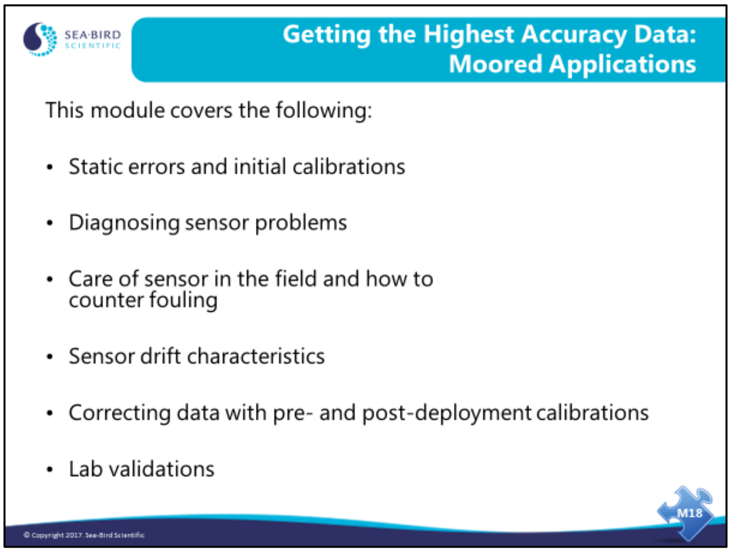
Getting the Highest Accuracy Data: Moored Applications

Sea-Bird Scientific University Module 18

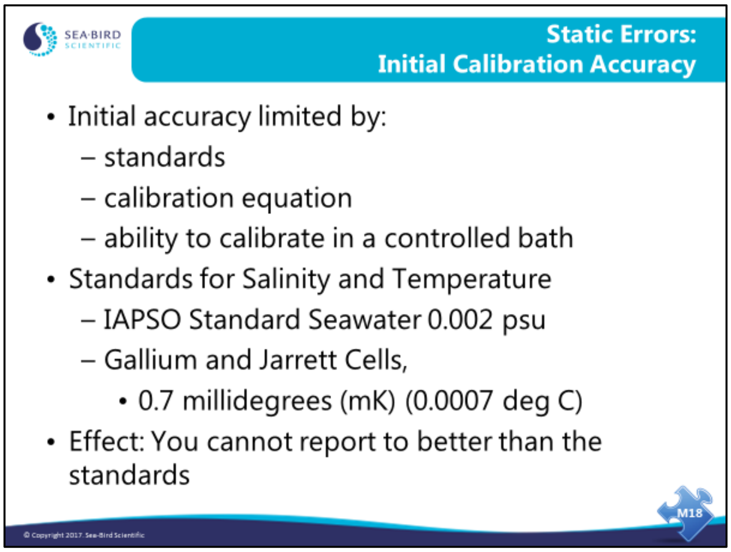
M18

Overview

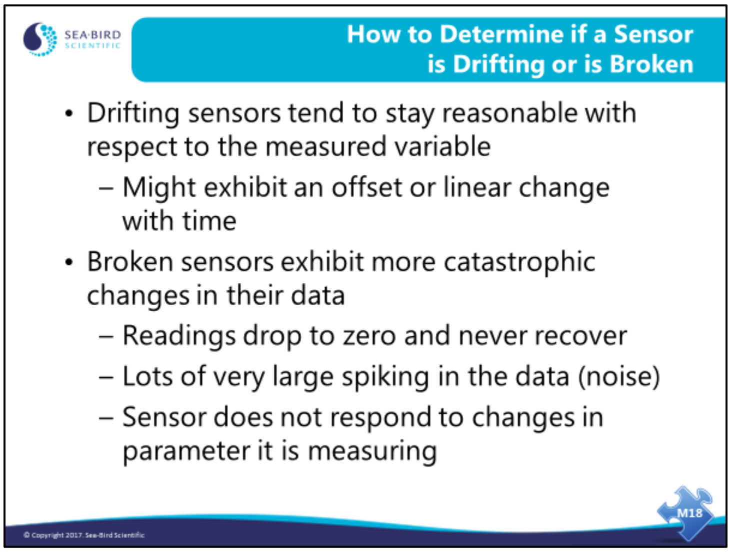


In the module we will discuss the means to get the highest accuracy in your moored measurements. This includes care of sensors in the field and understanding sensor drift characteristics. Moored instruments can exhibit unexpected drift in conductivity. Topics covered include pre- and post-deployment calibrations, field calibrations, and bio-fouling.

