

SOP 9: Postseason Quality Assurance and Calibration Evaluation version 2

1 Summary

1. After the October cruise, the primary CTD is returned to Sea-Bird for calibration of the sensors. All sensors on the primary CTD must be calibrated. Also, the dissolved oxygen (DO) sensor on the backup CTD is always sent in for calibration, regardless of whether or not it was deployed during the cruise year. If the backup CTD was deployed at all during the season then the whole unit (all sensors), rather than just the DO sensor, must also be calibrated in order to evaluate degree of sensor drift for the data it collected.
2. Because no water samples are collected for within-survey calibrations of the conductivity, fluorometer, or nephelometer sensors, the annual calibrations provide the only means for the program to independently assess sensor accuracy.
3. The Temperature Calibration Report and Conductivity Calibration Report detail sensor drift between the current and previous instrument calibrations. Use the “As Received” calibration values for purposes of determining drift during the period of instrument use. For Glacier Bay measurements, which describe a dynamic coastal domain, sufficient accuracy of temperature (°C) and salinity (PSU) data are achieved at the 0.01 and 0.03 levels, respectively. However, typical measurements will perform better than this, on the order of 0.002–0.005 for the temperature measurements and 0.01–0.02 for the salinity measurements. Water samples are not collected during the Glacier Bay cruises, so the monitoring program has only limited ability to assess and correct deviant readings.
4. After the calibration reports have been inspected, a data quality flag is assigned to each CTD cast, according to the criteria listed below. The process for setting database flags is detailed in SOP 11, OC_M.

2 Temperature Sensor Drift

1. Sea-Bird specifies typical drift of the temperature probes to be less than 0.002 °C per year. Presuming no major problems are noted with the temperature sensor, no calibration adjustments to the temperature measurements should ever be required. Check the “drift since last cal” value on the report and ensure this value is below 0.01 °C.
2. If the sensor offset is greater than 0.01, the cause should be determined through examination of the comments on the calibration report and/or in consultation with Sea-Bird. For offsets less than or equal to 0.01 °C, the data quality flag should be marked as “Good.” For offsets between 0.01 °C and 0.02 °C the data quality flag should be set to “Questionable,” and for offset greater than 0.02 °C the data quality flag should be set to “Bad.” In the rare case where the temperature calibration indicates a total drift of more than 0.01 °C, the cause of such a large offset is to be documented in the comments field of OC_M.

3 Conductivity Sensor Drift

1. Particular care must be taken when assessing the conductivity calibration values, because drift and complete cell failure can result from a variety of causes. Biofouling of the conductivity cell causes measurable changes in accuracy; a crack in the glass cell can cause

partial (minimal) or near-complete sensor failure. Typical drift of a conductivity cell should be in the range of 0.001–0.0025 PSU/month.

2. If the calibration report indicates a total conductivity cell drift of greater than 0.06 (≈ 0.0025 PSU/month for a two-year calibration cycle), then document this large drift in the OC_M comments and adjust the data quality flag accordingly. The data quality flag is marked as “Good” if the total conductivity cell offset is less than or equal to 0.06 PSU. The data quality flag is marked as “Questionable” if the total offset is between 0.06 and 0.2 PSU, and the data quality flag is marked as “Bad” if the total offset is greater than or equal to 0.2 PSU.
3. For the purposes of the GLBA program, no postcalibration salinity adjustments are made. Without in situ water samples, it is generally not possible to determine when the offset was generated or whether the offset occurred as a slowly drifting change in sensor characteristics. Researchers who would care to make the assumption that the drift occurred linearly with time can access the archived calibration sheets and spread the drift evenly (in time), as detailed in *Sea-Bird Application Note #31*, which can be downloaded from the Sea-Bird website.
4. In the rare case where the salinity calibrations exhibit a total drift of more than 0.2 PSU, the cause of such a large drift is probably catastrophic conductivity sensor failure, and the Sea-Bird sensor calibration report may note some significant problem; this is to be noted in the comments field of OC_M. If no single event stands out as the likely cause of failure, none of the salinity data should be certified as “Good.” If a likely cause for failure can be identified, the Project Leader will have the option of (1) certifying only data collected before this point in time with a “Questionable” data quality flag and marking data collected after this point in time with a “Bad” data quality flag, or (2) denoting all data collected as “Bad.” Employing comparisons of measurements collected in previous years along with measurements collected in the year of sensor failure can help diagnose when such a failure may have taken place. The deepest measurements in the water column would be most appropriate for such comparisons because the dynamic range of salinity values is smaller in waters below the more highly variable surface waters.