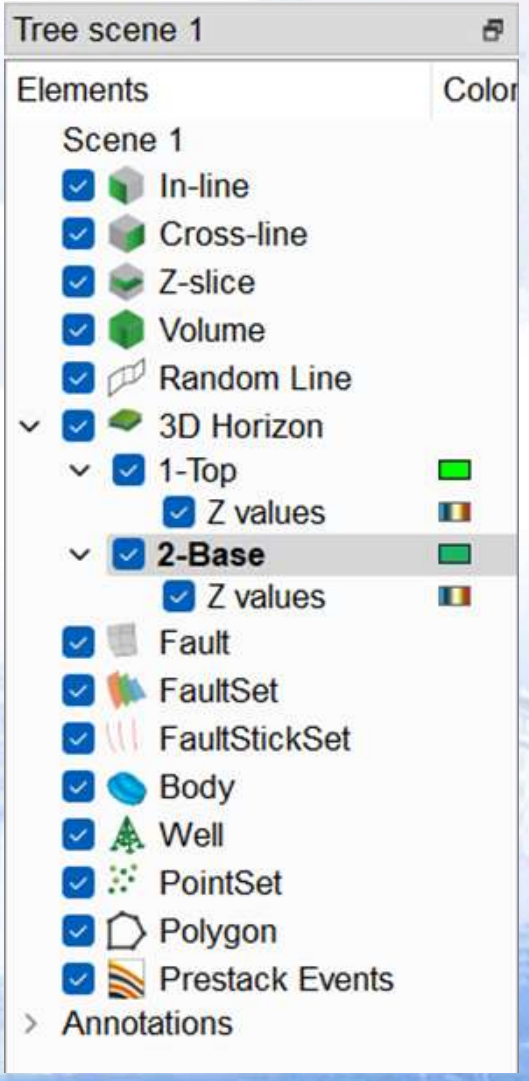
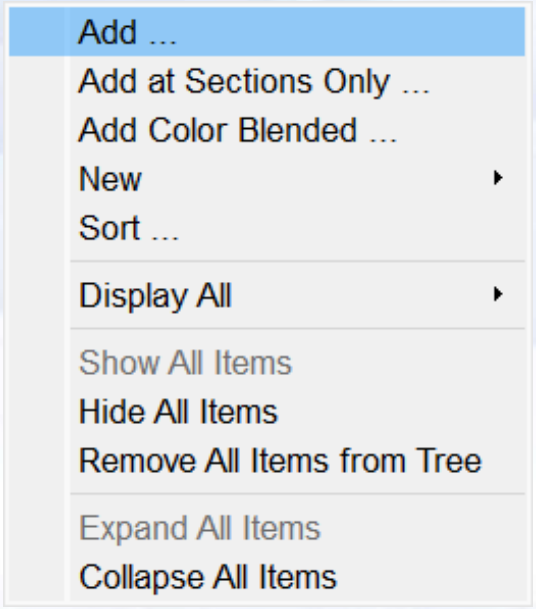
第3章 Tree和Elements

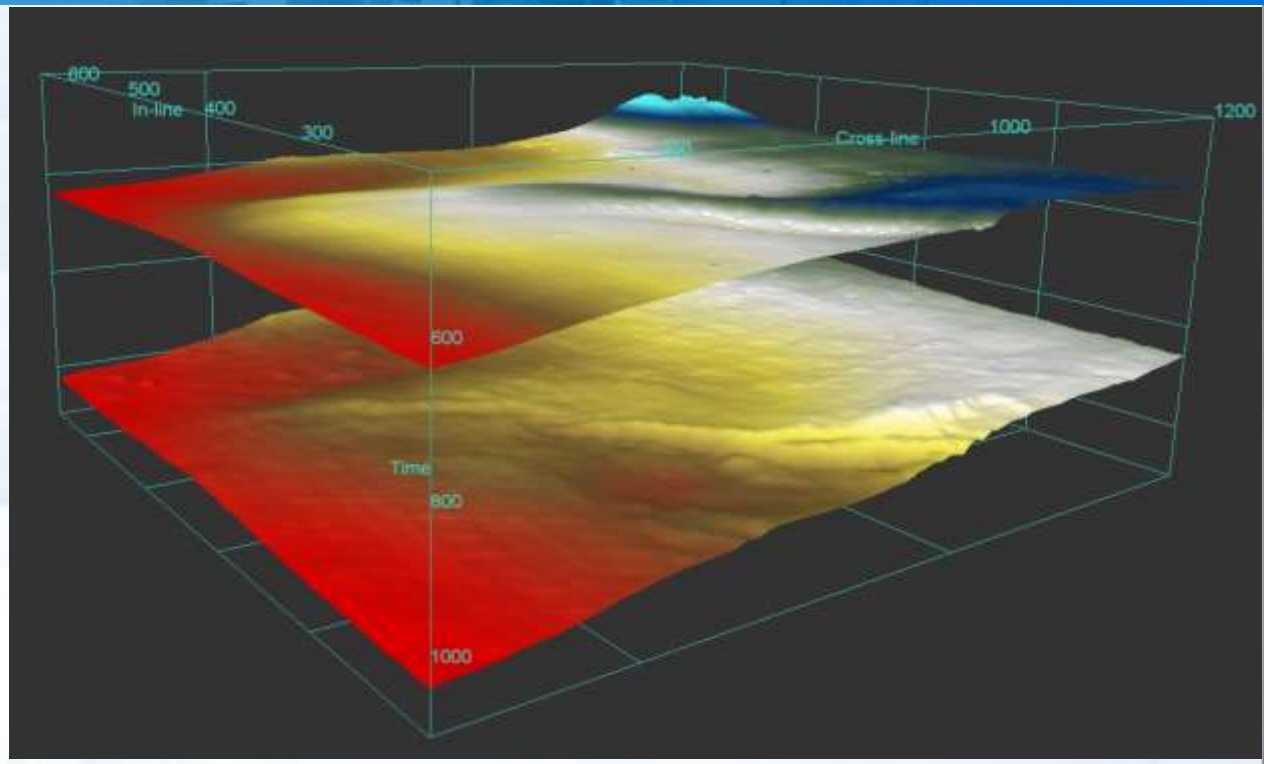


3.7 3D Horizon

F3_Demo，只有3D Horizon
Opendtect手册，分为2D Horizon和Horizon
3.7节PPT，主要是对已跟踪的层位的处理操作

3.7 Horizon

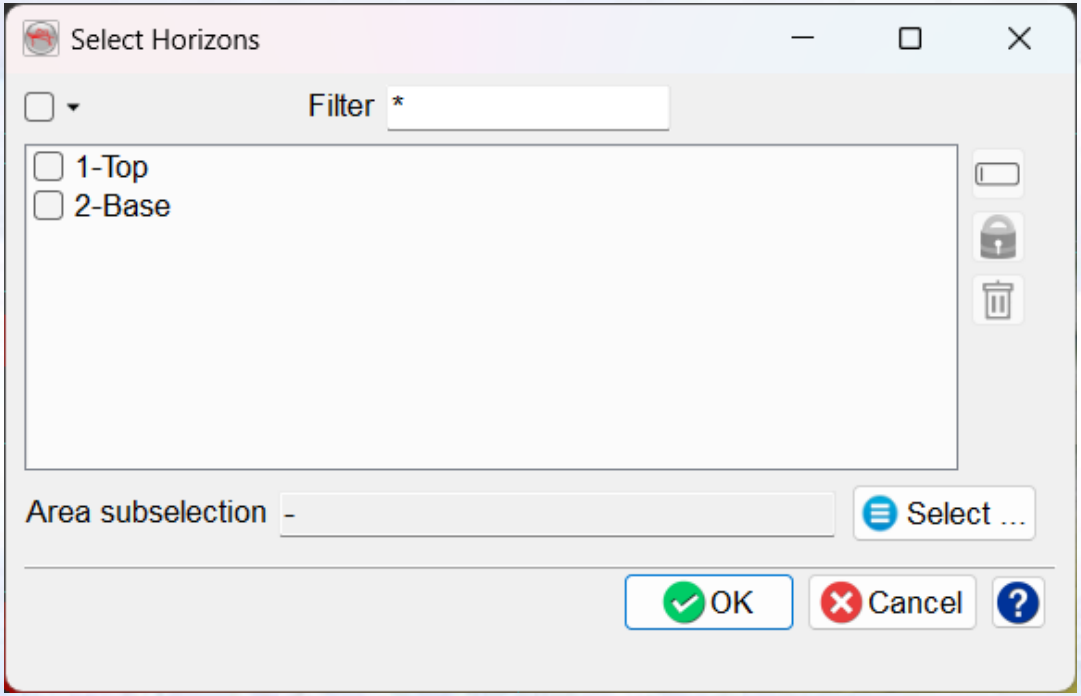




与手册的截图有很大差异！

F3_demo有2个层位文件：top和base

An existing horizon can be displayed in the scene by selecting *Add* option from the pop-up menu (see above). It will launch a horizon selector window from which multiple horizons can be selected. See also *Add color blended*.

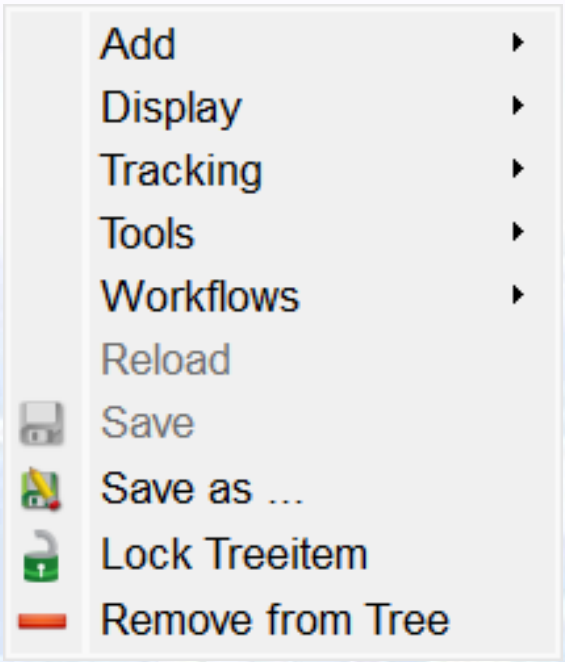


添加已有的层位

Once at least one horizon is displayed, there is an addition to the pop-out menu, *Display All*, which contains several options: only at sections, in full or both at sections and in full. *Only at sections* results in a horizon display (as a line) on the inline/crossline/timeslice. *Full* displays the complete horizon in 3D space.

