HYPACK
a xylem brand

Sounding Better!

# SBG Delayed Heave in HYSWEEP®

By Mike Kalmbach

## INTRODUCTION

This article shows how survey data is improved with delayed heave. Here we look at data from the SBG inertial system, which is new for HYPACK® 2018. Other systems (Applanix, Coda-Octopus, Novatel, etc.) provide delayed heave as well.

In case you are new to this, delayed heave is a post-processing method which uses acceleration data before and after heave points for better accuracy.

## SURVEYING

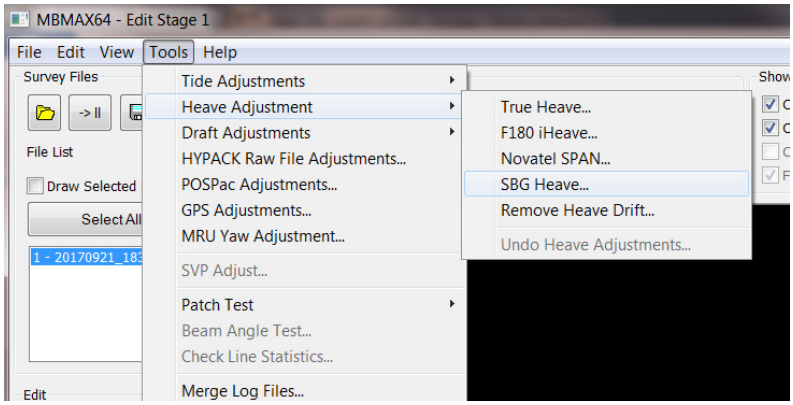
Delayed heave is logged by the SBG control program. In post-processing, the SBG files are loaded into 64-bit HYSWEEP® EDITOR (MBMAX64) for final corrections. The delayed data can be troublesome so it's best to run some test surveys to see it work end-to-end (logging through post-processing).

**NOTE:** Skip ahead to Figure 6 to see a potential problem.

## MBMAX64 PROCESSING

After loading your survey, use the Tools menu to access delayed heave files (Figure 1). This can be done at any time during editing and applied to raw (HSX) or edited (HS2, HS2x) files.

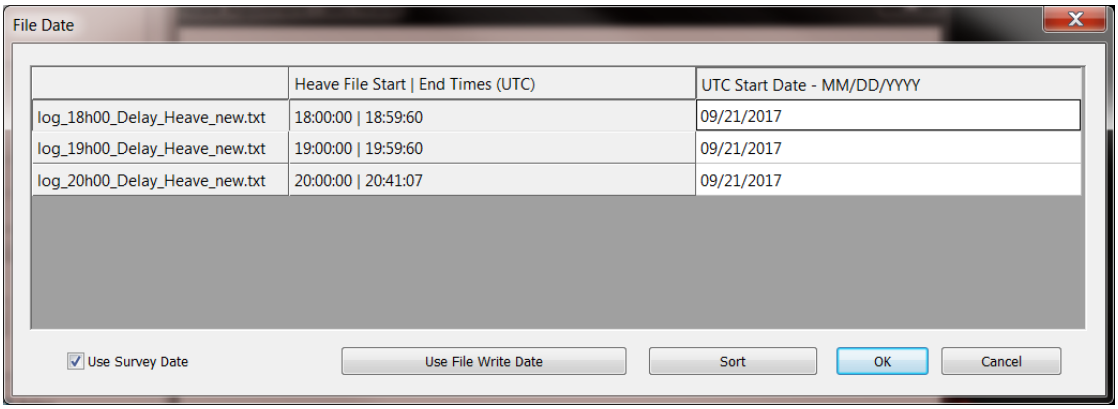
***FIGURE 1.*** *Use MBMAX64 Tools menu (Heave Adjustments, SBG Heave) to start the process.*



Open one or more files and a dialog like in Figure 2 pops up. It contains the selected files with time and date information (UTC). SBG delayed heave is stored in TXT files, a sample is shown at the end (Figure 7).

While UTC time is fixed, you can edit the date if necessary.

***FIGURE 2.*** *The selected delayed heave files with time and date information.*

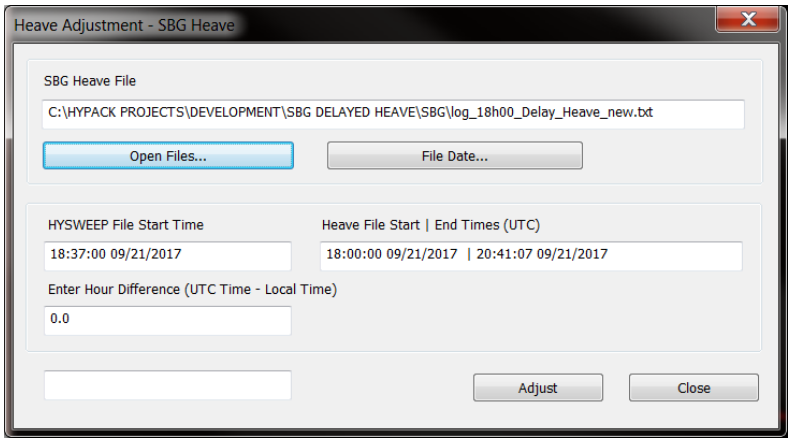



Click [OK] and the Heave Adjustment dialog (Figure 3) is available. Again there is date and time information to help you align the survey (local time) with delayed heave (UTC time).

