**DISSOLVED OXYGEN ANALYSIS**

**PIs**

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**1. Equipment and Techniques**

A Guildline Autosal 8400B (S/N 69-180) was used for all salinity measurements, with the water bath temperature set to 24°C. The laboratory air temperature was monitored during and between each run and internal ship temperature adjusted to maintain a lab temperature of 23-25°C where possible. This helped ensure stable reading values and improved accuracy. Samples were analyzed after they had been left to equilibrate to laboratory temperature (typically 12-36 hours after collection). The salinometer was standardized for each group of samples analyzed (1-5 casts, up to 57 samples) at the beginning and end of the sample run using IAPSO Standard Seawater Batch P-161. The salinometer readings were logged using a LabView program developed by Carl Mattson. The software prompted the analyst to flush the instrument’s cell and change samples when appropriate. A solution of Triton X-100 (1% dilution) was flushed through the cell following each run to remove excessive bubble formation from the high productivity waters sampled. The cell was then flushed with DI water followed by standard seawater, which was left in the cell between runs. For each calibration standard or sample, the salinometer cell was initially flushed at least 2 times before a set of conductivity ratio readings was taken.

**2. Sampling and Data Processing**

A total of 814 salinity samples were collected and measured, 680 of these from 53 out of a total of 73 CTD casts. Additional samples were taken on trace metal casts (124 samples) and for incubation experiments (10 samples). Salinity samples were collected in 200 mL Kimax high-alumina borosilicate bottles that had been rinsed at least three times with sample water prior to filling. The bottles were sealed with custom-made plastic insert thimbles and Nalgene screw caps. This assembly provides very low container dissolution and sample evaporation. Laboratory temperature was monitored electronically throughout the cruise. PSS-78 salinity (UNESCO, 1981)was calculated for each sample from the measured conductivity ratios. Any offset between the initial standard seawater value and its reference value was always within instrument precision, so no offset was made to following sample values. The difference (if any) between initial and final standards was noted, but no drift applied to sample data. If a drift in calculated salinity between initial and final standards was greater than 0.001, the data for the affected samples was flagged as suspect (flag 3). Bottle fire CTD data were crudely corrected with a linear fit model and compared with salinity sample data to allow for QC at a basic level. Salinity samples were then considered suspect (flag 3) if corrected primary and secondary sensor offsets from the salinity sample were greater than 0.006, or bad (flag 4) if the same offsets were both greater than 0.010. Samples for which it took 4 or more readings on the salinometer to get a satisfactory agreement have also been flagged 3.

**3. Narrative**

Setup occurred in Cape Town, South Africa from 2020-01-22 to 2020-01-25, the date of departure. The salinometer was initially set up and secured on the starboard bench in the hydrolab of the R/V Thomas G. Thompson. However, after several days of carefully monitoring laboratory temperature, it was deemed too unstable an environment for precise salinity analysis. The salinometer was then moved into the walk-in refrigerator forward of the computer lab. The best set-up for a stable environment seemed to be with the door ajar, the condenser and fan system off, and with a smaller fan in the corner of the space to circulate air. An initial bath temperature of 21°C was adjusted to 24°C, as a higher laboratory temperature was easier to maintain.

The second run of samples suffered from bubble nucleation within the cell and gave a slightly higher offset between initial and final standards (salinity drift of 0.001). No amount of flushing with DI water would clear these so a 1% solution of Triton X-100 was used as a surfactant to remove them, followed by copious flushing with DI and leftover standard seawater, which successfully cleared the cell of bubbles. Nucleation continued to be apparent (but much reduced) during subsequent sample runs, possibly due to the high particulate, high productivity surface waters that were being targeted on this cruise. As such, this cell cleaning procedure was used following every run of samples to remove bubbles and prevent the situation worsening.

On the second leg (Durban – Mauritius) additional “trip and fly” CTD casts were carried out for increased spatial CTD data resolution and additional DIC, alkalinity and nutrient measurements. These were not sampled for salinity as sensors would not have stabilized enough for effective CTD sensor calibration. Offset between salinity standards remained very low for the majority of the cruise (typically 0.0001-0.0002). However, for one run of samples the laboratory temperature was deemed too high to maintain a stable reading on the salinometer. Unfortunately, due to the high CTD sampling frequency and limited number of sample bottles, the samples had to be run regardless. This resulted in a drift in salinity of nearly 0.003 between initial and end standards. The data have not been drift-corrected as it is unclear if the offset was linear or stepped through the run of samples; instead they have been flagged as suspect (flag 3). Following this event, the engineers on board were notified of the issue of laboratory temperature and the ship’s indoor temperature reduced to allow for more stable conditions for salinity analysis.

Duplicate salinity samples were taken from ten niskin bottles on a deep cast (CTD 053). Nine out of 10 replicates agreed with a precision of 0.001 or better. Replicate salinity samples taken from duplicate bottom-depth niskin bottles on three deep CTD casts showed excellent agreement (+/- 0.0006).