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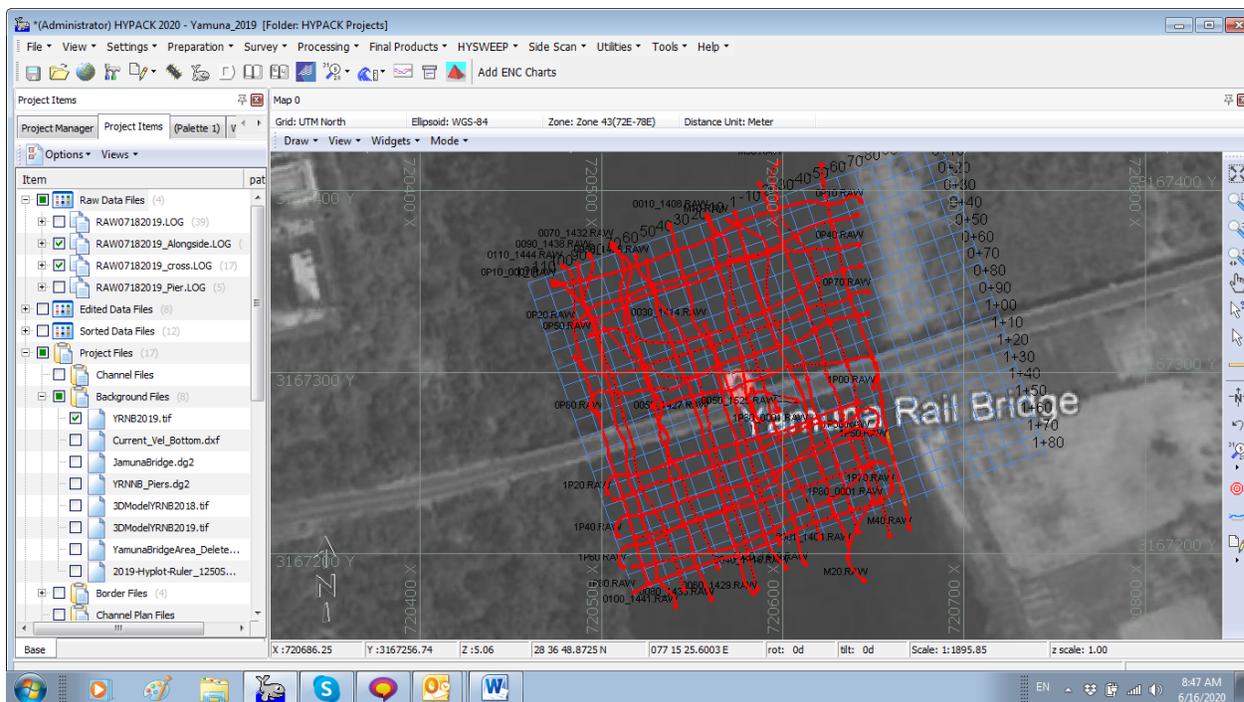
Comparison of the CROSS CHECK STATISTICS and the SURVEY STATISTICS Utilities

By Ivan Izaak

There are two utilities in HYPACK® 2020 that compare different data sets and help you to perform data analysis on intersections. There are similarities and differences. This article is intended to provide you a review of both so you can decide which one is better based on your survey type, your preferences in the reporting and, most importantly, on how accurate you were when steering the boat over the planned lines (if any were actually used in SURVEY)!

I have used the results of the survey over Yamuna River, India with the M9 HydroSurveyor by SonTek. I have performed it with the help of my SonTek colleague, Mr. Rajiv Bhatia back in the summer of 2019.

FIGURE 1. Area of the Survey with M9 HydroSurveyor near Yamuna Rail Bridge, India.



In the Figure 1, you can see the test area. The survey was done using two sets of planned lines – one is across the river and the other one is longitudinally in the river with 10m distance between the lines.

The data were processed using the SBMAX64 Editor (64-bit SINGLE BEAM EDITOR) with RTK Tides applied and position accuracy at RTK Fixed Mode.

