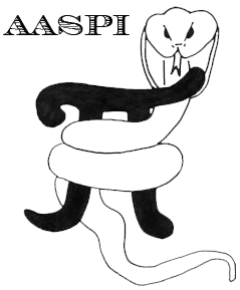
STRATAL SLICING A SCALAR DATA VOLUME – PROGRAM stratal_slice



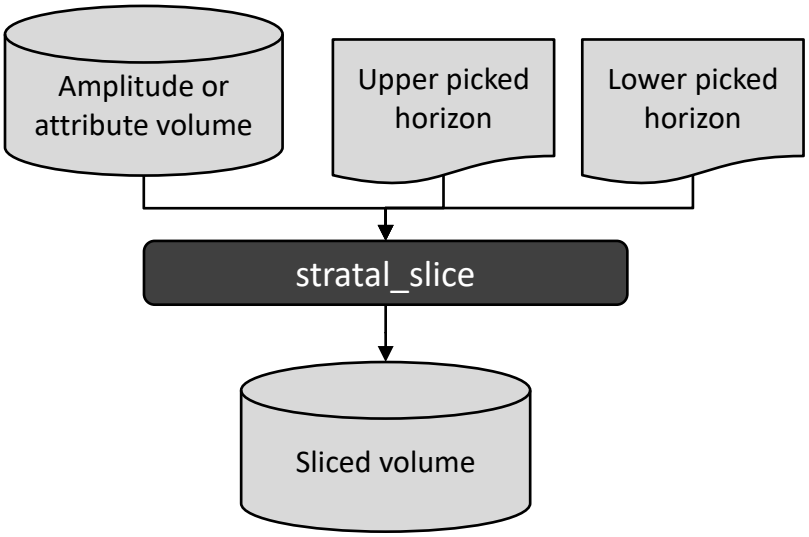
Contents

Overview

Extracting phantom horizon slices and stratal (or proportional) slices two some of the more common interpretation activities performed in interpretation workstation software. Since the interpretation workstation is the place where you picked your horizons, it is the obvious place to do such slicing and subsequent analysis. Nevertheless, there are reasons to create flattened or stratal sliced subvolumes in the AASPI software. Generating flattened volumes has value if your commercial software does not have a state-of-the-art spectral decomposition algorithm and you wish to generate a suite of volumes about a target horizon. Similarly, AASPI provides horizon-based clustering (also called classification) algorithms. AASPI programs **flatten**, **complex_spectral_flatten**, and **vector_flatten** flatten a user-defined window of input data defined about a picked horizon. AASPI program **unflatten complex_spectral_unflatten,** and **vector_unflatten** reverse this process. AASPI program **stratal_slice, complex_spectral_stratal_slice,** and **vector_stratal_slice** generate a suite of stratal (proportional slices) between two user-defined horizons. Flattened slices are computed by interpolating the input data using a $\varphi=2\pi f\Delta t$ Fourier phase shift of each Fourier component. Because the distance between stratal slices varies from trace to trace, it is more efficient to compute stratal slices using a simple six-point interpolation in the time (or depth) domain. Program **flatten**, **unflatten**, and **stratal_slice** work on scalar data volumes. Because there is a discontinuity about ±180°, phase and azimuth cannot be interpolated along the vertical axes. For this reason, complex spectra and vector quantities such as dip magnitude and dip azimuth should be flattened as pairs using programs **complex_spectral_flatten**, and **vector_flatten.** The same argument holds for interpolating to generate complex and vector stratal slices.

Computation Flow Chart

Program **stratal_slice** reads in a reference seismic or attribute volume as well as two picked horizons and generates a suite of stratal (also called "proportional") slices between the two horizons. Zeng (2013) provides an excellent discussion on the value of using stratal slices for seismic interpretation.



