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Recent developments of seismic exploration in the Tannwald basin

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The ICDP proposal DOVE (Drilling Overdeepened Alpine Valleys) intends to examine the Quaternary glacial cycles in the Alpine region. The sediment succession of overdeepened valleys and basins will be analysed in a multidisciplinary way. Other objectives are related to groundwater supply and geohazards in Alpine valleys. In the context of DOVE, a DFG-funded project studies the benefit of modern multi-component reflection seismics. This project intends to characterize the structure and facies of the sedimentary fillings and to transfer methodological results to the DOVE drill sites.

In 2014 and 2015 several reflection seismic surveys were carried out in the Tannwald basin, located about 50 km NE of Lake Constance. The basin constitutes a relict of one of the Rhine Glacier lobes in the Pleistocene. In total, we acquired five high-resolution profiles using P-waves, two profiles using horizontally polarized shear waves, and one profile using multi-component technique (SV- and SH-wave source, 3-component receivers) to explore the sedimentary filling of the basin.

The P-wave profiles generally show strong heterogeneity and variations in the reflection pattern. Distinct reflections in depths between 100 m and 200 m are identified as basement, i.e. top Molasse, which is supported by a nearby research borehole. In particular, a ramp-like structure is prominent over a distance of 450 m and dips about 10°. Internal structures of the basin filling form discontinuous reflection segments, which are only visible in parts of the profile. The SH-wave profiles resolve both internal structures in detail and the basement. Since the location of the SH-wave profiles coincides with P-wave profiles, a detailed comparison of the structures gained from P-wave and SH-wave seismic exploration is possible. Moreover, Vp/Vs and Poisson ratio are calculated from P- and S-wave velocities received from refraction seismic tomography and the stack velocities, respectively.

Further steps are processing and interpretation of the multi-component line, where we excited horizontally-polarized shear-waves orientated inline and cross-line. This enables a particular analysis of seismic anisotropy in the sedimentary filling, which is supposed to be glacially disturbed. A 3-D processing of cross-line excitation and registration will provide information about the spatial position of the reflectors. In addition, two seismic surveys are scheduled for 2016 in the Lienz basin, Austria.