Comparisons Between Two Surveys

by Pat Sanders

We get a lot of requests on how you can compare the results between two surveys. For examples:

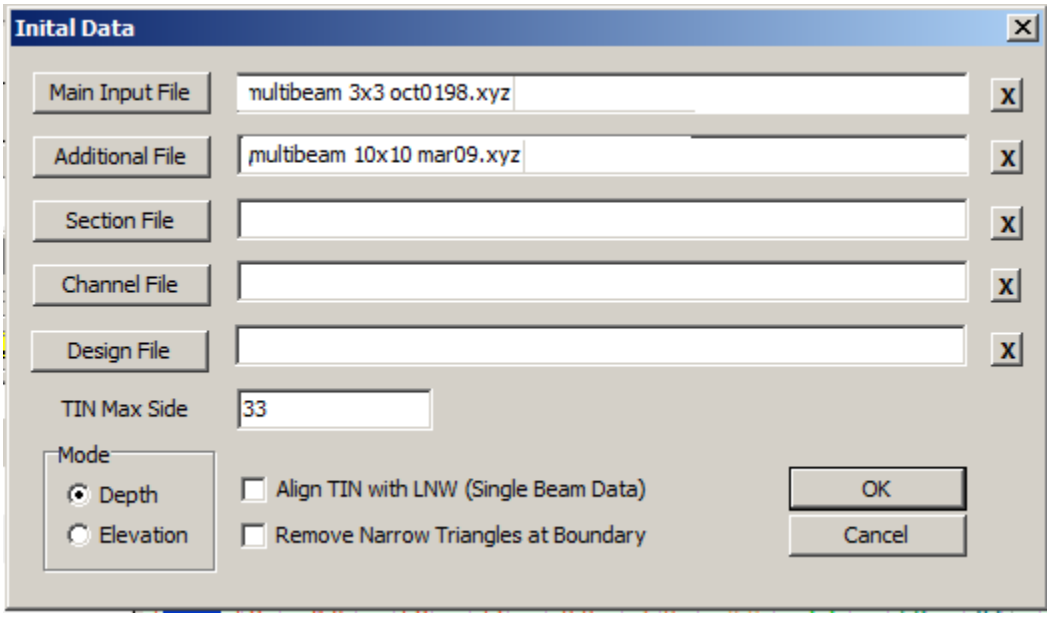
- We surveyed this area last year and re-surveyed it this year and want to know how much material has entered/left the area and see the areas where changes are happening.
- We have a pre-dredge and a post-dredge survey and would like to see a visual where the material has been removed.

You can easily perform the task in the TIN MODEL!

STEP 1: MAKE A DIFFERENCE MODEL.

In the TIN MODEL program, enter the data file(s) from your earliest survey as the Main Input File and the data file(s) from your later survey as the Additional File. The TIN MODEL program generates a surface model for both surveys.

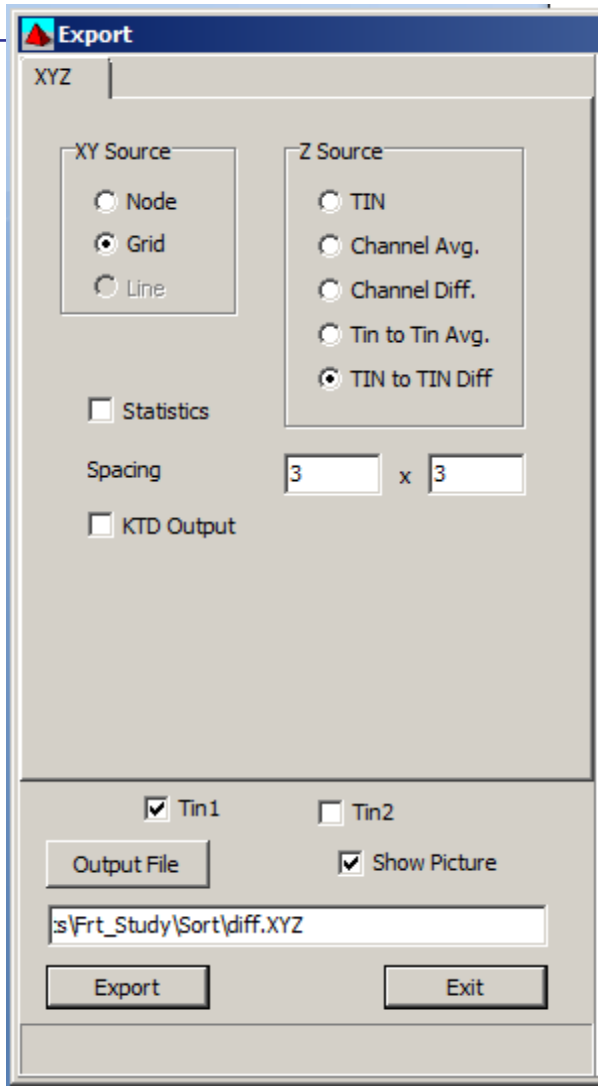
FIGURE 1. *Making a Difference Model in the TIN MODEL Program*