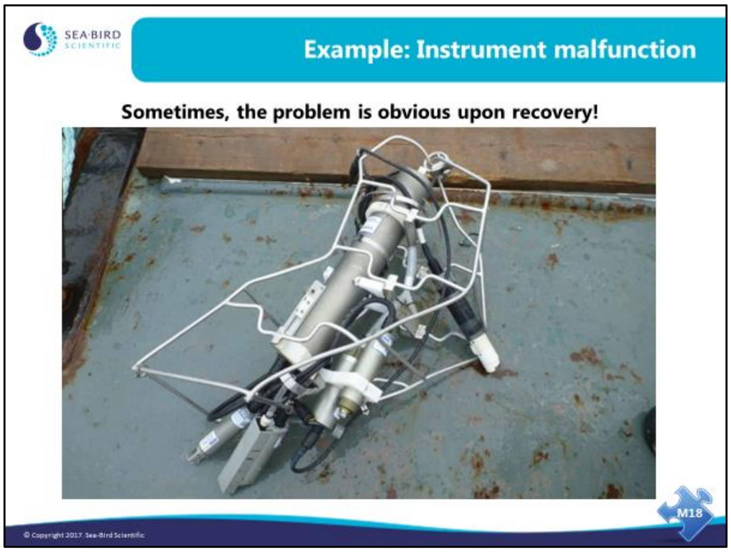
Static Errors



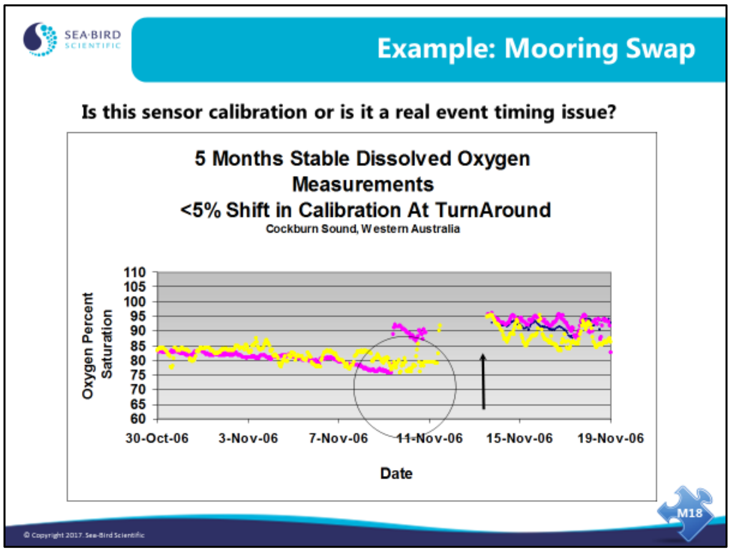
Static Errors (*continued*)



Instrument Malfunction

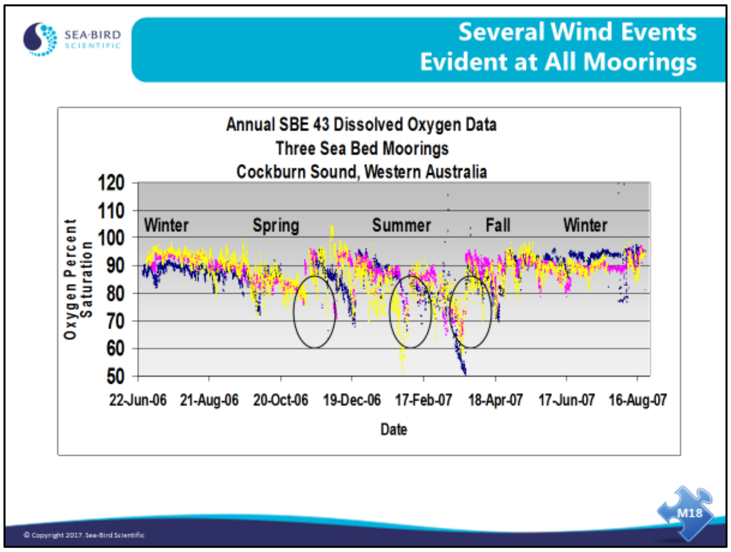


Instrument Malfunction (*continued*)



