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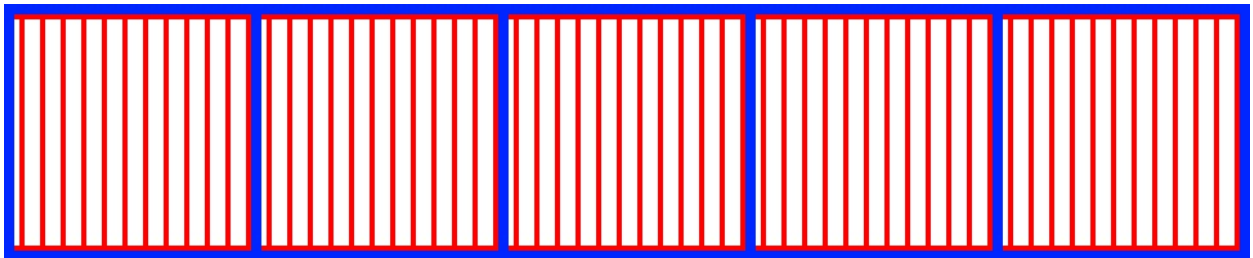
Sounding Better!

Sidescan Survey Waterfall Downsampling Methods Comparison

By Daniel Tobin

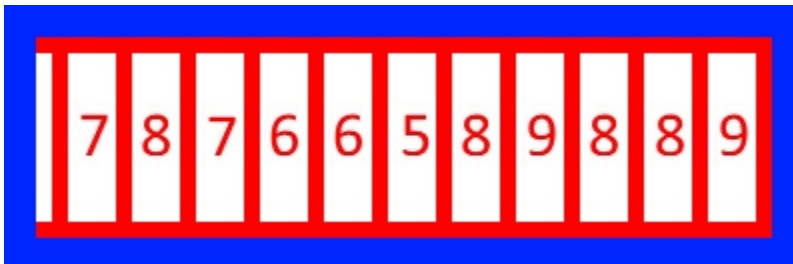
The definition of downsample is “to reduce the sampling rate of a signal.” In any scenario where you have a fewer number of pixels than samples to display a sidescan swath, some amount of downsampling is needed. In the case of displaying a sidescan waterfall, we downsample the number of samples in a swath to the number of pixels in the width of the waterfall display. A pixel is a very tiny point on your screen that can display a single color. Your screen uses millions of these to display images. You can see them if you use a magnifying glass to look at your screen.

Imagine this: if you have a sonar that can produce 1,000 samples per swath, but your waterfall display is only 100 pixels across, how do you display those 1,000 samples all at once? Each pixel is responsible for displaying 10 samples, but a single pixel can only ever display one value (or color). Here is a visual representation:



Let's say each blue box is a pixel on your screen (so there are 5 pixels in this example) and each of the red boxes are a single sample in a swath. Each pixel is filled with about 10 samples. A single pixel (blue box) can only be one color, but with 10 samples to represent, how do we choose a single color?

Pretend we have a budget sonar whose signal only range from 1-10. Let's zoom in on a single pixel:



In this one pixel, there are 11 samples: 7, 8, 7, 6, 6, 5, 8, 9, 8, 8, and 9. We need a way to set a value for the entire pixel – remember, a pixel can only represent a single value, not 11. Here is a list of potential waterfall downsampling solutions, all of which are available in 2019 Sidescan Survey and Targeting and Mosaicking (Hyscan):

- **Maximum:** Take the highest sample. This is what was used in previous versions of HYPACK Sidescan. Here, the entire pixel would be represented by sample strength 9. This will produce a brighter overall image.
- **Minimum:** Take the minimum sample, of course. Here, the pixel would use sample strength 5. The waterfall would be dimmer overall with this method.
- **First:** Use the first sample in the set. In this instance we would use value 7. This is potentially one of the more accurate downsampling methods but might not look the nicest.
- **Average:** The average of all the samples. The average here is 7.36. This will produce a smooth looking waterfall, and while it's potentially nicer looking, you might clip some peaks or valleys, and you're using a "fake" value – 7.36 doesn't exist anywhere in this pixel.
- **Median:** The median value in this dataset is 8. This option may be preferable because, while it won't produce as smooth an image as average, it will produce a very similar image. It also uses an actual value from the set (as opposed to the 7.36 in Average), and the value is more smartly selected than minimum, maximum, and first.

