

ABSTRACTS

O199 Analysis of a small magnitude earthquake sequence and its possible relation to the recent collapse of a tailings dam in south-east Brazil

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Following the recent collapse of an iron-mine tailings dam and subsequent mud flood in southeast Brazil, we located and characterized a seismic sequence occurring within the mine area and preceding the dam failure. Both the earthquakes and flood signals were recorded by the Brazilian Seismographic Network. The largest event, $mR=2.6$ (~ 2.0 Mw), occurred ~ 1.5 hours before the accident, and two other smaller events occurred around the time of the collapse. The signal from the mud flowing downstream from the dam starts around 4 p.m. (local time), lasts ~ 25 minutes, and has largest amplitudes at frequencies 1-4 Hz. A polarization analysis of the mud-flow noise recorded at two of the nearest stations indicates back-azimuth signals consistent with the location and time of the accident.

The tight spatio-temporal association between earthquakes and accident makes it highly unlikely ($p < 0.001\%$) that the small earthquakes had no relation to the rupture. Empirical curves of ground shaking due to small magnitude earthquakes at short epicentral distances, as in our case, show that maximum peak accelerations could potentially reach up to 3% of g . Furthermore, the collapsed dam was built following the upstream method, which despite of being one of the most commonly employed methods in the world, it is particularly prone to earthquake liquefaction and failure due to ground shaking. Thus we propose as possible contributing factor for the dam collapse either ground shaking and/or soil liquefaction triggered by the earthquakes. In order to prove these hypotheses, a complete multidisciplinary study of the dam structure and soil conditions is necessary.

Consequently, we emphasize that the hazard from small, nearby earthquakes, however unlikely, should be taken into account as an additional factor in the risk evaluation during projects of tailings dams. A revision of dam construction policies and related legislation is therefore recommended to avoid future accidents.