In this example, the customer saw a rapid decline in oxygen. They assumed the sensor was going bad so planned to recover it. They recovered the sensor, and swapped it a few days later with a newly calibrated sensor. They observed a large shift in oxygen (~5%) and complained that the sensors were not working.

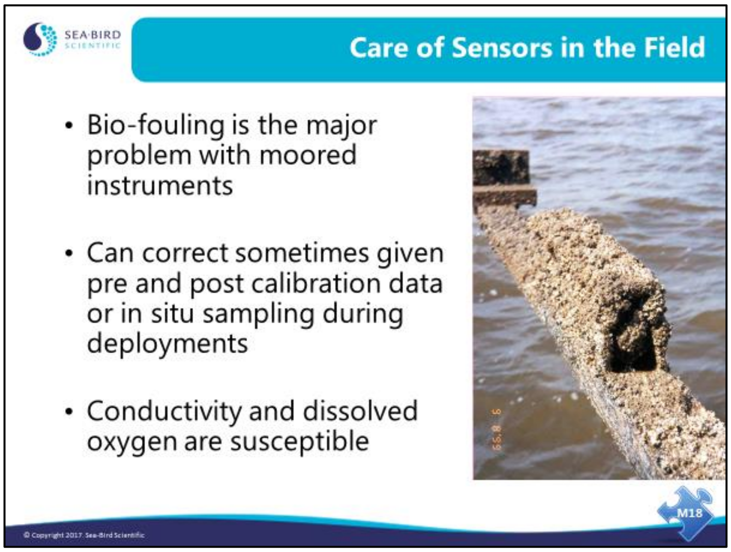
Instrument Malfunction (*continued*)



In this example, there is an apparent slow mean drift in sensor output with time. However, the large wind-driven events in the oxygen data are not sensor related and occur on regular 2-10 day time scales. This is observed at all moorings in this bay. Furthermore, the mix-down occurs very quickly (over the course of several hours to a day), so removing without an immediate sensor replacement during an event will cause a missed natural occurrence, and mislead the data.

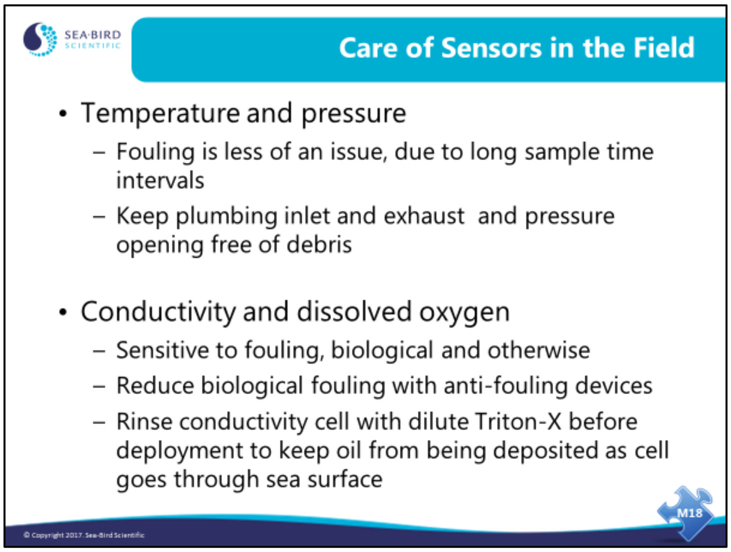
When all the nearby mooring data were analyzed, it became clear that the sensor swap occurred during a wind event, and that the bulk of the 5% shift observed on the previous slide was probably caused by a natural occurring event, rather than indicative of a sensor problem or drift.

