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Processing ADCP data in HYPACK®

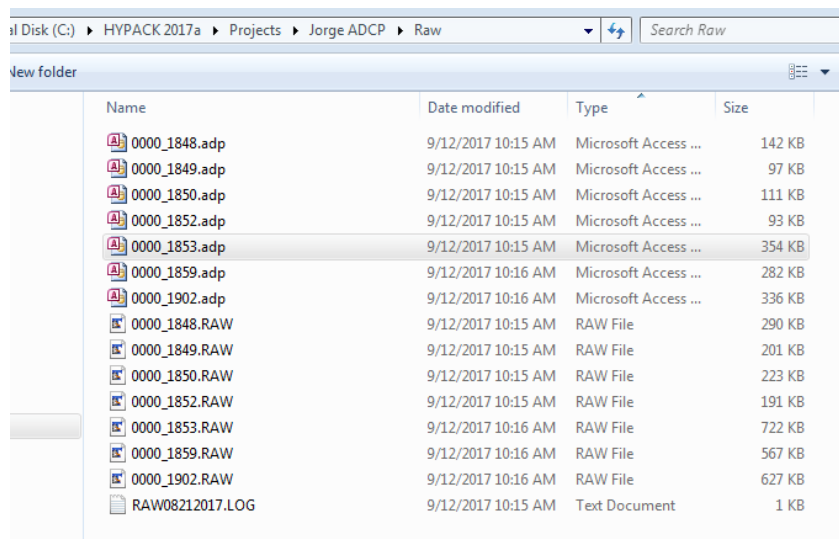
By Christian Shaw

ADCP profiler data can be collected and processed in HYPACK®. This guide will concentrate only on the processing of ADCP profile data in the ADCP PROFILE routine that can be found in the HYPACK® Utility menu.

ADCP profiler systems measure the velocity through the water column using the Doppler Effect based on the reflection of sound from suspended particulate matter in the water column. The phase change in frequency is directly proportional to the velocity of water in which you are traveling.

It is important to have the ADCP parameters set for the ADCP.dll optimally so that you have the best data available to you in the ADCP PROFILE program. The recorded measurements are subdivided into what we call bins or depth cells. Each bin contains the average of the returns within that bin dimension. The bin parameters in the ADCP driver (the number of depth cells and the depth cell size) should be set and tested before collecting mission data. This is because HYPACK® only collects the data within these cells which is saved to the profile data (*.RAW & *.ADP) files in the project \Raw folder.

