SECOND EUROPEAN CONFERENCE ON EARTHQUAKE ENGINEERING
AND SEISMOLOGY, ISTANBUL AUG. 25-29, 2014

SEISMICITY-BASED ESTIMATION OF THE DRIVING FLUID PRESSURE IN THE CASE OF SWARM ACTIVITY IN WESTERN BOHEMIA

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Two recent major swarms in Western Bohemia occurred in the years 2000 and 2008 within almost the same portion of a fault close to Novy Kostel, Western Bohemia, Czech Republic. Previous analysis of the year 2000 earthquake swarm revealed that fluid intrusion seemed to initiate the activity while stress redistribution by the individual swarm earthquakes played a major role in the further swarm evolution. Here we analyze the new swarm occurred in the year 2008 with regard to its correlation to the previous event as well its spatiotemporal migration patterns. We find that

i. the main part of the year 2008 activity ruptured fault patches adjacent to the main activity of the swarm 2000, but that also
ii. a significant overlap exists where earthquakes occurred in patches in which stress had been already released by precursory events;
iii. the activity shows a clear migration which can be described by a one-dimensional (in up-dip direction) diffusion process;
iv. the migration pattern can be equally-well explained by a hydrofracture growth, which additionally explains the faster migration in up-dip compared to the down-dip direction as well as the maximum up-dip extension of the activity.

We use these observations to estimate the underlying fluid pressure change in two different ways:
Firstly, we calculate the stress changes induced by precursory events at the location of each swarm earthquake assuming that observed stress deficits had to be compensated by pore pressure increases;
and secondly, we estimate the fluid overpressure by fitting a hydrofracture model to the asymmetric seismicity patterns. Both independent methods indicate that the fluid pressure increase was initially up to 30 MPa.

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