

An aerial photograph of a submarine on the ice surface of the Arctic Ocean. The submarine is dark and partially submerged, with its conning tower visible. Several people are standing on the ice near the submarine. The ice is cracked and textured, with a small dark object on the ice in the lower right. The background shows a vast, flat expanse of ice under a bright sky.

SCICEX XCTD update

- Timeline
- Results
- What's next?

SCICEX XCTD Timeline

- Dedicated Science Cruises 1995-1999
 - ~ 100 analog XCTDs per cruise
 - ~ 85-90% success rate
 - crucial data on changing Arctic Ocean conditions
- Science Accommodation Cruises
 - digital XCTDs
 - higher failure rate
 - noisy
- 2008
 - Sippican: known source of XCTD failures ('timeout circuit')
- 2009
 - SAC Science Plan in preparation
 - XCTD test at ICEX-09
 - Results:
 - T, S, Z quality acceptable
 - complete failure to reach design depth
 - 'success' rate fairly high
- 2010
 - Sippican identifies source of XCTD failures to achieve design depth
 - XCTD open water test by ASL
 - Results: inconclusive

ICEX-09 XCTD Test

Objectives:

- Demonstrate successful deployment of UISSXCTDs using launch procedure that accommodates the 'timeout circuit'
- validate the XCTD design specs for temperature, conductivity, depth

| | Z | T (°C) | C (mS/cm) |
|------------|---------------|--------|-----------|
| Range | 0 – 1000 m | | |
| Accuracy | 2% or 20 m | 0.02 | 0.03 |
| Resolution | 17 cm | 0.01 | 0.017 |

Results:

- 12 of 16 probes launched returned data (75%)
- none of the probes returned data from greater than 600 m
- data revealed none of the salinity spiking typical of the earlier analog data

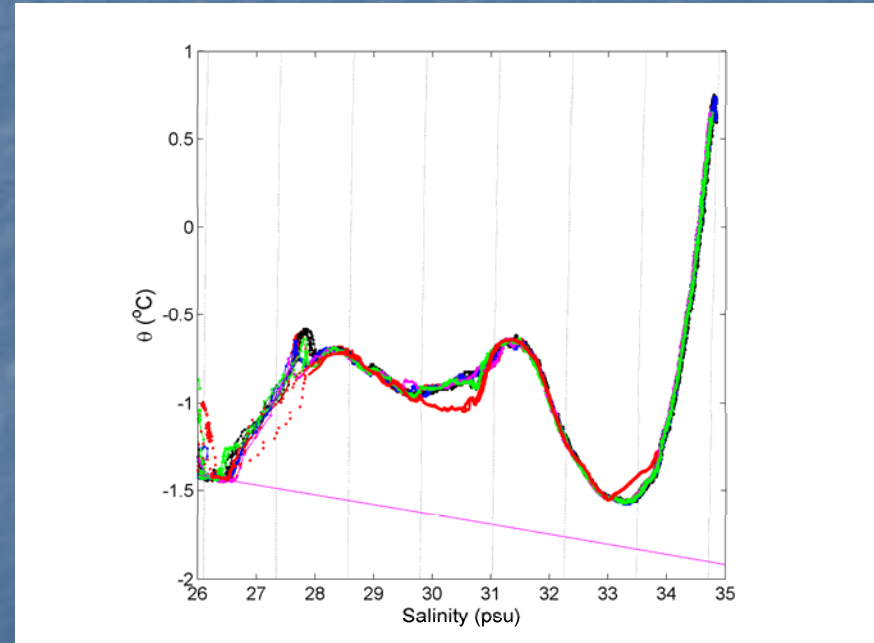
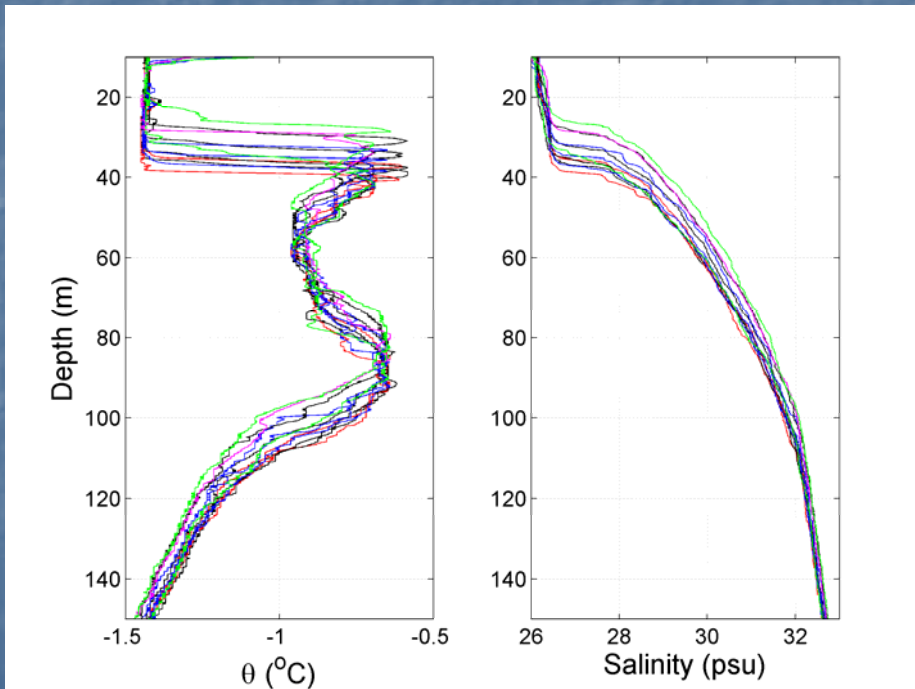
ICEX-09 XCTD test