These downsampling methods will be available whether collecting data in SIDE SCAN SURVEY or previewing data in TARGETING AND MOSAICKING. Please note that your downsampling method does not affect your data or the final output mosaic in TARGETING AND MOSAICKING. This is for previewing only.

To select a downsampling method, select the Sidescan Controls button in either SIDE SCAN SURVEY or TARGETING AND MOSAICKING.

FIGURE 1. TARGETING AND MOSAICKING:

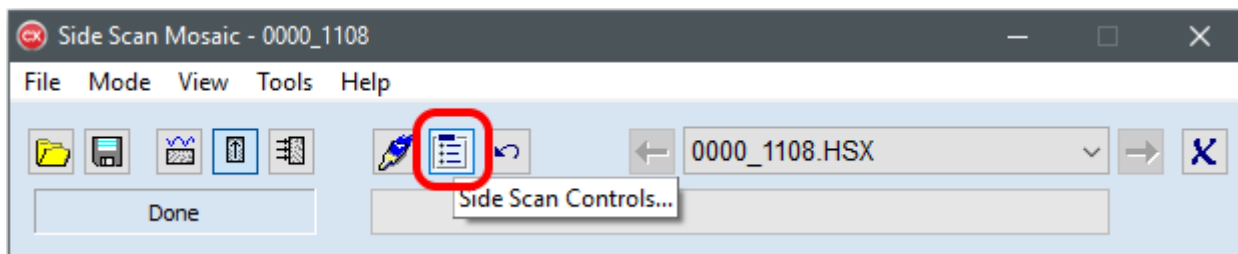
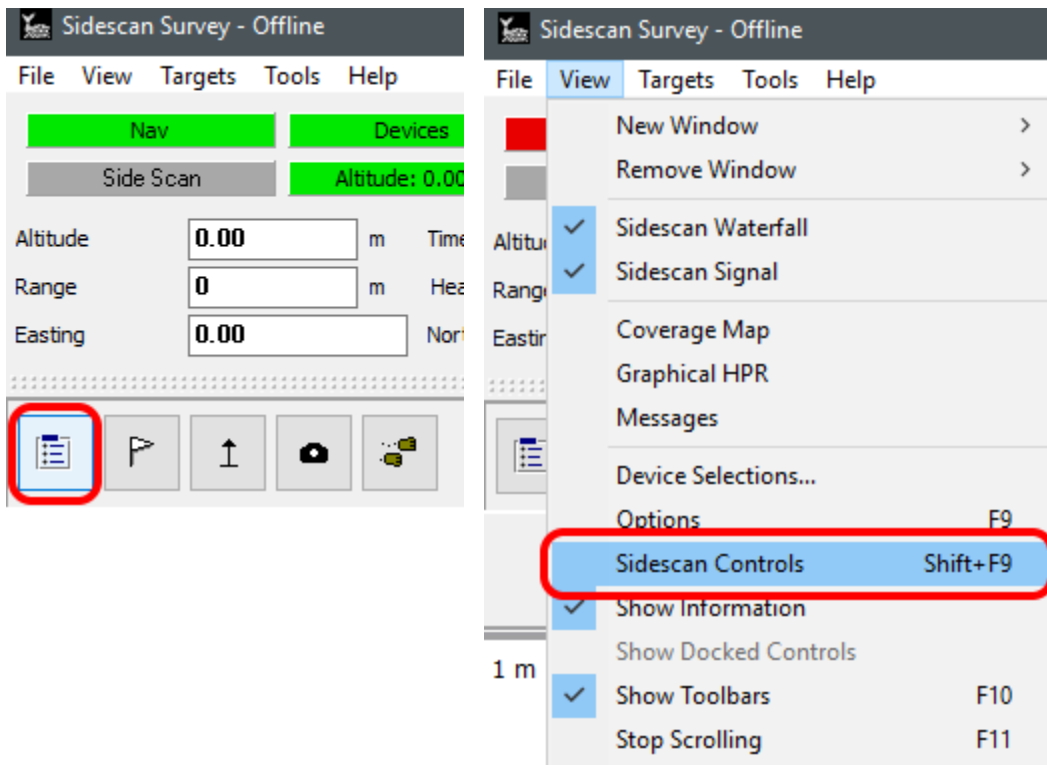
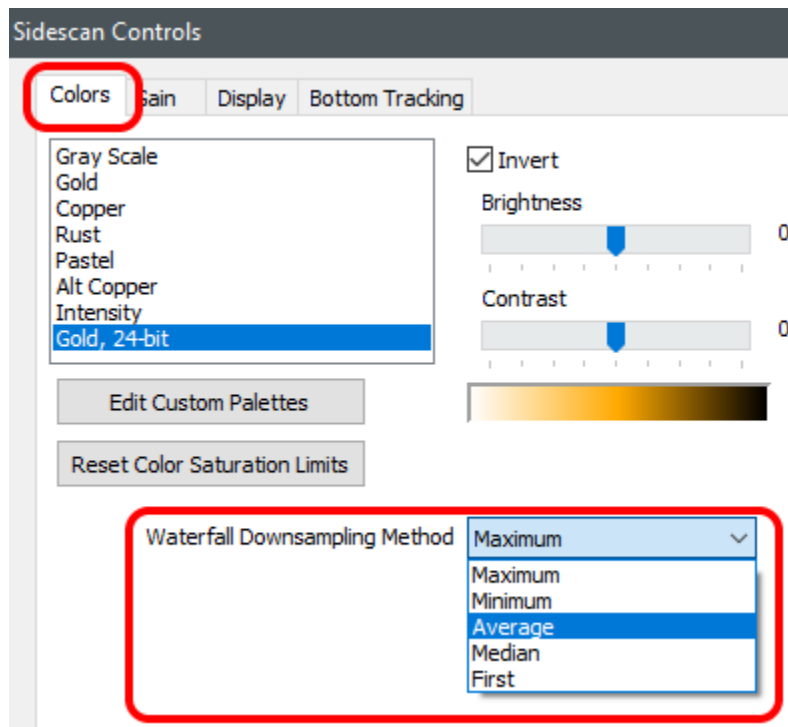