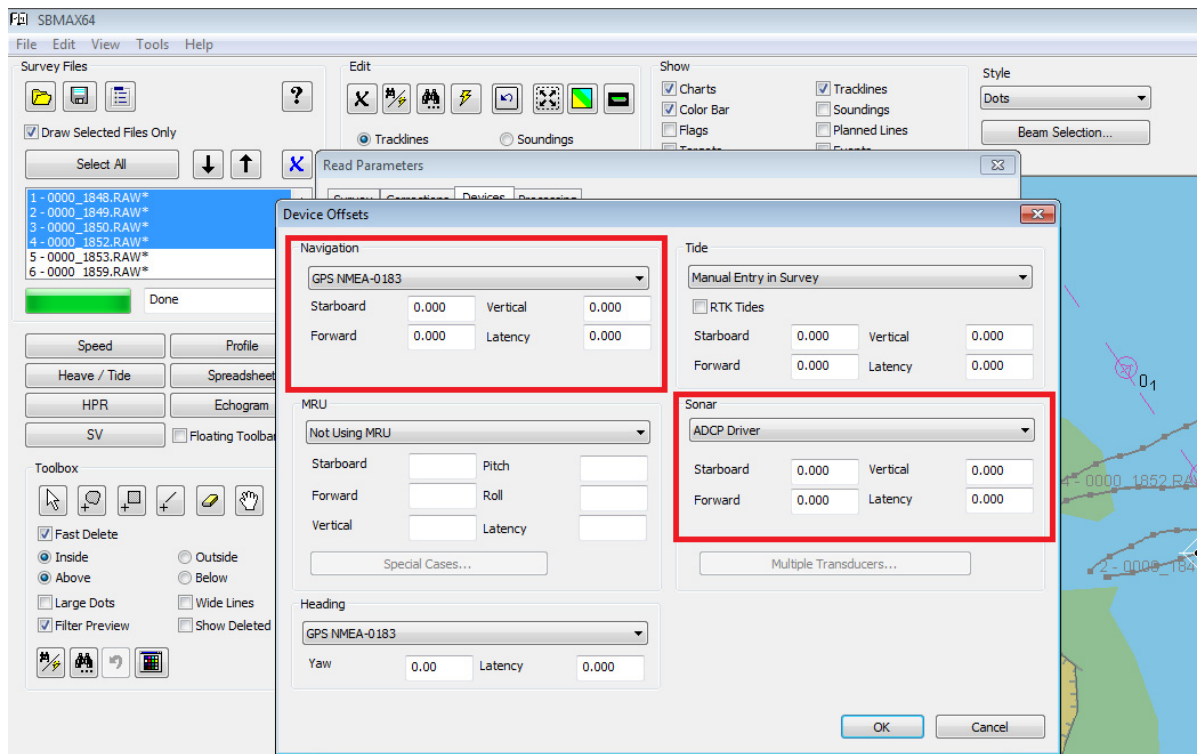
FIGURE 1. Raw ADCP Survey Data



Name	Date modified	Type	Size
0000_1848.adp	9/12/2017 10:15 AM	Microsoft Access ...	142 KB
0000_1849.adp	9/12/2017 10:15 AM	Microsoft Access ...	97 KB
0000_1850.adp	9/12/2017 10:15 AM	Microsoft Access ...	111 KB
0000_1852.adp	9/12/2017 10:15 AM	Microsoft Access ...	93 KB
0000_1853.adp	9/12/2017 10:15 AM	Microsoft Access ...	354 KB
0000_1859.adp	9/12/2017 10:16 AM	Microsoft Access ...	282 KB
0000_1902.adp	9/12/2017 10:16 AM	Microsoft Access ...	336 KB
0000_1848.RAW	9/12/2017 10:15 AM	RAW File	290 KB
0000_1849.RAW	9/12/2017 10:15 AM	RAW File	201 KB
0000_1850.RAW	9/12/2017 10:15 AM	RAW File	223 KB
0000_1852.RAW	9/12/2017 10:15 AM	RAW File	191 KB
0000_1853.RAW	9/12/2017 10:16 AM	RAW File	722 KB
0000_1859.RAW	9/12/2017 10:16 AM	RAW File	567 KB
0000_1902.RAW	9/12/2017 10:16 AM	RAW File	627 KB
RAW08212017.LOG	9/12/2017 10:15 AM	Text Document	1 KB

