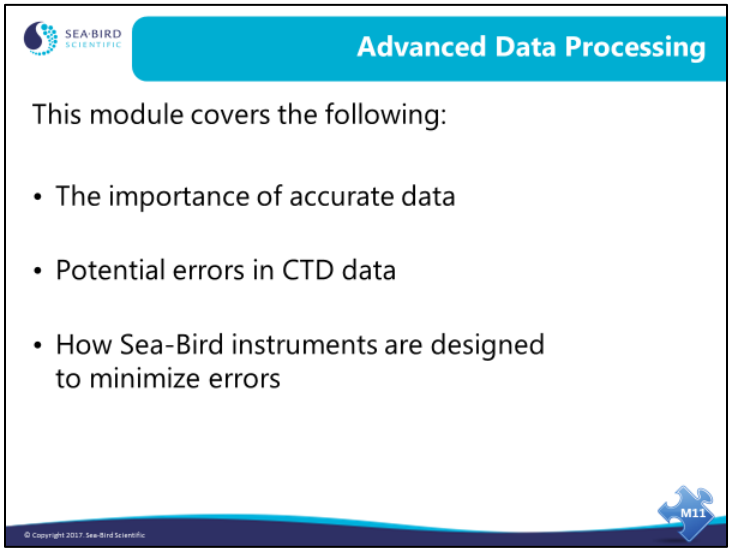
Advanced Data Processing: Dynamic errors in CTDs

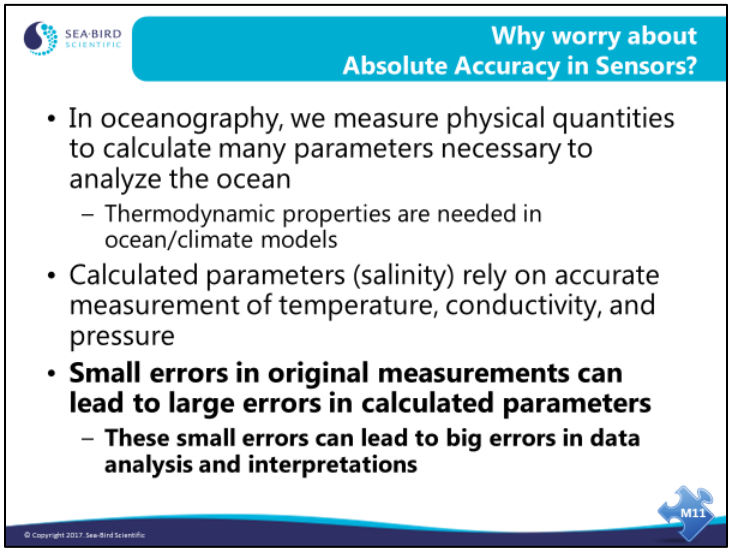
Sea-Bird Scientific University Module 11

Overview

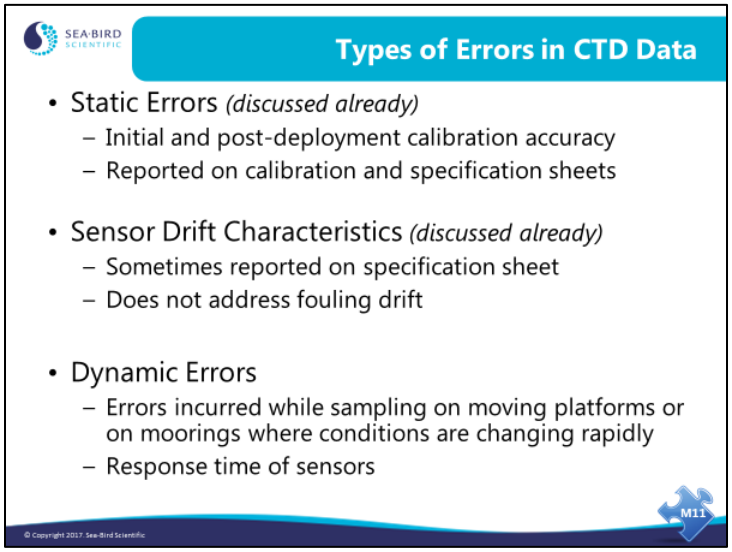


The advanced data processing sections are the final topics about profiling CTDs. This section will explain small artifacts caused by frequency counting, plumbing, and sensor physics. Understanding these topics will help explain most of the peculiar things that you might observe in your data if you look closely.

