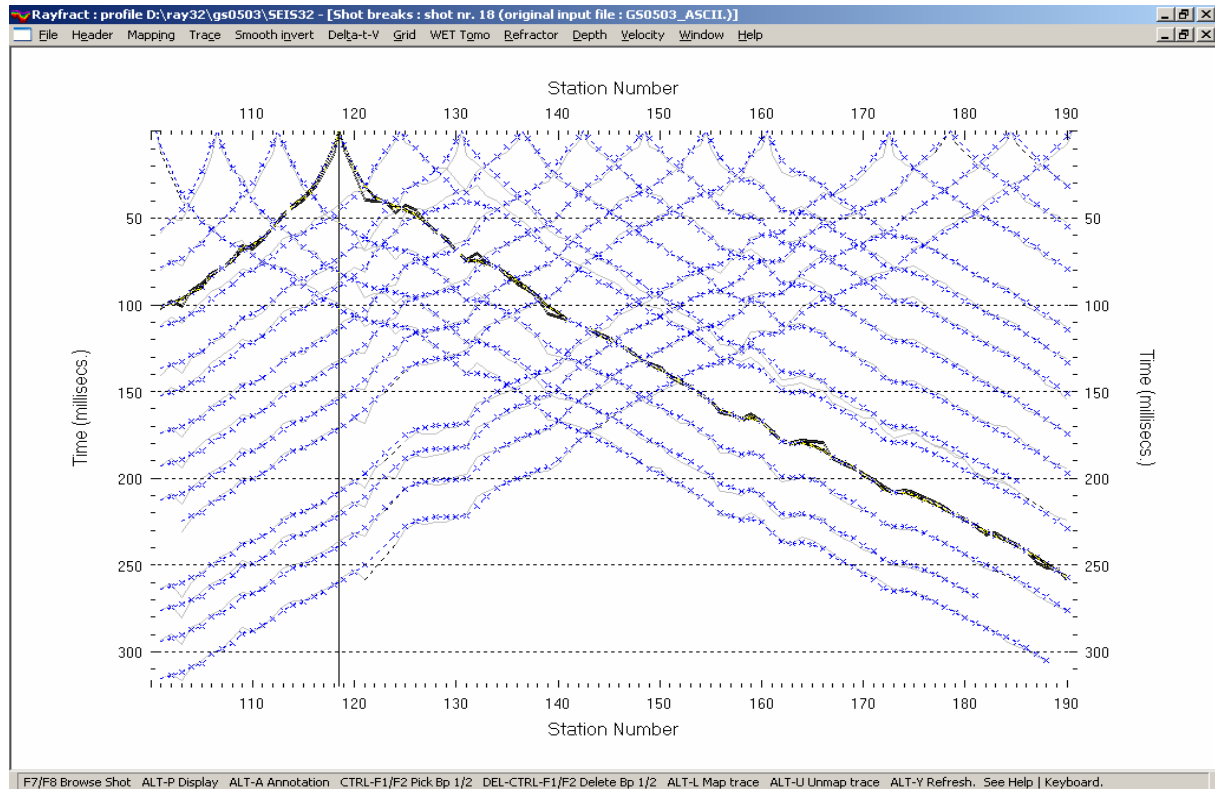


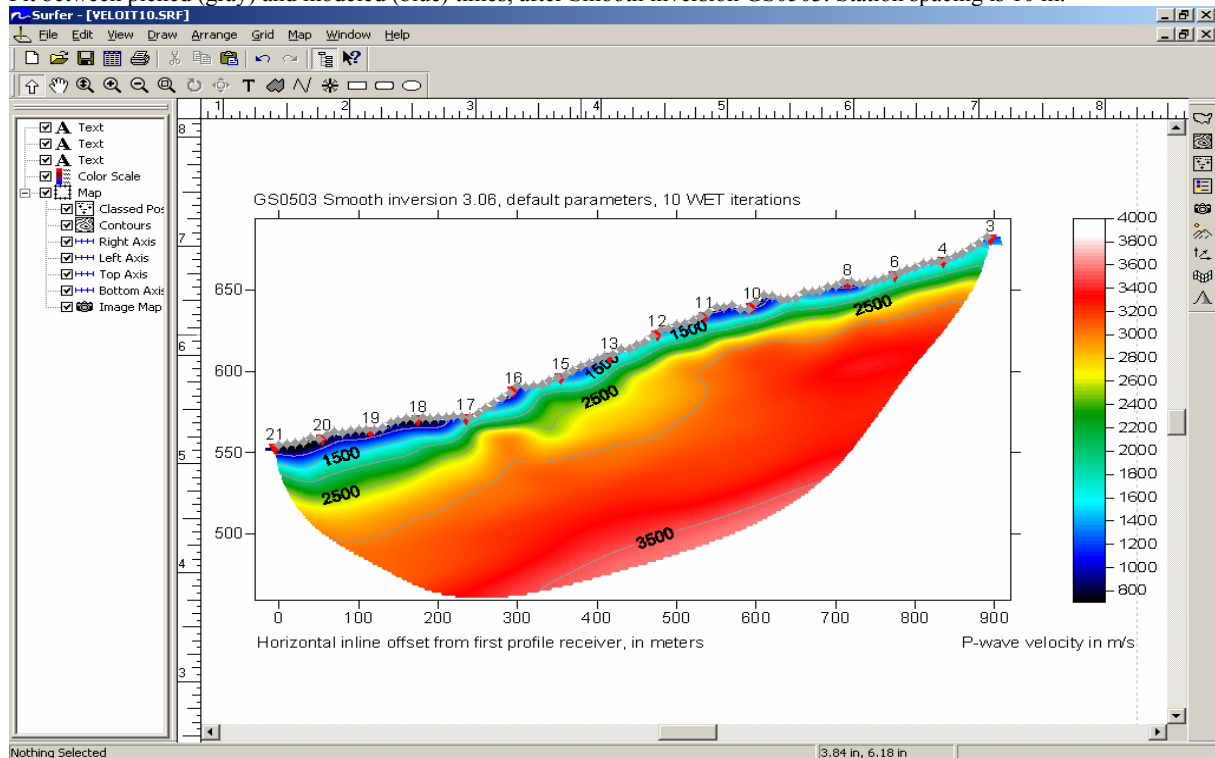
## Landslide imaging JOANNEUM RESEARCH lines GS0503 and GS0801, correlation at crossing point:

Here we show Smooth inversion with our Rayfract® software version 3.06, of two crossing lines recorded and made available by Dr. Grassl, [JOANNEUM RESEARCH Forschungsges.mbh](http://www.joanneum-research.at), Austria. Line GS0503 was recorded along dip of the landslide surface and with a station and receiver spacing of 10 m. Line GS0801 traverses the landslide surface along strike, with a spacing of just 2 m.