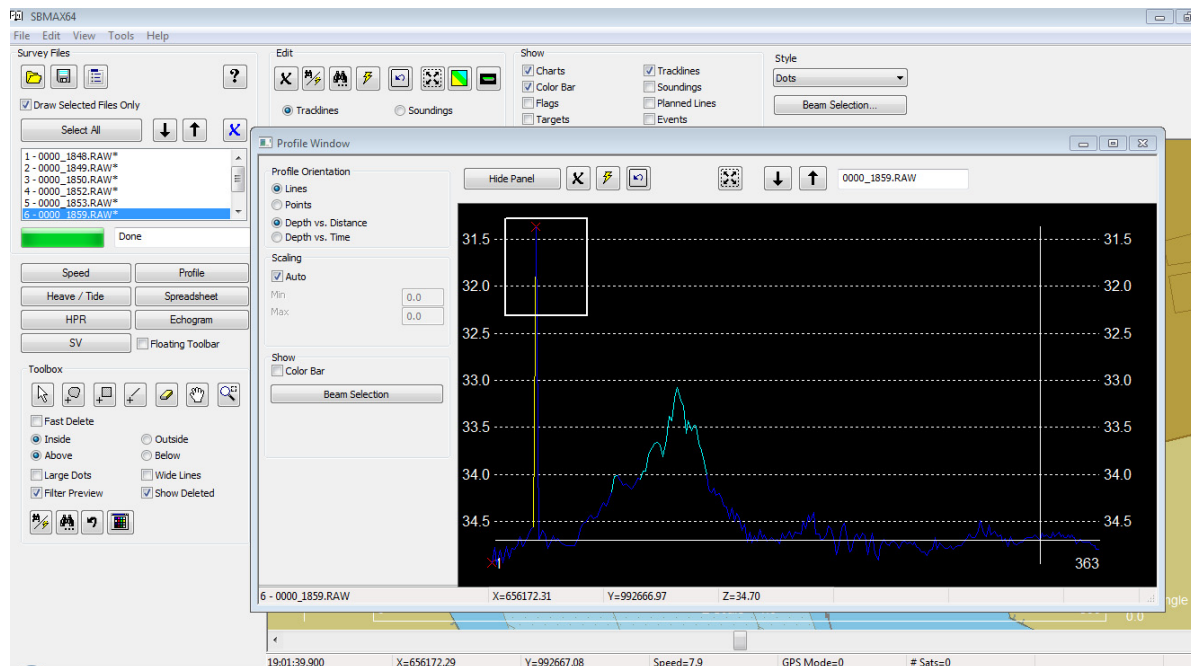
1. Once the data is collected, the first step is to simply **step the *.RAW files through the SINGLE BEAM EDITOR**. SBMax64 (64-bit SINGLE BEAM EDITOR) was used in this example.
 - a. In the Read Parameters, when defining the positioning and sonar devices, it is best to **choose the GPS for navigation and the ADCP driver for the sonar**. The GPS is preferred as most systems are now RTK capable and they can resolve a better position than the position from the ADCP.

FIGURE 2. Specifying Devices and Offsets in the 64-bit SINGLE BEAM EDITOR



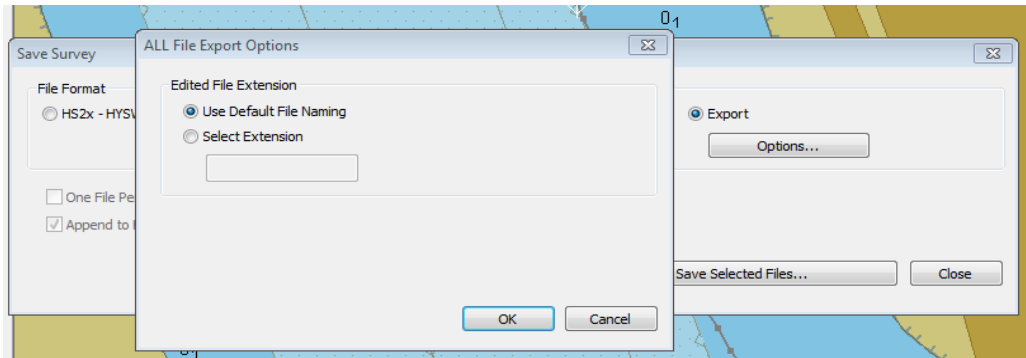
- b. In the editor, you will make edits like you normally would with single beam data. Step through each transect, **remove any spikes**, and **QC the position and tide data**.

FIGURE 3. Cleaning the Raw Data



- c. **Save the data.** In SBMAX64, the default save format is HS2x format. The ADCP profile program needs the older, All format for now. Select FILE-SAVE SURVEY and select the Export option in the Save Survey dialog. ([Options] allows you to configure the saved file extension.) This will save to the ALL file format.