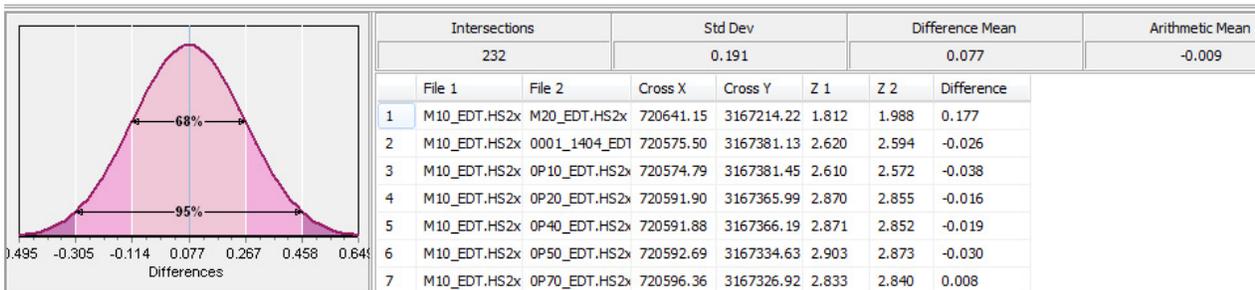
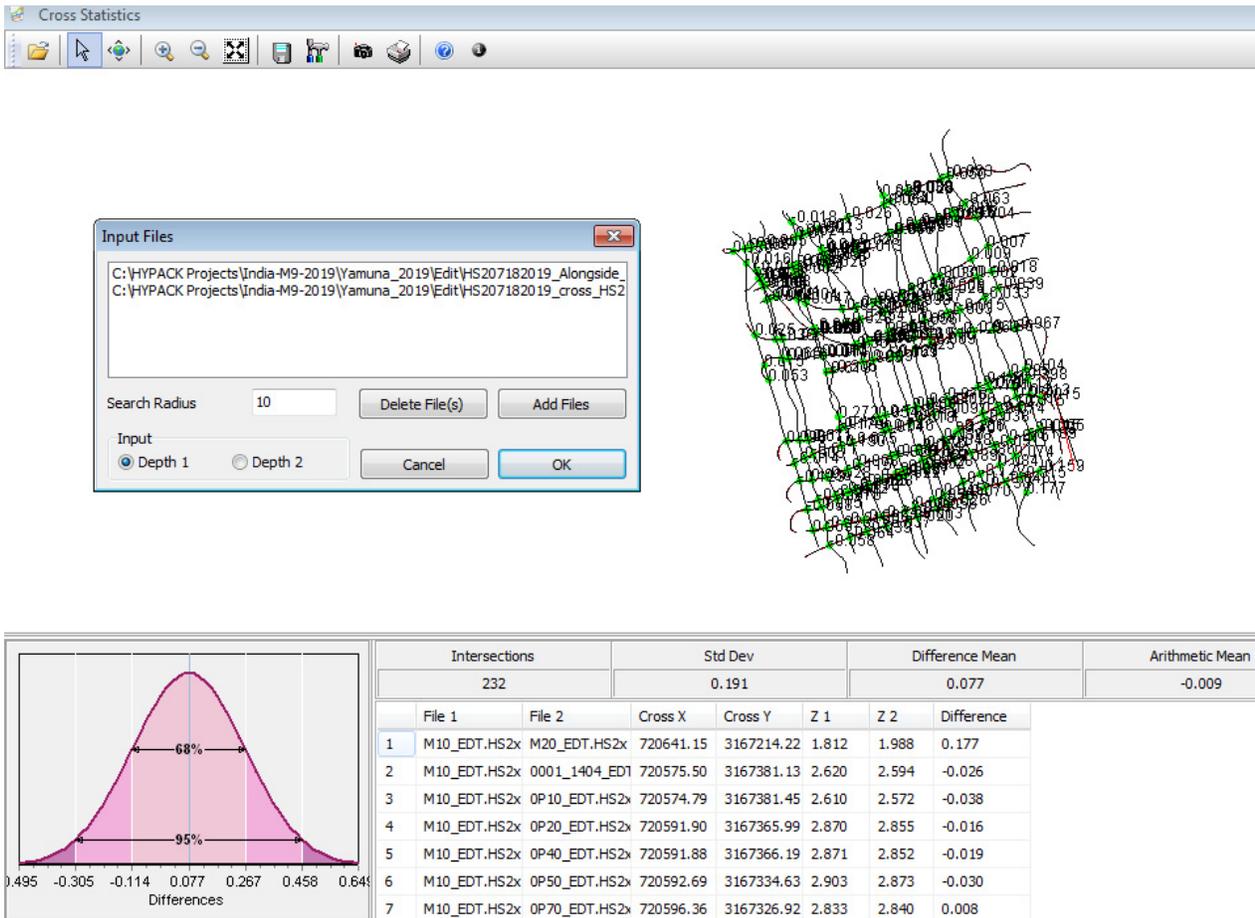
Now let's see how both utilities work.

