

The Value of a Digital Water Column Echogram - Vegetation

How the CEESCOPE™ and CEE ECHO™ echogram output provides critical quality control and post processing capability to avoid reporting inaccurate survey results in areas of moderate or heavy bottom vegetation.

Surveyors conducting GNSS surveys using a rod and (RTK) rover do not have any problems making sure their measurement is being taken at exactly the right place – it is the point on the ground that they can see the range pole touching. When conducting hydrographic surveys using an echo sounder and GNSS, the surveyor has no such ability to see that the sonar beam is in exactly the right place – i.e. just touching the bottom. If the echo sounder is outputting a depth value, which is subtracted from the GNSS antenna elevation to give the bottom elevation, the surveyor to some extent relies on faith that the echo sounder output and therefore final bottom elevation is correct.

While calibration exercises such as a bar check provide confidence that the sonar will properly report depth, these checks are conducted in perfect conditions – with a flat metal plate! It cannot be simply assumed that **any** echo sounder will **always** report the correct depth in the real world, especially when there is soft mud or silt, or when sub-aquatic or floating vegetation is present.

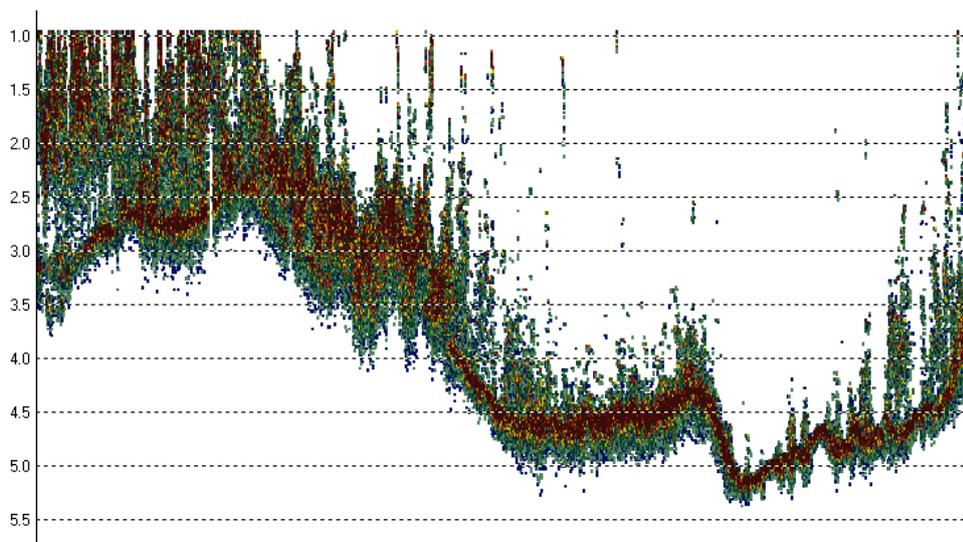


Figure 1. CEESCOPE™ digital echogram showing heavy vegetation

It cannot be assumed that a basic shallow water 200 kHz echo sounder will always know where the “real” bottom is. If vegetation is thick, or there is a heavy suspended sediment load, the sonar may report a value shoaler than the true depth. And when using an echo sounder that merely reports a digital value for depth on each sonar ping, there is no way that results can be checked for accuracy in post processing. This is exacerbated by ping rate (number of depth results per second); inexpensive echo sounders with low ping rates (1-5Hz) have sparse data densities, leading to the position where it may be completely impossible to identify where the “real” bottom lies and the survey results become useless.

Using the CEESCOPE™ or CEE ECHO™ with a 20Hz maximum ping rate eliminates the uncertainty in depth measurements. Gathering such a dense point cloud maximizes the amount of data thinning that can be applied and still retain good results. Also, the simultaneous recording of a full water column digital echogram presents a critical QC advantage. The CEESCOPE and CEE ECHO transmit a sonar ping (or rather 20 pings, per second) and record the entire returned echo. Then, an algorithm reports the best estimate as to where the bottom is – twenty times per second, that is the “digital depth”. At the same time, the entire echo response is split up vertically into 3200 separate slices and the intensity of each slice is recorded and output to the acquisition software in the form of an echogram – in addition to the digital depth. The echogram is represented on the plot shown in Figure 1, a fairly extreme patch of weeds. When using hydrographic acquisition software, the surveyor can see the entire water column echogram in real time to make sure that the bottom is being properly identified. Even if simply recording the data on the CEESCOPE or CEE ECHO internal memory with no connected computer, the echogram is recorded internally allowing post processing to eliminate vegetation-affected data.

A common situation that can render basic echo sounders useless is when vegetation is present as shown in this example. Even if the CEESCOPE or CEE ECHO does not track the bottom perfectly in real time, the recorded echogram allows the surveyor to post process each survey line to make sure that the proper bottom elevation is reported, re-digitizing the soundings. It is quite likely that a basic echo sounder system offering digital depth only – especially with a low ping rate - would significantly underestimate the water depth and therefore overestimate the true bottom elevation in this case.

Even in ideal survey conditions, having a supporting echogram enables the surveyor to report results with a high degree of confidence, presenting a survey product with a greater level of security.