Temperature and Salinity profiles

- XCTD downcasts

Temperature/Salinity relationships

- T,S accuracy
- precision (repeatability)



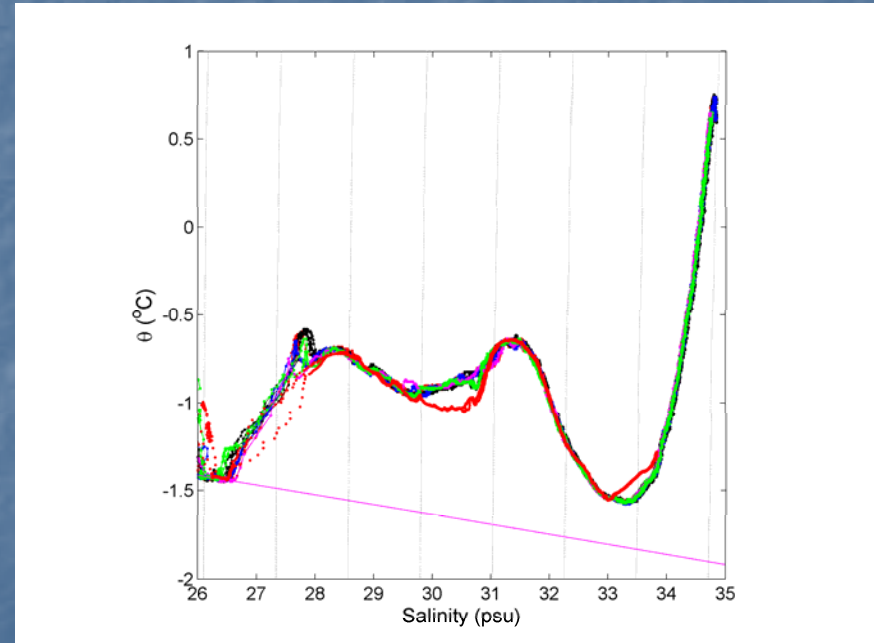
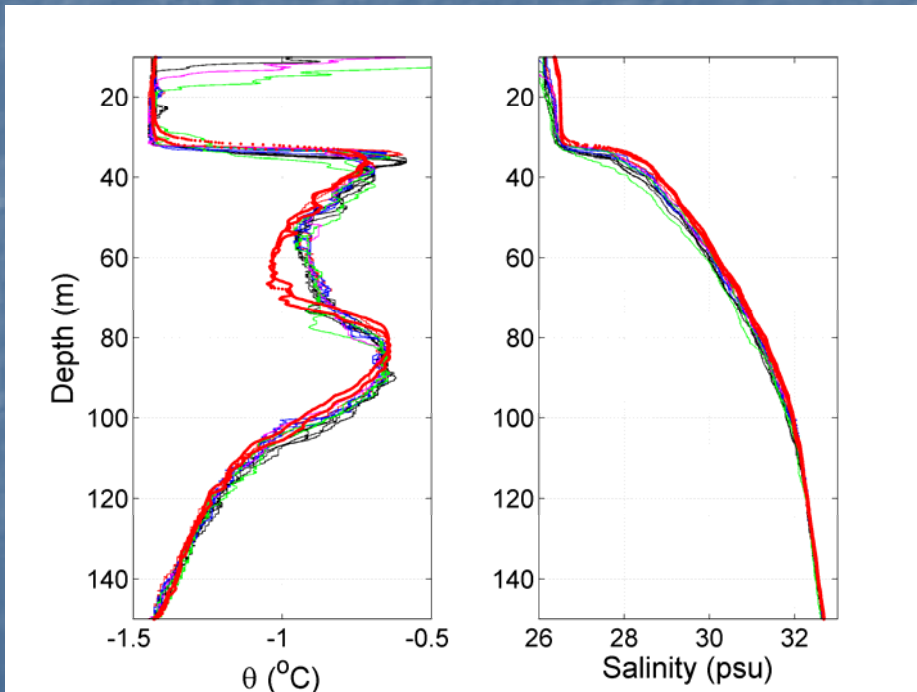
ICEX-09 XCTD test