CROSS CHECK STATISTICS (CCS)

The CCS utility is located under the UTILITIES menu in the HYPACK® Shell menu. It reads the edited HS2X (or older ALL) format single beam data. It looks for the intersections of the planned lines that were used when you collected the data and then, based on the search radius you enter (Figure 2), it finds the soundings in different files and computes the statistics.

So, this utility showed 232 points for the comparison, and the Standard Deviation is 0.191m. This means that the TVU (Total Vertical Uncertainty) is 0.382m, which is too big and we have had some mutual dispersion of the data as if there was motion we did not account for. The bias is 0.077, which is good and means the data accuracy is fine with the IHO S44 Special Order requirement. The report in this utility looks as follows (Figure 2):

FIGURE 2. CROSS CHECK STATISTICS Results



The **advantage** of the CROSS CHECK STATISTICS program: it's been there for many years and is familiar to our customers.

The **disadvantages**:

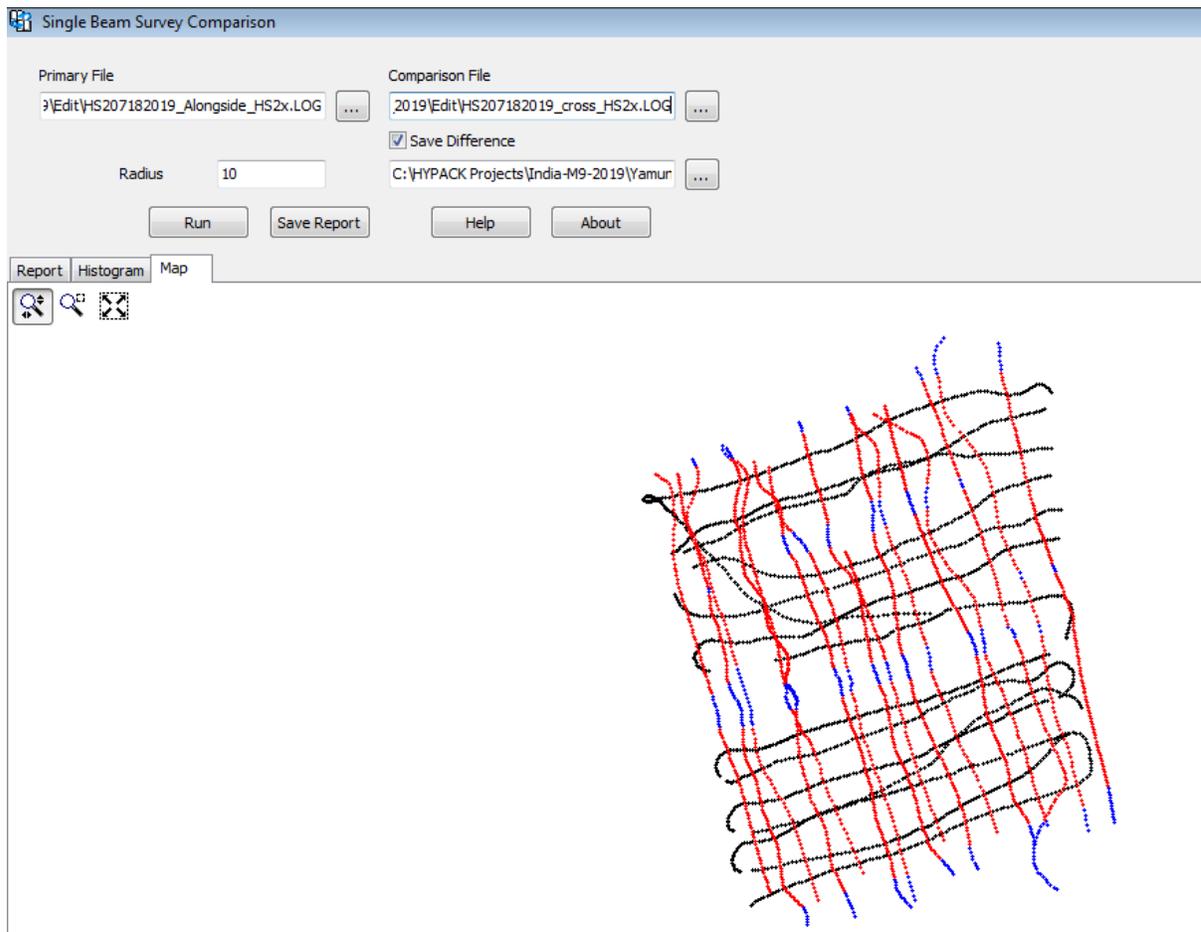
- It can only read edited single beam data. If you want to compare your multibeam or laser data, you must first make them look like single beam data. This can be done in the TIN MODEL.
- Since the program is looking for the intersections between the planned lines, you had to accurately survey over these planned lines; otherwise, the program will do a poor job.