FIGURE 2. Sidescan Survey—Click the Icon (left) or Select VIEW-SIDESCAN CONTROLS:



Under the Colors tab there's a drop-down menu with all the downsampling methods:

FIGURE 3. Sidescan Controls—Colors Tab



Here is a set of images comparing the different downsampling methods.

FIGURE 4. *Maximum (left) and Minimum (right)*

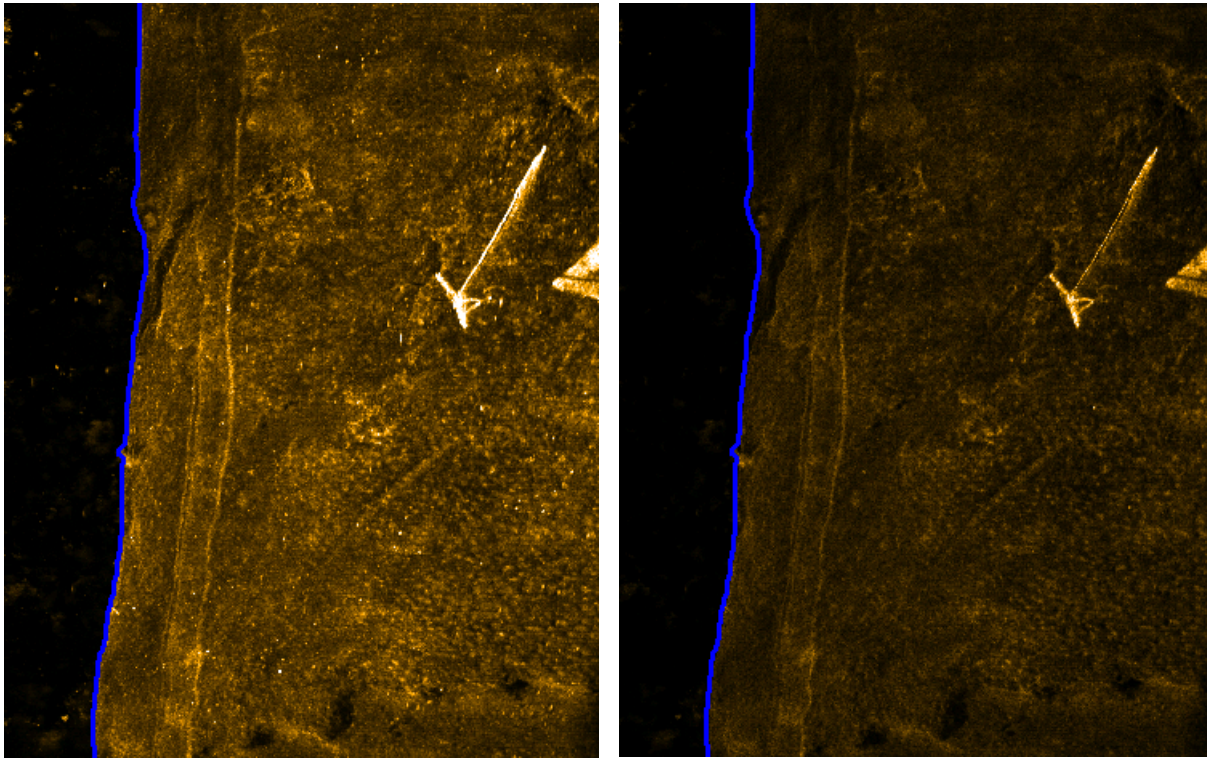


FIGURE 5. First (left), Average (right)