Output file naming convention

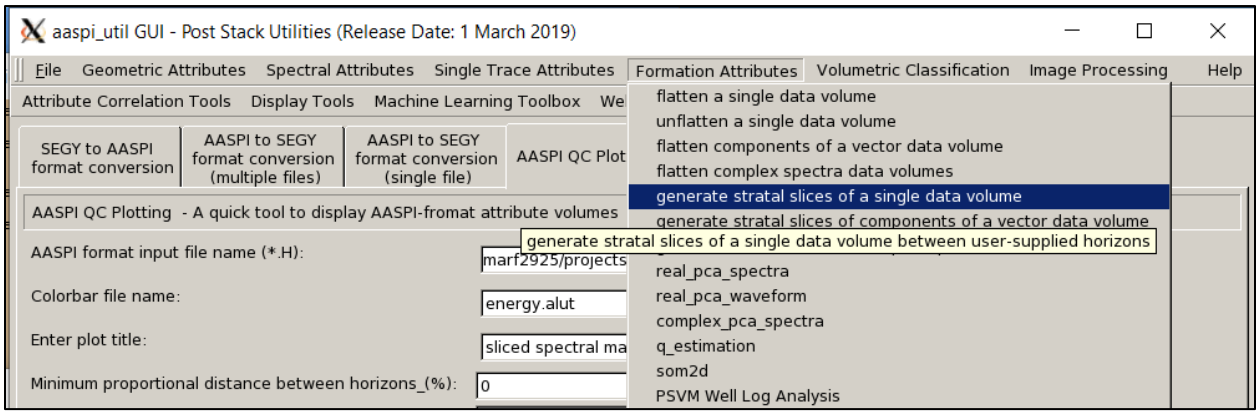
Program **stratal_slice** will always generate the following output files:

Output file description	**File name syntax**
Stratal-sliced volume	stratal_sliced_*unique_project_name_suffix*.H
Program log information	stratal_slice_*unique_project_name_suffix*.log
Program error/completion information	stratal_slice_*unique_project_name_suffix*.err

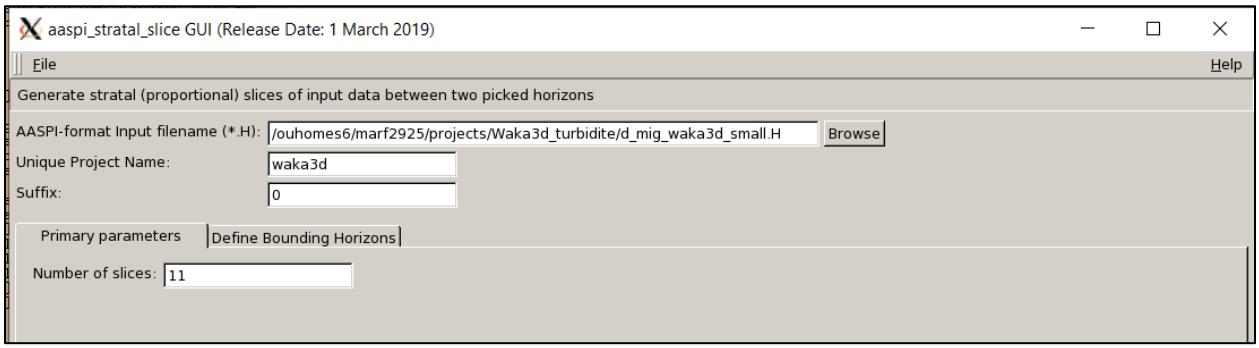
where the values in red are defined by the program GUI. The errors we anticipated will be written to the **.err* file and be displayed in a pop-up window upon program termination. These errors, much of the input information, a description of intermediate variables, and any software trace-back errors will be contained in the **.log* file.