STEP 2: OUTPUT AN XYZ DIFFERENCE FILE:

1. **Under the Export menu, select XYZ.** The Export window (Figure 2) appears.

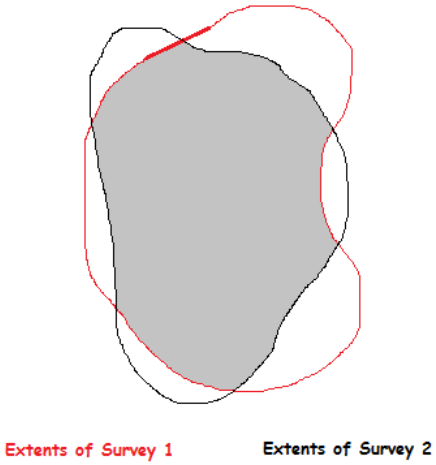
FIGURE 2. Export Window



2. **Select the "TIN to TIN Diff" model.**
3. **In the XY Source frame, you can select to make either a gridded model (I have specified a 3 x 3 grid) or a node model.** In the node model, it will determine the difference between the two surfaces at each XYZ point contained in the two data sets.
4. **You can ignore the TIN1 and TIN2 checkboxes** when doing a TIN-to-TIN Difference model.

THE MATH:

FIGURE 3. The Extents of Survey 1 (red) and Survey 2 (black)



Let's say your original project was in "Depth Mode". That means that Z is positive downwards. Let's use the following values:

Z1 = 12.8m (Depth from earlier survey)

Z2 = 11.4m (Depth from later survey)

Difference = 12.8 – 11.4 = 1.4m

This means we have *gained* 1.4m of material at this location.

Z1 = 10.6m (Depth from earlier survey)

Z2 = 11.4m (Depth from later survey)

Difference = 10.6 – 11.4 = -0.8m

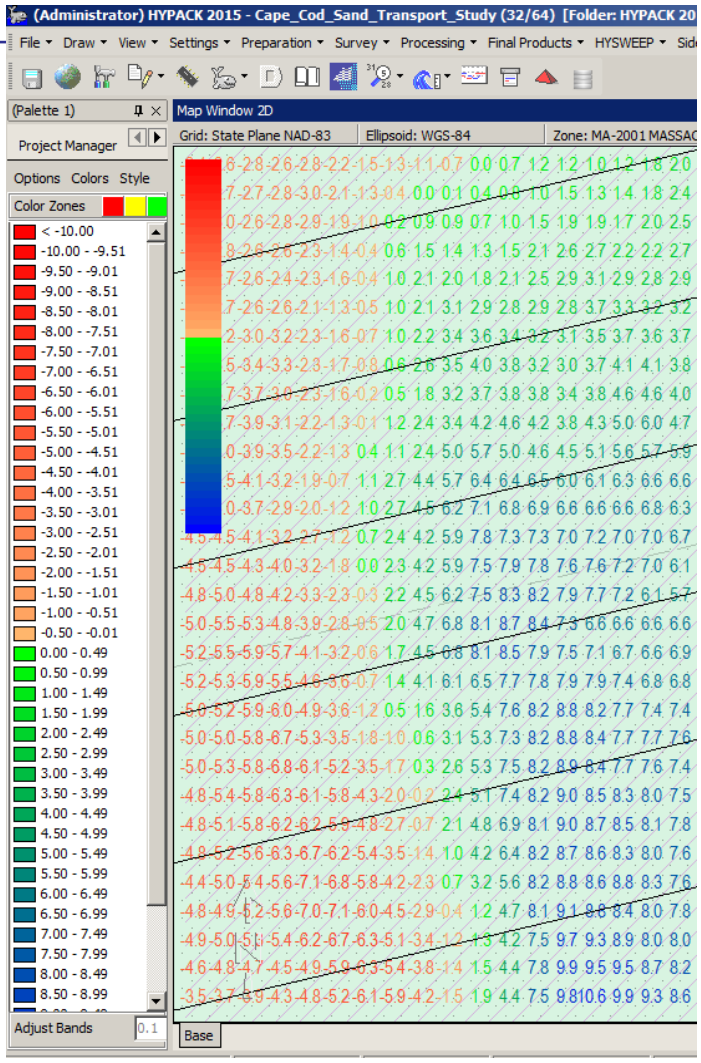
This means we have *lost* 0.8m of material at this location.