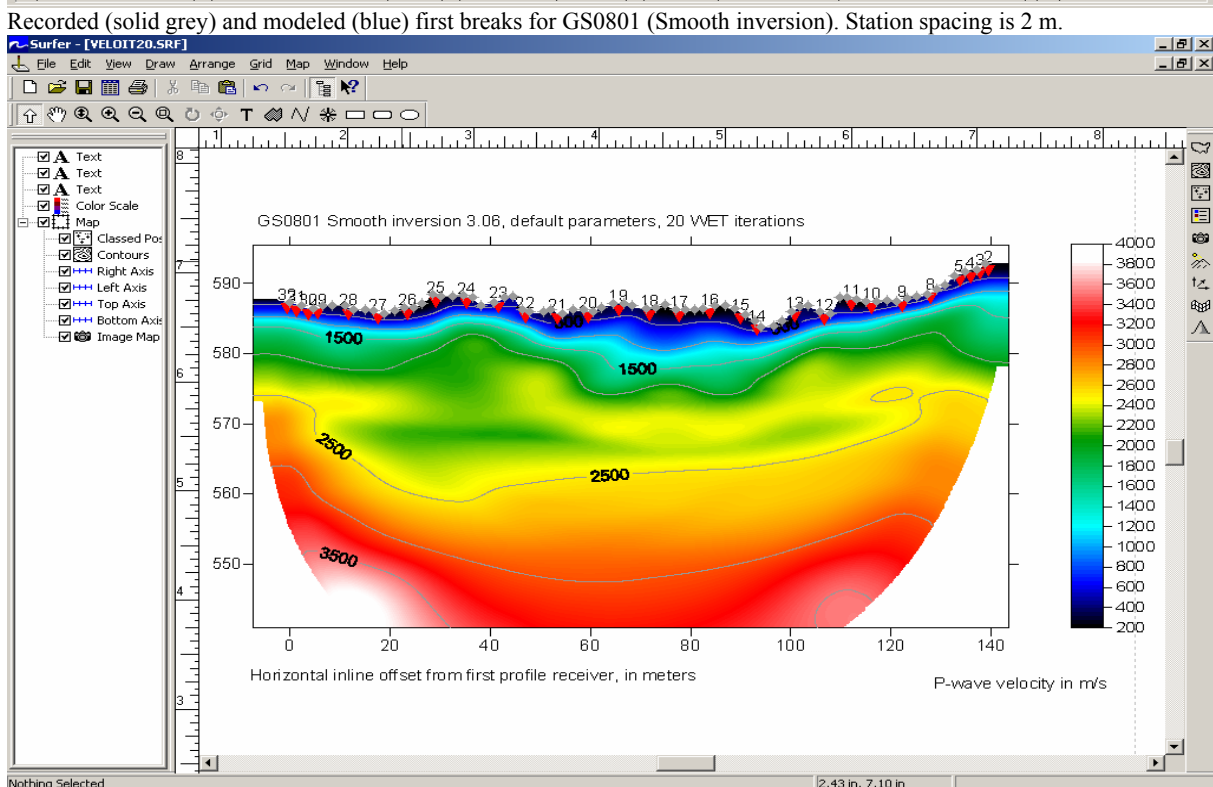
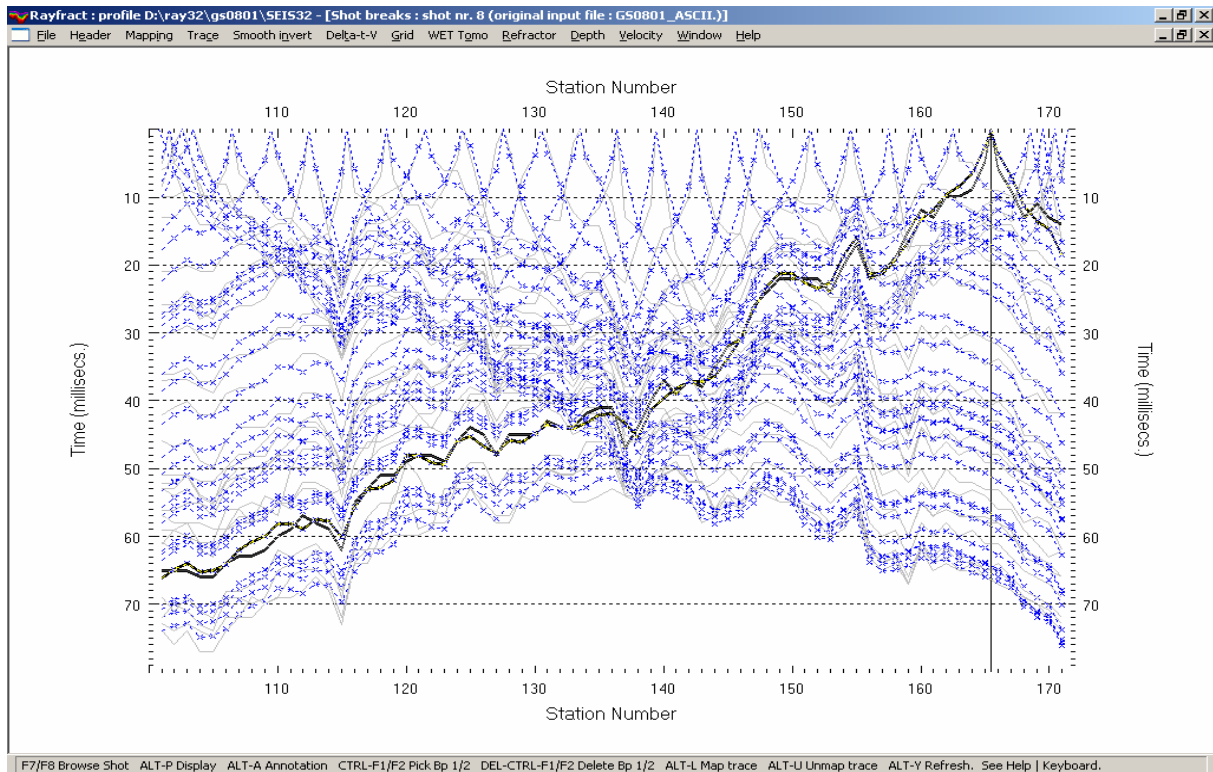
Strong lateral and vertical velocity variation and inhomogeneity typical for landslides are evident in traveltime curves and resulting Smooth inversion output for line GS0801 (see next page).



Fit between picked (gray) and modeled (blue) times, after Smooth inversion GS0503. Station spacing is 10 m.



