Changes between GLOBEClaritas 2025.1.1 and 2025.2.1

24th February 2025 to 29th July 2025 (Revisions 17680:17870, libclaritas 1615:1666, python 2169:2340)

GLOBEClaritas is excited to deliver the new release 2025.2.1 to clients. This release delivers a suite of innovative features designed to improve the user experience and supercharge your processing workflow to unlock deeper geological insights.

We want to take this opportunity to remind users of our email addresses for support (support@globeclaritas.com) and general information (info@globeclaritas.com) We appreciate your continued support of the GLOBEClaritas software and welcome your feedback - it enables us to improve the software continually.

Follow us on LinkedIn to keep up to date with the latest news and information from the Claritas team.

Release Highlights

- **New UHR Seismic COSA Statics Module:**
  The new **HRSTATICS** module estimates static corrections from sea-floor pick times for ultra-high-resolution marine surveys.
- **Enhanced Data Visualisation & QC:**
  Significant updates to our Python-based seismic viewer now enables users to compare datasets and supports pre- and post-stack seismic. The viewer has comprehensive analysis tools, as well as the capability to pick and QC FK/Tau-P/Radon and Radial transform mutes, and trace header overlays.
- **Surface Consistent Amplitude:**
  The **SCAMP** module now includes a **Marine** option.
- **New APPEND Module:**
  A new **APPEND** module allows for easier temporal merging of datasets with the ability to APPEND additional data at the end of existing seismic trace.
- **Improved supported browsers and selection widget for HTML Documentation:**
  Updated the browser selection widget to support a broader range of modern browsers including Chromium, Google Chrome, Opera, and Brave, as well as the simple Claritas browser. Obsolete options have been deprecated.

- **TOMO3D Enhancements:**
  Now supports 2D geometries and datasets for an improved user experience.
- **New File Cleanup Utility – dotbot:**
  A new python based utility called ‘dotbot’ to simplify removal of hidden files from Claritas project directories.

Supported platforms.

Supported platforms for 2025.2.1 are:

- Rhel8/9, AlmaLinux8/9
- Ubuntu 22.04/24.04,

and on Windows via,

- Windows Subsystem for Linux (WSL1/WSL2)

New UHR COSA statics module.

The HRSTATICS module is designed for ultra-high-resolution marine surveys to estimate static corrections from sea-floor pick times. The correction estimated by HRSTATICS compensates for average streamer depth and undulations of the streamer caused by towing and sea conditions.

Why it matters

UHR seismic acquisition usually uses shallow towed streamers and sources. This makes the depths of these poorly constrained due to interaction of the sea-state with the streamer and the tow vessel. The depth variability is made more problematic when the high-frequencies used in these surveys are taken into account. The HRSTATICS module estimates static corrections to compensate for the variability in the depths of the source and receivers due to sea-state, and for the average depth of the streamer.

How it works

The measured arrival times are dependent on the:

- distance to the sea-floor, the mean vertical position of the source,
- vertical displacement of the source due to sea-conditions,
- mean vertical position of the streamer and
- undulations of the streamer caused by sea-conditions.

The sea-conditions are expected to cause depth variations that change rapidly in time and space, and which have zero mean. The depth variability can thus be treated as a random variable in the estimation process, under the assumption that sea-floor depth (beneath the mean sea-surface) varies relatively smoothly over the scale of the sampling interval (how many depth measurements are available within any given area). This simplifies the estimation procedure, such that only the mean vertical positions of the acquisition need be estimated, and all other terms are combined into the noise component of the least- squares inversion.

The noise component can be broken down into three parts:

- the spatially uncorrelated measurement error,
- the correlated streamer undulations
- the correlated source variability

The streamer component is modelled as random variables having standard deviation defined by:

- the WAVEAMP parameter
- correlation function defined by WAVELEN.

Depending on the orientation of the waves impinging on the streamer, the streamers may move up in unison or undulate with a wavelength equal to the sea-wave wavelength. Hence, the covariance function is assumed to be a sinc function within each streamer. This has the property of allowing undulations equal-to or greater in wavelength to the WAVELEN parameter.

The covariance between streamers of neighbouring shots is more problematic as it depends on;

- the speed of the vessel,
- the timing of the source
- the incidence angle of the sea-waves on the streamer

Due to this complexity, neighbouring streamers are assumed to be uncorrelated. Similarly, the covariance between source depths of neighbouring shots is assumed to be uncorrelated. The random fluctuations of the source depth are thus assumed to only affect the current shot.

There is an ambiguity in the depth of the source, receivers and the sea-floor. If all of these change by the same amount, then the travel times will not be affected. For this reason, the estimation must be constrained so that the depths cannot vary infinitely.

Therefore, HRSTATICS holds the mean source depth at zero depth.

The estimated channel depths are usually poorly constrained with respect to a constant displacement term, hence, the estimation equations (weakly) constrain the average of the channel depths to be zero. The result of these constraints is that the static times will be accurate only to a constant value displacement.

The residual from the estimation is decomposed into its three parts:

- source depth variability,
- streamer undulation
- measurement errors

Subtracting the measurement errors from the pick measurements gives an estimate for the actual pick times.

This is written out as the HRSTATICS_REPICK trace header.

Removing the estimated (average) streamer position from the modelled times (i.e. the pick times without any measurement errors or sea- state effects) gives an estimate for the pick times without sea-state or streamer depth.

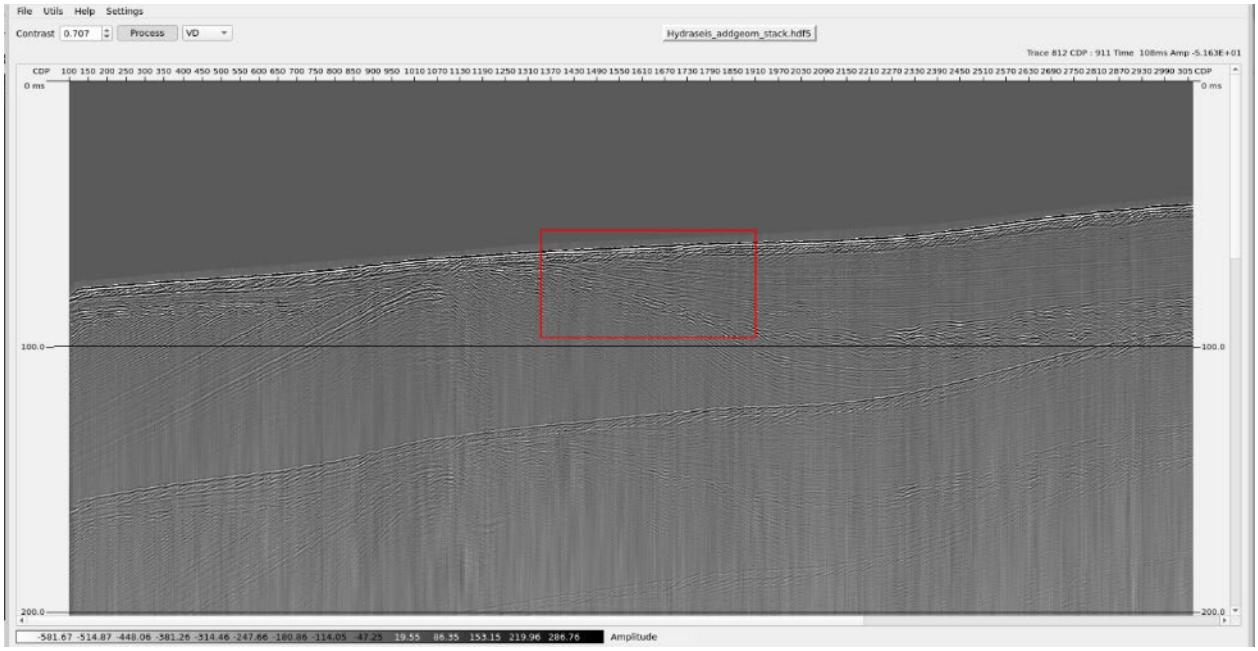
This is written out in the HRSTATICS_ADJPICK header.