Note that the *TIN MODEL only generates a difference where the two models overlap.* If you examine Figure 3, the differences between the two surveys would only be generated in the gray-shaded area.

VIEWING THE DIFFERENCE FILE IN THE HYPACK SHELL:

The Difference file is just an XYZ file where the Z-value represents the difference between the two surveys.

FIGURE 4. *Sample Difference File*



- **If it is positive,** it means that the depth from the later survey is shoaler than the original depth at that location.
- **If it is negative**, it means that the depth in the later survey is deeper than the original depth, meaning you have lost material at that location.

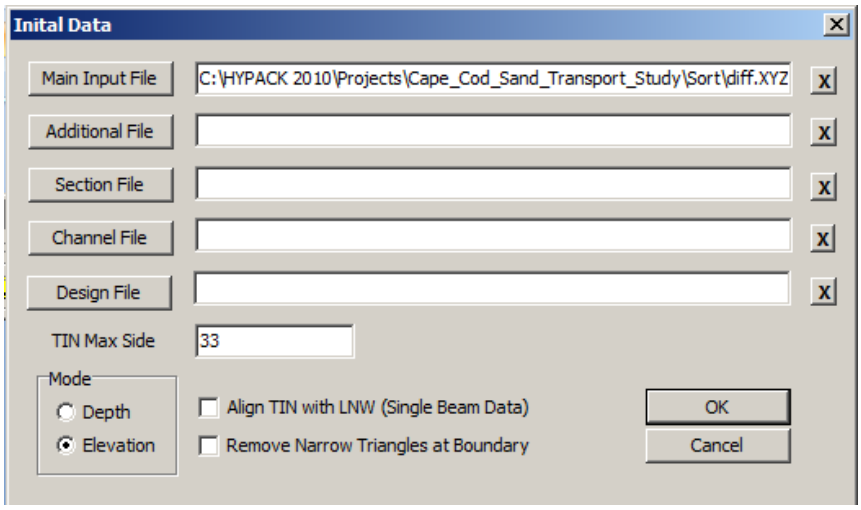
So, a -3.2 means you have lost 3.2m (or feet, if you are on a foot grid) of material. A 2.4 means you have gained 2.4m of material.

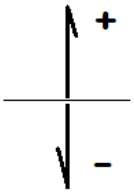
In Figure 4, the color palette is set to show areas where you have lost material in colors from orange to red and areas where you have gained material from green to blue.

VIEWING THE DIFFERENCE FILE IN THE TIN MODEL.

You can load the difference XYZ file back into the TIN MODEL to visualize the changes in the bottom between the two surveys. Although our original data files were in depth (Z positive downwards), we have to treat the difference file like it is an elevation-based data file.