Track new sub menu is used to start a new horizon interpretation.

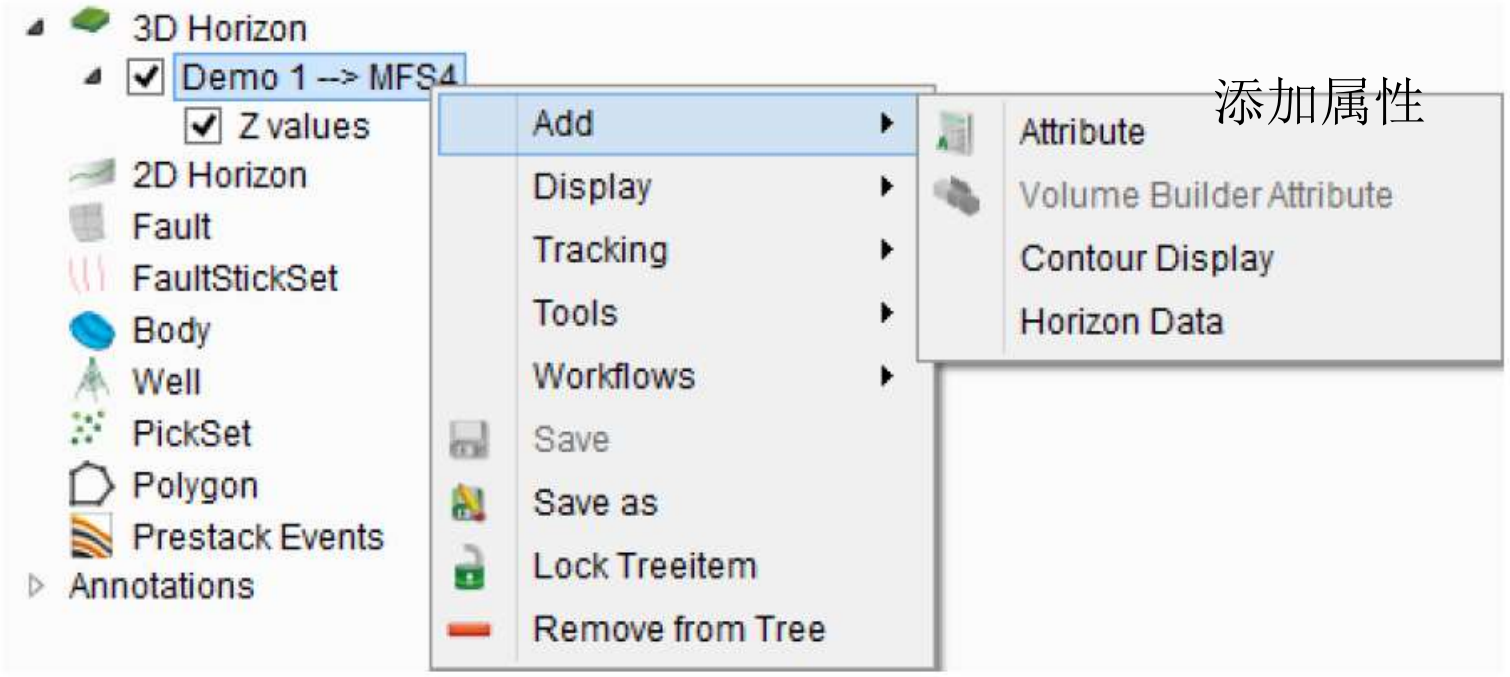
The popup menu from a displayed horizon has several options, which are covered in the following sections:



3.7.1 Add Attribute

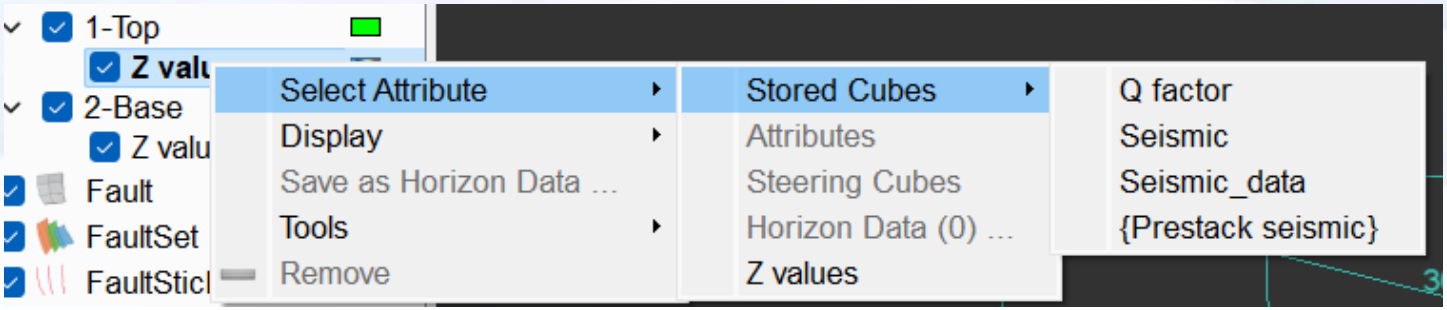
This allows choosing the data to display on the horizon from stored cubes, a calculated attribute from the current attribute set, or horizon data that were included with the horizon already. For Horizon data a dialog will popup where you can select multiple data files. After loading you can browse through the data by pressing the 'Page Up' and 'Page Down' buttons on your keyboard.

For PgUP and PgDn to work, the mouse pointer must be in the scene.

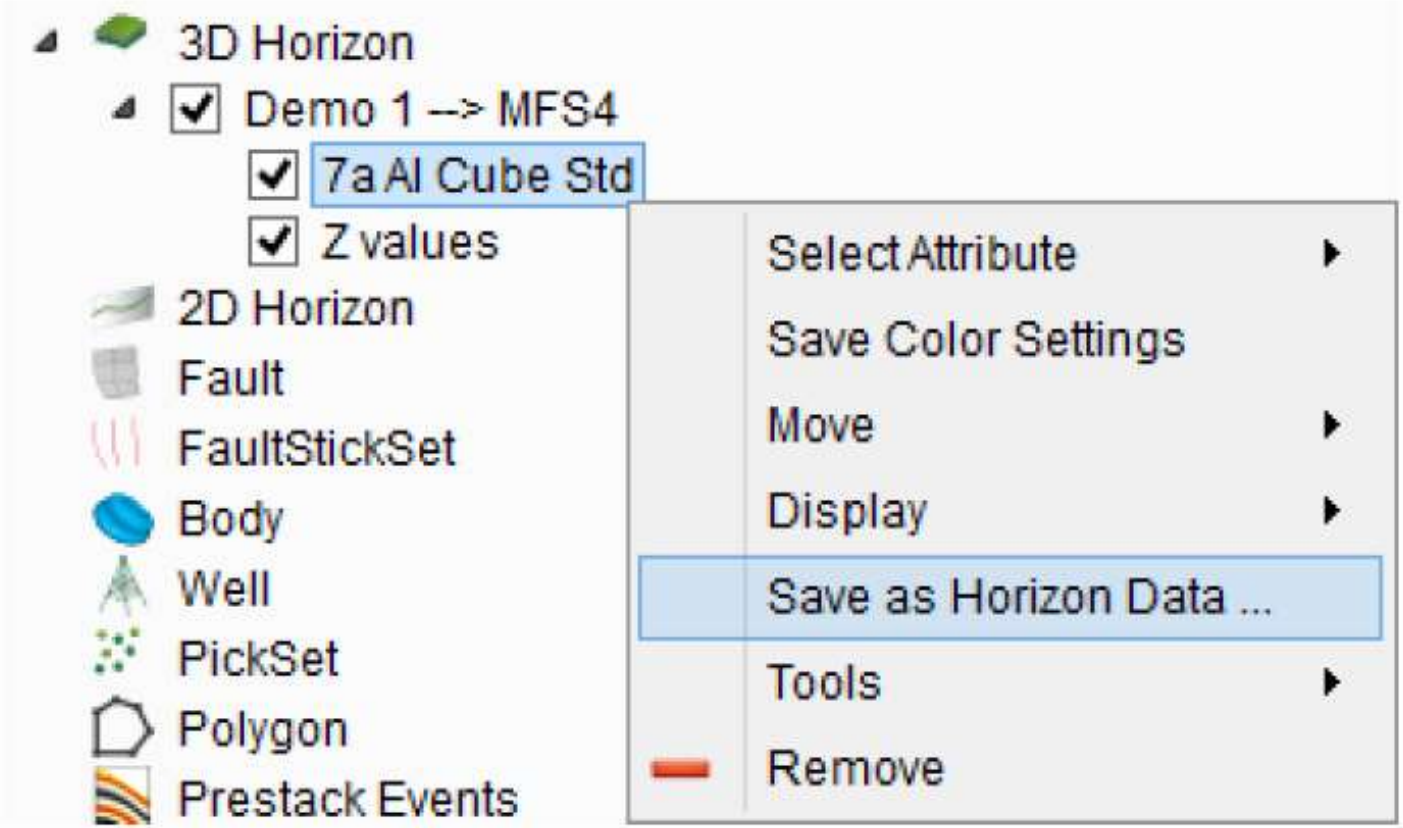


3.7.1 Add Attribute

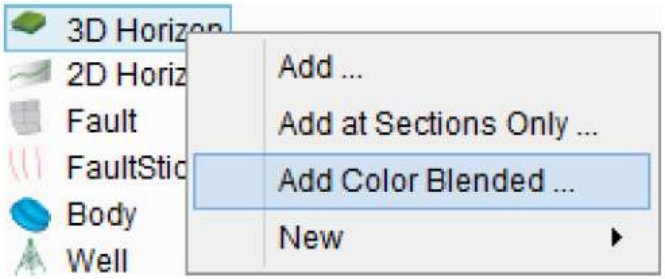
Once a horizon is added (with its Z-values displayed in the scene), it is possible to also right-click on '*Z-values*' in the tree to give you other options:



