



# Characteristics of the ongoing seasonally rain-induced seismicity in Jurupema, SP

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## Abstract

We report on the ongoing rainwater induced seismicity in Jurupema, located the interior of the state of São Paulo, where we have been monitoring the seasonality of this phenomenon since 2016. The seasonal precipitation increase precedes the onset and increment of seismicity, as the induced seismicity fluctuates from averaging about 130 events per month with magnitudes between -0.2 to 2 Mw during the heavy rain season, to the absence of seismic events during the "dry" months.

Of the more than 1500 seismic events underneath an area of 20 km<sup>2</sup> between 2016 and the beginning of 2019, we follow the seismicity variations and perform full moment tensor analysis when possible. We identify two main regions where events are more frequently occurring and have mostly prevalent sub-horizontal dipping planes, the very shallow events between 100 and 200 m and from 600 to 700 m depth. They suggest that the confined aquifer characteristics of intermittent sandstone layers and fractured basalt rocks condition the characteristics of the seismicity occurring underneath Jurupema.

The facilitating factor of uncased water wells that support the transport of water from upper to lower aquifers, and their location in the area of persistent seismicity, promote that the stress conditions of the fractured basaltic rock inside the shallow confined aquifers can be affected by the intrusion and percolation of significant amounts of rainwater, thus affecting the pore-pressure conditions.

The notable similarities of the seismicity to that of the previously recorded earthquake sequences in Bebedouro, 50 km away from Jurupema, correlate both to the seasonal precipitation changes and the location of water wells used for irrigation drilled contemporary to the onset of seismicity. We see this induced seismicity as a phenomenon that could be more commonly occurring in other regions under similar weather conditions and aquifer and host rock characteristics, such as the Parana basin.

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