Geophysical Research Abstracts
Vol. 13, EGU2011-6950-1, 2011
EGU General Assembly 2011

Location performance of the ALPAACT seismic network

Maria-Theresia Apoloner (1), Ewald Brückl (1), Johanna Brückl (2), Walter Loderer (1), Stefan Mertl (1), and Bernd Schurr (3)

(1) Institute of Geodesy and Geophysics, Vienna University of Technology, Vienna, Austria (maria-theresia.apoloner@tuwien.ac.at), (2) Graf Starhemberggasse 26, 1040 Vienna, Austria, (3) GFZ - German Research Centre for Geosciences, Potsdam, Germany

High seismicity clustering around the Mur-Mürz valley and the Vienna basin transfer fault system witness ongoing north-eastward directed extrusion and escape processes of the Pannonian lithospheric fragment relative to the European platform. Magnitudes of instrumentally recorded earthquakes in this area exceed Ml=5 slightly. Historically documented earthquakes reached Ml∼6 and paleoseismological investigations give evidence for an M∼7 earthquake in the Vienna basin. Accurate absolute location of earthquakes and their spatial relation to known faults is an issue not only for a deeper understanding of the actual tectonic processes. It is also important for estimating seismic hazard for the capital Vienna and the densely populated and highly developed surrounding areas. The existing network of seismic observatories is too sparse to guarantee high precision earthquake location.

One goal of the project ALPAACT (Seismological and geodetic monitoring of ALpine-PAnnonian ACtive Tectonics; http://info.tuwien.ac.at/geophysik/research/alpdynamics/alpaact.htm, sponsored by the Austrian Academy of Sciences) is improvement of earthquake location in the area addressed before. Seven long term seismic stations equipped with 30 s and 120 s broadband seismometers were deployed in the target area during 2009 and 2010. 10 broadband stations provided by GFZ have been added to this network for the period of 1 year. Additional data are routinely collected from 35 permanent seismic observatories within a radius of ∼ 250 km around the target area. Hypocentre location uses a 3D P- and S-wave velocity model of the lithosphere down to a depth of 60 km which was derived from active source seismic data (CELEBRATION 2000, ALP 2002; http://www.alp2002.info/). Magnitudes of earthquakes analysed so far reach from Ml=1.5 to Ml=2.7. Due to the range of relatively low magnitudes and the spatially and temporally varying noise level at the individual seismic stations, the number and geometry of stations yielding accurate travel time data vary from one earthquake to the next. Furthermore, the removal of the GFZ station will also cause a data reduction. Obviously less accurate data result in lower location accuracy. However, a bias on hypocenter locations caused by the changing availability of stations is to be avoided.

For the investigation of bias on hypocentre location due to a reduced number of available stations we used the higher magnitude earthquakes, consecutively cancelled travel time data for location, and observed the thus induced variation of the focal coordinates. Decomposition of the travel time residuals into station terms and an offset dependence lead to an improvement of the travel time calculation. One explanation for the offset dependence is a slightly lower vertical velocity gradient in the upper mantle then currently used in den model. The station terms (standard deviation ∼0.3 s) show a geologically plausible spatial distribution. The maximum number of available travel times (P- and S-waves) was about 40. Reduction of travel time data by 50% leads to chaotic jumps of the epicentres within a radius < 2 km, mostly < 1 km. Tests with synthetic data demonstrate that further improvement of location accuracy could be achieved only by more accurate travel time picks. Current and future efforts concentrate on this issue. The already relocated earthquakes cluster along a 49 km long segment of the Vienna basin transfer fault system in the southern Vienna basin and deviate from a plane less than 2.7 km.