FIGURE 5. *Building a TIN Model with the Difference File*



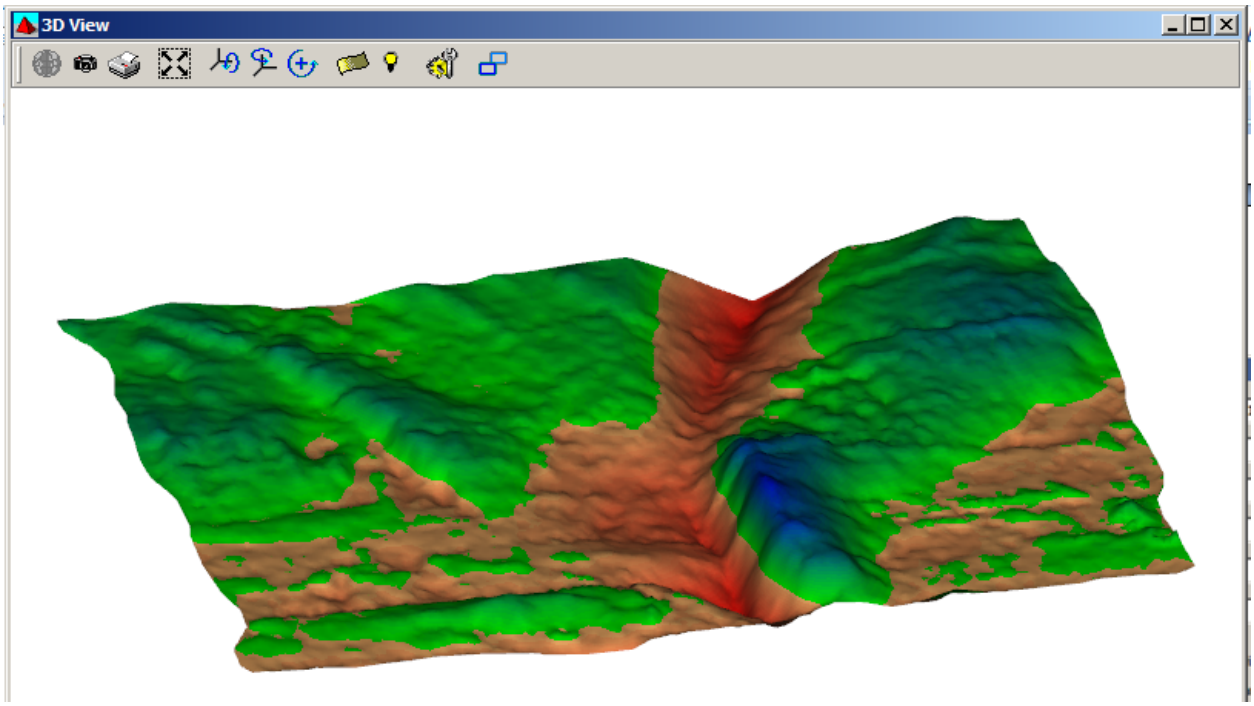


Areas where you have gained material are positive values. The greater the gain, the greater the Z-value. In order for the model to be “right-side up”, you need to tell the TIN MODEL program that the difference file is “Elevation Mode” in the lower left hand corner.

IMPORTANT: **If you fail to do this**, *your model will be upside down and your cut/fill values in a TIN-to-LEVEL computation will be reversed*!

We can then go to the 3D View and look at the color-coded view in TIN MODEL:

