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Location Performance of the ALPAACT Seismic Network

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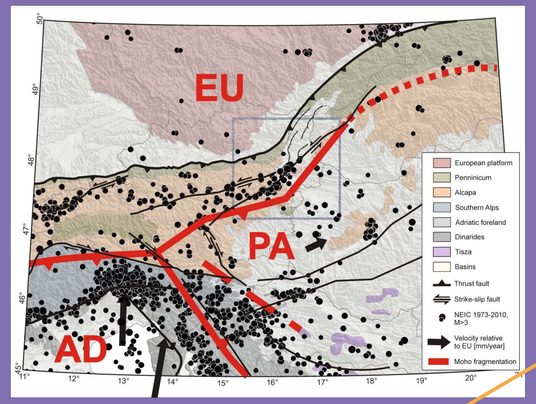
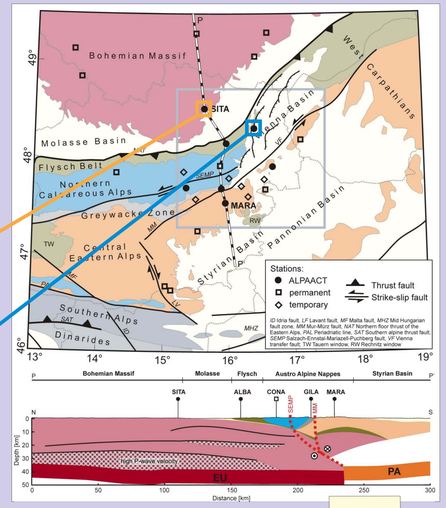
The study area of ALPAACT is situated at the transition of the Eastern Alps to the Pannonian basin and the Western Carpathians. WARR experiments revealed a distinct fragmentation of the Moho discontinuity and the uppermost mantle into the European (EU) and Adriatic (AD) plates and the Pannonian fragment (PA). These crustal blocks form a triple junction below the bifurcation of the Alps into their most eastern part and the Dinarides. Seismicity and actual deformations observed by geodetic methods indicate ongoing convergence between AD and EU and lateral extrusion of PA to the east. The latter process is accompanied by dextral strike slip between AD and PA in the Dinarides and sinistral strike-slip between EU and PA in our study area (e.g., Brückl et al., 2010).

Tectonic Setting 1



ALPAACT

Seismological and Geodetic



Monitoring of ALpine-PAnnonian Active Tectonics 2

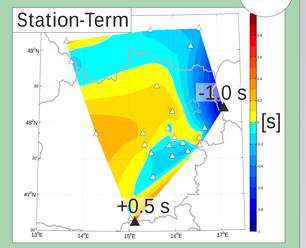
17 seismic stations, equipped with broadband seismometers (Reftek 130, Guralp 3ESPD, Earthdata PR 6-24 Portable) form the temporary ALPAACT network. Recordings from 26 observatories complete the data set used for location.
The temporary stations are located on different geological units of the Eastern Alps, their foreland, the European platform, and the transition to the Pannonian basin. Crustal structure below these stations varies significantly. Seismic wave propagation, ambient noise, and ground response are closely related to these geological structures.

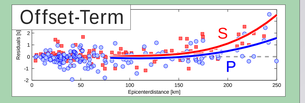
Localisation

The picking of the arrival times was done manually with the software Seismon by Mertl (2010). Afterwards the picks were exported to NonLinLoc by Lomax (2008) a package for locating earthquakes using a 3D-velocity-model. The models for P- & S-wave underground velocity were provided by Behm, et al. (2007).

Residual Decomposition 2A

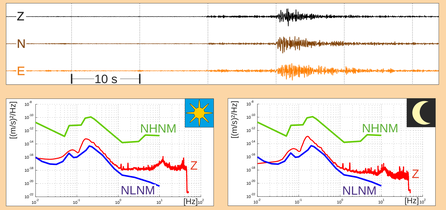
To improve the travel time calculation the residuals were split into offset and station terms. One explanation for the offset dependence is a slightly lower vertical velocity gradient in the upper mantle then currently used in the model. The station terms show a geologically plausible spatial distribution.
These correction terms were added up and entered a second localisation as static corrections.



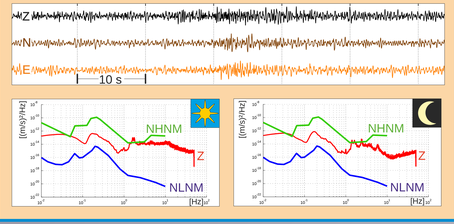


Correction Terms

Schiltern - countryside

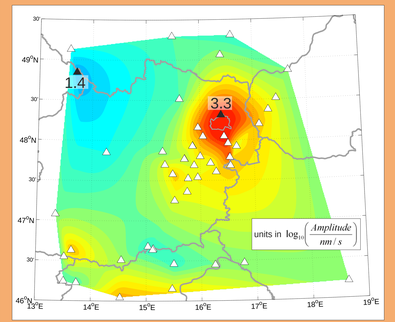


Bisamberg - city outskirts



Noise Analysis

Detection Limits 2B



For the investigation of bias on hypocenter location due to a reduced number of available stations we used high magnitude earthquakes (<2.7), consecutively cancelled travel time data used for location and observed the thus induced variation of the focal coordinates.
Chosing of travel time data used was done with detection limits derived from a small set of earthquakes. The resulting map shows the strong anthropogenic noise around Vienna as well as enhanced propagation to the North-East due to the crustal structure.
Noise analysis was used for validation and compared to the New High (NHNM) and Low Noise Model (NLNM) by Peterson (1993) and is shown for two stations: Schiltern and Bisamberg.

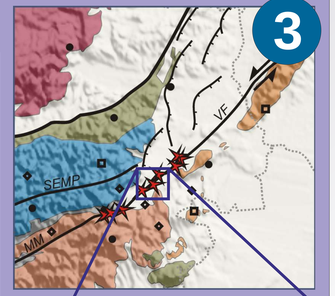
Magnitude changes Network Configuration

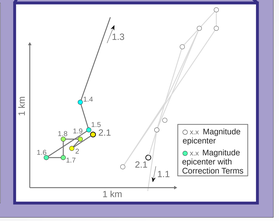
Results & Conclusion 3

The nine relocated earthquakes cluster along a 50 km long segment of the Vienna basin transfer fault system in the southern Vienna basin and deviate from a plane less than 2.9 km. Additionally a downward trend of epicenters in North-East-direction was detected.

Reduction of travel time data in 0.1 Magnitude-steps using detection limits leads to chaotic jumps of the epicenters within a radius < 2 km, mostly < 1 km.
Correction terms, calculated by decomposition of the travel time residuals into station terms and an offset dependence, improve the travel time calculation. A comparison of localisations at different magnitudes shows, that reducing travel time picks to simulate earthquakes of less than 1.8 the estimated location accuracy (Hausmann, et al. (2010) is exceeded.

An enlarged data set of earthquakes would be beneficial for determination of correction terms as well as the mapping of faults. However, tests with synthetic data demonstrate that further improvement of location accuracy depends on travel time picks, which will be the major interest in future research.





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