The difference between this header and HRSTATICS_REPICK is the static correction required for the uppermost part of the recorded section (i.e. near the sea-floor). The HRSTATICS_SRC header contains the displacement of the source divided by the water velocity (either given or estimated), representing the static correction for a vertically incident ray-path, and is used for correcting deeper arrivals for source depth variations.

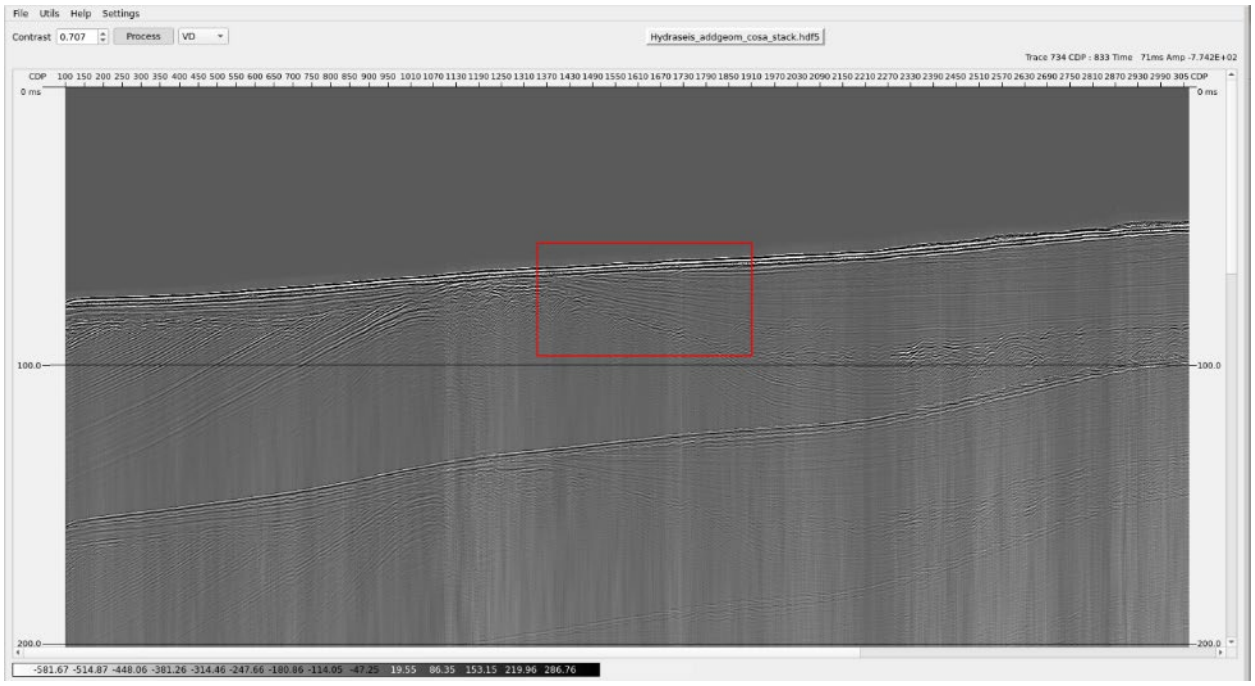
Similarly, HRSTATICS_REC is the streamer depth (from the estimated average streamer depth and the stochastic portion calculated from the covariance modelling of the residuals), divided by the velocity. The HRSTATICS_TOTAL header is the sum of HRSTATICS_SRC and HRSTATICS_REC, being the total correction to apply to deeper (than the sea-floor) reflections, under the assumption of vertically incident ray-paths at source and receivers.

HRSTATICS will down-weight observations that it thinks are outliers. Nevertheless, these will still influence the estimates, especially if there are many aberrant picks. At the end of processing, HRSTATICS will tell the user the size and shot/channel of the worst residual.

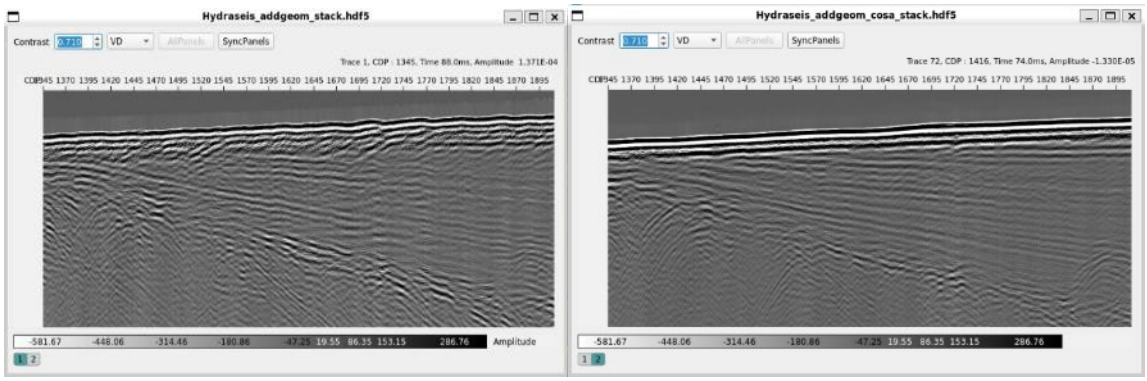
If the residual is much larger than the expected pick uncertainty, at the very least, the user should plot the pick header and the HRSTATICS_REPICK header for that shot. The two should agree to a reasonable level, and they should agree with the waveform. Poor quality picks should be improved, or the traces should be turned off (TRTYPE set to 0).