Invoking the stratal_slice GUI

Program **stratal_slice** is launched from the *Formation Attributes* within in the main **aaspi_util** GUI:

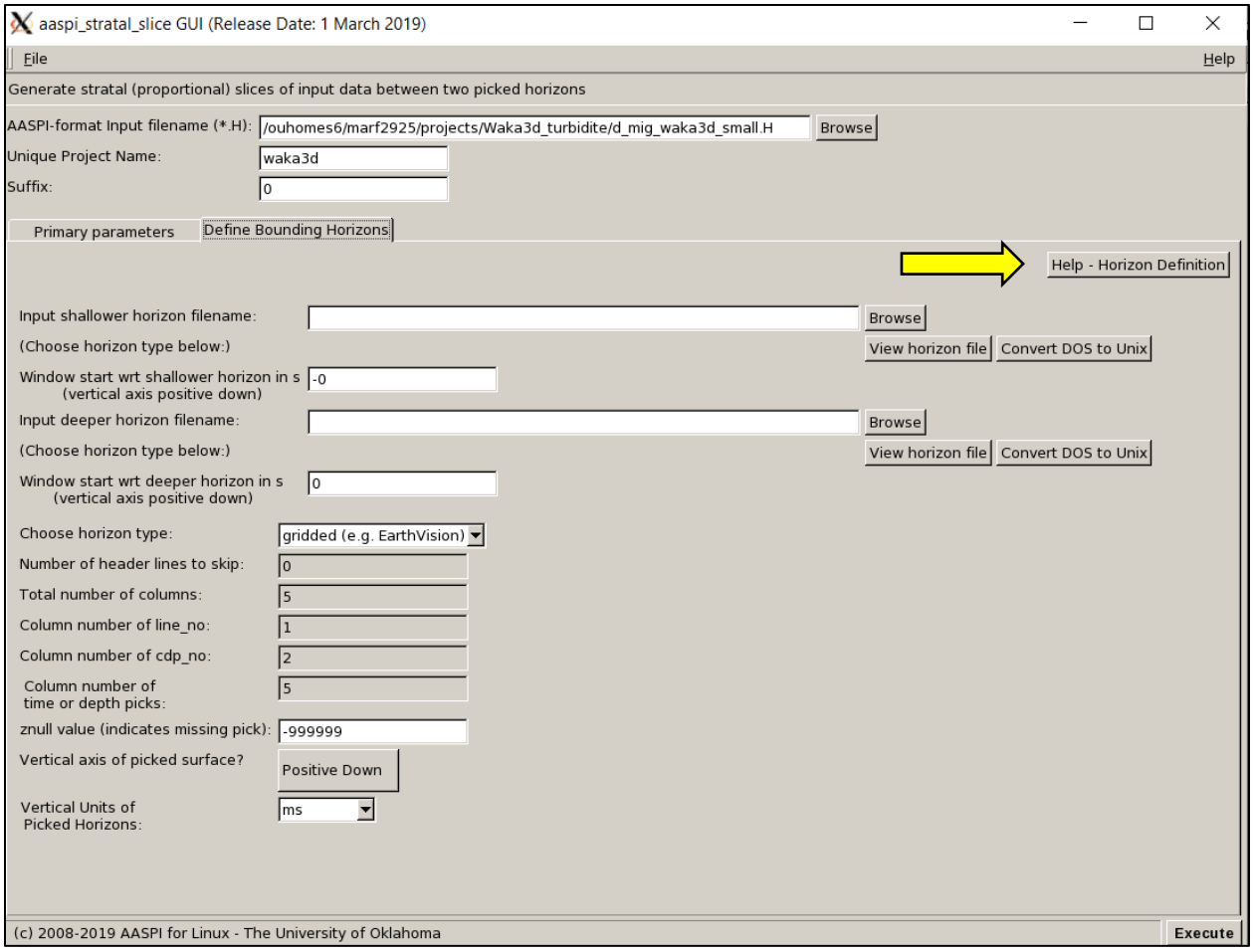


The following GUI appears:



There is only one parameter to define on the *Primary parameters* tab – the number of output slices. The default value of *nslice*=11 will slice the volume at levels that are 0%, 10%, 20%, 30%,…, 90%, and 100% of the distance between the picked (and possibly shifted) horizons. If only the top and bottom horizon slices are desired, you should set *nslice*=2.

