Video-Seismic coupling for debris flow study at Merapi Volcano, Indonesia

Sandy Budi Wibowo (1), Franck Lavigne (1), Philippe Mourot (2), and Bambang Sukatja (3)

(1) Paris 1 Pantheon-Sorbonne University, Laboratory of Physical Geography, UMR 8591 CNRS, Meudon, France, (2) Myotis S.A.S. Monitoring System, Echirolles, France, (3) Sabo Research Center, Ministry of Public Works of Indonesia, Sleman, Indonesia

Previous lahar disasters caused at least 44.252 death toll worldwide from 1600 to 2010 of which 52 % was due to a single event in the late 20th century. The need of a better understanding of lahar flow behavior makes general public and stakeholders much more curious than before. However, the dynamics of lahar in motion is still poorly understood because data acquisition of active flows is difficult. 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 coupling between video and seismic data analysis. We installed a seismic station at Gendol river (1090 meters asl, 4.6 km south from the summit) consisting of two geophones placed 76 meters apart parallel to the river, a high definition camera on the edge of the river 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 represents 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 difference could be improved by the results of analysis of video recordings, especially to differentiate the debris flow and hyperconcentrated flow phase. The lahar video is accessible online to the broader community (https://www.youtube.com/watch?v=wlVssRoaPbw).

Keywords: lahar, video, seismic signal, debris flow, hyperconcentrated flow, Merapi, Indonesia.