SURVEY STATISTICS

This new program is located under the UTILITIES – FILE WORK. It can read edited HS2X format files (either multibeam or single beam data), or XYZ files. This is good for multibeam data comparisons!

The program compares each sounding in the Primary File with the closest point in the Comparison File that falls within specified Radius (so, it does not need planned lines).

FIGURE 3. SURVEY STATISTICS Main Window



After you have selected the input files and set the Radius, you may optionally export the differences as an XYZ file. Check Save Difference and name the differences XYZ file.

Tip: It is good to use the difference file in the TIN MODEL program for further analysis.

When you click [Run], **red** dots show the points for comparison from the Primary data, **blue** shows points not taken into comparison from the Primary file, and **black** points show the Comparison File.

Now, you can either just view the Report (text information) or Histogram (graphic of distribution) tabs or you can save the report to a PDF file to be included into your SURVEY REPORT as in Figure 4.

SS program has found 1955 points (while CCS could only find 232) and the sigma was 0.09 (2S = 0.18m that is quite fine for the Special Order Survey S44 Standard) compared to 0.382m by CCS with the same bias value (0.01 compared to 0.077 from CCS).

FIGURE 4. SURVEY STATISTICS report in PDF format.

The **advantages** of the new SURVEY STATISTICS program:

- Can read both, multibeam and single beam data in either HS2X or XYZ formats. More flexible!
- Finds more intersections (as it does not look for the intersection between planned lines, but rather between real sounding points).
- Does not care about planned lines.
- Better report (in the PDF format) with improved graphics and an option to save the differences XYZ file.

The **disadvantages**:

- It does not show the maximum difference – I think this is good to check the quality of the editing process.
- It is new and more testing is required for you to decide if you prefer to use this one instead of the more traditional CCS program.

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ARITHMETIC MEAN: 0.01
STANDARD DEVIATION: 0.09
PERCENTAGE BETWEEN +S AND -S: 98.26%
-10σ: 0
-9σ: 0
-8σ: 0
-7σ: 0
-6σ: 0
-5σ: 0
-4σ: 0
-3σ: 0
-2σ: 0
-1σ: 1925
+1σ: 0
+2σ: 0
+3σ: 0
+4σ: 0
+5σ: 0
+6σ: 3
+7σ: 20
+8σ: 3
+9σ: 3
+10σ: 1
  
```