FIGURE 4. *Configuring the Saved File Extension*

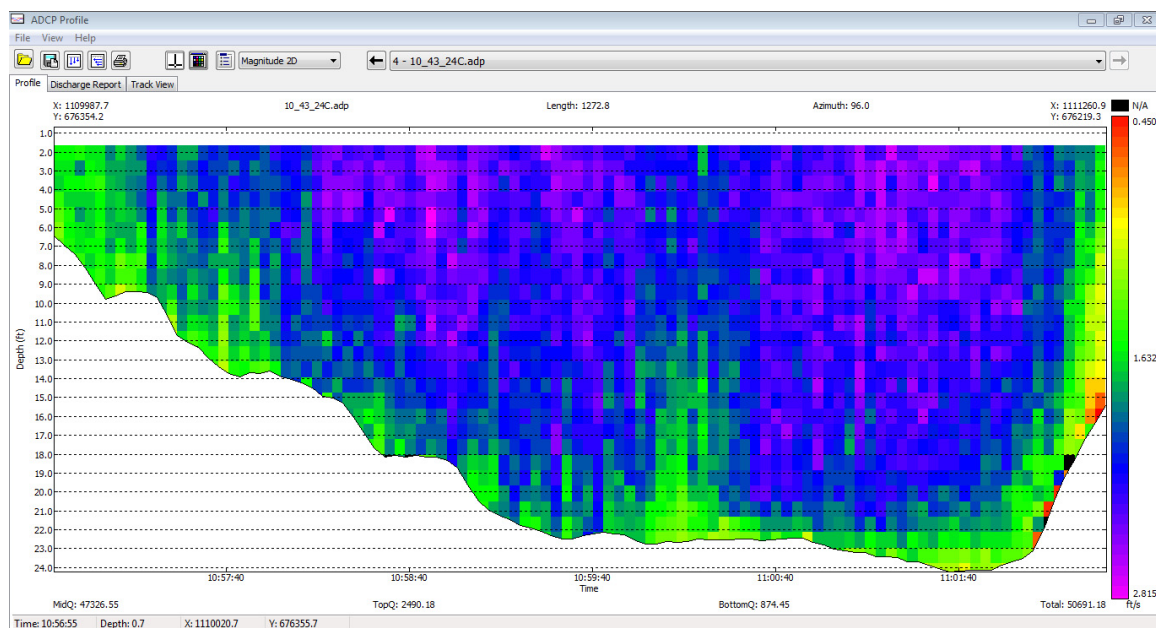


2. **Open the ADCP PROFILE program.** You can find this program under UTILITIES-ADCP-ADCP PROFILE.

The profile program is capable of displaying the velocity data in a few different formats. A few of them are more helpful than others. The Magnitude 3D and 2D, along with Direction are most commonly used. Others have been deprecated or are for the use of specific customers only. There is no editing data in the ADCP profile program.

In this program you simply view, export and produce a discharge report.

FIGURE 5. *ADCP Profile Data*



There are many settings in the ADCP PROFILE program. I will not talk about them all and most of them can be left in the default position. The ones that have the most importance I will outline.

FIGURE 6. View Options - Profile View

ADCP Bottom Track: You can bottom track from either a single beam system or the ADCP. In our opinion, the ADCP system does a better job bottom tracking and should be the choice.

Use Veritime: This uses the timing component from HYPACK® SURVEY. This can be from PPS or the \$ZDA message produced by your GPS system

Use Edited File for Pitch and Roll: Motion data can come from your MRU, if installed. The beam and lobe data from the ADCP can be corrected by an MRU. If you have an MRU you will want to use it

FIGURE 7. View Options - DXF Output Tab

Arrow Length: Length in geodesy units for the vector arrow.

Interval: Geodetic distance along planned line to plot vector arrow.

Vector Type: Flood, Ebb and Restricted Current have different display types. The base of the arrow feathers to the port, starboard, or both respectively.

FIGURE 8. View Options-Velocity Tab
(top), Depth Profile (bottom)

In the Velocity tab, there are provisions for Start and End Edges of the profile. When the water depth becomes too shallow for the vessel to traverse, you can project the velocity up to the top of the bank. The shore pings define how many pings to insert.