Stack COSA statics not applied.



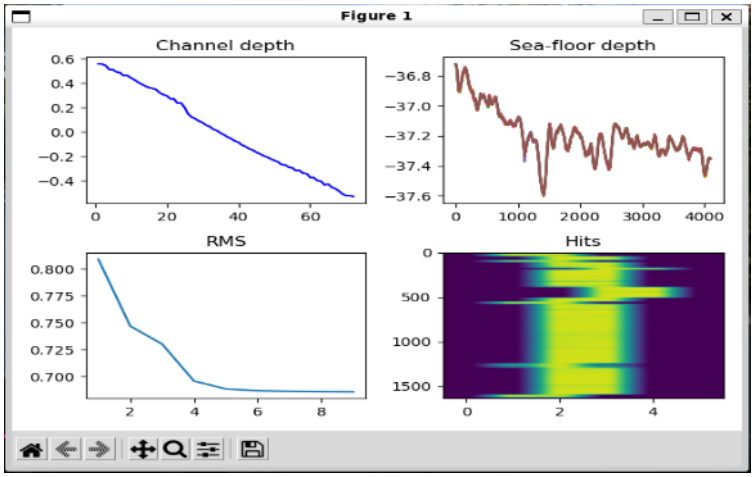
Stack COSA statics applied..



Stack COSA statics not applied Stack COSA statics applied.

To aid QC of the resulting statics solution, the HRSTATICS module generates the following plots :-

- Estimated channel depth
- Estimated sea-floor depth
- Fit of the model (milliseconds) versus iteration number,
- “Hits” (the number of reflections within each grid-square).



HRStatics QC Plots

Channel Depth

Channel depth shows the approximate vertical positions of the channels with respect to some datum parallel to (and close to) the mean sea-level. The user should check for large displacements of individual channels, which may indicate problems with the channels themselves or with the picking of those channels. The trend of the depths with channel number should be relatively flat. This will not be the case when a wrong velocity value has been used.

Sea-floor Depth

The “Sea-floor depth” plot will consist of multiple depth-versus-distance plots. The individual plots represent the estimated depths along parallel profiles running along the longest axis of the model domain, usually the direction of travel of the acquisition vessel. The depths should be relatively smoothly varying, but it is expected that there will be small amounts of short-wavelength noise at the length-scale of the model grid-spacing.

RMS Plot

The “RMS” plot should show a trend of decreasing values with each iteration, however there will also be a slight oscillation associated with overshoot of the estimation process. The oscillations will eventually die-down as iterations progress. The final fit value will be an estimate for the total variability in the pick times, being a combination of the accuracy of the picking of the arrivals and the variability due to sea-state induced effects. If the sea conditions are relatively benign, then the final fit value should be approximately the same as the sample-rate.

Hit Plot

The “Hit” plot is a colour-mapped image showing the number of reflections within each model grid square. The axes are in grid position, not distances. The scale across and up the plot will not be

the same; the horizontal scale will usually be greatly stretched. The user can move the mouse pointer over a plot cell to see its value. The observed cells will usually have hit values of tens to low hundreds.

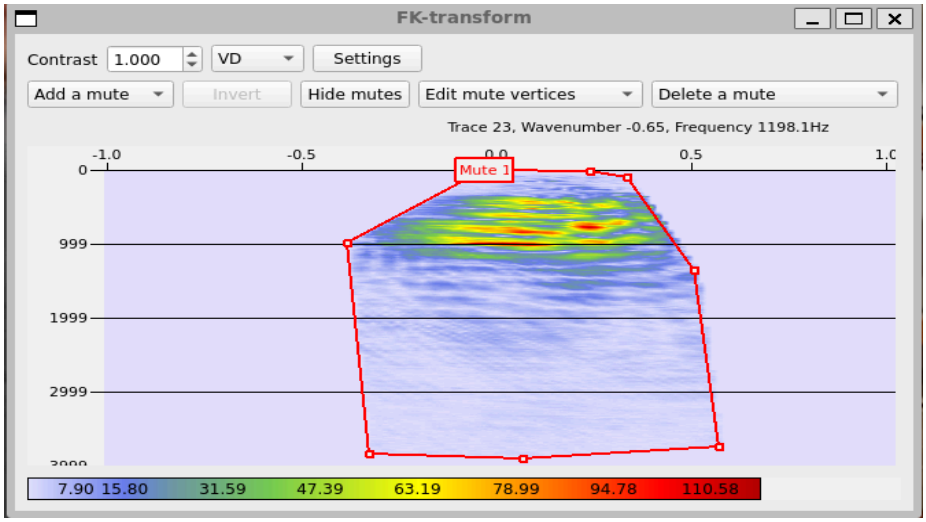
Improved Data Visualisation and QC.

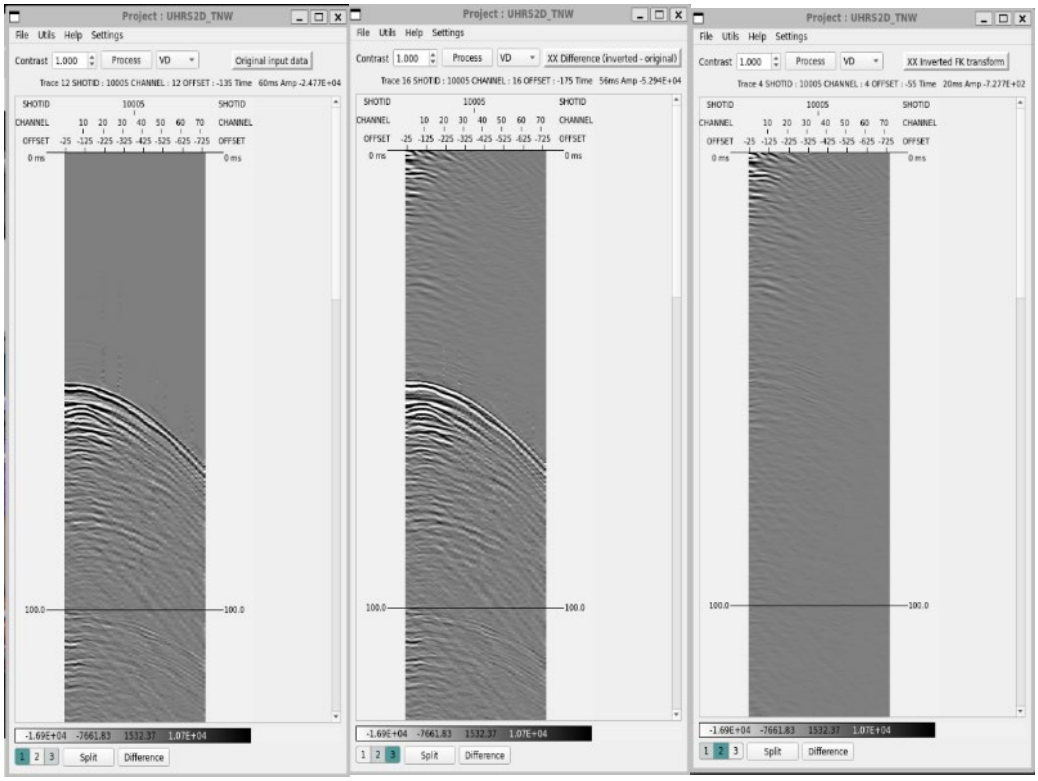
Development continues apace on the new Qt based seismic viewer, building on the functionality from the last release which allowed for comparison of pre- and post-stack gathers. In this release we have enabled the analysis functions which include:-