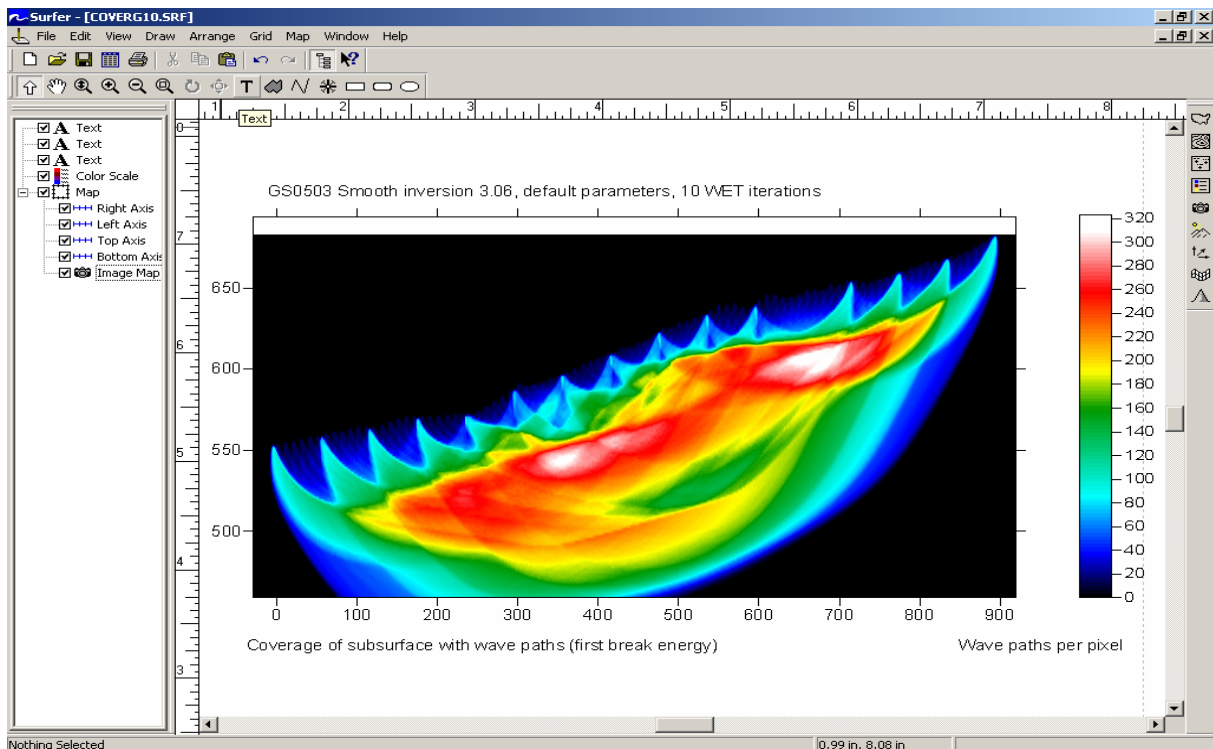
Smooth inversion 3.06 line GS0503, default parameters, 10 WET iterations. Station spacing is 10 m.



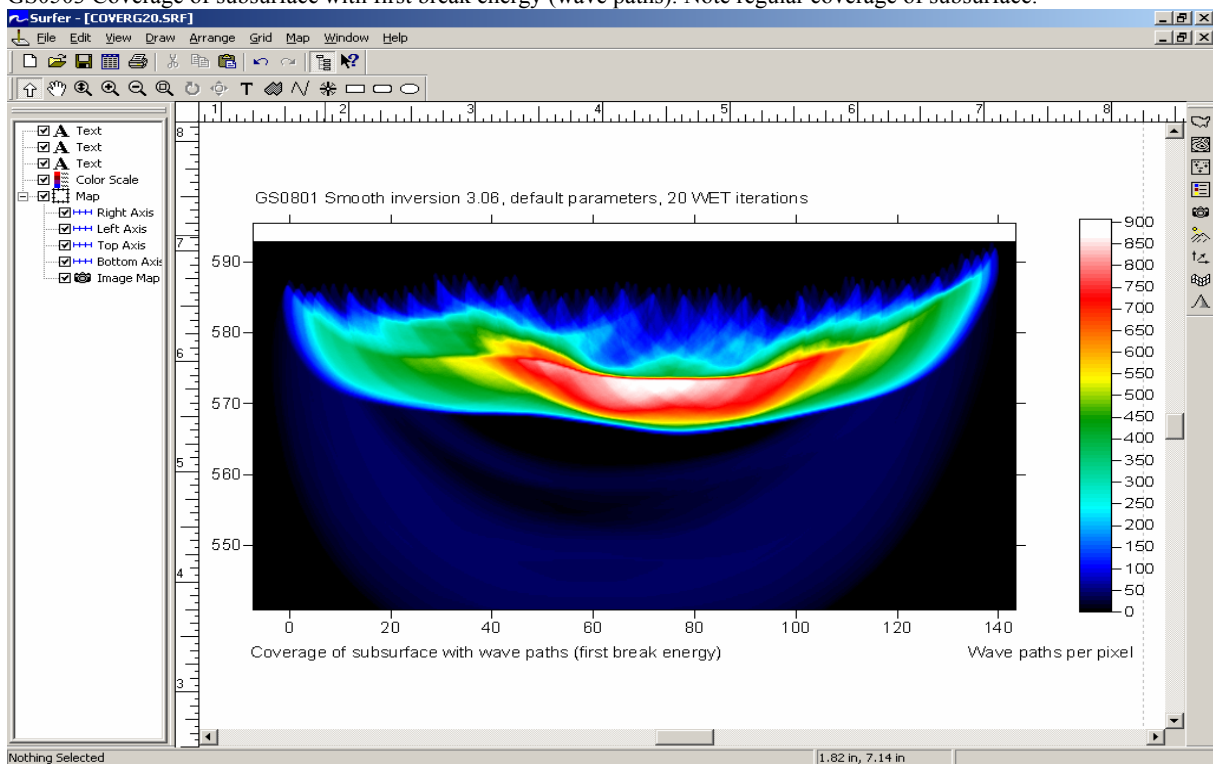
Crossing point is at GS0503 station 134 (shot 15) and GS0801 station 104 (shot 29). As described by [D. J. White 1989. Two-dimensional seismic refraction tomography. Geophysical Journal, volume 97, pp. 223-245](#), resolution of surface seismic tomograms decreases towards edges of tomogram, since here all rays are predominantly aligned parallel to each other.