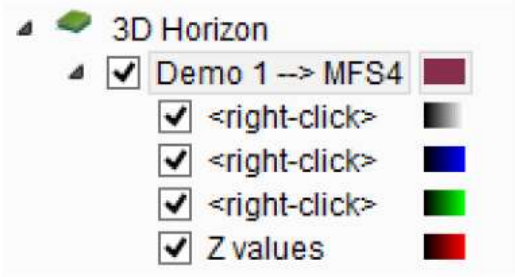
Furthermore, once a horizon has an attribute displayed, it is also possible to '*Save as Horizon Data*'... and will be visible in the '*Manage 3D Horizons*' window:



3.7.2 Color-Blended Display



⇨ becomes ⇨

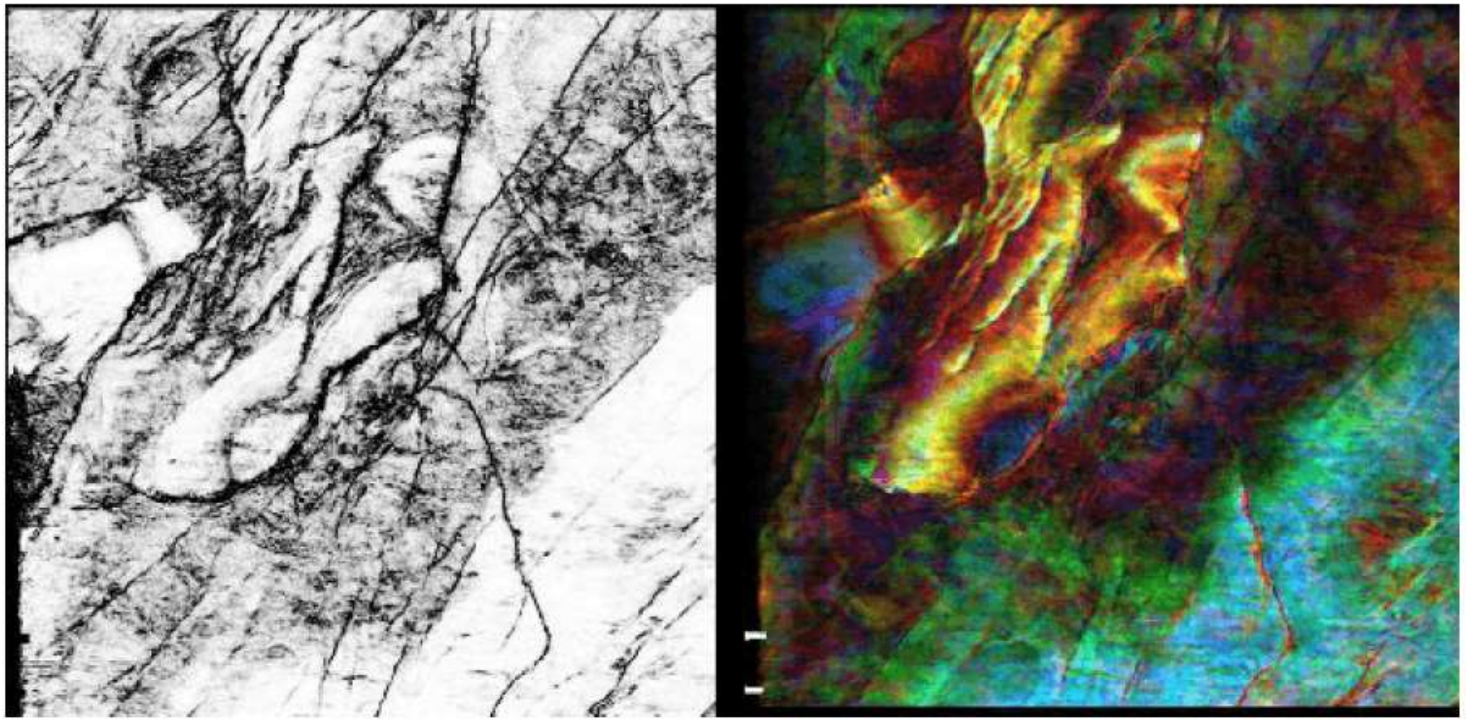


The load color blended sub-menu displays an RGBA (red-green-blue and alpha) blended horizon(s) in the scene. This is used to blend multi-attributes with similar spectral outputs. This is an interactive tool especially to color blend the iso-frequency grids (or attributes).

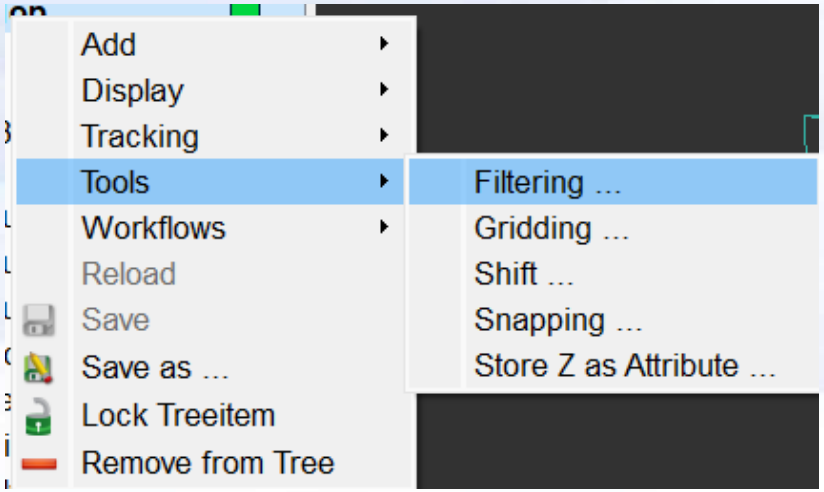
Color blended display:

RGBA blending attribute display* is used to create a normalized color-blended display that often show features with greater clarity and enhances a detail map view. Traditionally, it is used to blend the iso-frequency responses (Spectral Decomposition), but a user can blend three/four different attributes that define a spectrum that is comparable. For instance, spectral decomposition outputs the amplitude at discrete frequencies. So, it renders the same output (unit=amplitude). Depending upon a geological condition or the objective, FFT short window or CWT (continuous wavelet transform) can be chosen. Results are best displayed on time/horizon slices, volume.

A color blended map view (image on right) of the spectral decomposition (red-10hz, green-20Hz, blue-40hz). Compare the results with the coherency map (image on left). Note that the yellowish colored fault bounder region is thicker as compared to the surrounding regions. The faults throw (red-color) are also clearly observable. Semblance/similarity together with color blended spectral images can reveal better geological information.



3.7.3 Tools



Several processing algorithms may be applied to horizon and will be described here:

- Adding points to existing horizons by interpolation (grid)
- Filtering interpretations
- Snapping an existing interpretation to a given amplitude event.
- Storing the Reference Z as an attribute

完成层位追踪后，建议如下的工作流顺序：

1. Snap the interpretation to a given event (min/max/zero crossing).
2. Grid the snapped grid since snapping can generate holes.
3. Filter the output grid.