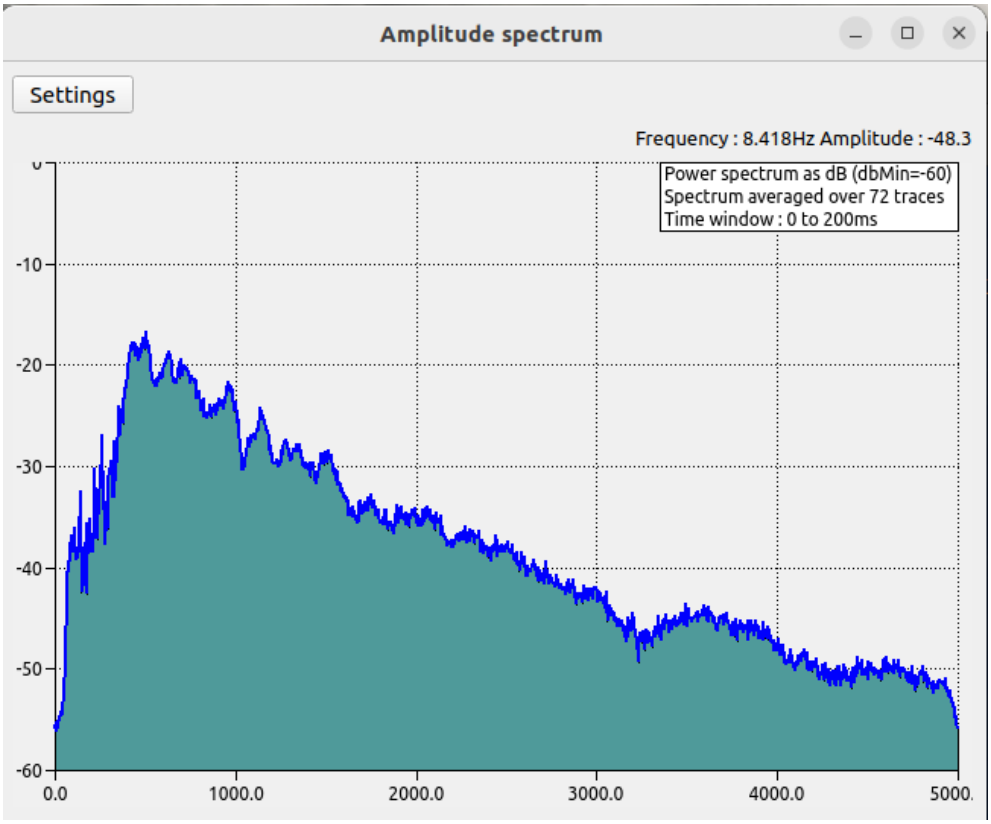
- FK Spectra
- Frequency Spectra graph
- Frequency Spectra (traces)
- Frequency Characteristics
- Tau-P transform (XT)
- Tau-P transform (FK)
- Parabolic radon transform
- Radial transform
- Autocorrelation zoom
- Amplitude decay curves
- Instantaneous Frequency
- Instantaneous Phase
- Instantaneous Amplitude
- Cos (instantaneous phase
- Amplitude Histogram
- Text header display

In addition to the analysis windows there is now the capability to pick mutes in the FK, Tau-P, Parabolic Radon and Radial transforms. Once the mute has been picked the data can be inverted back to the XT domain, producing displays of the input, muted and difference data. This allows the user to QC their mutes and edit or delete points as needed and save the mute to a .mut file for application in a processing flow.

A powerful feature not previously available is that the mutes are displayed, labelled and editable by clicking and dragging points, or clicking to add or delete points. The XT inversion display automatically updates in real time while the mutes are being edited.