Care of Sensors in the Field



This SBE 37 is deployed in the tide waters of Georgia. Biological activity surges when the water temperature exceeds 20 °C. The researcher uses extra bio-fouling protection on each end of the conductivity cell and protects the pressure housing of the instrument with packing tape and silicon grease.

Care of Sensors in the Field (*continued*)



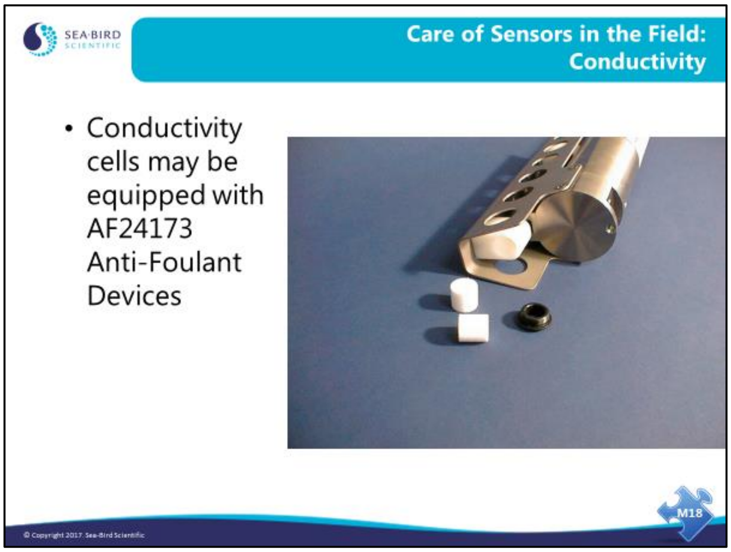
As we have discussed, thermometers are very robust. In moored applications, the sampling interval is much longer than the time constant of the thermometer, so except in extreme conditions fouling does not affect thermometers.

Occasionally, when a Sea-Bird instrument with a Druck pressure sensor is deployed in a muddy and/or biologically productive environment, the pressure port may partially fill with sediment or the pressure port plug vent hole may be covered with biological growth. Either of these occurrences can cause a delay in the pressure response, or in extreme cases can completely block the pressure signal. Sea-Bird developed a high-head pressure port plug for these types of deployments. See **Application Note 84** on our website for details.

Note: Newer pumped SBE 37 MicroCATs (SMP, IMP, SIP) and all IDO and ODO SBE 37 MicroCATs (SMP-IDO, IMP-IDO, SIP-IDO, SMP-ODO, IMP-ODO, SIP-ODO) are not compatible with the high-head pressure port plug.

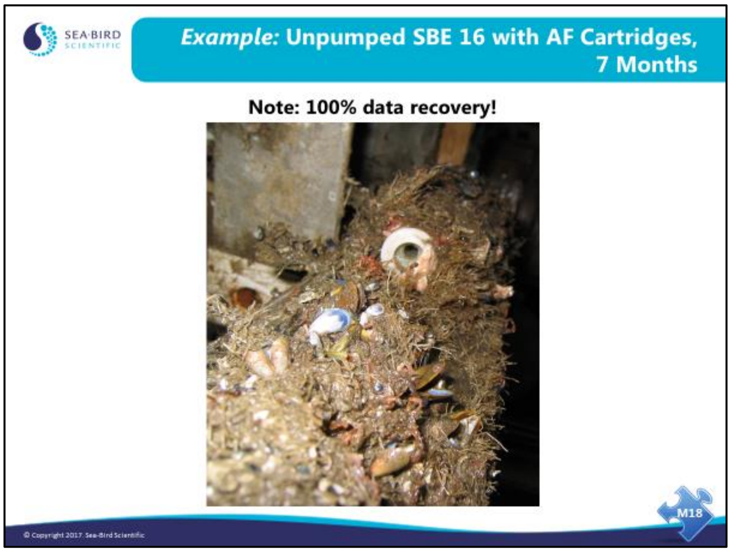
We'll talk more about conductivity sensors and dissolved oxygen sensors.