The **Start and End Edge** options define the shape and the **Coefficient**. This is the shape of the slope.

- A **triangle** works best for gently sloping areas to shore.
- A rectangle is best for more vertical changes to the shore.
- The **Start Width** and **End Width** set the distance to extend out from the start and end of the surveyed line.
- The **Reference** section is used differently depending on environmental factors. Typically ADCP bottom track is best with no Bottom Track offset. If you have a moving bottom, such as moving sand or fine silt that continuously moves, then you should have these parameters to enter in the “Bottom Track Offset” section. (Ask Joe Burnett here at HYPACK how he does it with a multibeam system.)

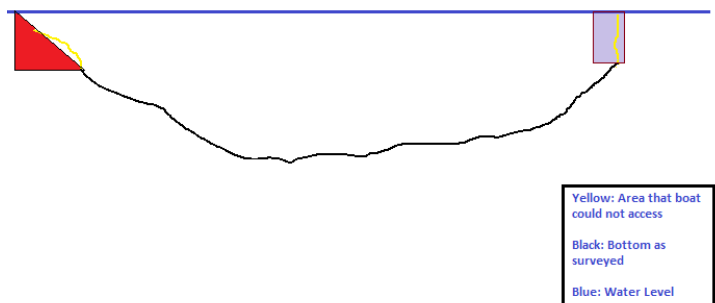
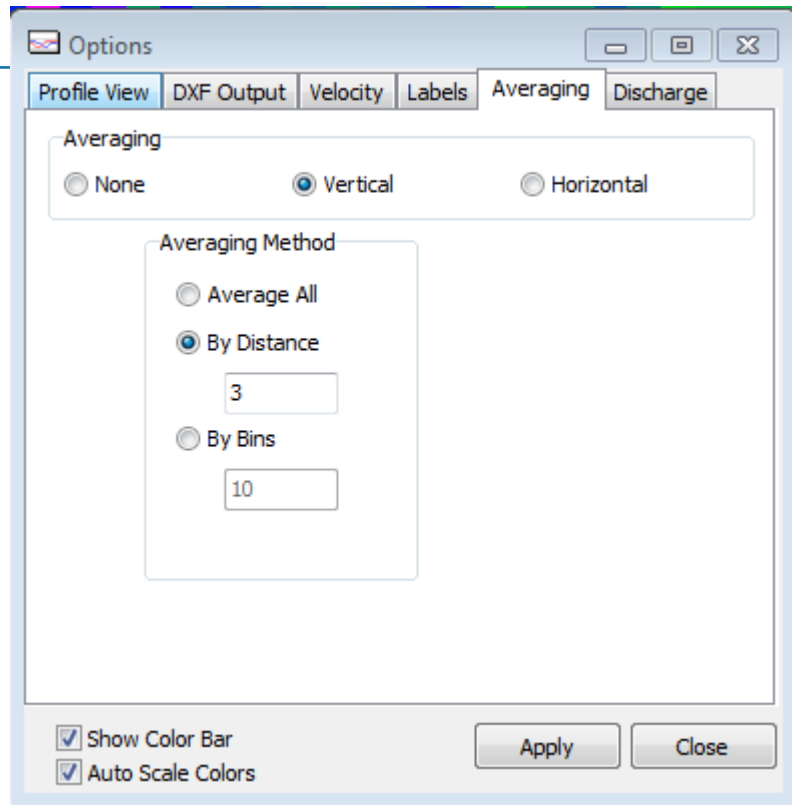


FIGURE 9. View Options - Averaging Tab

The Averaging tab under View Options can help “Smooth” or average data in the profile for a different effect. Although it can really have drastic effects on your data, it is not recommended. It is really in the program to fix “Bad” data, if not collected properly in the field.