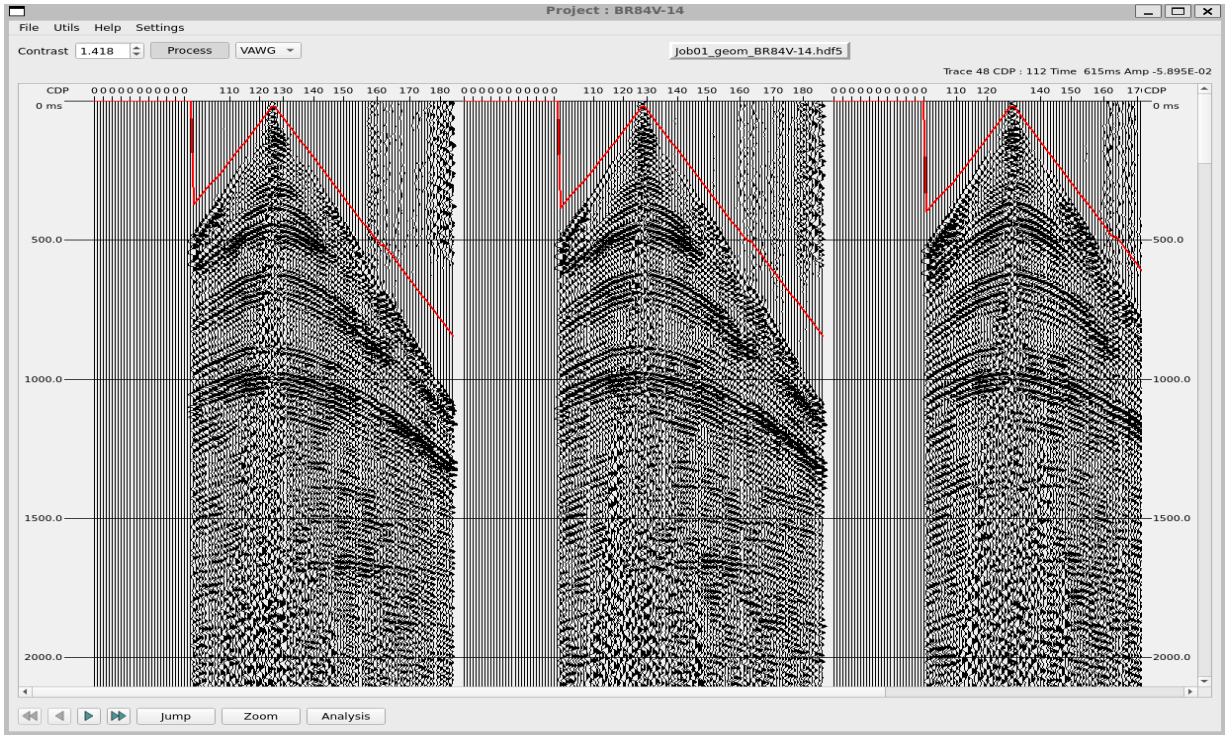

FK-transform
Contrast 1.000
VD
Settings
Add a mute
Invert
Hide mutes
Edit mute vertices
Delete a mute
Trace 23, Wavenumber -0.65, Frequency 1198.1Hz
-1.0
-0.5
0.0
0.5
1.0
0
999
1999
2999
Mute 1
7.90 15.80 31.59 47.39 63.19 78.99 94.78 110.58


Project : UHRS2D_TNW
File Utils Help Settings
Original input data
XX Difference (inverted - original)
XX Inverted FK transform
Split
Difference

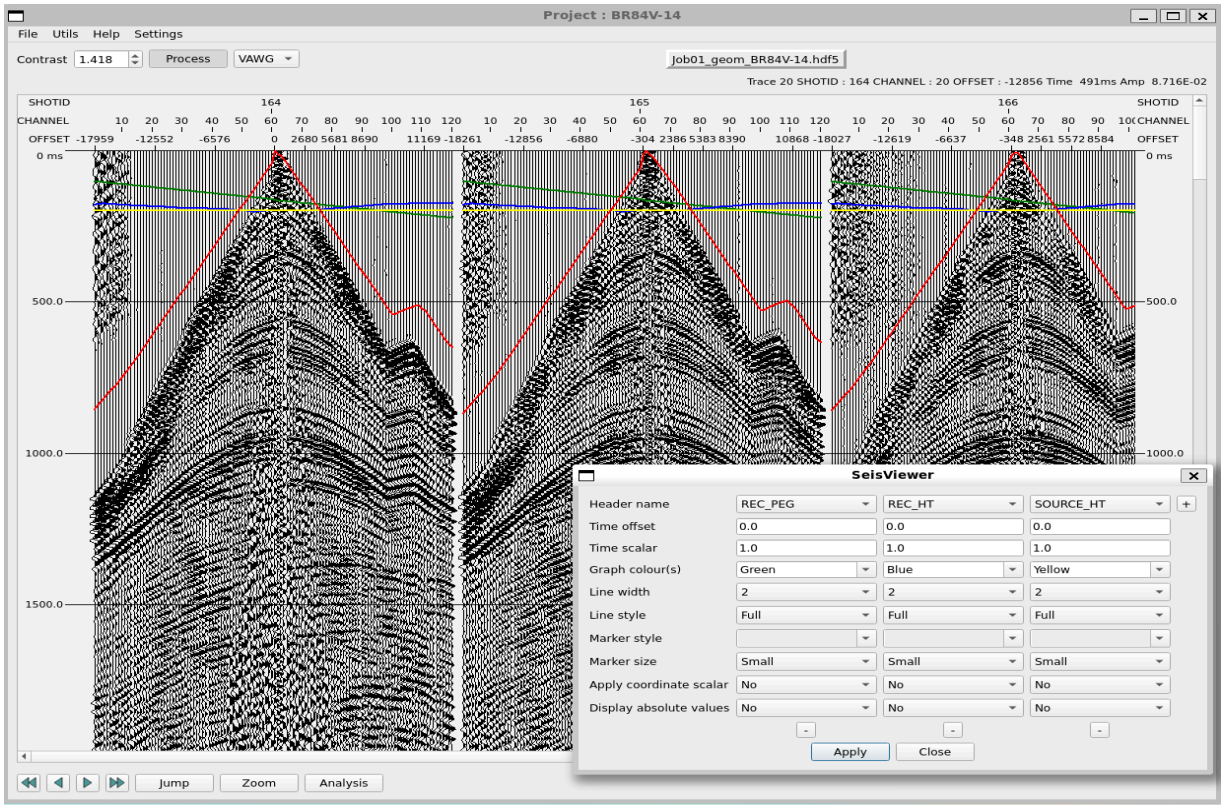


Seisviewer – Analysis and invert functionality

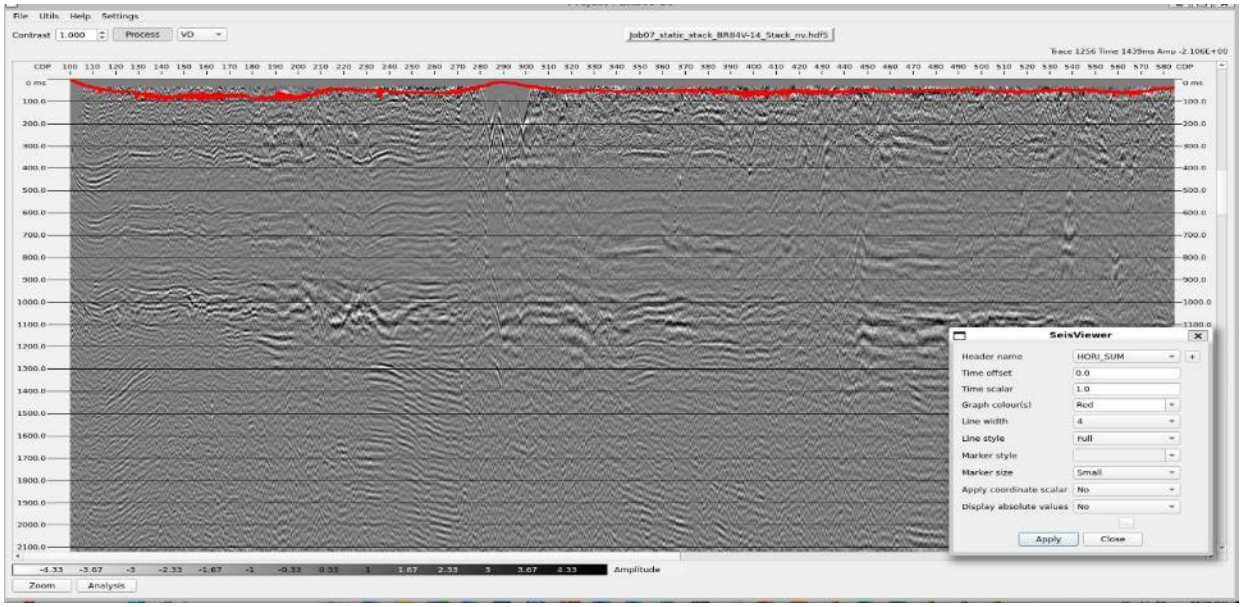
Trace header overlays have also been enabled and the parametrisation simplified. We have retained the specific offset trace header overlay for ease of use.