Why worry about absolute accuracy?

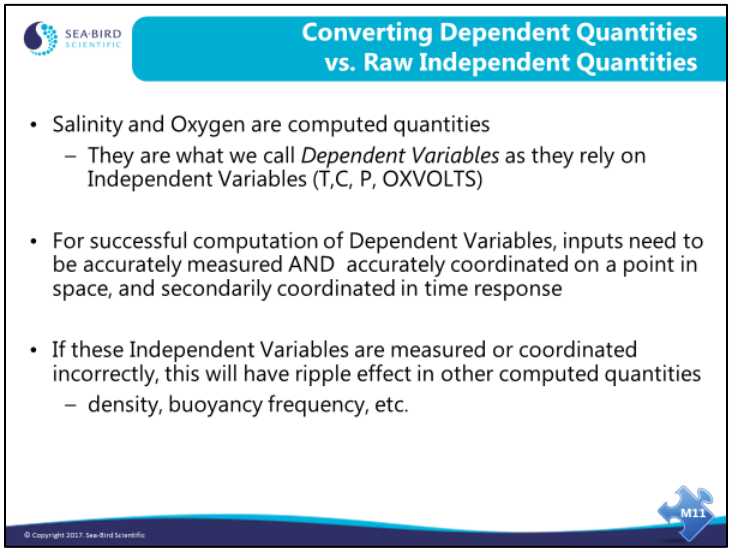


Errors in CTD Data

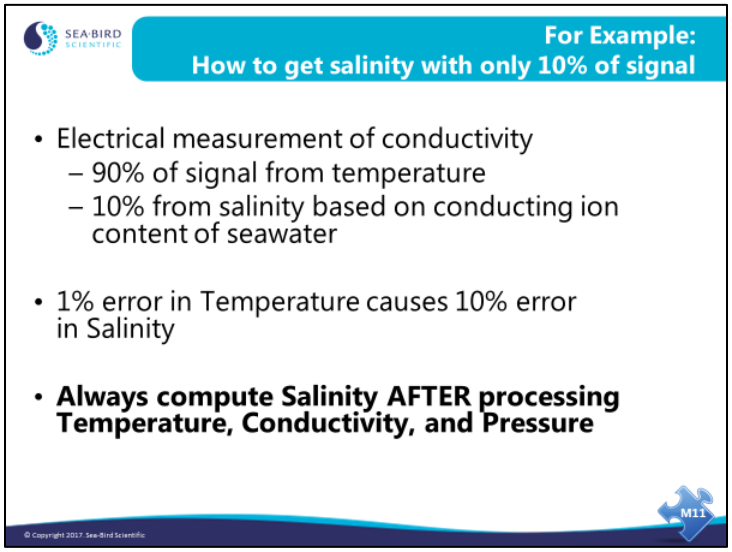


In this module, we discuss how to process and improve data for Dynamic Errors.

