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Tomographic Analysis of the West Bohemia Seismic Zone

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The West Bohemia Seismic Zone is located on the border between Czech Republic and Germany. This region has several areas which experience periodic microseismic swarm activity. The installation of the West Bohemia Seismic Network (WEBNET) has allowed constant monitoring of the town Nový Kostel and surrounding area. Nový Kostel is one of the most active areas. Larger swarms, such as those in 1997, 2000, 2007, 2008 and 2011, have been studied in terms of source mechanisms and swarm characteristics. Despite these analyses, questions remain regarding the subsurface structure in and around the focal zone, and the swarm trigger.

In this study, we investigate the seismic velocity structures within and around Nový Kostel using double-difference tomography and Weighted Average Model (WAM) post-processing analysis. To do this, we calculate a set of velocity models using a range of reasonable starting parameterizations that are compatible with the experimental information used. The WAM analysis produces a single averaged model and calculates the weighted standard deviation at each inversion node. By averaging the models together, bias and artefacts from the starting models are reduced. In addition, the weighted standard deviation is used to assess the averaged Vp and Vs models for stability and resolution. The full control on the reliability of the Vp and Vs models allows us to also calculate a Vp/Vs model by directly dividing the P and S seismic velocities.

Initial results using a subset of the 2008 swarm indicated a low-Vp/Vs layer overlaying the focal zone, and high Vp and Vp/Vs values along the fault zone. This hinted towards a low-permeability layer acting as a fluid trap, and potentially triggering the swarms. Here, we further the investigation by using the full WEBNET catalog from 1991-2011. We invert the full catalog of P and S arrival times along with detailed inversions of individual swarms to produce a structural model of the Nový Kostel area.