Seisviewer – Offset overlay



Seisviewer – Offset and other header overlays



Seisviewer –Header overlays – stack fold

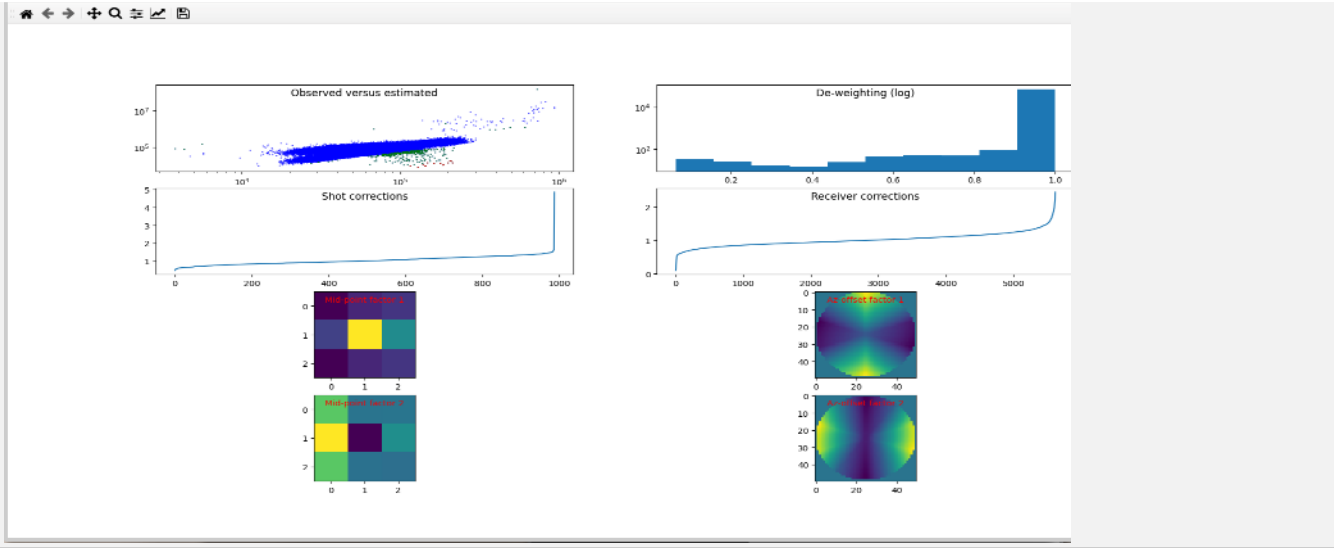
Surface Consistent Amplitude – Marine capability.

As part of the 2025.2.1 release we have enhanced the **SCAMP** module to work with towed streamer marine seismic data. A new REVNR option has been added to the SCALING parameter which controls what components of the amplitude correction are calculated and applied to the data.

When using the REVNR scaling mode to process marine data it is advised that the OFF_RES term be set to a length that spans ~10-channels. This will ensure any short-wavelength variations due to channel-sensitivity will be filtered out of the resulting offset term.

In the case of UHR surveys, careful attention needs to be paid to the dimensions of the survey. The MID_RES parameter needs to be set to some fraction of the total length of the survey. The default value of 1000-metres is on the order of the dimensions of a small UHR acquisition and therefore may not provide enough resolution to image amplitude variations across the survey.

A value of 200-metres may be more reasonable for this scale of survey. For 2D surveys the AZ_NUM parameter can be set to its lowest limit (2), as there will not be any azimuthal variation.



SCAMP – QC Plot – REVNR marine seismic data.