Temperature and Salinity profiles

- XCTD downcasts (ML depths aligned)
- ICEX CTD (red)

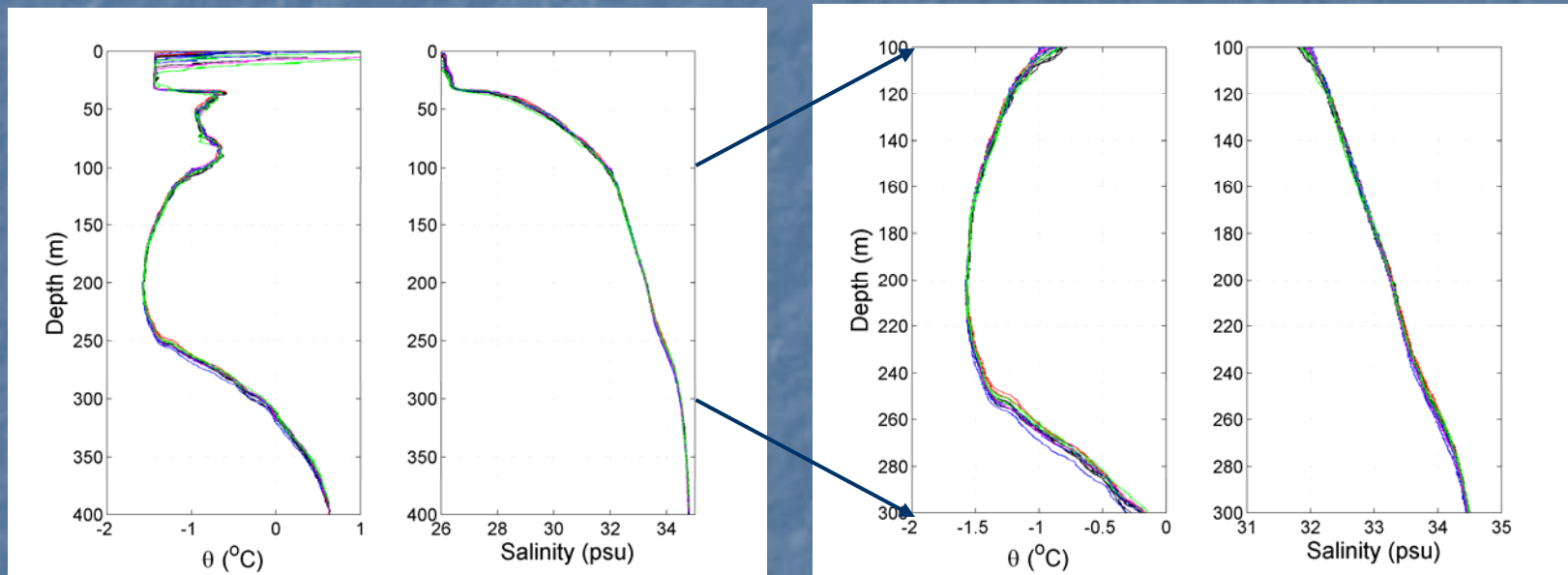
Temperature/Salinity relationships

- T,S accuracy
- precision (repeatability)