3. **Save out Vector Data.**
 - 2D and 3D DXF current vectors

FIGURE 10. 3D DXF export saves out vector lines with radius circle

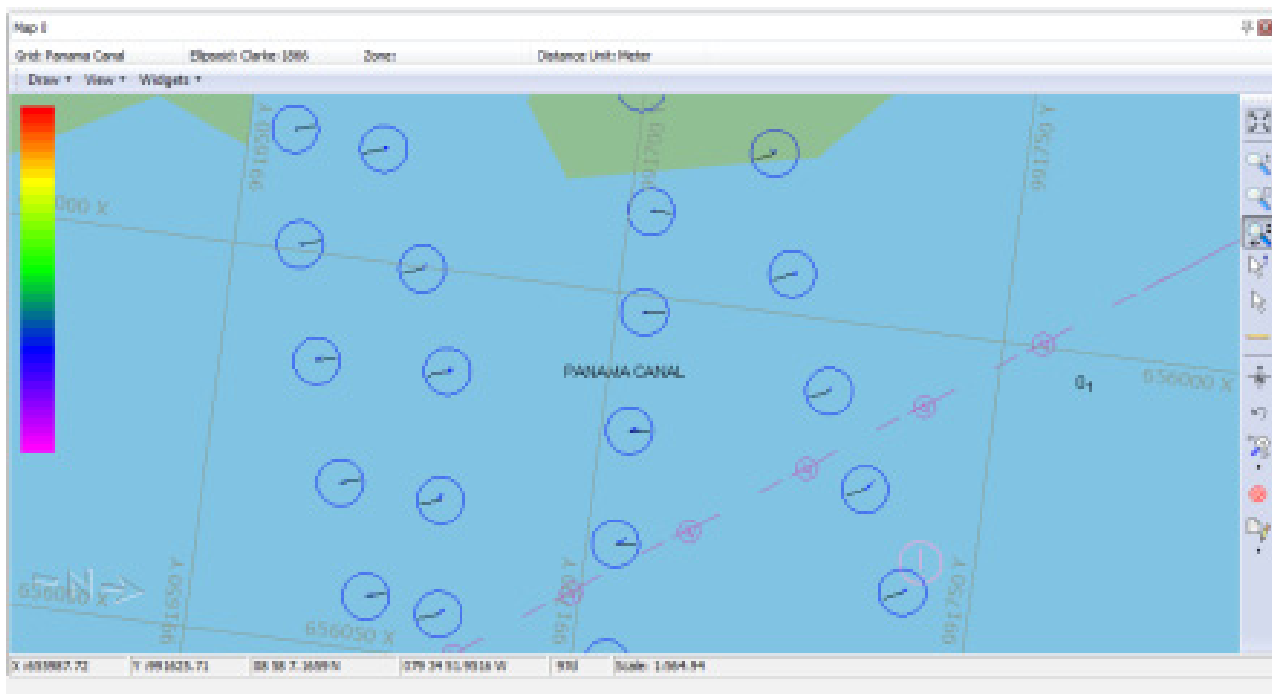
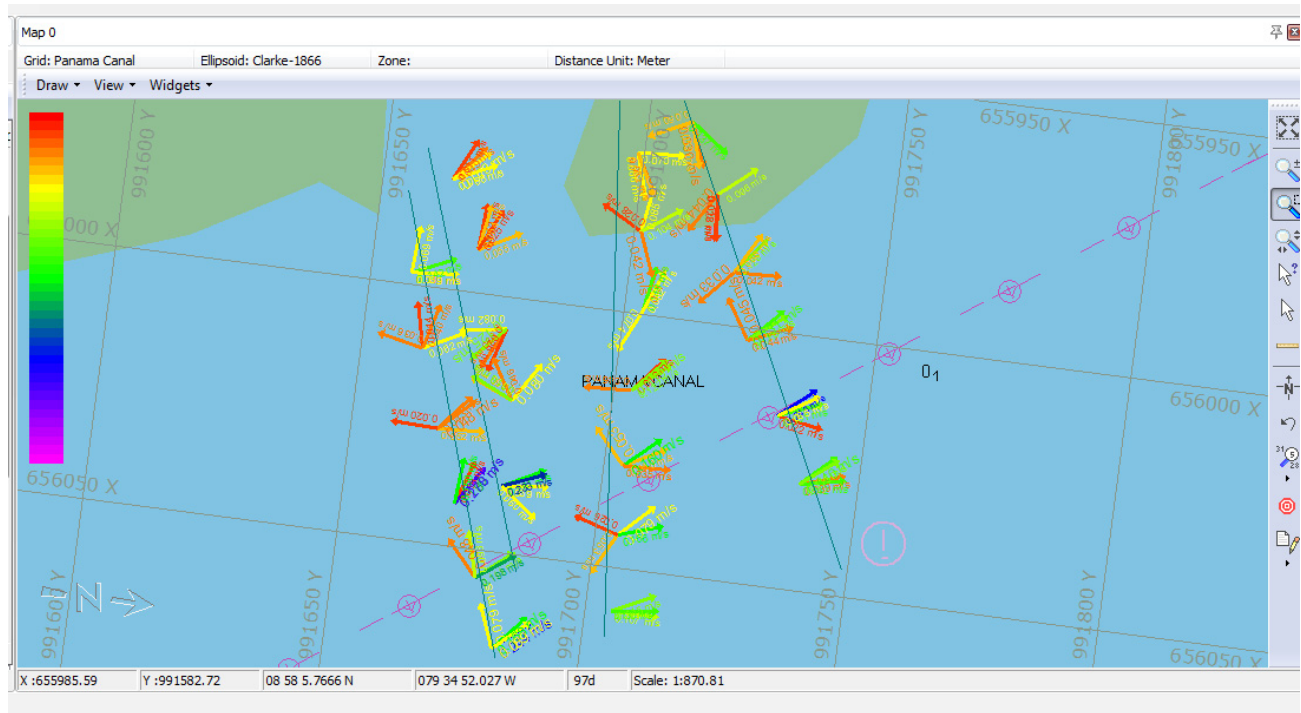
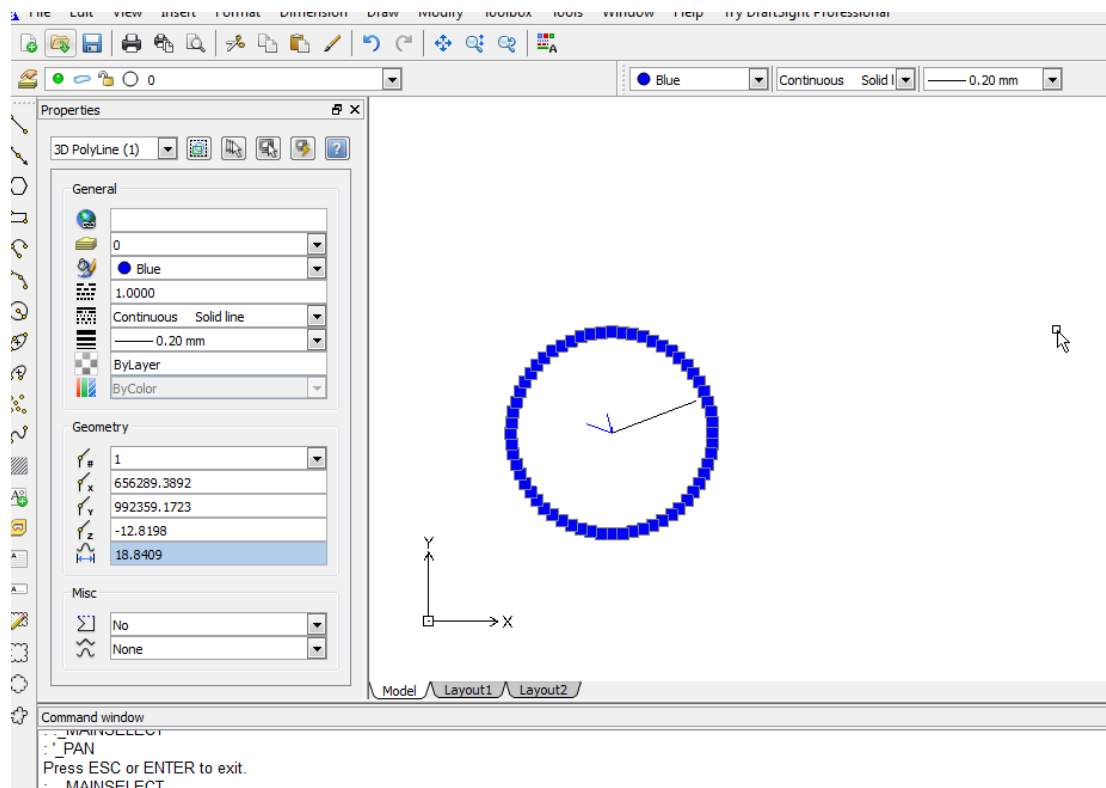