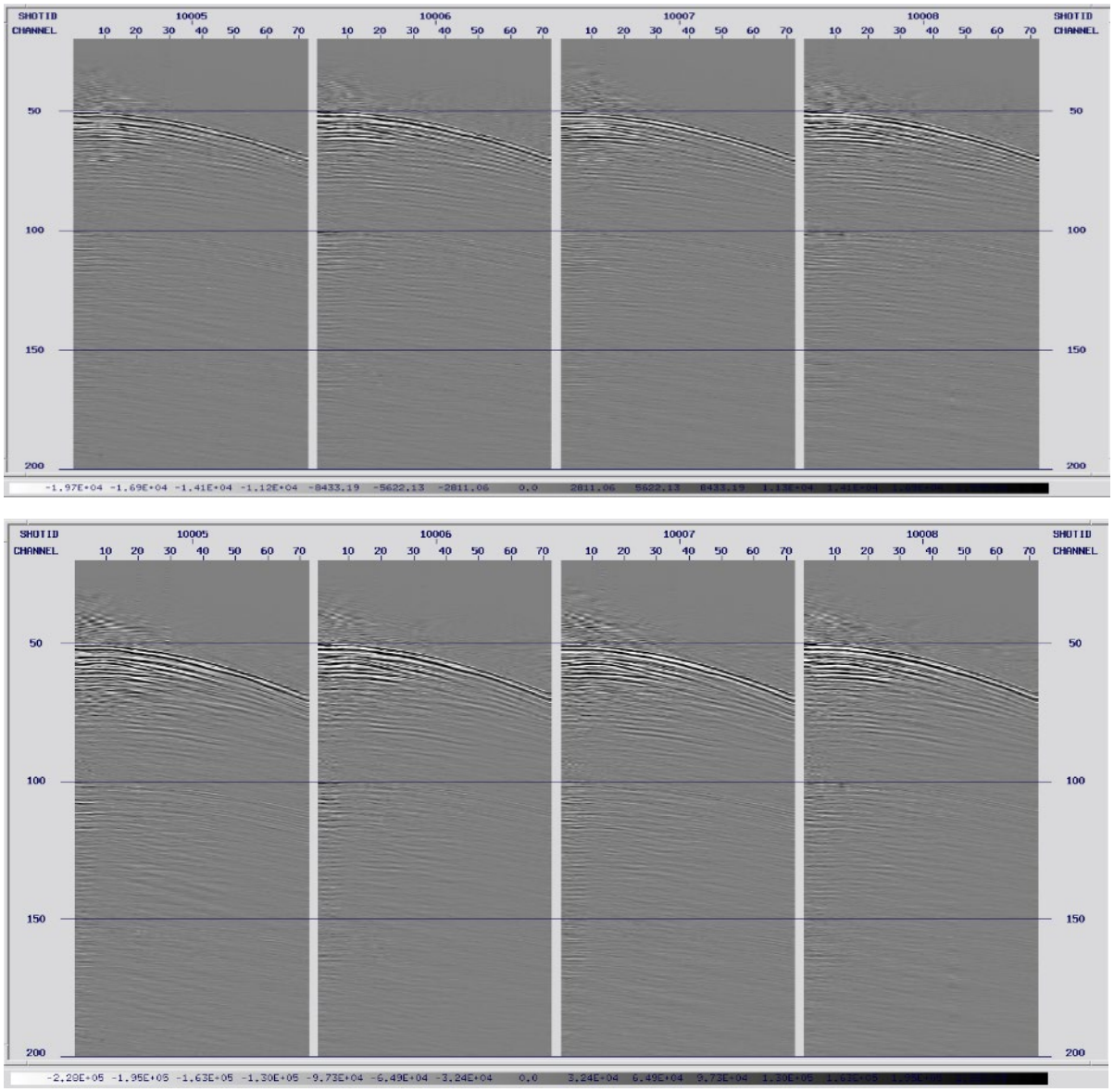
Processing Ultra-High-Res Marine Data

The REVNR scaling was added for processing ultra-high-resolution (UHR) marine data. This scaling mode is similar to REV, except that the receiver parameters are not estimated. Marine acquisition differs from land acquisition in that the receivers are not stationary installations that are recording multiple shots, so estimating receiver scaling does not make any sense.

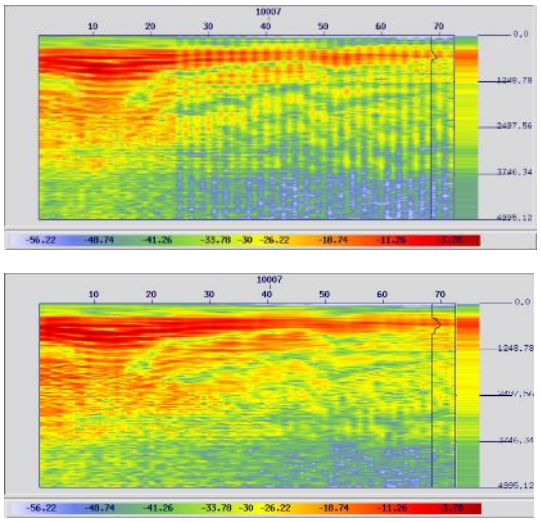
In UHR there are often amplitude variations from illumination effects due to sea-state at the source, channel drop-out due to hydrophones impinging on the sea-surface, and channel sensitivity (which is a constant across all shots). The difficulty with directly modelling these amplitude effects is that they are all offset- (channel-) dependent. This means that we cannot separate the offset dependent term due to the usually observed decrease in amplitude with distance from e.g. spherical divergence, which we want to keep, from the offset-dependent terms due to the factors mentioned, which we want to eliminate.

To solve this problem we could assume that the offset-dependent amplitudes that we wish to keep are smooth (with offset and with source location), and the other effects are just random variations.

In fact, the estimation of the offset dependent amplitudes should already be relatively smooth due to the way the model is formulated. As a simplification, if all the variations due to acquisition effects are assumed to be independent random variables, then these can be added into the observation uncertainties. These uncertainty magnitudes are estimated automatically by SCAMP, therefore the method is automatically handled without any further changes to the estimation procedure.



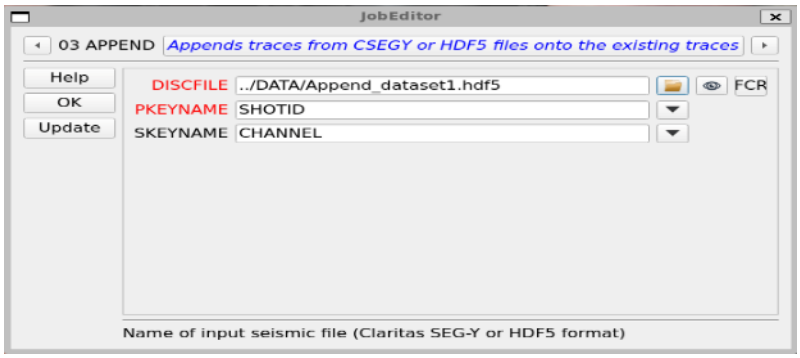
Marine shot gathers pre- and post-SCAMP



Marine shot gathers- frequency spectra traces pre- and post-SCAMP

New APPEND module to allow easier temporal merge of datasets.

APPEND is a new disc input process which reads trace data (and/or headers) from a disc file in the Claritas internal format and appends (in time) the traces to the ends of the existing traces in the job stream. Appending a 2 second dataset to a 4 second dataset will result in a 6 second dataset.



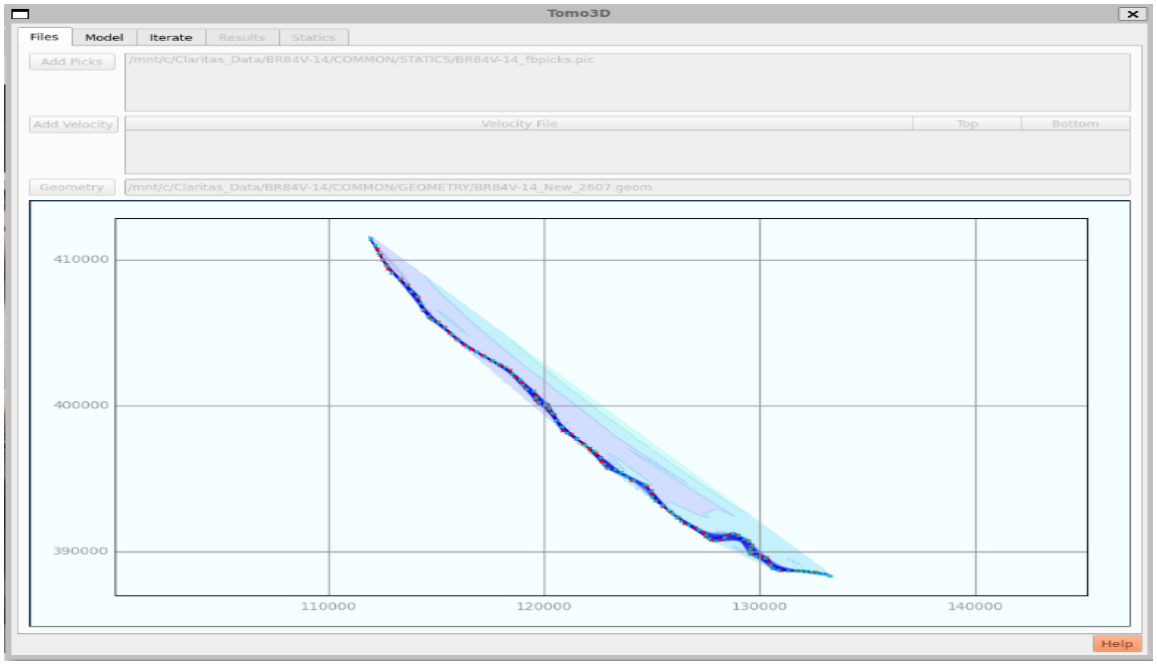
Append module parameter form

APPEND reads files produced by the SEISWRITE process module, DISCWRITE process module or the WRITESEGY process module. APPEND is not used at the start of a job, but somewhere in the middle. The trace ordering of the two data streams does not have to be identical.