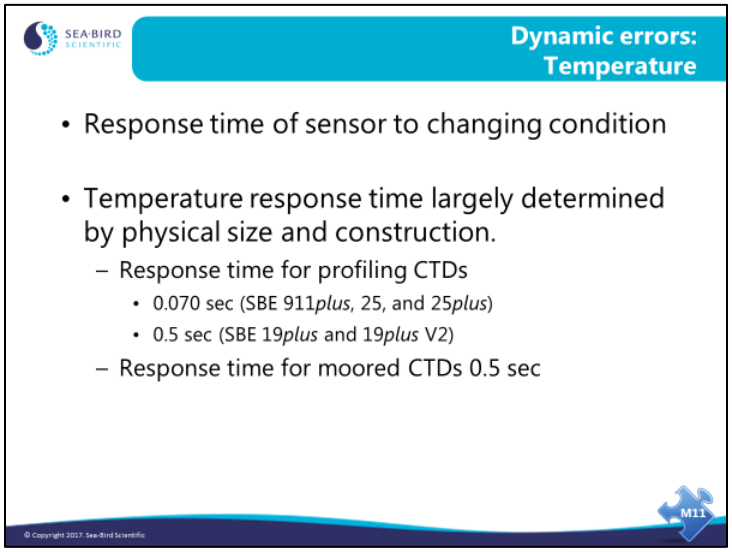
Dependent versus Independent Variables



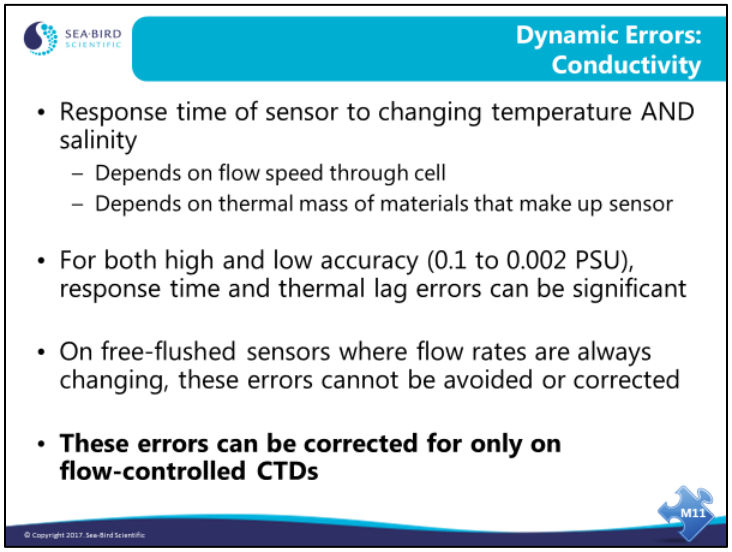
Dependent versus Independent Variables *(continued)*