Care of Sensors in the Field: Conductivity

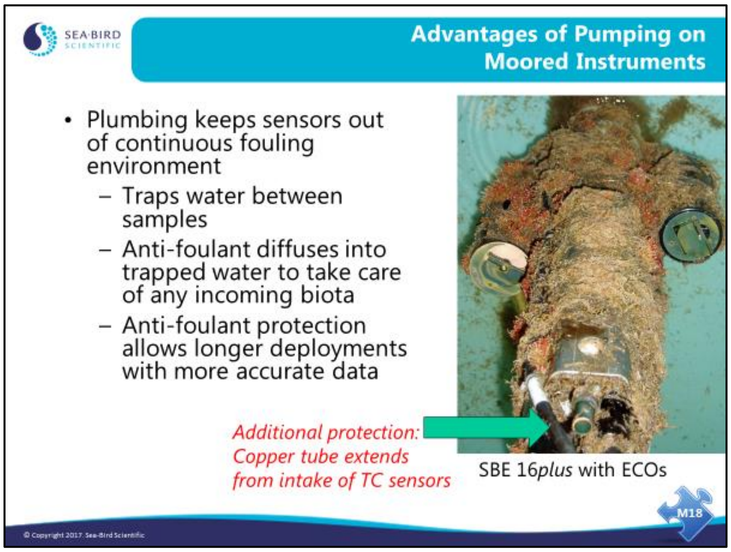


On conductivity sensors, a very thin coating can change the cell geometry, having a large effect on the conductivity measurement.

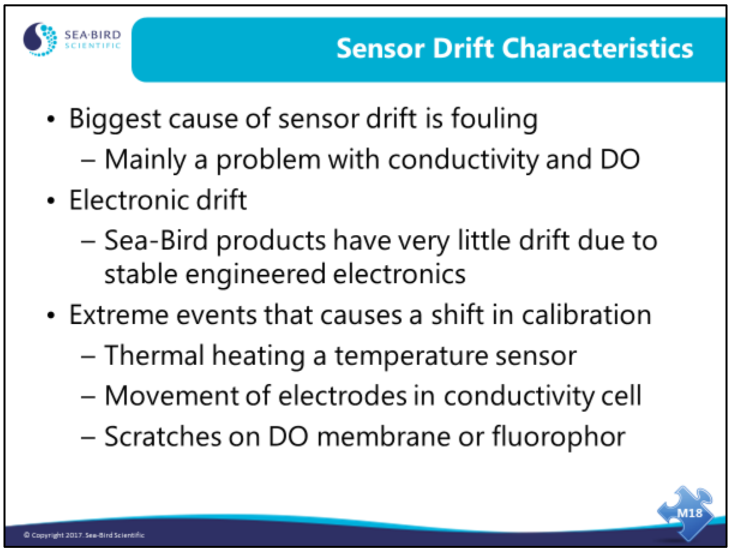
Care of Sensors in the Field: Conductivity (*continued*)



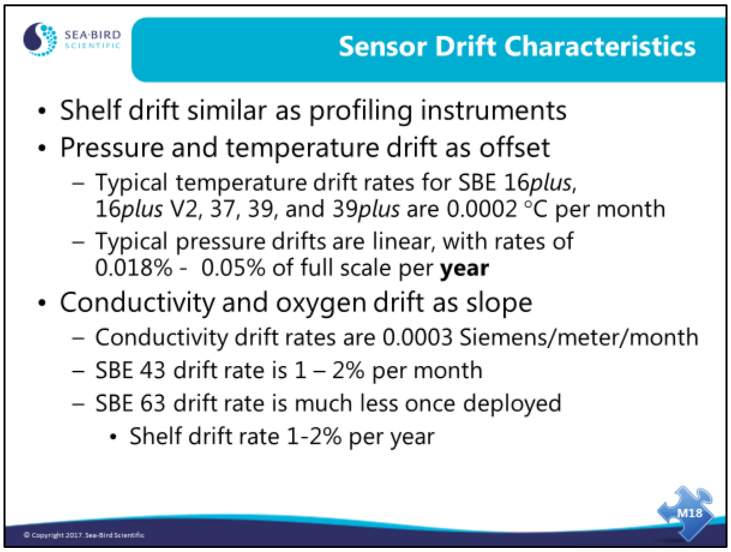
Care of Sensors in the Field: Conductivity (*continued*)