ICEX-09 XCTD probe performance

- XCTD downcasts (ML depths aligned)
- precision (repeatability)
- ensemble statistics of profile averages over 205m +/- 2.5m depth



| Statistic | Z | T | C | S | Z ml |
|-----------|-----|--------|--------|--------|-------|
| Average | 205 | -1.57 | 2.66 | 33.31 | 32.04 |
| RMS | | 0.0040 | 0.0011 | 0.0134 | 3.66 |
| Spread | 5 | 0.0143 | 0.0041 | 0.0494 | 12.71 |

ICEX-09 XCTD Test

Objectives:

- Demonstrate successful deployment of UISSXCTDs using launch procedure that accommodates the 'timeout circuit'
- validate the XCTD design specs for temperature, conductivity, depth

Conclusions:

- returned data 'success rate' lower than for analog probes used during SCICEX
- failure to achieve specified maximum depth is problem needing resolution
- when successfully returned, quality of the data is good enough for use

December 2010 XCTD Test

Motivation:

- Sippican identified a data acquisition software problem that would affect all XCTDs (ship, air-launched as well as sub-launched) and assured availability of a tested software solution by a late autumn

Test:

- ONR approved funding for a test of 16 XCTD probes
- ASL attempted launch of 3 of these probes Dec 4-5, 2010

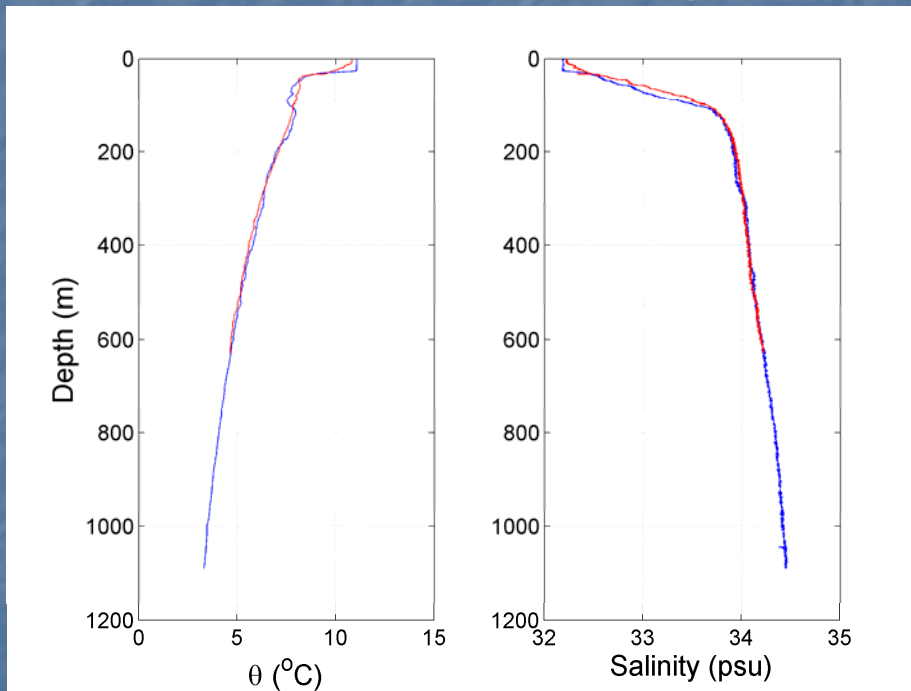
Result:

- 1 probe failed pre-launch test (and was thus not launched)
- 1 probe returned data to 644 m (not to spec'd depth)
- 1 probe returned data to 1088 m
- data (both T & C) was noisier than ICEx-09 data
 - suggestive of a software problem

December 2010 XCTD Test

Results:

- 2 XCTD profiles (cleaned below)
- noisier than ICEX-09
 - isolated points w/ $T = 0.00^{\circ}\text{C}$, $C = 1.5 \text{ mS/cm}$
- profiles from surface?
- not all profiles reach max design depth



Conclusions:

- success rate: inconclusive; not enough probes launched
- max depth: wrong version data acquisition software used???

SCICEX SAM XCTD sampling

- What's next?
- Continue XCTD test deployments (13) in ICEX-11
 - Follow Science Plan recommendations
 - Ensure use of correct software
 - Follow-up on XCTD noise and first-depth issues
- ONR proposal for SAM sampling in 2012-2013
 - Assume ICEX-13?