Dynamic Errors in Temperature

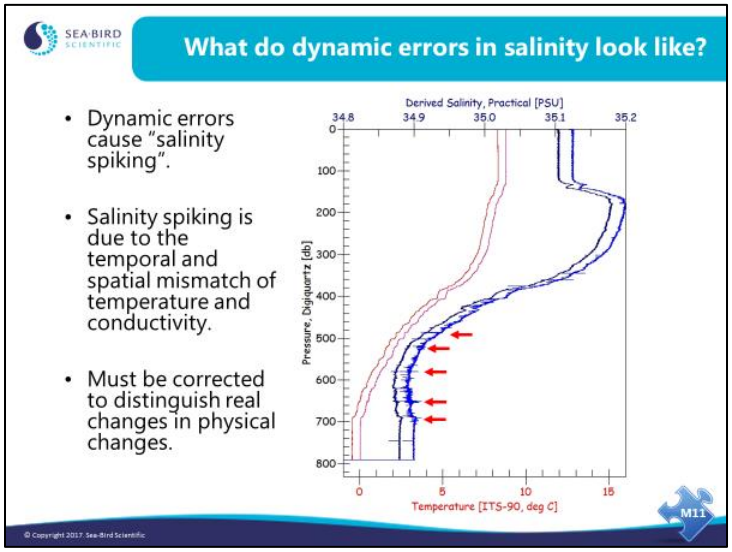


Dynamic Errors in Conductivity

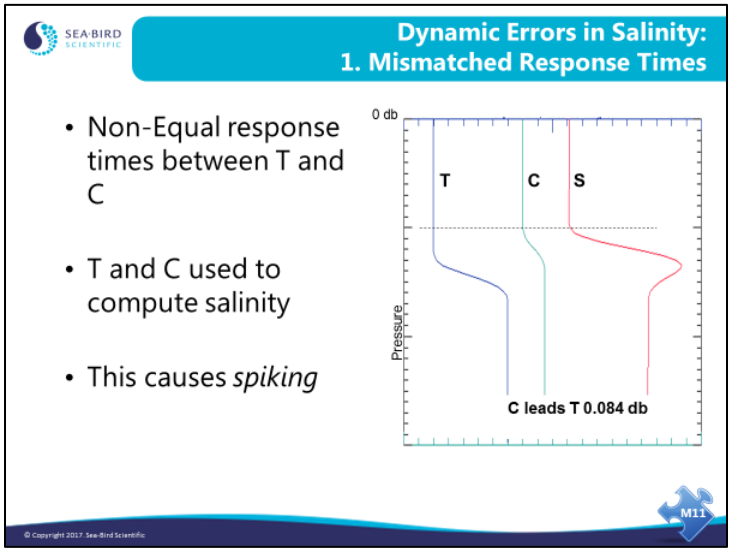


In these examples, the temperature and conductivity sensors are not sampling the same water parcel. This will lead to errors in computed salinity and density.

Dynamic Errors in Salinity *(continued)*

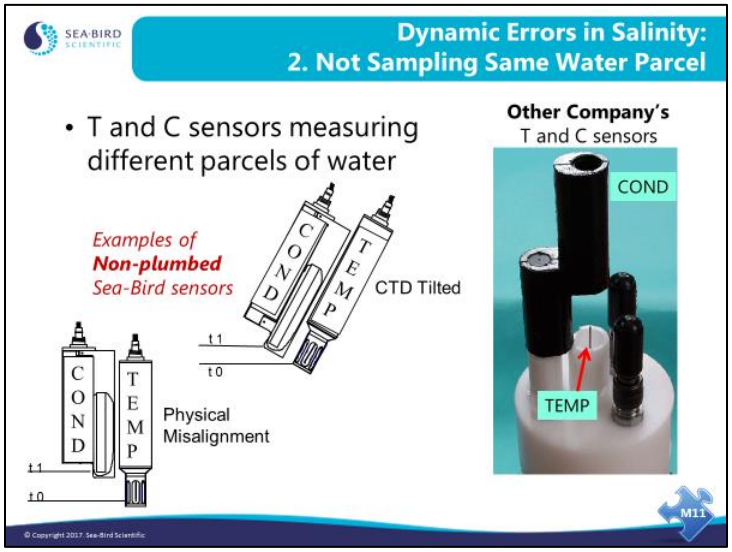


Dynamic Errors in Salinity *(continued)*

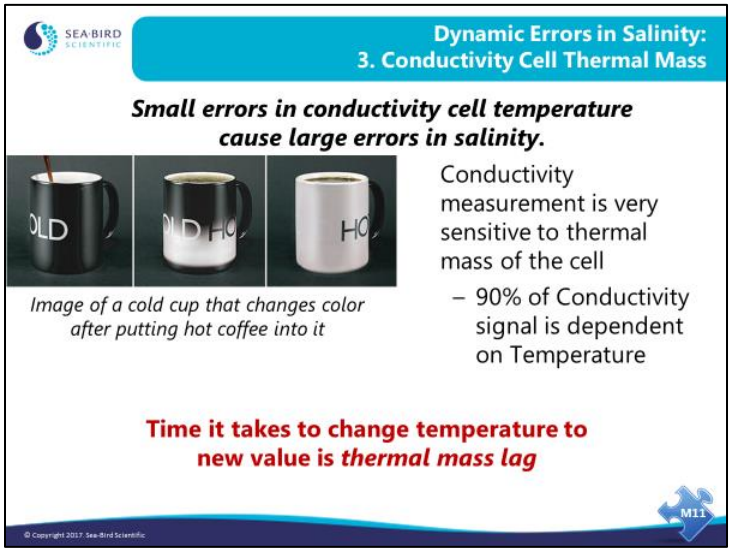


In this example, the conductivity sensor responds to a change faster than the temperature sensor. This causes the salinity to *spike* high of correct.