The *Define Bounding Horizons* tab appears like this:



These parameters are defined under the Help -Horizon Definition tab indicated by the yellow arrow, or if you are accessing this documentation from the web under http://mcee.ou.edu/aaspi/documentation/Software_Structure-AASPI_horizon_definition.pdf .

Theory

Because stratal slices are unequally spaced in time or depth, we will use an eight-point Lagrange interpolation algorithm rather than a Fourier method to interpolate. A stratal slice at time *T* is then of a scalar variable *d*(*t*) is then:

$$d(T)=\sum_{j=-3}^{+4} w_j d(t_{k+j}) \qquad (1)$$

where w_j are the Lagrange weights:

$$\begin{aligned}
w_{-3} &= (p+2)(p+1)p(p-1)(p-2)(p-3)(p-4)/5040,\\
w_{-2} &= (p+3)(p+2)p(p-1)(p-2)(p-3)(p-4)/720,\\
w_{-1} &= (p+3)(p+2)(p+1)(p-1)(p-2)(p-3)(p-4)/240,\\
w_{0} &= (p+3)(p+2)(p+1)p(p-2)(p-3)(p-4)/144,\\
w_{+1} &= (p+3)(p+2)(p+1)p(p-1)(p-3)(p-4)/144,\\
w_{+2} &= (p+3)(p+2)(p+1)p(p-1)(p-2)(p-4)/240,\\
w_{+3} &= (p+3)(p+2)(p+1)p(p-1)(p-2)(p-3)/720, \text{ and}\\
w_{+4} &= (p+3)(p+2)(p+1)p(p-1)(p-2)(p-3)(p-4)/5040.
\end{aligned} \qquad (2)$$

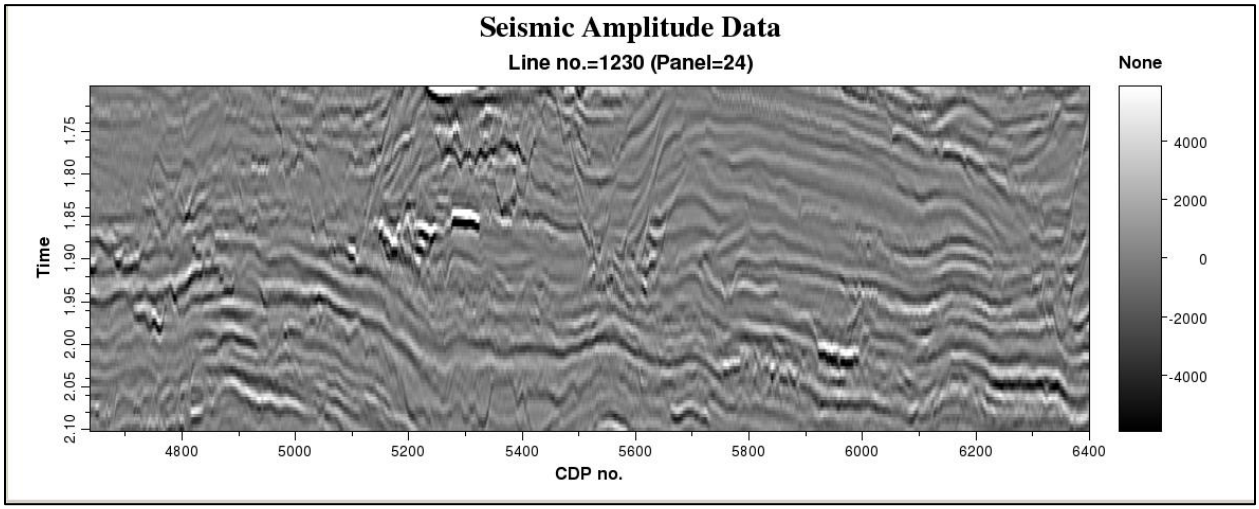
Data samples *j*=-3,-2,-1,0 are above time *T* and samples *j*=1,2,3,4 are below time *T* and the k^{th} data sample is