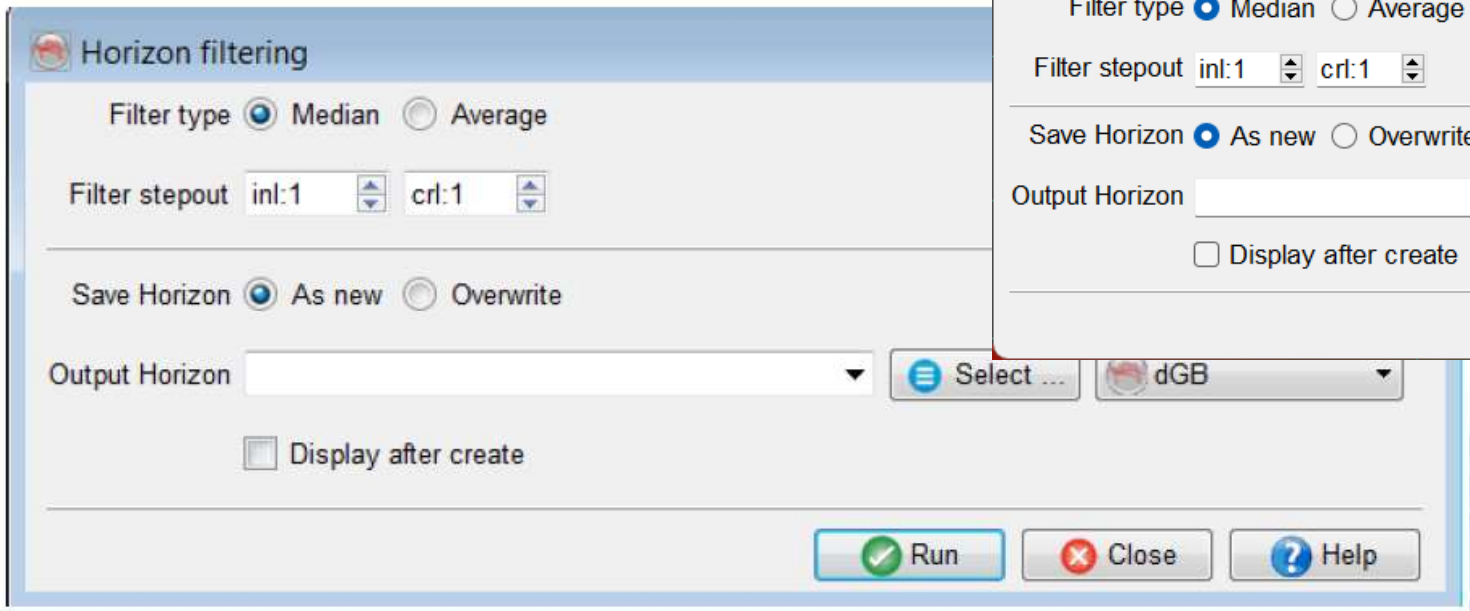
注：Tools下的功能，是在完成层位追踪后，执行的步骤。

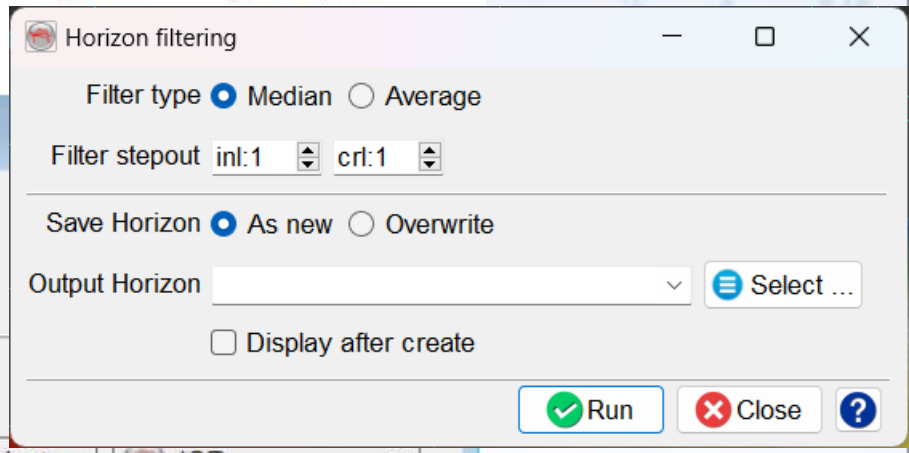
Filtering ...
Gridding ...
Shift ...
Snapping ...
Store Z as Attribute ...

手册的Tools下的功能介绍，与软件截图有很大差异。
按照GNU版本软件的功能模块，做了调整。

3.7.3 Tools 1 Filtering

The "filter" utility enables filtering of the horizon using either median or average filter. The inline and crossline step-out should be defined. The larger the step-out, the smoother the result of the filter.





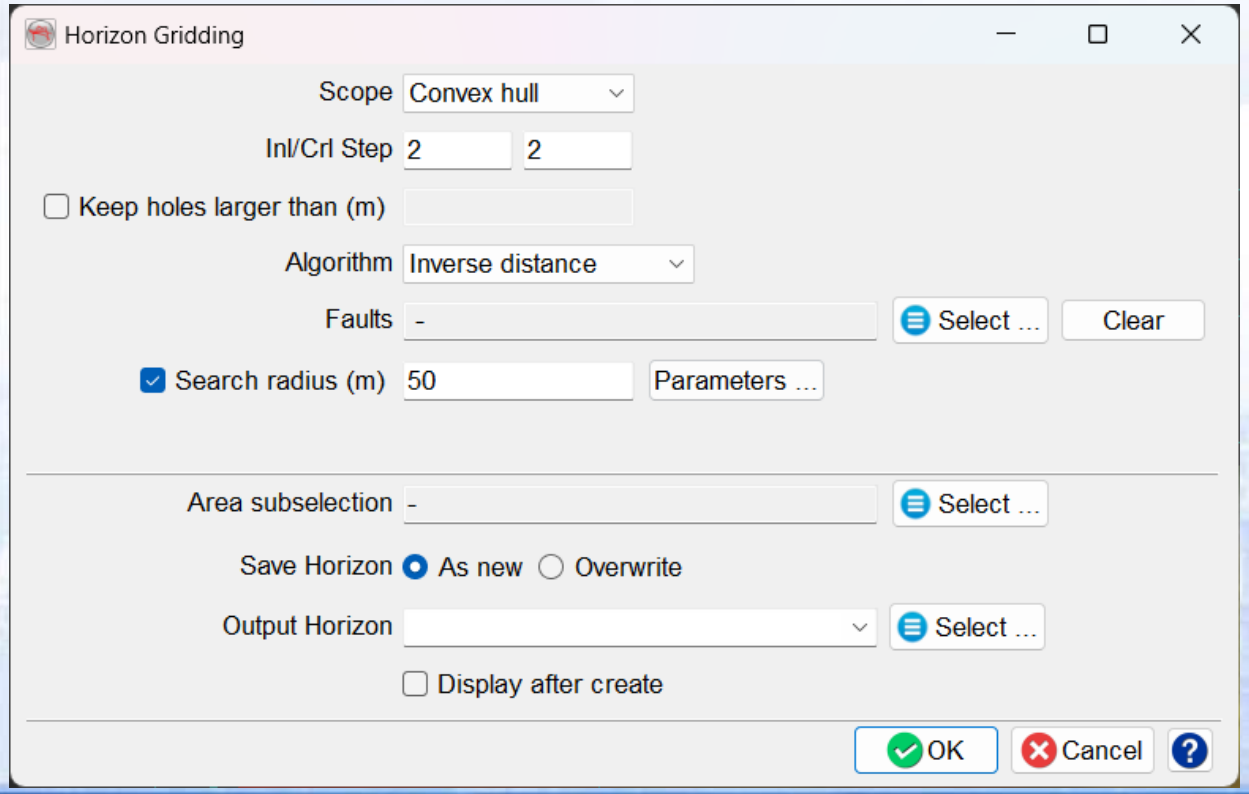
GNU

层位的过滤，使用中值或平均值过滤。这样使层位更光滑。

3.7.3 Tools 2 Gridding

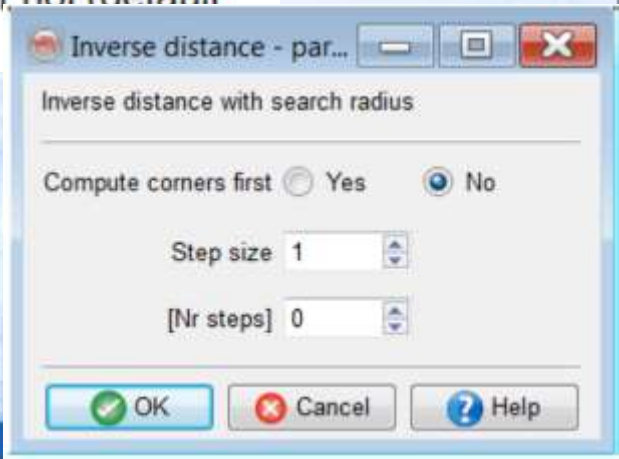
This utility is used to grid/interpolate a horizon having gaps/holes or to filter (average/median) a horizon grid. There are several gridding algorithms supported in OpendTect.

追踪的层位可能为空洞，使用该功能网格化/插值来填补。



Gridding Parameters:

- **Geometry:** There are different types of geometries that are used to do interpolation. The Full survey is used to interpolate (in-/out-wards) the Horizon-Z values within the entire survey box. The Bounding Box defines the rectangle fitting the horizon geometry, which is generally smaller than the survey box. The Convex hull type of area fitting also restricts the gridding geometry within the horizon boundaries. To grid the gaps or holes in a horizons, the Only holes type of gridding geometry is used.
- **Inl/Crl step:** The default steps correspond to the sampling rate of the input horizon. The step can be decreased up to the survey sampling rate to get a higher resolution horizon.
- **Algorithm(s):** Inverse distance algorithm uses an inverse distance method of interpolation. Inverse distance requires the search radius with optional parameters (step-size and number of steps). The step size of '1' means that one bin would be used in all directions to interpolate the horizon Z-values. Whereas the number of steps define the number of concentric circles for inverse distance computation. For these steps, the grid computation can be set to the corner points for the defined radius or not (default option).



层位网格化参数：
几何
增加（减少）步
算法：反距离插值(IDW)