We propose to look at 2,500 m/s contour in above two tomograms, since 3,000 m/s contour is almost at bottom of GS0801 tomogram (too close to tomogram edge). For GS0801, look at shot 26 instead of 29 (too close to left tomogram edge), to get meaningful elevation estimate of this contour. Contour depth below topography is about 25 m, at shot 26. This agrees well with GS0503 contour depth of about 20-25 m, below shot 15. GS0503 was recorded in 2005, and GS0801 in 2008.

The landslide became active a few months ago (in 2007) and was sliding at 1-2 m a day while measuring line GS0801.



GS0503 Coverage of subsurface with first break energy (wave paths). Note regular coverage of subsurface.



GS0801 Coverage of subsurface with first break energy (wave paths). Note velocity inversion below 570 m.

For GS0503, first break energy strongly penetrates the subsurface to almost the bottom of the tomogram. For GS0801, the velocity inversion at about elevation of 570 m causes most of the first break energy to critically refract at the top of this velocity inversion. Only far offset traces show wavepaths refracted by deeper interfaces. Reliability of WET output decreases with decreasing wavepath coverage. So for GS0801, WET output below 570 m has to be regarded with caution.

To invert the data for GS0503, please

- Download the original first break data and geometry files from <http://rayfract.com/tutorials/g0503.zip>.
- create a new profile database named GS0503, with a Station spacing of 10 m. See our manual <http://rayfract.com/help/manual.pdf> chapter 1.1.
- copy GS0503.ZIP to \RAY32\GS0503\INPUT with Windows Explorer, and unzip it there.

- import the GS0503.ASC file as described in chapter 1.11, with *Default spread type* „10: 360 channels“.
- import \RAY32\GS0503\INPUT\GS0503.COR with *File|Update header data|Update Station Coordinates...*
- import \RAY32\GS0503\INPUT\GS0503.SHO with *File|Update header data|Update Shotpoint coordinates...*
- invert the data with *Smooth invert|WET with 1D gradient initial model*. Proceed as lined out in chapter 1.14.

To invert the data for GS0801, please

- Download the original first break data and geometry files from <http://rayfract.com/tutorials/g0801.zip> .
- create a new profile database named GS0801, with a *Station spacing* of 2 m. See our manual chapter 1.1 .
- copy GS0801.ZIP to \RAY32\GS0801\INPUT with Windows Explorer, and unzip it there.
- import the GS0801.ASC file as described in chapter 1.11, with *Default spread type* „10: 360 channels“.
- import \RAY32\GS0801\INPUT\GS0801.COR with *File|Update header data|Update Station Coordinates...*
- import \RAY32\GS0801\INPUT\GS0801.SHO with *File|Update header data|Update Shotpoint coordinates...*
- invert the data with *Smooth invert|WET with 1D gradient initial model*. Proceed as lined out in chapter 1.14.

Processing was done on an HP Compaq nx7400 portable with Intel Core 2 Duo processor, running at 1.83 GHz and with 1 GBytes of RAM. Smooth inversion with default Delta-t-V and WET settings took about 5 minutes for each profile.

We would like to thank Dr. Grassl for making available these interesting and high quality data sets, and for his valuable feedback.