



Earthquake swarms triggered by intense rainfall? The Hochstaufen project.

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The temporal behaviour of seismicity in the area of Bad Reichenhall, SE-Germany, is well known from several decades of seismological observations. Usually, an annual maximum in seismic activity is observed in the months with the highest precipitation between spring and late summer. In addition to this long term seasonal variation, swarms of microearthquakes occur nearly every year. In the majority of cases they are preceded by above-average rainfall events. We postulate that this seismicity, located in the Hochstaufen Massif near Bad Reichenhall, is strongly influenced or even triggered by meteorological and/or hydrological parameters. This hypothesis is tested with data recorded by a seismological network of five permanent stations which were installed during 2001. Additional mobile stations were deployed in 2002 (3), 2003 (4), and 2004 (9). To complete the observations, hydrological and meteorological data are recorded by seven weather stations and a number of ground water gauges located in the area. We present results of a detailed investigation of two microearthquake swarms recorded in 2002. Both were preceded by strong rainfall events and reached a maximum of seismic activity ten days after the onset of precipitation. Standard hypocentre estimations (based on a minimum 1D velocity model) of more than 500 events could be derived. However, we were able to refine the hypocentre distribution of some of this events by using waveform similarities of several seismic clusters found in the swarms. The observed migration of hypocentres into depth enables us to estimate the hydraulic diffusivity by applying a simple pore-fluid pressure diffusion model. Our estimates are in good agreement with those of laboratory measurements and hydraulic fracturing experiments accomplished by other researchers.