FIGURE 6. *Difference Model in TIN MODEL*



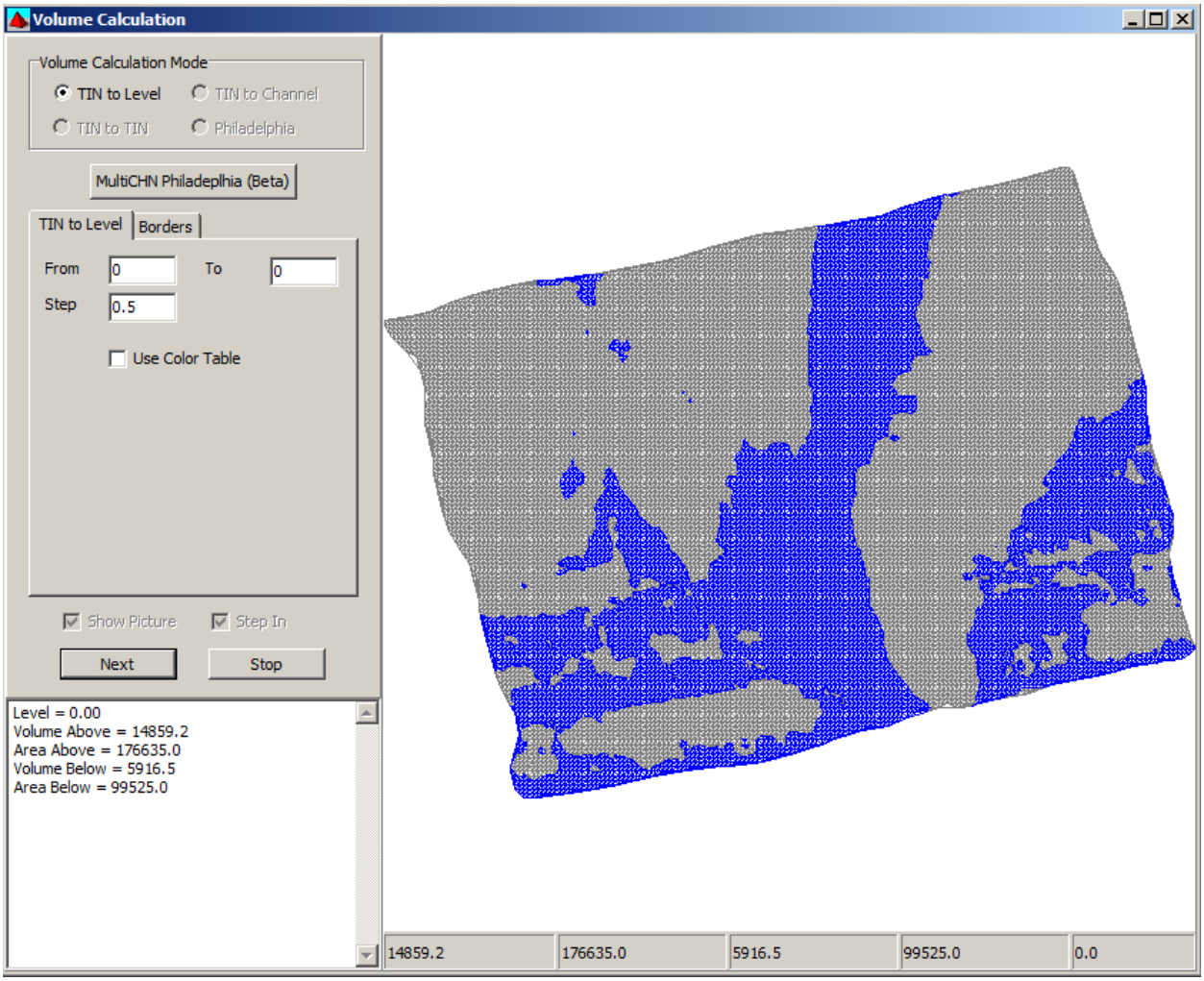
You can export the graphic to a GeoTIF by changing the Spin and Rotation to 0 degrees and then clicking the “World” icon (far left).

NET GAIN OR NET LOSS?

To determine if you have had a net gain or a net loss of material between the two surveys, you can run a TIN vs LEVEL volume computation at the Z = 0 level. Anywhere the Z-value is above zero, you have gained material and it will show up as “Fill”. Anywhere the Z-value is below zero, you have lost material and it will show up as “Cut”.

1. **Select CALCULATE – VOLUME and select the TIN to LEVEL computation**.
2. **Set the “From” and “To” Z-levels both equal to 0.** Don’t worry about the “Step”.
3. **Click the ‘Calculate’ button**. In Figure 7, the right-hand side shows the result if you filled the model up with water (blue) to Z = 0. This shows all of the regions where you have lost material. The gray colored region shows where you have gained material.

FIGURE 7. *TIN-to-Level Results*



The volume summary (lower left) shows you have regions where we have gained 14,859m^3 and regions where you have lost 5,916.5m^3. The difference between them (14859 minus 5916) shows you have gained 8,940m^3 of material in the overlapping regions between the two surveys.