

Processing of the SCICEX '98 Submarine Data

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1 CORRECTING DRAFT DATA

Ice drafts were collected with the DIPS3 system during the first half of the SCICEX '98 cruise from August 2 through August 16. The depth gauge worked adequately well for measuring the gross movements of submarine, but poorly for capturing small changes in draft. The problem was due to a sticky depth gauge valve (red trace in Figure 1). When the depth detector reported a constant value, the draft measurements were contaminated by the unavoidable porpoising movement of the submarine (Figure 2).

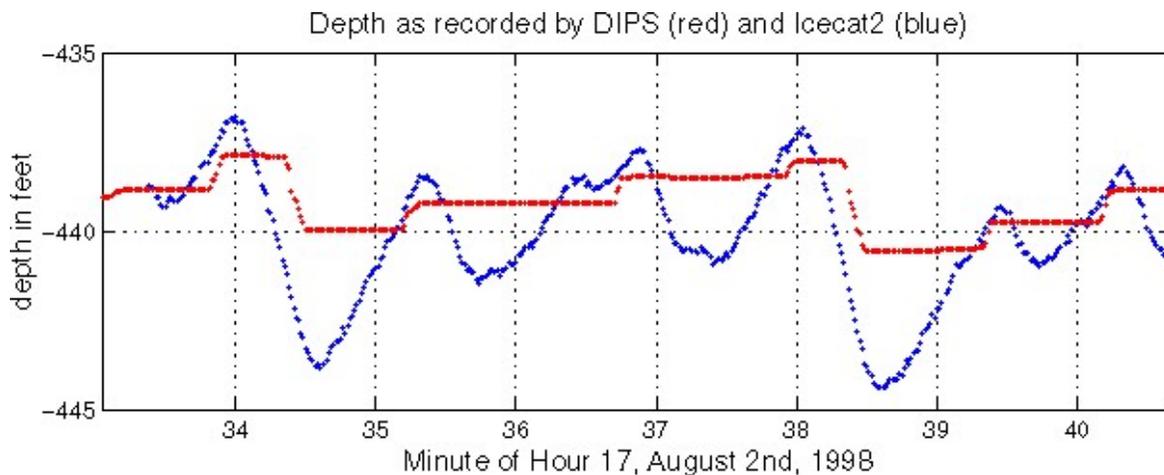


Figure 1. Sample of depth data from the submarine depth detector (red) and the Icecat2 pressure data converted to depth (blue), while the DIPS3 system was recording data. The depth detector is sticking, not responding to small changes in depth. The Icecat2 data were shifted down by 45 feet and to the right by 20 seconds.

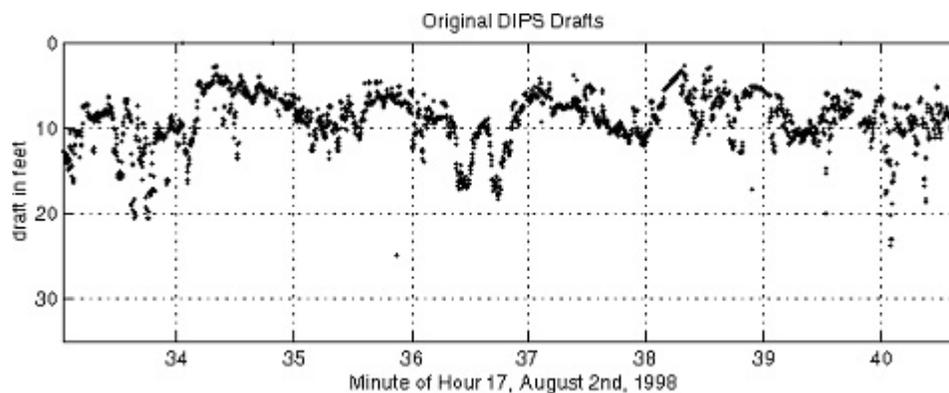


Figure 2. Ice drafts recorded by DIPS3 for the same period as shown in Figure 1.