"Enter Hour Difference (UTC Time – Local Time)" is important. For example, if your survey is in the US Eastern Time Zone enter +5.

Click [Adjust] to apply SBG delayed heave.

***FIGURE 3.*** *More dates and times! Make sure the time difference (UTC – Local) is correct.*



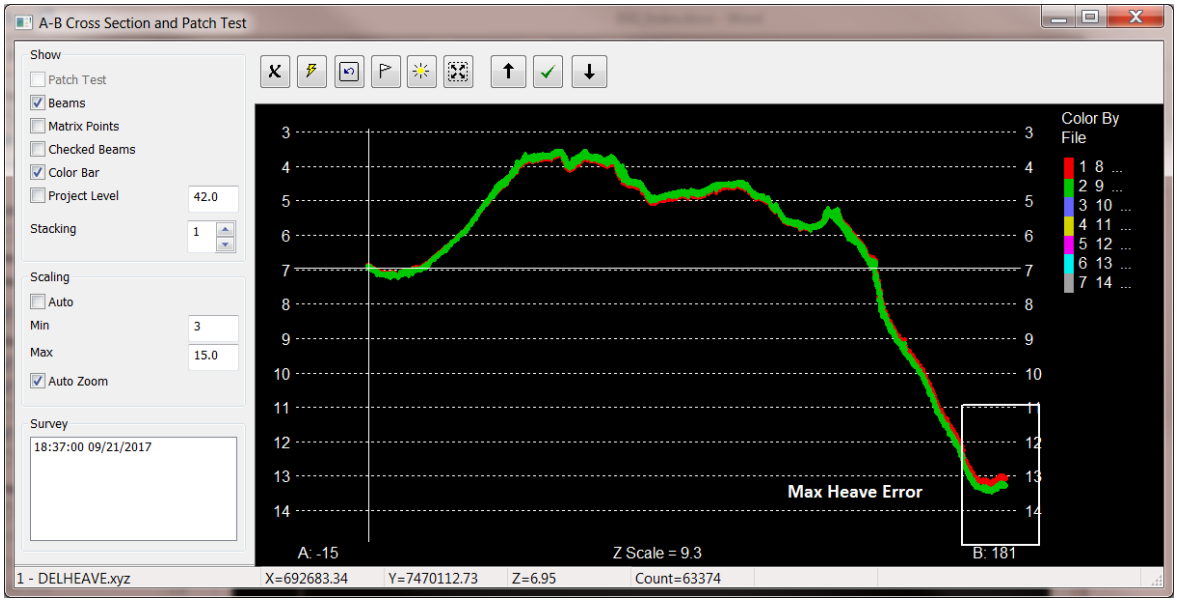

The timing stuff is tedious but, once that's right, the results are worth the effort.

Figure 4 is the heave time history for a survey line. Red is real-time heave and blue is delayed heave. We see about 10 cm error in the real-time heave. This is a common occurrence; there's not enough run up before starting a line and heave is not quite settled.

***FIGURE 4.*** *Red = real time heave, Blue = delayed heave. 10 cm error in real time heave is fixed with delayed heave.*


Figure 5 shows an along track depth profile, with and without delayed heave. There's the 10 cm error at start of line.

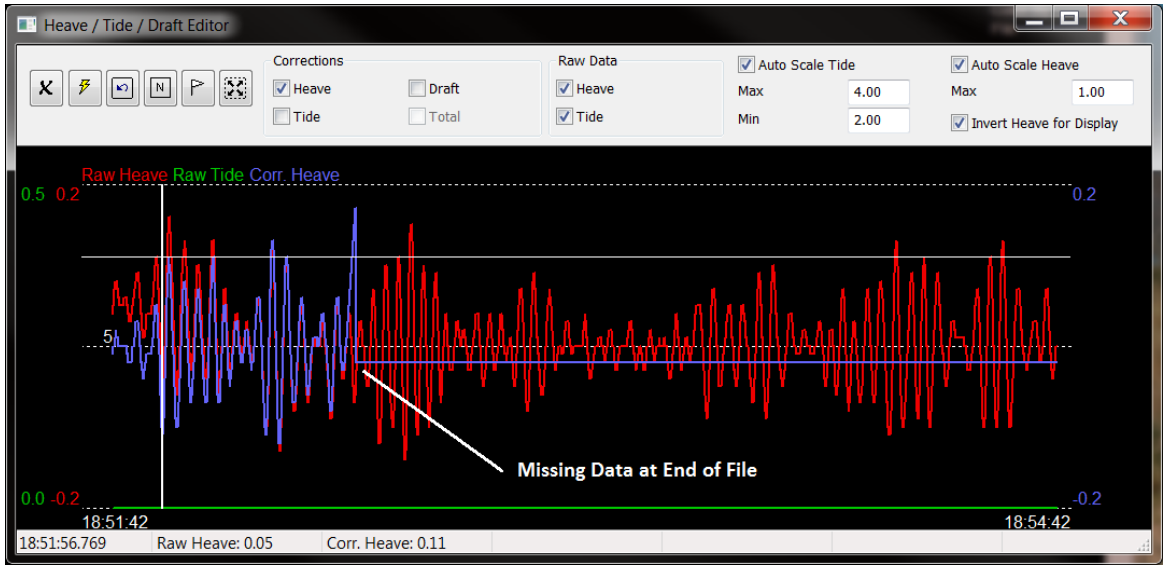
***FIGURE 5.*** *Heave error in the depth profile.*




