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Are the recurring earthquake swarms in West-Bohemia rain triggered?

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In past decades, a significant effort was spent to find the origin of recurring earthquake swarms in West-Bohemia/Vogtland. Widespread understanding accepts that crustal fluids migration along the fault zones is responsible for earthquake triggering in this area. Recently, a new model was suggested, which tests the hypothesis whether the diffusion of hydraulically induced pore pressure could be a valid trigger mechanism. In this approach the precipitation signal was transformed by diffusion equation to the hypocenter depth and statistically compared with the earthquake occurrence in time and concluded that at least 19% of the seismicity could have been triggered by rain.

In our study we apply a different approach to verify the validity of these results. We use two types of rain signal on the input which is compared with the time series of earthquake weekly rate for the past 25 years. To remove the strong episodic character of the swarm seismicity we use a declustered seismic catalog, which is characteristic by almost continuous seismic activity.

The rain signal is represented first by the precipitation data and second by the water level data in the Horka reservoir, which is located above the main focal zone of Nový Kostel. We test the possible relation to the earthquake swarm activity by cross correlating both the rain signal types and the seismicity rate. To amplify the possible seasonal periodicity of the data we stacked the explored time series data (precipitation, water level and seismic activity) according to their occurrence date in a single year. The results show that in any of the input data and seismicity do not correlate.

In the next step, we tested the possible (annual) periodicity of the data in question by the singular spectral analysis (SSA), which is a sensitive method to identify possible periodic signals in the presence of noise. While the water level data showed a striking peak for the period of 1 year, any indication of annual periodicity was never found in the seismicity data. Accordingly, we conclude that our analysis has shown no influence of the precipitation or the water level fluctuations in the Horka dam to the earthquake swarm activity in West Bohemia/Vogtland.