Geophysical Research Abstracts
Vol. 14, EGU2012-1470, 2012
EGU General Assembly 2012

Natural microseismicity investigated using double-difference tomography: a 3D look at the 2008 swarm in the Novy Kostel area, Czech Republic

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The Novy Kostel region in West Bohemia is an area prone to periodic bursts of natural microseismic activity. In this study, we use 476 events from the October 2008 earthquake swarm recorded on the WEBNET seismic network. The foci occurred on the northern extension of the Marianske-Lazne Fault near the town of Novy Kostel in the Czech Republic. Initial source locations indicated a rupture zone approximately 3 km along the fault with the sources spread over 4 km depth, centered at 9 km. We use the double-difference tomography method to study the fault structure by relocating the sources and inverting for the P and S velocities in the rupture region.

Events are first relocated using the HypoDD program (Waldhauser and Ellsworth, 2000) using both catalog and cross-correlated datasets. These datasets, along with the absolute time picks are then used by the TomoDD program (Zhang and Thurber, 2003) to iteratively relocate the sources and invert for the 3D seismic structure. This dataset is ideal for this procedure as the cluster is very condensed and the WEBNET network offers ray coverage in all directions.

The relocated events flatten onto a fault plane striking at 169 degrees NE. This fault plane has three sections with distinct dip angles. At the shallowest (up to 8 km) and deepest (10 – 11 km) parts of the fault, the dip is shallow, whereas the middle section has a steep dip angle. Most events occur at the deeper part of the middle section. The inverted velocities correspond well to results from regional seismic refraction surveys (e.g., CELEBRATION 2000). Here, more details of the 3D velocity structure are revealed. As expected, velocities to the east of the fault are overall higher, corresponding to the uplifted northern margin of the Eger Rift. Finer structures surrounding the source region are also resolved.

References

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