



Waveform Tomography of the Salzach Valley

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A 3-km-long refraction survey near Zell-am-See, Austria, provides a detailed characterization of the sedimentary structure and the depth to bedrock of the Salzach Valley. A low resolution first-arrival tomography model was derived from the data that served as a starting model for a full waveform inversion in the 4-26-Hz-band. The waveforms are modeled in the acoustic approximation, and the inversion is performed in the frequency domain. The final data fit is excellent in the central parts of the valley, but it degrades significantly towards the edges. In addition to the differing subsurface coverage, we interpret this as a result of the acoustic approximation being well suited for the largely unconsolidated valley fill. In contrast, the sediment-bedrock interface creates strong converted phases that prevent reconstruction of detailed features in the underlying crystalline crust.

The resulting waveform model shows an up to 0,5 km thick sedimentary fill over bedrock, which is surprisingly large compared to the much larger, but shallower, Salzburg Basin. The P-wave structure of the sediments shows a significant velocity inversion, which is interpreted as a pressured aquifer overlying a 150-m-thick unsaturated zone.

Near the surface, the seismic model is controlled by coincident deep GPR and ERT profiles. The good structural agreement emphasizes the quality of the results. From the comparison with other 2D waveform-inversion studies from a variety of scales, we conclude that refraction surveys at this scale are ideal candidates for full waveform inversion because of the typically relatively low signal frequencies.