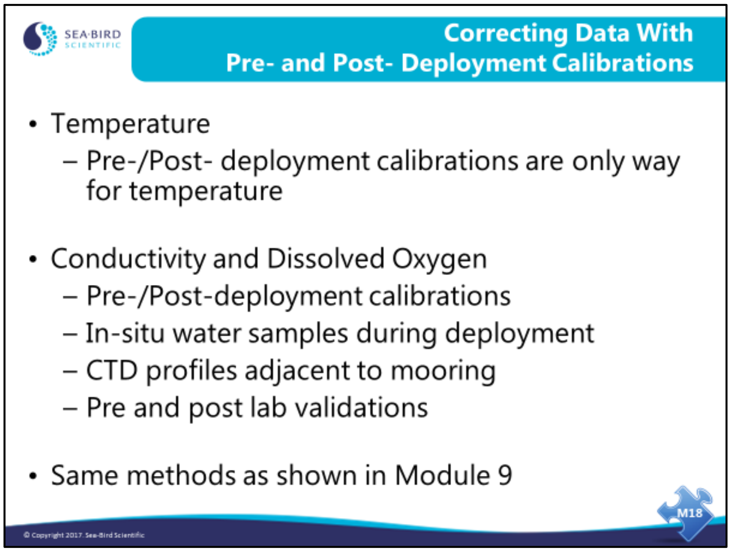
Sensor Drift Characteristics



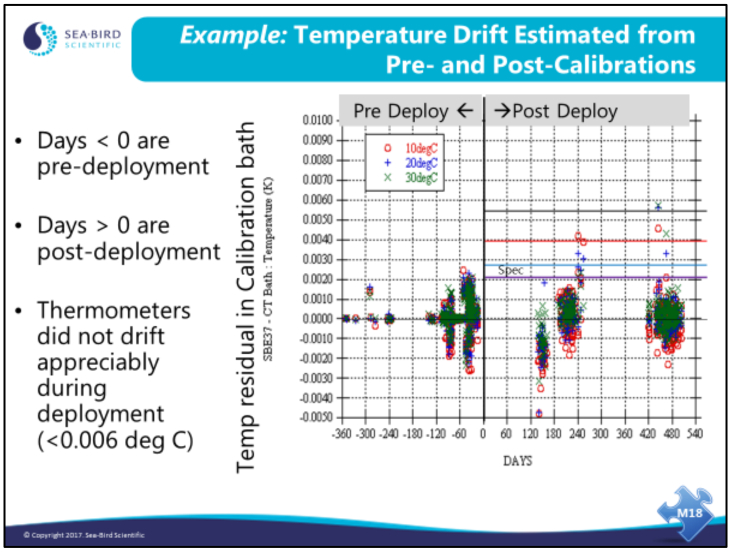
Sensor Drift Characteristics (*continued*)



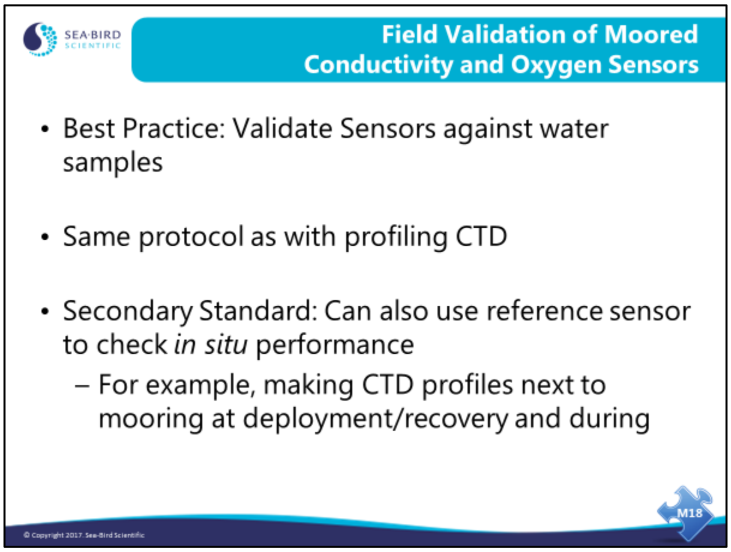
Correcting Data with Pre- and Post-Deployment Calibrations



