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3-D velocity structure of upper crust beneath NW Bohemia/Vogtland

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erreicht. Die Antwortfunktionen von AE Sensoren sind aus diesem Grund grundsätzlich komplex und haben einen deutlichen Einfluss auf die gemessenen Signale.

Im Rahmen des JAGUARS (Japanese-German Underground Acoustic Emission Research in South Africa) Projektes wurden in der Mponeng Gold Mine in Carletonville, Südafrika AE-Sensoren in Kombination mit vollständig kalibrierten Beschleunigungsaufnehmern installiert. Durch Dekonvolution der aufgezeichneten Signale konnte die vollständige Antwortfunktion der AE-Sensoren (Amplitude und Phase) für Frequenzen zwischen 1kHz und 17kHz extrahiert werden.

Im untersuchten Frequenzbereich alleine konnten drei Resonanzfrequenzen bei 2.5 kHz, 6 kHz und 10 kHz identifiziert werden. Die Richtungsabhängigkeit der Sensoren konnte quantifiziert werden und zeigt bei orthogonalem Einfall eine Reduktion von mehr als -10dB.

Wir demonstrieren anhand von synthetischen Daten, dass die komplexe Antwortfunktion der AE-Sensoren zu einer signifikanten Verstärkung der Amplitude führt. Der Verstärkungsfaktor hängt dabei stark von Frequenzgehalt und Stärke des einfallenden Signals ab. Die Amplitude wird in Abhängigkeit von Magnitude, Distanz und Richtung des seismischen Signals nichtlinear bis zu über Tausend Prozent verstärkt.

Wir demonstrieren die Auswirkung einer unbekanntem Sensor-Antwortfunktion auf die Magnitudenbestimmungen für verschiedene Netzgeometrien und wie Fehler bei der Magnitudenbestimmung eingeschränkt werden können.

Seismologie - SO-3.001

3-D velocity structure of upper crust beneath NW Bohemia/Vogtland

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We present preliminary results from a travel time tomography investigation of the upper crust beneath west Bohemia/Vogtland region which is characterized by a series of phenomena like occurrence of repeated earthquake swarms, surface exhalation, CO₂ enriched fluids, mofettes, mineral springs and enhanced heat flow. This region is an excellent location for an ICDP drilling project targeted to a better understanding of the crust in an active magmatic environment.

The data set were taken from permanent and temporary seismic networks in Germany and Czech Republic from 2000 to 2010, as well as active seismic experiments like Celebration 2000 and quarry blasts. Seismic Handler was applied for picking P and S wave arrival times. Before travel time inversion, we selected 399 events which were recorded by 9 or more stations and azimuthal gap < 160°.

In the first step a simultaneous inversion of P and S wave 1-D velocity models together with relocations of hypocenters and station corrections was performed. To test the reliability of earthquake locations we performed two experiments: first relocation of randomly perturbed earthquakes in the preferred 1-D velocity model, second mislocations of shots to check the accuracy of the earthquake positions.

In the next step, 3-D tomography was performed. The obtained minimum 1D velocity model was used as starting model for the 3-D Vp and Vp/Vs velocity models. P and S wave travel time tomography employs damped least-square method and ray tracing by pseudo-bending algorithm. For model parametrization different cell node spacings have been tested to evaluate the resolution in each node. Synthetic checkerboard tests have been done to check the structural resolution. Then Vp and Vp/Vs in the preferred 3D grid model have been determined. Earthquakes locations in iteration process change till the hypocenter adjustments and travel time residuals become smaller than the defined threshold criteria. Finally the analysis of the resolution depicts the well resolved features for interpretation. We observed lower Vp/Vs ratio in depth of 5-10 km close to the foci of earthquake swarms and higher Vp/Vs ratio is observed in Saxoturingian zone and surrounding area.

Seismologie - SO-3.002

Ambient noise surface wave tomography in NW-Bohemia/Vogtland region

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The W-Bohemia/Vogtland region at the border between Germany and Czech republic is a place of presently ongoing geodynamic processes in the intra-continental lithosphere, which result in the occurrence of repeated earthquake swarms, mantle-derived fluid exhalations, mofettes, mineral springs and enhanced heat flow. It is a key site to study the mantle-crust interaction in an active magmatic environment, and has been proposed as a site for scientific drilling. Fluid reservoirs have been proposed for the upper crust as well as for the crust-mantle transition zone, but their direct observation is still missing.

Using the vertical and transverse component ambient noise data, we estimate both Rayleigh and Love waves from ambient noise cross-correlation waveforms to investigate the crustal seismic structure of W-Bohemia/Vogtland. More than 2000 Rayleigh and Love group-velocity dispersion curves are obtained by time-frequency analysis of stacked ambient noise cross-correlation functions between station pairs using the data between 2002 and 2004 recorded at 43 seismic stations from BOHEMA experiment and between 2006 and 2008 recorded at 79 seismic stations from permanent station networks of Germany, Czech Academy of Sciences (WEBNET) and PASSEQ experiments.

At each period between 1 and 10 s, group velocity maps are constructed, all corresponding to different sampling depths, and thus together giving an indication of the velocity variations in 3D extending to a depth of about 15 km.