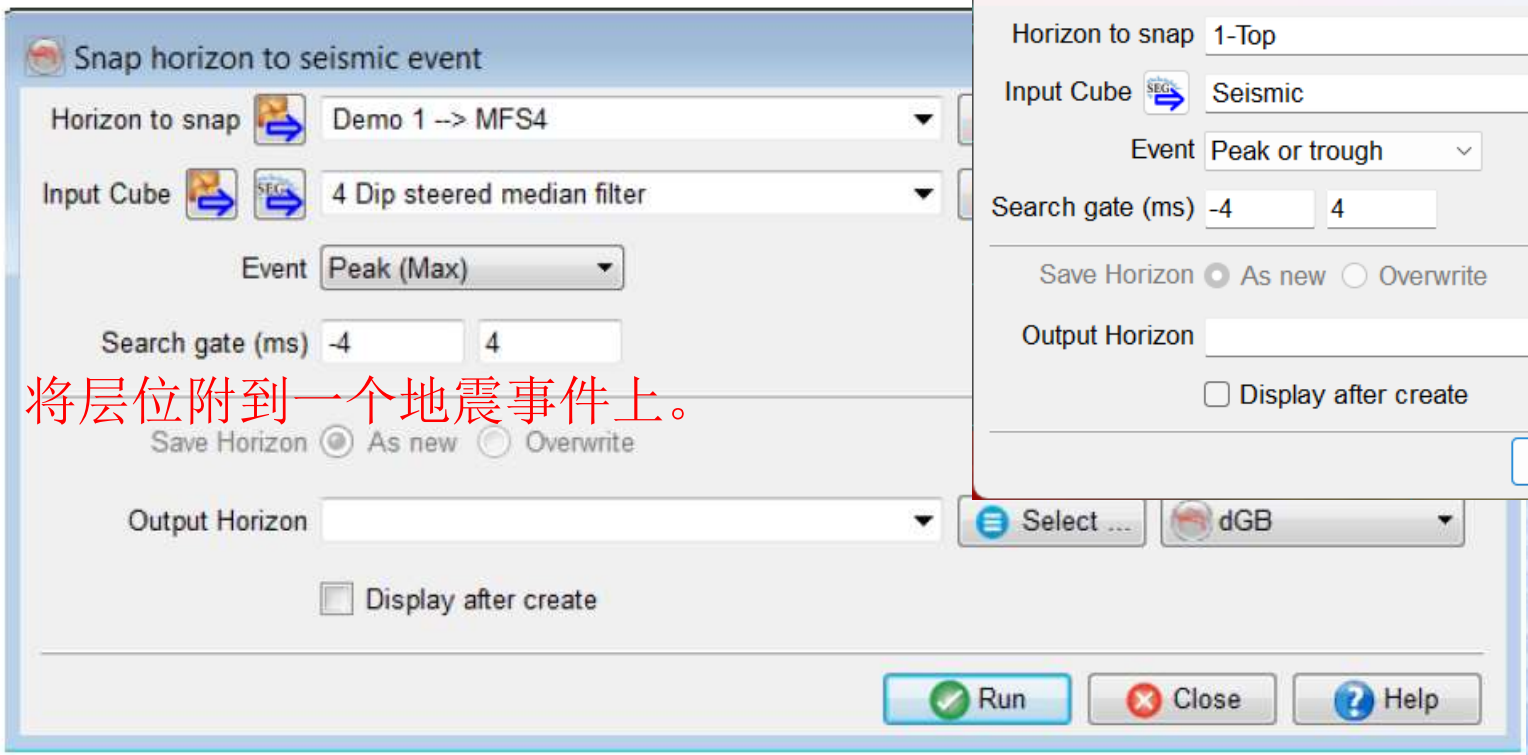
- *Triangulation* is a fast gridding algorithm, which uses triangulation method of interpolation. The interpolation can also be defined by providing an optional maximum distance (radius) by setting interpolate option checked.
- *Extension* uses a simple linear interpolation algorithm to extend the horizon Z-values outward using the number of steps (bins), which need to be defined in the following parameter field (Number of steps).
- *Continuous Curvature (GMT)* is a continuous curvature algorithm of interpolation, which is a part of the GMT Plugin of OpendTect. Please check the GMT website for further details. This algorithm only requires the tension parameter (ranges from 0-1), which controls the smoothing. The tension 0 gives minimum curvature type of surface interpolation, while the tension of 1 gives a harmonic surface.
- *Nearest Neighbour (GMT)* is also another interpolation algorithm coming from the GMT Plugin of OpendTect. This algorithm requires the search radius to be defined. It is mostly useful for a regularly spaced grid data. Please check the GMT website for further details.

层位网格化的各种插值算法。

3.7.3 Tools

3.7.3.3 Snap-To Event (GNU版本: Snapping)

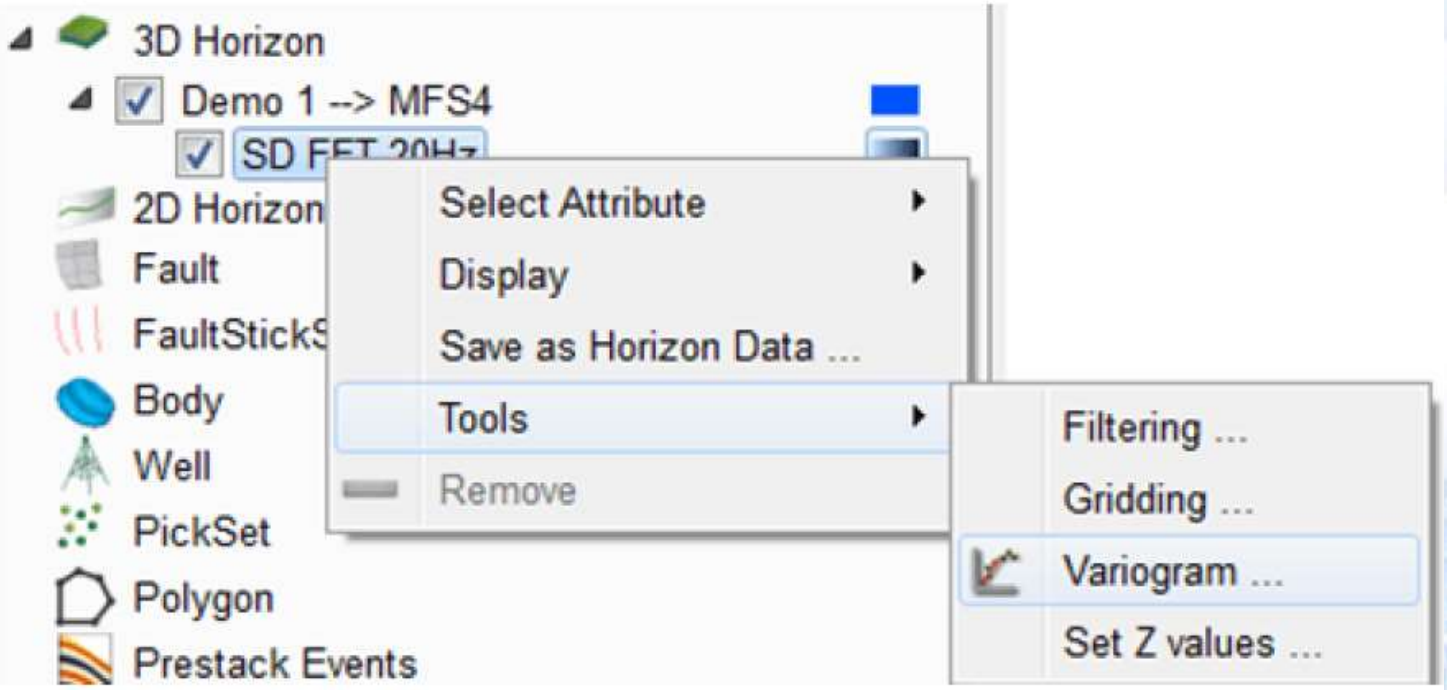
In case the horizon is not correctly snapped to a seismic event, this option can be used. The user should define the input data, the event type (peak or trough, zero-crossing etc.), the search gate relative to the original horizon, and whether the snapped horizon should be saved as new or overwrite the original horizon



将层位附到一个地震事件上。

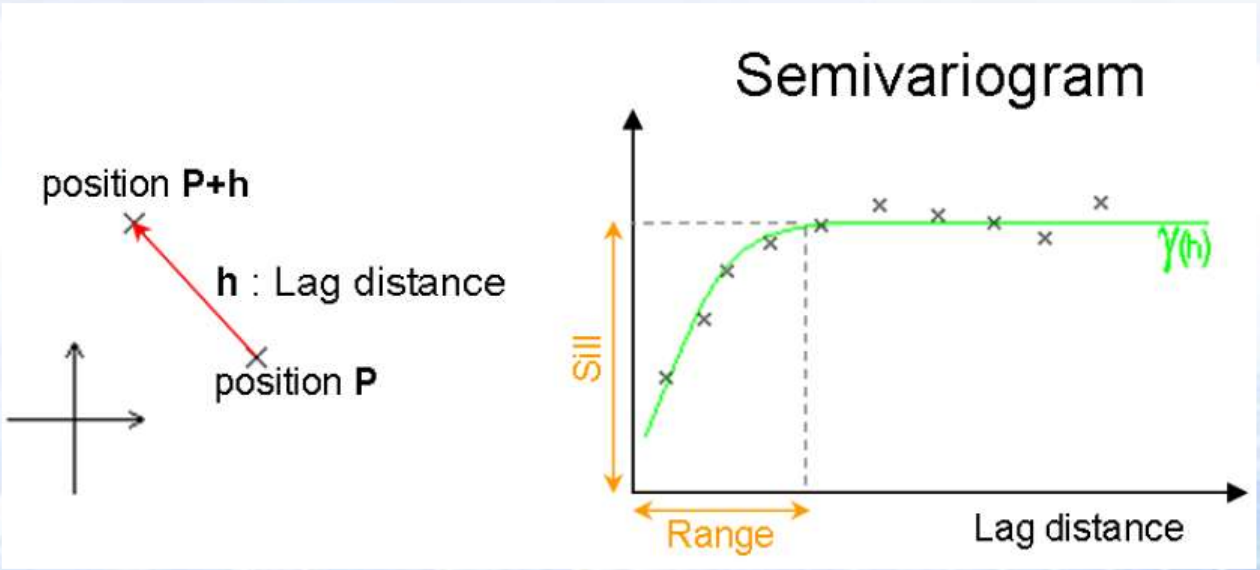
3.7.3 Tools　　3.7.3.4 Variogram

For any horizon data displayed on a horizon, a horizontal variogram can be computed:

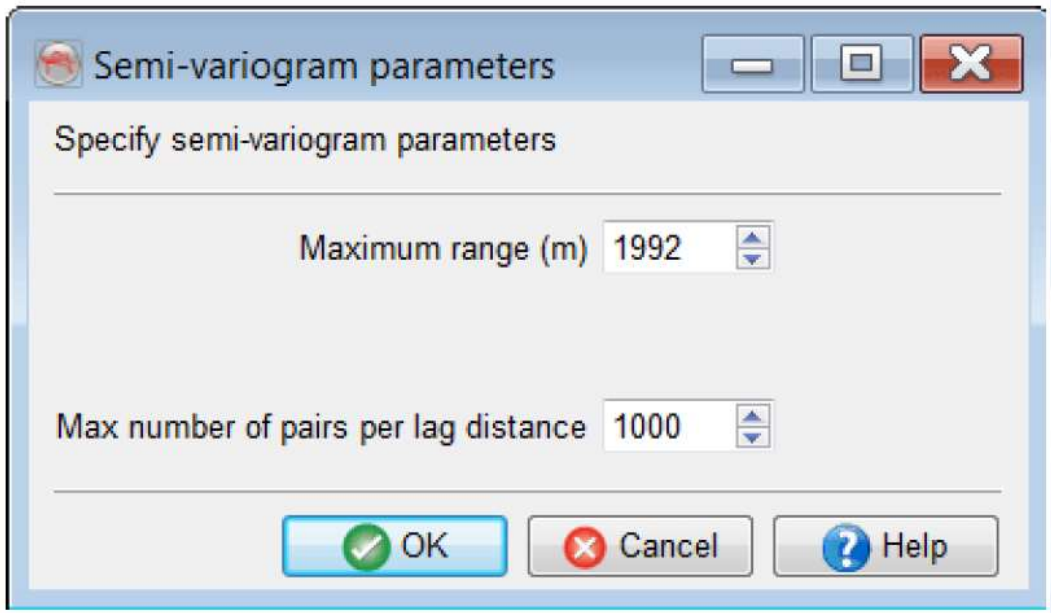


显示方差图，首先要保存Horizon Data

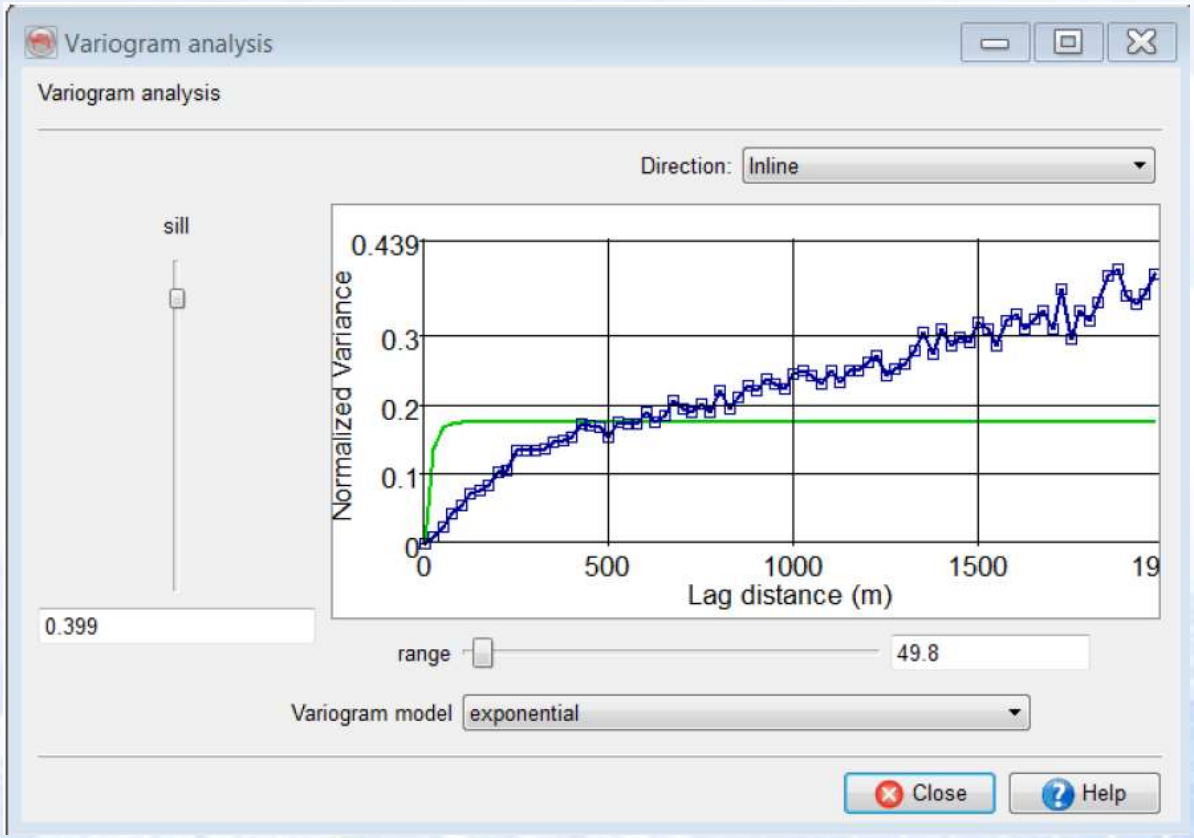
The variogram describes the spatial continuity, here in the horizontal direction but it can also be computed vertically from the crossplot tool. It is commonly represented as a graph that shows the variance in measure with distance between all pairs of sampled locations. Modeling of relationship among sample locations to indicate the variability of the measure with distance of separation is called Semivariogram or Variogram modeling. Variograms are important when doing inversion as it allows to predict a value at a location where it has not been measured.



To compute the variogram, parameters need to be provided: the maximum range (maximum distance allowed between the pairs for the analysis), the step and the minimum pairs per log distance:

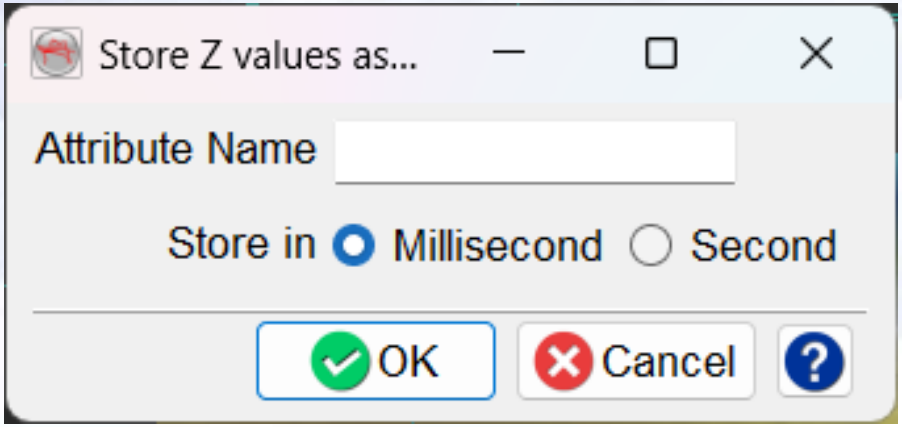


Once the variogram has been created, the analysis consists in finding the model that best fits the measured data in changing the variogram type and changing the sill and range:



3.7.3 Tools

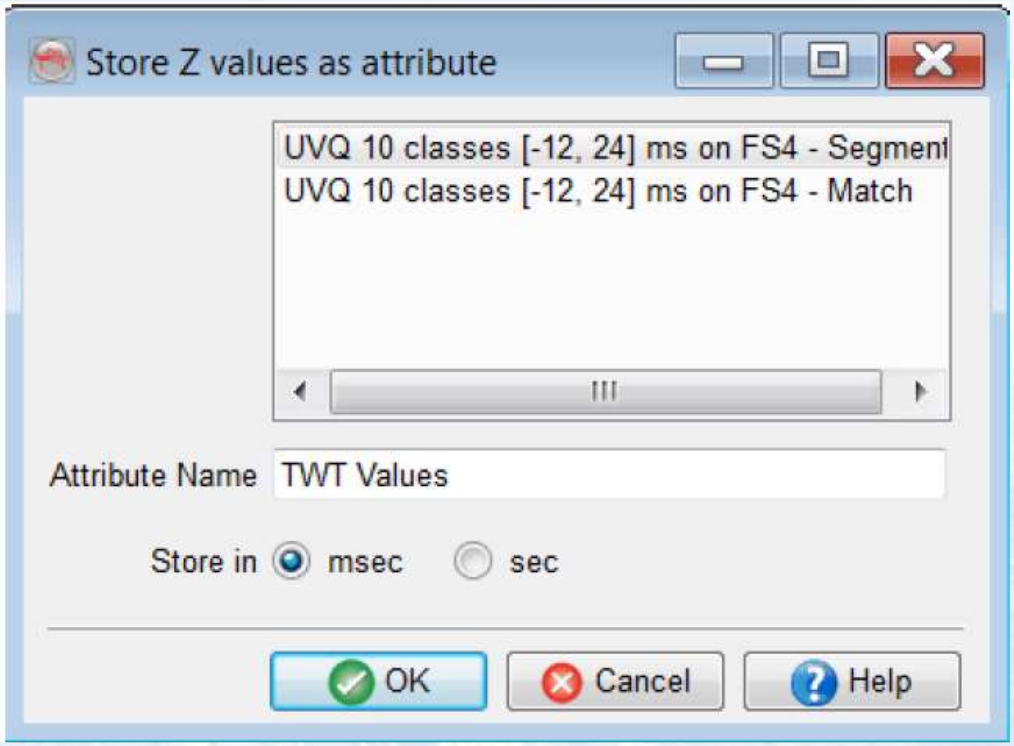
4 Store Z values (GNU版本)



3.7.11 Store Z as Attribute 移到Tools了

This option gives the possibility to store 'Z' values as a Horizon data for an horizon. Subsequently, this newly created attribute can be used to change 'Z' values of another horizon by means of Set Z values.

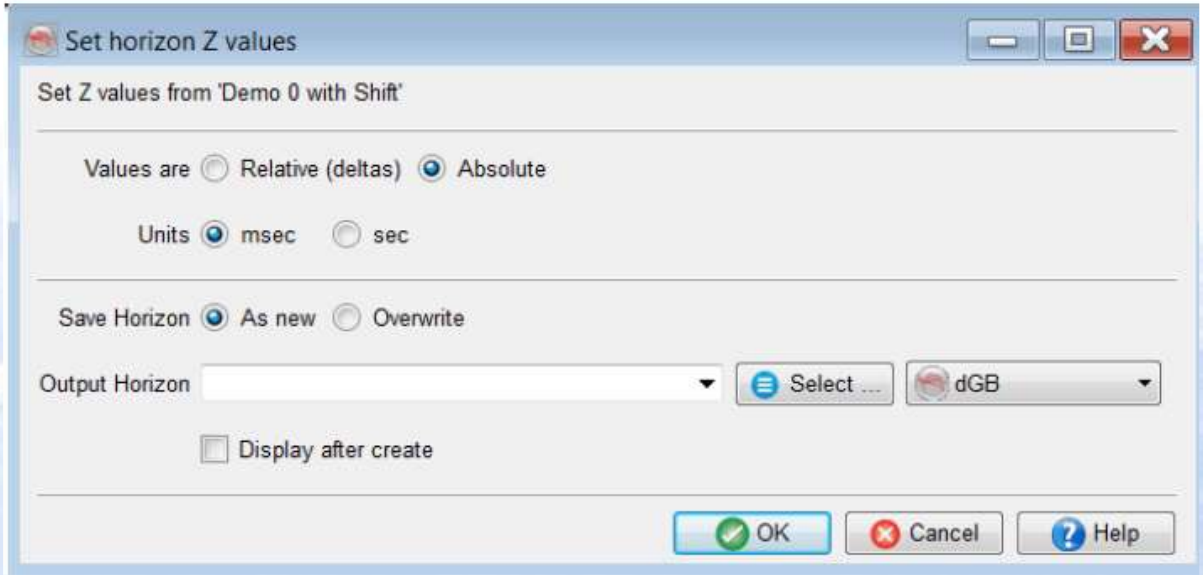
The name of the new 'Z' attribute and in which units it will be saved need to be specified.