FIGURE 11. 2D DXF Current Vector Export saves vector arrows with discharge velocity



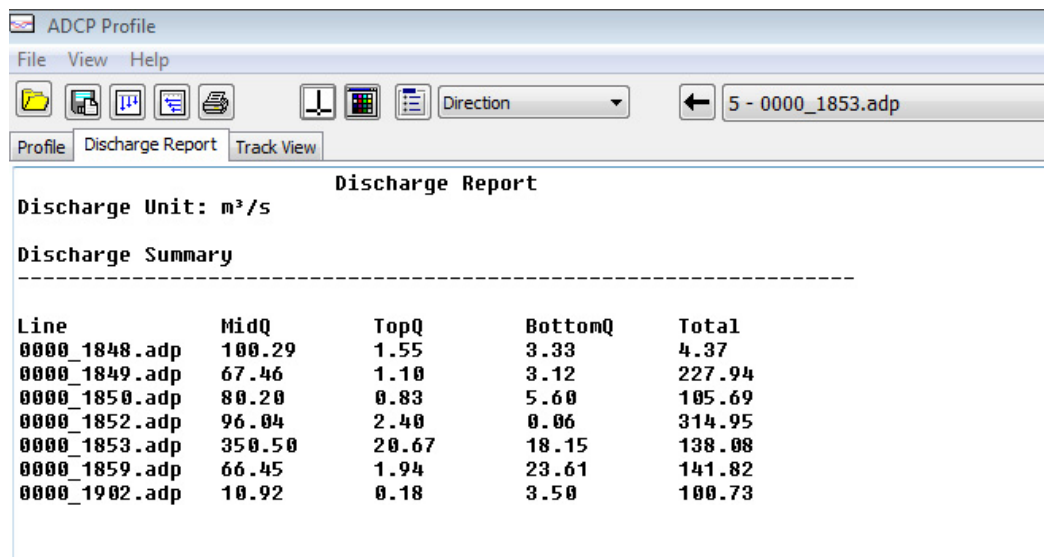
- **3D Vector** contains radial polyline with bottom track elevation.

FIGURE 12. 3d Vector



- **The Discharge Report** shows the discharge flow for each planned line. Each vertical component of the channel is broken out into three parts. The top, middle and bottom of the channel are reported. This report is expressed in the units chosen in the ADCP profile options

FIGURE 13. Sample Discharge Report



ADCP collection and processing considerations:

- Setup ADCP driver in HYPACK SURVEY properly. It has an effect on processing.
- Run planned lines perpendicular to the known flow of the water.
- Always use ADCP bottom track in processing unless it computes it poorly (which is rarely the case.)
- View data in ADCP PROFILE in 2D and 3D Magnitude or Direction. The other views will be less helpful.
- For technical information about ADCP, the USGS guide is the authoritative source of information (<https://pubs.usgs.gov/tm/3a22/>)