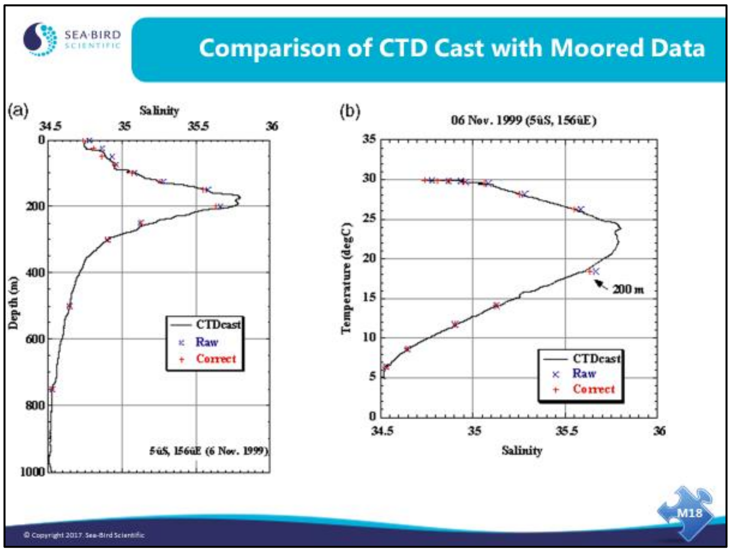
Temperature Drift from Pre- and Post-Deployment Calibrations



Field Validation of Conductivity



Correcting Conductivity and Temperature Data: Example

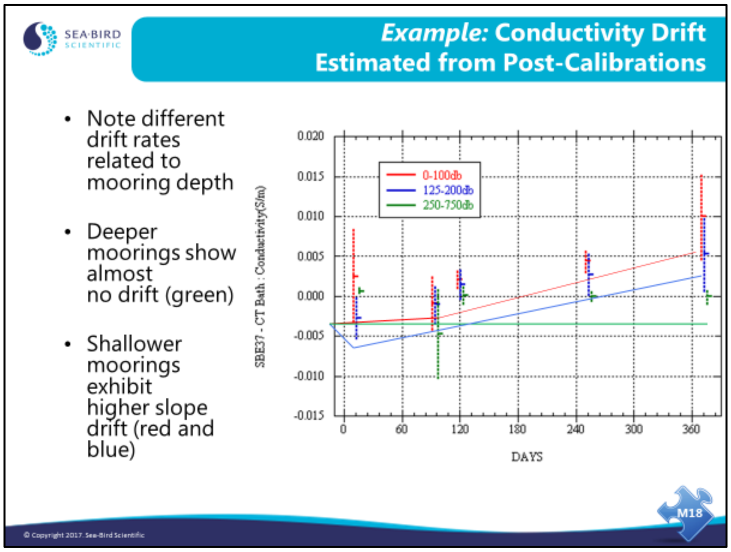


Here is a plot of a CTD cast with the mooring data overplotted on it. Raw and corrected values are shown. Although the scale is rather coarse, the correction improved the agreement between the instruments.

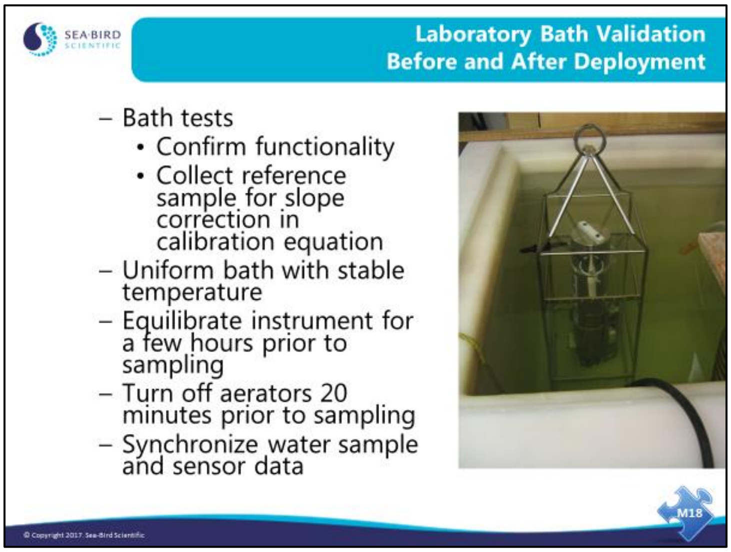
When comparing data collected by moored instruments with data collected in a CTD profile, it is important to keep in mind that even though the mooring is fixed in place, the ocean moves around it. There can be substantial variability over a fairly small time interval. Most of the time there is little hope of having the CTD in place at the moment the moored instrument is taking a measurement.