3.7.12 Set Z Values

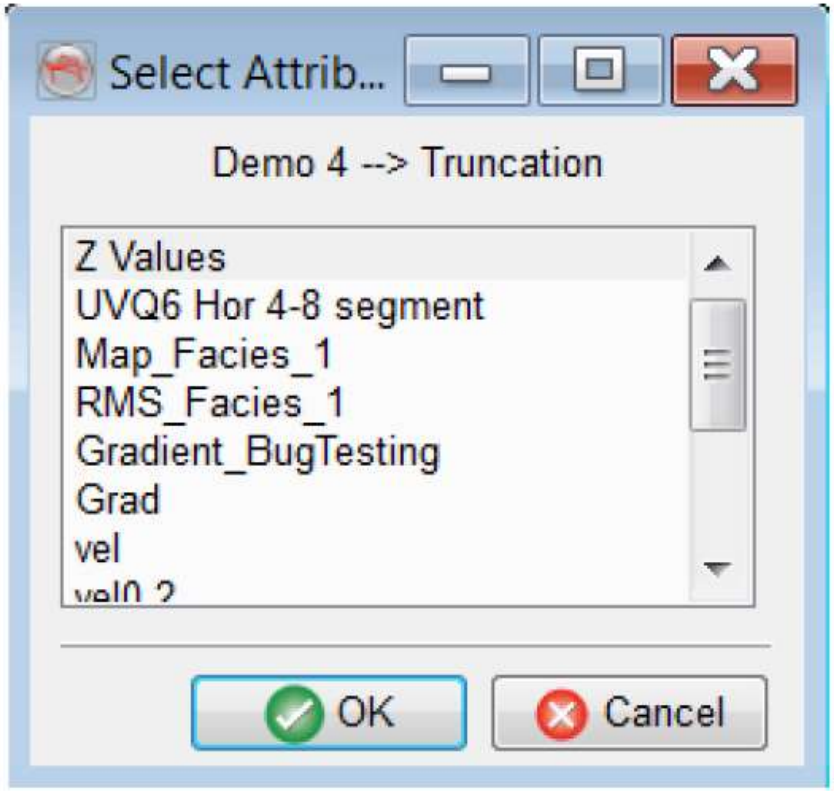
A 'Z' value surface attribute (see Store Z as attribute) can be used to shift a horizon or completely change its 'Z' positions using the *Set Z values* option.

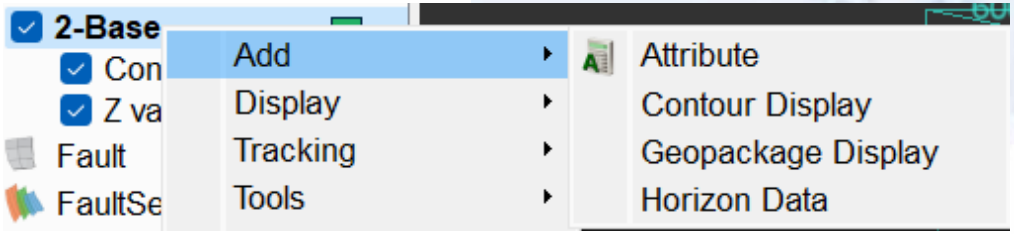
Specifying values as *Relative (deltas)* will shift the horizon; infact the software adds the attributes 'Z' values to the 'Z' values of horizon to achieve this shift. *Absolute* is used while completely changing the 'Z' values of the horizon to the 'Z' values of the surface attribute. Specification of units of 'Z' values (i.e. in 'milliseconds' or 'seconds') is also required.



3.7.4 Display Contours （不在Tools中了）

Add Contour Display: This option displays the contour on the horizon. That the contour step (interval) is automatically calculated but can be edited at any time. The input for the contour display can be either a reference Z or any surface attribute like Similarity, Energy, Dip etc ...