To correct the corrupted ice draft data, the depths were replaced with pressure measurements from the Icecat2 system, which was mounted on the sail of the submarine. The pressure data converted to depth are shown in blue in Figure 1. The Icecat2 and DIPS3 systems did not have synchronous clocks nor did they march at the same rate. The time offset between the two was determined by comparing the depth signatures during rapid descents, assuming that the sticky depth gauge was forced into the proper position by the associated rapid pressure increase. The best fit line of time offset over all rapid descents over the cruise was used to shift the time of the Icecat2 depths to the DIPS3 time vector. The DIPS3 depths were finally replaced with those from Icecat2 and the drafts were corrected with the following equation:

$$\text{Draft}_{\text{corrected}} = \text{Draft}_{\text{original}} - \text{Depth}_{\text{DIPS3}} + \text{Depth}_{\text{Icecat2}} + D$$

where D is the vertical distance between the two sensors. Figure 3 shows an example of original draft data (a) and corrected draft data (b) where much of the porpoising has been removed. More details can be found in Dickinson et al. (2002).

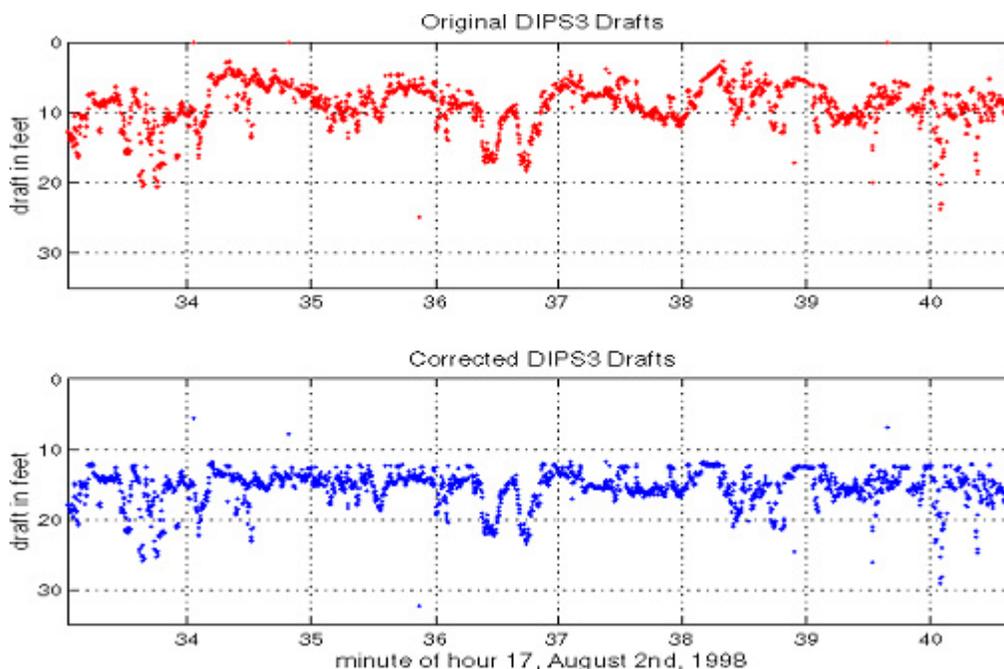


Figure 3. (top) Original DIPS3 drafts (same as in Figure 2) and (bottom) corrected drafts.

2 PROCESSING ICE DRAFT DATA

The corrected ice drafts were processed for their statistics with the same software package provided by Bronson Hills Associates [Bronson Hills Associates, 1994]. In processing the ice profiles, the drafts were first interpolated to 1-m spacing and then grouped into 10 to 50-km segments along straight tracks. The statistics were then computed for each segment.

Along the cruise, the submarine conducted many off-track measurements of XCTD and 3-D spiral water samples. During these operations, the ship made numerous turns (typically 2-3°/s), which could result in a longer sonar path length and thus thinner ice draft than its actual value. To minimize this uncertainty, records collected during XCDT and 3-D water samples were excluded from processing. These excluded data consist of no more than 16% of the total.

Two other types of records were also excluded from the 50-km segments and their statistics: (1) bad records due to false returns, and (2) short (less than a few kilometers), off-track segments between two consecutive long (~10-20 min) turns. The bad records were identified and flagged during the initial data screening at the Arctic Submarine Laboratory. Removing these bad records at the early stage of processing created some data gaps. Any gap shorter than 30 sec was later filled with 1-m interpolation. The interpolated records were removed if they disagreed with the surrounding draft measurements.

The SHEBA ice survey, centered at about 79.55° N and 160° W, was conducted along four crisscross legs on August 5 and 6. Each of these sample legs was broken into several 12 to 50 km segments and labeled as `.sheba` accordingly.

3 CONTACT INFORMATION

Note: This document was created in 2002, so this contact information may be out of date.

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5 REFERENCES

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