When choosing locations to make corrections, consider the position of the thermocline and other variables that can add error to reference samples (Winklers or CTD comparisons). Also, be aware that pressure sensors on moored instruments need to be checked, as pressure is an important variable in the salinity calculation. Large errors in pressure can create large errors in salinity.

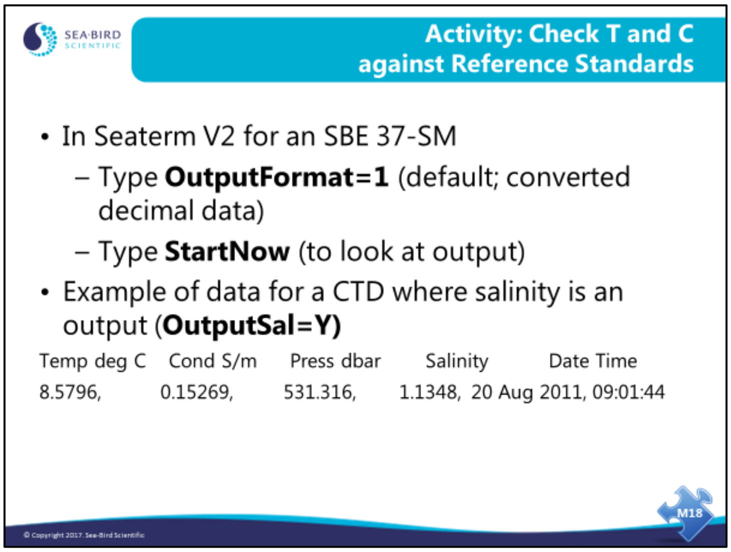
Correcting Data with Pre- and Post-Deployment Calibrations (*continued*)



Lab Validation



Activity: Validate T and C against Reference Standards



Recommended Format for C and T Validations using bottled Standards and References
OutputFormat=1 (default): converted decimal data
tttt.tttt,ccc.ccccc,ppppp.ppp,ssss.ssss,vvvvv.vvv, dd mmm yyyy, hh:mm:ss
where
tttt.tttt = temperature (°C, ITS-90).
ccc.ccccc = conductivity (S/m).
ppppp.ppp = pressure (decibars); sent only if optional pressure sensor installed.
ssss.ssss= salinity (psu); sent only if **OutputSal=Y**.
vvvvv.vvv = sound velocity (meters/second); sent only if **OutputSV=Y**.
dd mmm yyyy = day, month, year.
hh:mm:ss = hour, minute, second.

Example of data from a DIFFERENT CTD (not one above), with salinity as an output.

Temp deg C	Cond S/m	Press dbar	Salinity	Date Time
8.5796,	0.15269,	531.316,	1.1348,	20 Aug 2011, 09:01:44

To get salinity as an output (Recommended):
Type OutputSal=Y in Command Line Window.
OR
In Send Commands Window, under Output Format Setup, Click on Set Data Output Format, select 1 in the Argument for Command box below, and Execute.
Note: You may have to hit Return (Enter key) in the Command Line Window first if this does not execute right away as instrument might have gone into quiescent mode.

After you set **OutputFormat =1**, click on Enable Output of Salinity, and Execute.
Click Capture button on Menu bar to create .cap capture file.
Type **StartNow** to look at data real-time on the screen.
Type **Stop** to stop the logging.
Click Capture button on Menu bar to close .cap file you just created.
Look at .cap file; you will see that you saved all testing information for your QA/QC.