## REMEMBER THE DELAY

Figure 6 shows a bad thing that happens when SBG logging is cut off too early. There are no heave corrections through the flat line.

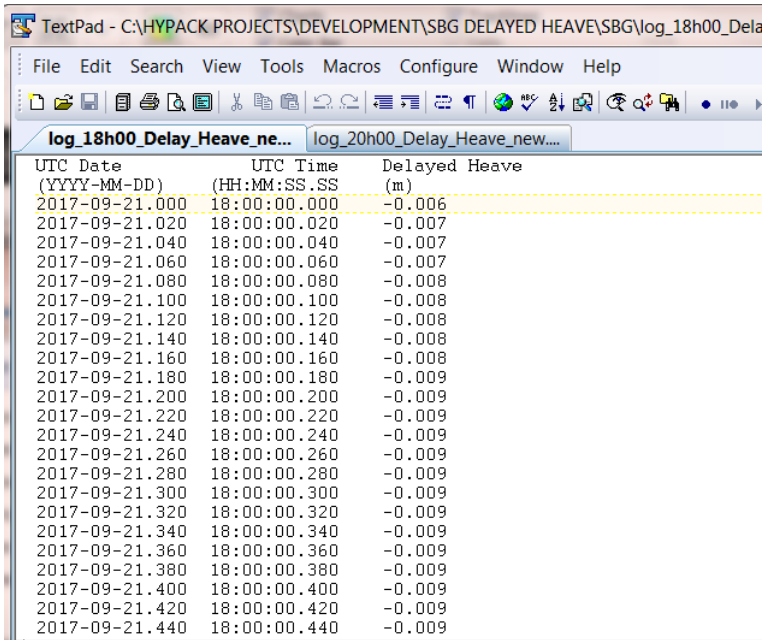
*FIGURE 6. Figure 6: Delayed heave is cut off at end of file. Make sure this doesn't happen.*




## SBG File Format

It's a TXT file you can easily check out. Early SBG firmware added milliseconds to UTC date and that has since been fixed (SBG Center 2.4.100-stable). MBMAX64 ignores the misplaced milliseconds.

*FIGURE 7. Figure 7: Sample SBG file.*




| UTC Date (YYYY-MM-DD) | UTC Time (HH:MM:SS.SS) | Delayed Heave (m) |
|---|---|---|
| 2017-09-21.000 | 18:00:00.000 | -0.006 |
| 2017-09-21.020 | 18:00:00.020 | -0.007 |
| 2017-09-21.040 | 18:00:00.040 | -0.007 |
| 2017-09-21.060 | 18:00:00.060 | -0.007 |
| 2017-09-21.080 | 18:00:00.080 | -0.008 |
| 2017-09-21.100 | 18:00:00.100 | -0.008 |
| 2017-09-21.120 | 18:00:00.120 | -0.008 |
| 2017-09-21.140 | 18:00:00.140 | -0.008 |
| 2017-09-21.160 | 18:00:00.160 | -0.008 |
| 2017-09-21.180 | 18:00:00.180 | -0.009 |
| 2017-09-21.200 | 18:00:00.200 | -0.009 |
| 2017-09-21.220 | 18:00:00.220 | -0.009 |
| 2017-09-21.240 | 18:00:00.240 | -0.009 |
| 2017-09-21.260 | 18:00:00.260 | -0.009 |
| 2017-09-21.280 | 18:00:00.280 | -0.009 |
| 2017-09-21.300 | 18:00:00.300 | -0.009 |
| 2017-09-21.320 | 18:00:00.320 | -0.009 |
| 2017-09-21.340 | 18:00:00.340 | -0.009 |
| 2017-09-21.360 | 18:00:00.360 | -0.009 |
| 2017-09-21.380 | 18:00:00.380 | -0.009 |
| 2017-09-21.400 | 18:00:00.400 | -0.009 |
| 2017-09-21.420 | 18:00:00.420 | -0.009 |
| 2017-09-21.440 | 18:00:00.440 | -0.009 |