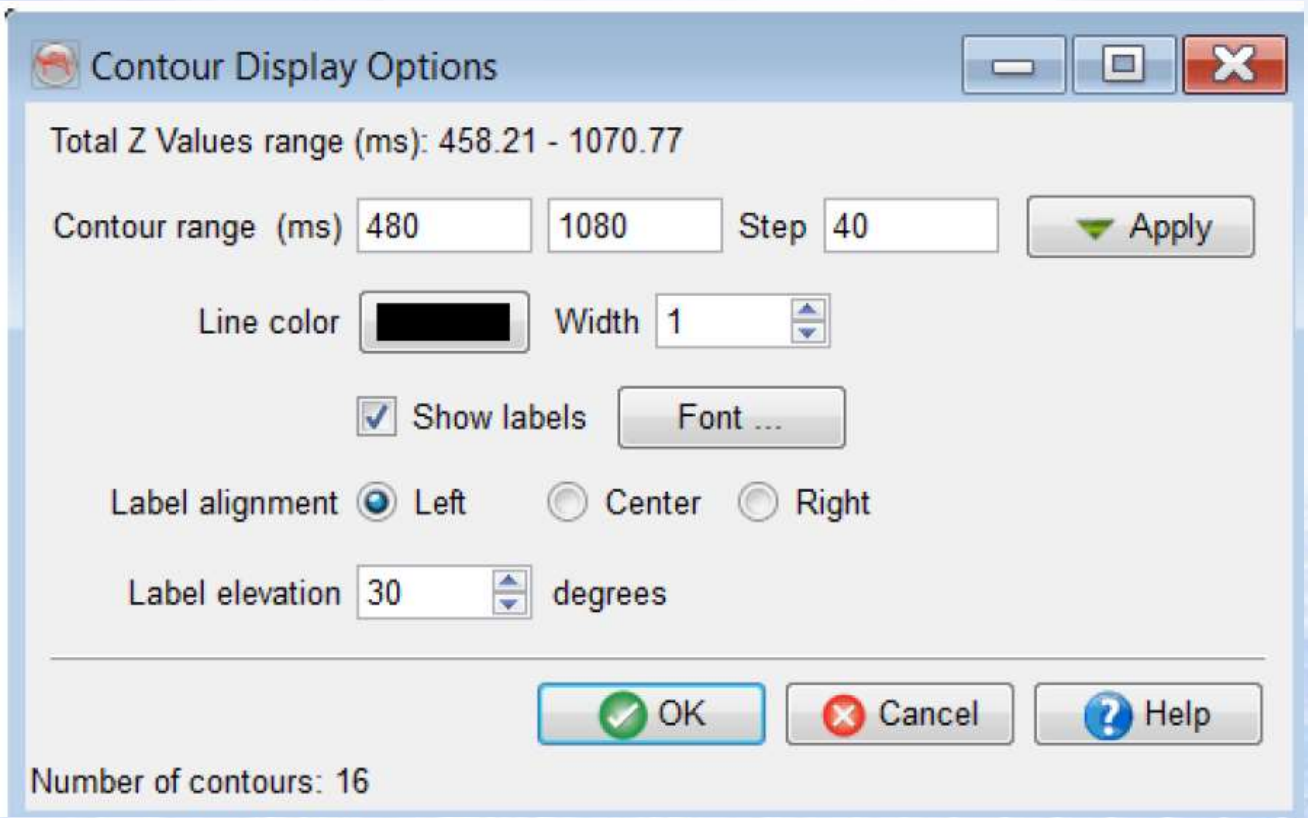




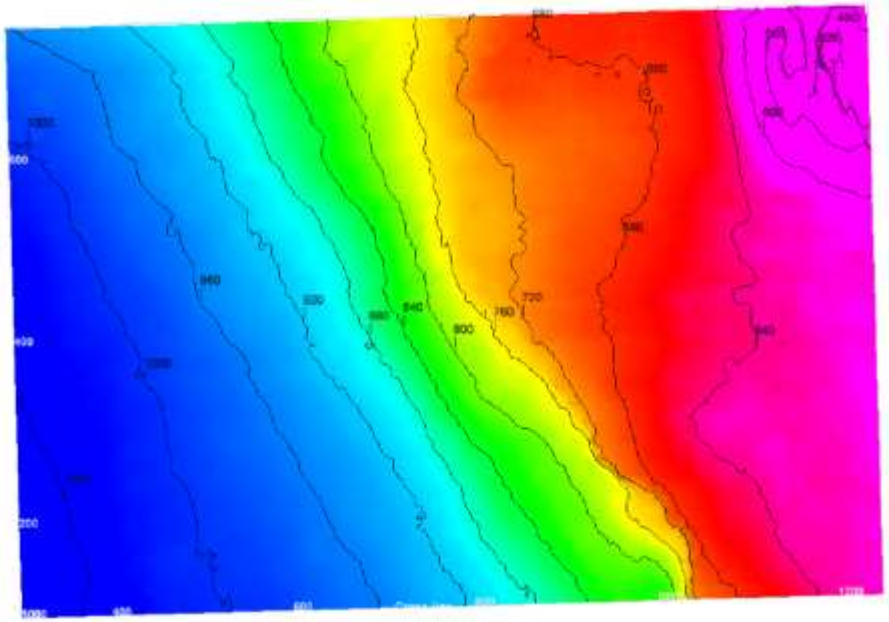
该功能移到Add弹出菜单下了

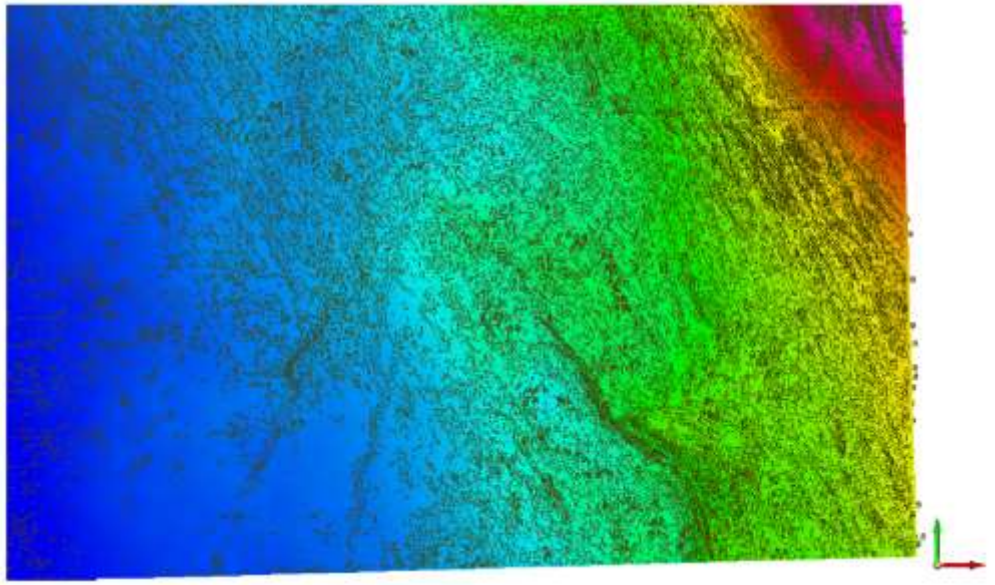
The contours properties can be manipulated by right-clicking on the Contour attribute in the horizon element.

A user can adjust contour range/index, color and line thickness.



The images below show a horizon with both reference Z and Similarity contours, respectively:

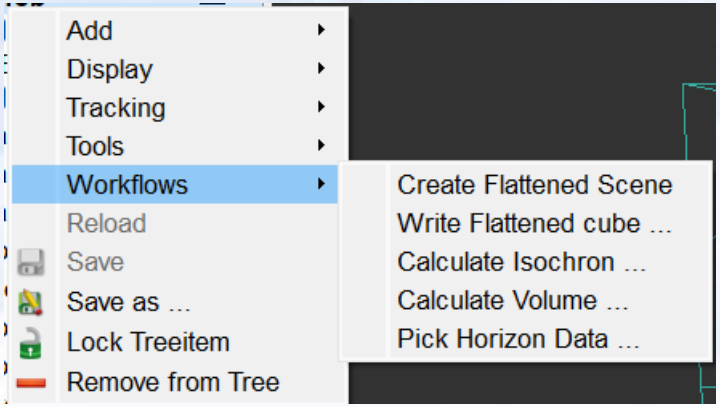




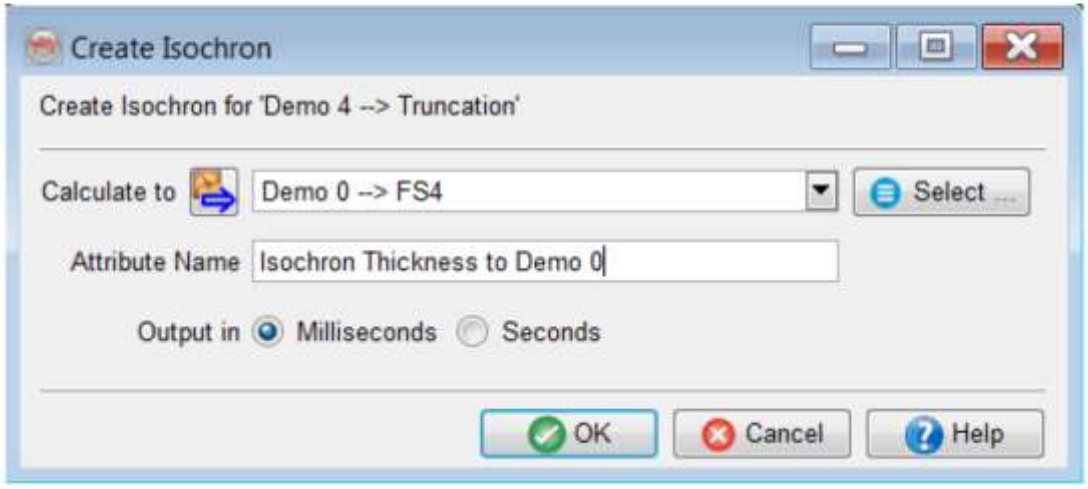
参考Z值和相似性的等值线图

3.7.5 Calculate Isopach

不在tools下了，移到Workflows弹出菜单下了



Calculate isopach: This option will compute the time or depth difference between two horizons. The computed grid will be displayed as a new layer on this horizon and may be stored as a surface data. The output will always be in seconds, meters, or feet.



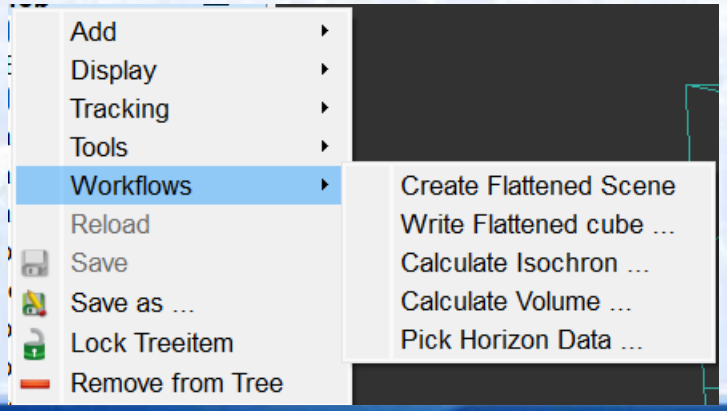
计算2个层位之间的时间或深度差异

3.7.6 Flattening

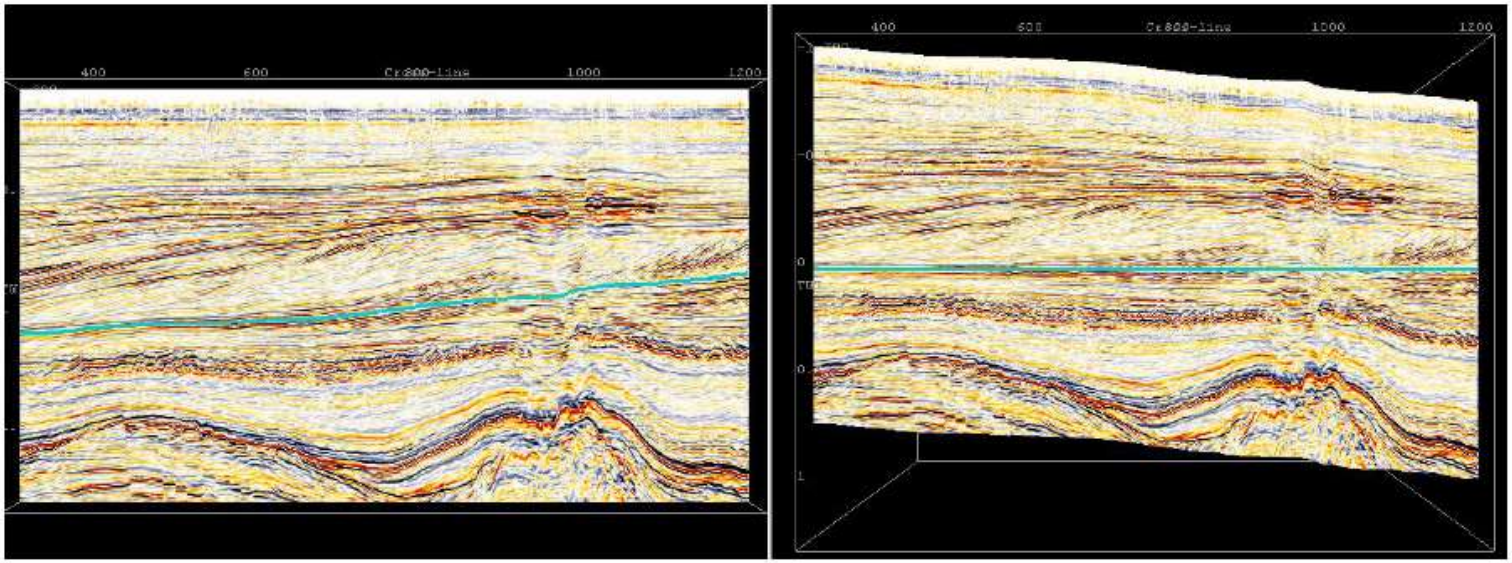
不在tools下了，移到Workflows弹出菜单下了

Write Flattened Cube: It creates the flattened seismic at specified time value of horizon. The output is stored as a new flattened cube. The user can choose the benefit of this option by flattening the cube at the horizon. 地震数据压平

Flatten: 图像压平，可理解为具有相似特点的图像合并到一块。



Create flattened scene: This option enables the user to create a second scene in which the data is displayed relative to the flattened horizon. This can be a very useful tool in specific situations. By flattening a horizon, the user gets an idea of the approximate section at the time of the deposition of this horizon. The tectonic history can be derived from the difference between the original section and the "restored" section. Another advantage of flattening the horizon is that it becomes easier to evaluate the depositional environments.



Unflattening the cube: Should you need to unflatten the cube then please refer to the following: Delta Resample Attribute