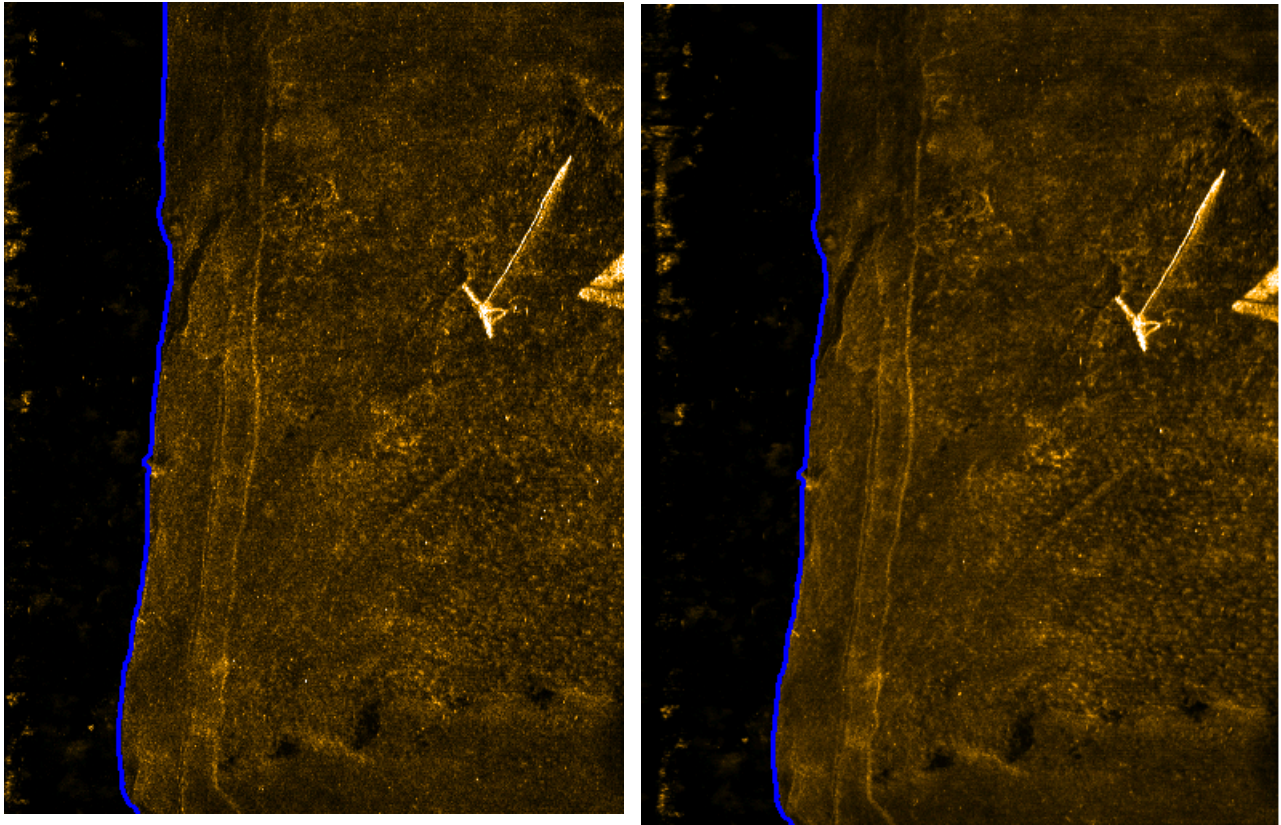


FIGURE 6. Median:

Through all these images, no adjustments were made other than the downsampling method. In this dataset, **Median** and **Average** produce very similar images. **First** closely resembles these two as well, although the image is slightly grainier. **Minimum** and **Maximum** produce darker and brighter images respectively. SIDE SCAN SURVEY and TARGETING AND MOSAICKING both default to the Average downsampling.

