Improved interpretation of SAGEEP 2011 blind refraction data using Frequency-Dependent Traveltime Tomography

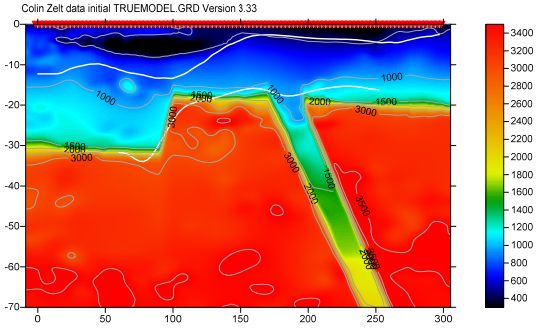


Fig. 1 : Basement step with fault model. See Zelt et al 2013 Blind test of refraction methods.

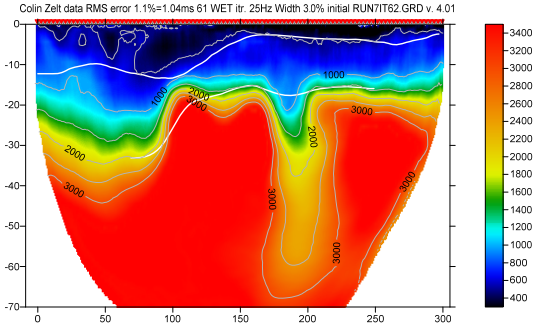


Fig. 2 : multiscale WET inversion with WDVS @63Hz. See Rohdewald 2021.

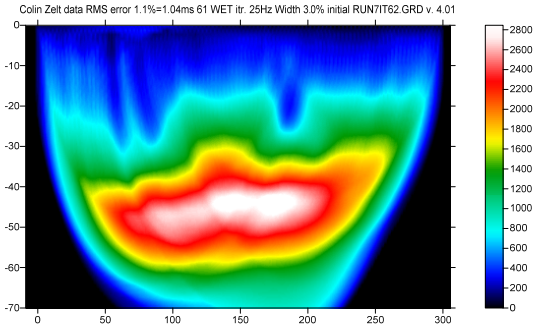


Fig. 3 : WET wavepath coverage plot obtained with Fig. 2. Unit is wavepaths per pixel.

❑We demonstrate improved resolution in P-wave velocity tomograms obtained by inversion of the synthetic SAGEEP 2011 refraction traveltime data (Zelt 2010) using Wavepath-Eikonal Traveltime Inversion (WET; Schuster 1993) and Wavelength-Dependent Velocity Smoothing (WDVS; Zelt and Chen 2016).

❑We use a multiscale inversion approach and a Conjugate-Gradient based search method. Our default starting model is a 1D-gradient model obtained directly from the traveltime first arrivals assuming diving waves (Sheehan, 2005). As a second approach, we map the first breaks to assumed refractors and obtain a layered starting model using the Plus-Minus refraction method (Hagedoorn, 1959).

❑We compare tomograms obtained using WDVS to smooth the current velocity model grid before forward modeling traveltimes vs. tomograms obtained without WDVS (Rohdewald, 2021). Results show that WET images velocity layer boundaries more sharply when engaging WDVS.

❑We determine the optimum WDVS frequency iteratively by trial-and-error. We observe that the lower the used WDVS frequency, the stronger the imaged velocity contrast at the top-of-basement. Using a WDVS frequency that is too low makes WDVS based WET inversion unstable exhibiting increasing RMS error, too high modeled velocity contrast of overburden anomalies and too shallow imaged top-of-basement.