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Dynamic earthquake triggering in southeast Africa

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We present results of the first systematic search for dynamic triggering of microearthquakes in southeast Africa. Historically, Africa has been poorly monitored by seismic networks. However, several recent temporary and permanent seismic networks have been deployed across the continent, collecting high-quality datasets. We analyzed seismic waveforms from 53 broadband and short-period stations in SE Africa, aiming to identify increases in the rate of microearthquakes and tremor coincident with the passage of teleseismic waves of the Mw8.6 2012 Indian Ocean earthquake, an earthquake that triggered seismic activity worldwide. We found evidence of triggered local earthquakes and no evidence of triggered tremor in the study region. We computed β-values in order to evaluate the statistical significance of the observed increase in seismic activity. We found statistically significant dynamic triggering at 7 stations. Two of these stations are located in the northeast coast of Madagascar. The other 5 stations are located in the Kaapvaal Craton, southern Africa, around one of the most active clusters of seismicity in the region, which has been associated to both natural and anthropogenic factors. Surprisingly, we found no evidence of dynamically triggered seismic activity at stations near the active structures of the East African Rift system (EARS). Although hydrothermal activity has been identified close to the stations that recorded dynamic triggering, it also exists near the EARS structures where no triggering was observed. Our results suggest that factors other than solely tectonic regime and geothermalism are needed to explain the mechanisms underlying earthquake triggering. We investigated the possible relationship between peak ground velocity (PGV) observed at each station during the passage of teleseismic waves and the existence of triggering. A clear relationship between surface wave PGV and dynamic triggering does not exist. However, stations where triggering was observed present a high vertical PGV in comparison to the horizontal PGV. The high vertical to horizontal PGV ratio suggests a local distortion of the wavefield, possibly due to topography, structure or site effects, which may facilitate triggering.