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Geophysical investigations of the Eastern Alpine crust and upper mantle

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Currently the deep structure of the Eastern Alps and their surroundings is intensively studied by several large-scale geophysical investigations. We present latest results and ongoing projects.

3D seismic refraction experiments CELEBRATION 2000 and ALP 2002 delivered much new insight into the P-wave velocity distribution of the crust and the structure of the complex Moho boundary in the area. Those experiments employed a total of 1791 receivers which recorded seismic waves from 94 blasts. The results are 3D velocity model of the crust, a new Moho depth map and several detailed 2D interpretations. The most important outcome is the determination of a pronounced fragmentation of the crust, including the new interpretation of the crustal block “Pannonia” which may be related to Miocene-to-date extrusion tectonics.

Based on these results, the ALPASS experiment was launched to investigate the structure of the upper mantle down to the 660 km discontinuity. 110 permanent and 79 temporarily deployed stations recorded earthquake waveforms in the time from May 2005 to April 2006. These data provide the input for surface wave inversion, receiver functions and teleseismic tomography. Of particular interest is the question of direction of subduction in the Eastern Alps, since several previous investigations yield ambiguous results. For teleseismic tomography, 144 events have been selected and a first model of the P-wave velocity structure of the upper mantle will be presented.

Magnetotelluric soundings targeting the crust have been performed in the frame of the DIMS project. Ten test measurements with different instruments were carried out along the Hungarian-Austrian border. Another 33 measurements followed a seismic profile from the Hungarian border toward NW. Preliminary results indicate low resistivity of sediments in the Graz Basin in the SE part of the profile, as opposed to the highly resistive Eastern Alps in the NW. Large-scale tectonic fractures appear as conductive dikes. The long period soundings along the Hungarian-Austrian border might delineate the asthenosphere.

We conclude that all three projects deliver much new insight into the deep structure of the investigated area. The joint interpretation of the existing and forthcoming models will contribute to a better understanding of the complex geodynamic processes that took place in the Eastern Alps.

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