$$k = \mathrm{INT}\left(T/\Delta t\right), \qquad (3)$$

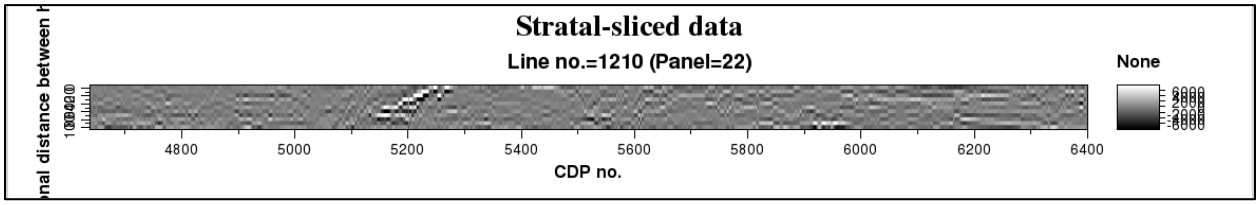
where the function INT defines the integer just below the value *T* for a sample increment Δ*t*
where the normalization constants have been left out.

Example: Stratal slices through turbidites in the Waka3d survey, Canterbury Basin

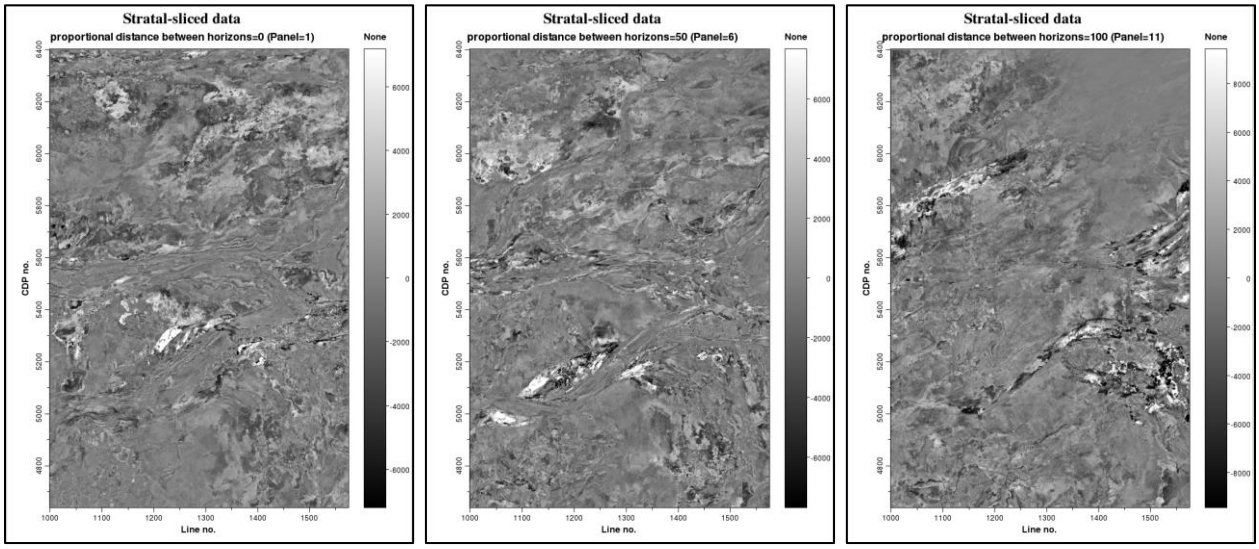
A vertical slice through the input seismci amplitude data volume looks like this:



while a vertical slice through the 11-stratal slice volume looks like this



The stratal slices at the 0%, 50%, and 100% look like this



References

Zeng, H., 2013, Stratal slice: The next generation: The Leading Edge, **32**, 140-144.