Improved functionality for Tomo3D

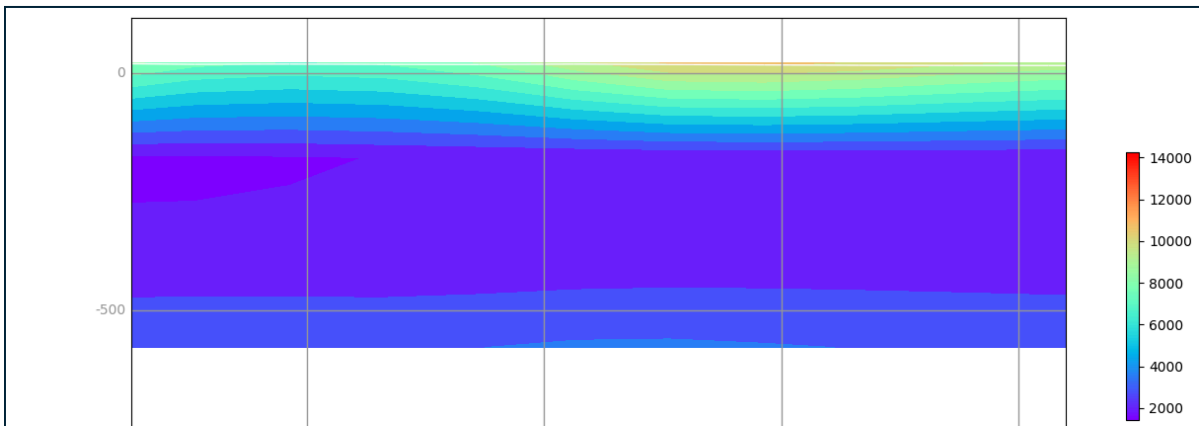
Whilst it has always been possible to analyse and develop 2D near surface velocity models and statics solutions with the Tomo3D application it was complicated by the need to re-bin the 2D line onto a 3D grid before running the Tomo3D application, which in many situations made it less appealing for users.

The application has been updated to accept both 2D Geometries and .hdf5 files with 2D geometry applied.



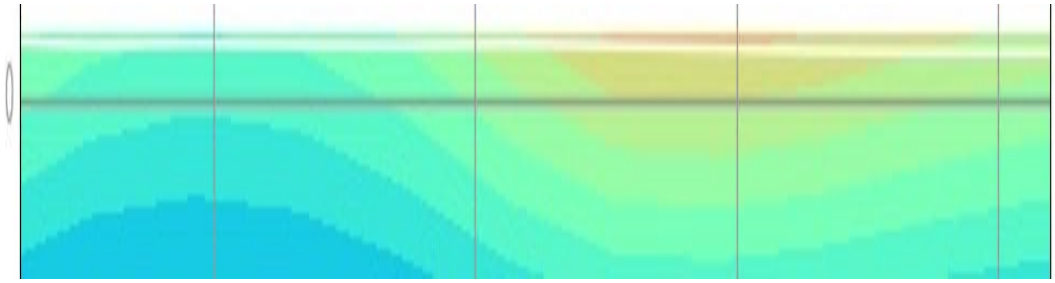
Tomo3D – Input form and Map QC.

The results tab of the launcher allows users to view the velocity model in inline/crossline or depth slice view, this update to Tomo3D remembers if the users has zoomed in or out and by how much. As you move between the different displays between inline/crossline or depth slices the user defined zoom is maintained.



Tomo3D – Velocity Model – Inline view -Zoomed.

You now also annotate the topography on the inline/crossline displays as the white line shown below.



Tomo3D – Topography displayed

Disc clean up utility

Like many software packages Claritas generates hidden files related to seismic data, applications and job flows which provide useful information in terms of preferred parameters data viewing etc. However, these do tend to build up over time and can be left orphaned if the associated data/velocity or other filetype is deleted removed.

To combat this we have created a simple tool to remove these hidden files, the application can be run from the command line to list all hidden files present in the project or projects defined.

Use the command: dotbot -p projname -la

The user can also control which folders the application looks for files within the project, and what files are removed. Switches allow the user to remove :-

s: **Safe to remove**
- Claritas hidden files that are not used – i.e orphaned files where associated data has been removed.

o: **Ok to remove**
- Claritas hidden files that can be deleted – application parameters information etc.

r: **Risky to remove**
- All Claritas hidden files, including dynamic trace headers and history (primarily associated with Claritas csegy files)

p: **Pattern**
- Selects hidden files on the basis of a user defined pattern given in single quotes

u: **Unknown**
- Hidden files that are not recognised as being associated with Claritas

a: **All**
- Selects all hidden files, i.e. a combination of u and r options documentation for dotbot can be found by typing dotbot –help into the command line.

Miscelleneous improvements

- The AREAL module has a new mode option, PEAK_FREQ, which outputs the dominant frequency (the peak position of the smoothed amplitude spectrum) within a specified time window.

- The geometry application has a new option to create wiggly-line binning with constant azinmuth bins. The bins are still centered on the CDP coordinates, but will all be aligned in the same direction. This is a special use case, which has been useful in deep crustal seismic profiling.

Bugs found and fixed.

CLARITASBUGS-4316 TOMO3D: QC displays on the results tab would not hold the zoom when swapping between normalised and velocities or INLINE/CROSSLINE and Depth slice.

CLARITASBUGS-4317 REFSTAT3D: Was incorrectly estimating depths too deep due to bug in code.

CLARITASBUGS-4319 Browser selection in the launcher wasn't functioning as expected.

CLARITASBUGS-4332 SeisCAT aborting with buffer overflow on Ubuntu.

CLARITASBUGS-4333 JobEditor was aborting on Rhel8/9 when Add or Insert buttons pressed

CLARITASBUGS-4337 Griffon was not writing correct header format for new headers

CLARITASBUGS-4338 JobEditor was not excluding modules listed as being in development.

CLARITASBUGS-4340 HRDEGHOST crashing when traces with trtype=1 have zero amplitude.