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Seismic classification of rainfall-induced lahars at Volcán de Colima, México

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Rainfall-induced lahars are one of the most common phenomena in tropical volcanoes. Volcán de Colima (VdC) is the most active volcano in Mexico regarding intra-eruptive lahar generation. Lahars represent one of the main hazards for local communities located within a radius of 15 km from the summit. During the rainy season, from May to October dozens of lahars occur in the different ravines draining the VdC. Since 2007, lahar monitoring is performed for both research and civil purposes. Rain gauges, seismic sensors, cameras, and infrasound sensors are part of the current monitoring system deployed at Montegrande ravine (MR) which is located in the southern flank of the volcano. Here we present the data collected during the 2018 monitoring season that are composed of seventeen flow events, six of which feature the most complete dataset ever collected at MR. Data are recorded with multiple stations including broad-band seismic sensors (120 s), geophones (4.5 Hz), short-period seismometers (1 Hz) and a video camera installed along a 1.5 km channel reach. Three types of lahars have been classified based on the join-analysis of seismic signals and video images of these latter six events: dry front, diluted and multi-front. These classes are related to the solid-liquid composition and dynamics of the flows, and to the rainfall amount possibly triggering the processes. A linear discriminant analysis (LDA) is proposed to classify the rest of the events using seismic and rainfall records. Preliminary results show how the flow velocity and the presence of coarse fronts, inferred by means of cross-correlation method and inspection of the video images respectively, are the first factors controlling the characteristics of the seismic signals. This work also demonstrate how seismic techniques represent a valuable tool to describe the remarkable variability of flow dynamics along the travel path.