Dynamic Errors in Salinity *(continued)*



Dynamic Errors in Salinity *(continued)*



All materials can be heated up, some more easily than others. For example, a cast iron pan will get hotter than an aluminum pan when heated for the same length of time. A ceramic cup full of hot tea can be comfortably held, but a metal cup full of hot tea would be too hot to hold.

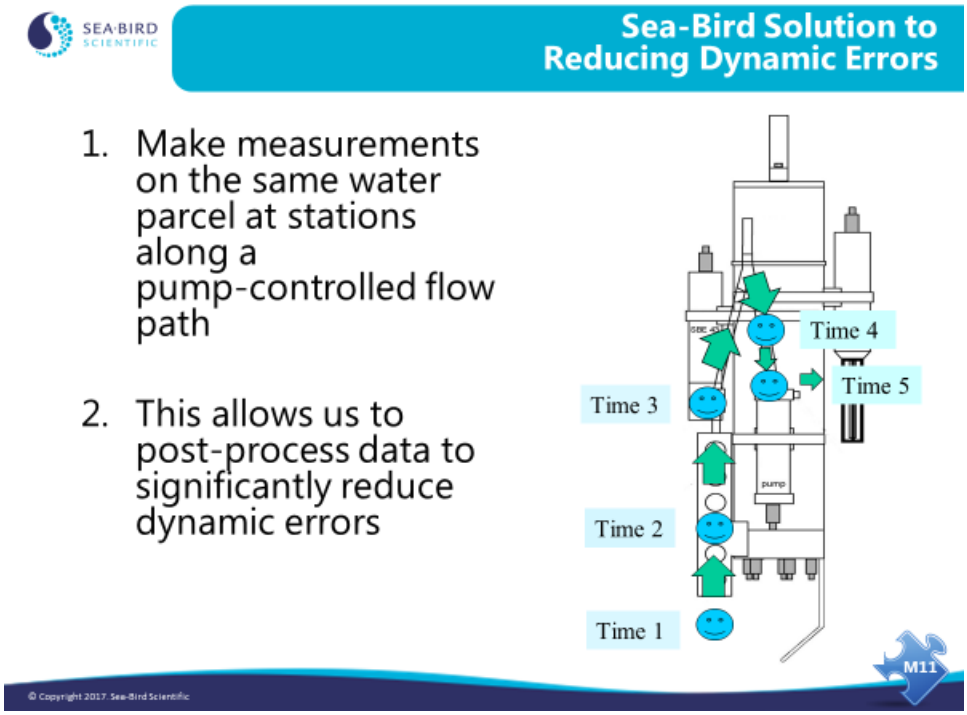
Different materials have different capacities for heat. The amount of heat that any given amount of material can hold is either called that material's thermal capacity or its **thermal mass**. The lower its heat capacity, the less energy it needs to raise its temperature. If it has a high heat capacity, it can store a lot of energy at any given temperature.

Since sensors are made of thermally conductive materials, we should understand how the sensor body materials affect the thermal mass, hence the measurement.

Dynamic Errors in Salinity *(continued)*

The error caused by ship motions, known as ship heave, comes from the instrument package disturbing the water that it is trying to sample. Because of this, there is no numerical solution for the problem. SBE Data Processing has an editor that will mark (flag) the offending data, so that it is not used in your final calculations. As winch technology improves, we can expect to see vessels equipped with motion compensation capability, which will greatly reduce this problem. Until that is available, you may want to profile a bit more quickly to reduce the effect of ship heave in rough water.

Reducing Dynamic Errors



Reducing Dynamic Errors *(continued)*