



## **P- and S-wave surveys reveal the fill of overdeepened Alpine glacial valleys**

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Seismic imaging and characterization of the geometry and the sedimentary succession of glacially overdeepened Alpine valleys is usually conducted in the past with success using P-waves. In advance of a project of the International Continental Scientific Drilling Program, the Leibniz Institute of Applied Geophysics evaluates the potential of S-wave reflection seismic using multicomponent techniques for this task.

We acquired S-wave datasets at two locations: (1) the Tannwald Basin, a distal branch basin of the Rhine glacier, and (2) the Lienz Basin, an inner-mountainous basin at the confluence of major ice-streams. Several SH-wave profiles using a horizontal polarized source (4 m spacing) and receivers (1 m spacing) were acquired. In addition, 6-component surveys were acquired by two orthogonal horizontal directions of excitation (4 m spacing) and 3-component receivers (2 m spacing) to analyse differently-polarized S-waves. A 100 x 100-m<sup>2</sup> area was recorded with this 6-component technique as well (3 m inline/9 m crossline spacings). Sweep frequencies for the vibrator sources (LIAG's mini vibrators MHV4S and ELVIS-7), ranged from 10 to 100 Hz for 10 s duration.

In Tannwald Basin, we achieved differing results regarding the SH-wave technique. We developed optimal processing schemes for the different test sites, including time-variant scaling to emphasize near-surface reflections, attenuation of the surface waves by fk-filtering, and spectral whitening to increase resolution. On the one hand, we gain very good results that enables us to differentiate facies inside the sedimentary fill of the overdeepened basins from only several metres below the surface down to the base of the basin at ~250 m depth. On the other hand, some profiles at the same location were disturbed by surface waves.

The analysis of SH-wave data demonstrates that the offset can be kept quite small and encouraged us to conduct a small 3-D S-wave survey using 6-components. The interpretation of a corresponding P-wave survey benchmarks the S-wave data. The S-wave sections show most geological structures on the components of the same source-receiver orientation. A prestack data rotation focussed the energy to the radial and transversal components that corresponds to the SV- and SH-domains. Reflectivity on the other (mixed) components indicates wave conversion.