

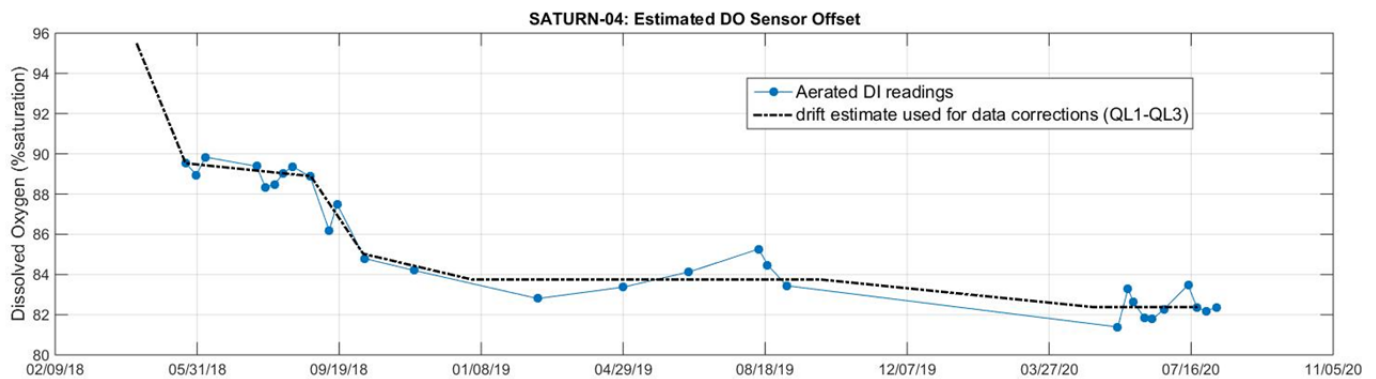
Evaluation and Correction of SATURN-04 Dissolved Oxygen (DO) Measurements (4/14/18 – 7/1/20)

Background:

The dissolved oxygen sensors deployed at SATURN-04 are evaluated with measurements of 100% aerated deionized (DI) water prior to deployment. In addition, aerated DI is transported to the station and is pumped through the system on a regular basis to monitor the performance, fouling and or drift of the sensor *in situ*.

Data Evaluation & Correction Details:

A single sensor was deployed during this time period (beginning on 4/14/18). A previous DI reading indicated that the sensor was reading about 5% low at the point of deployment. Aerated DI readings at the station began on 5/22/18 and showed that the sensor had drifted to an approximate offset of 10.5% by that point. Subsequent in-situ DI readings were used to inform corrections for sensor drift/fouling. Drift was assumed to be linear during periods of time where DI readings were not collected. In the figure below the in-situ DI readings are shown in blue (data are included in a table at the end of this document). The estimated drift used for data corrections is shown with the black dashed line. While the data appear to suggest some “upward” drift in the summer of 2019, it is our experience that these sensors drift only downward and so a linear fit through these DI data was used during this time period.



Correction Calculations:

The correction factor (CF) is an adjustment to the Soc term of the sensor calibration and is an adjustment to the slope of the calibration rather than offset. In simplified terms, the CF is calculated as the ratio of the known good reading (in this case 100%) to the observed reading :

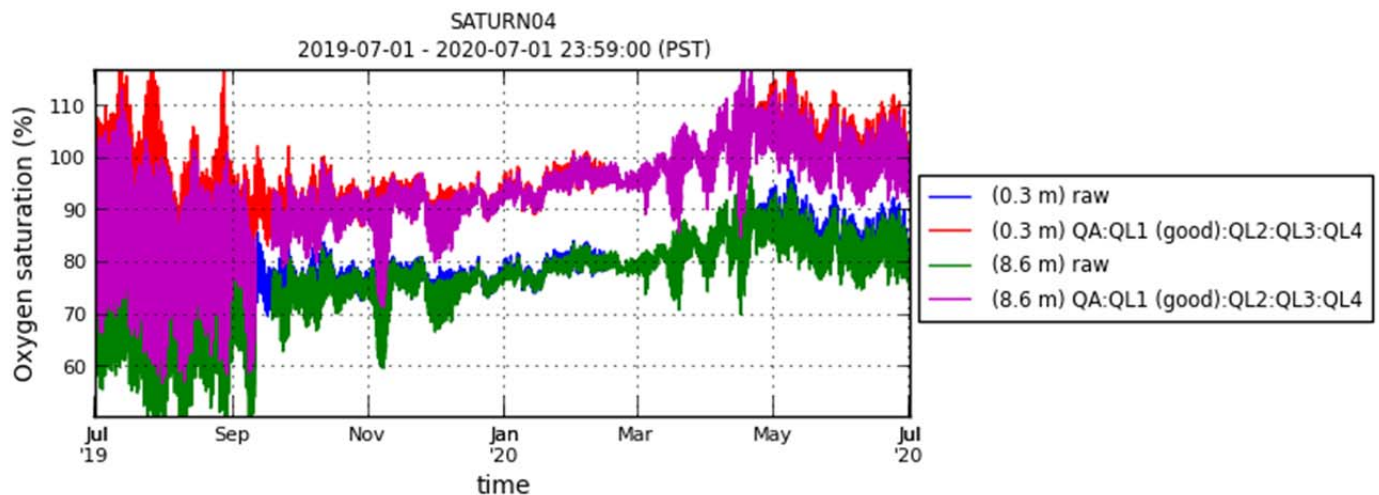
$$CF = 100\% / (\text{reading in 100\% aerated DI}) ; \quad \text{Corrected data} = \text{raw data} * CF.$$

*See SBE application note 64-2, June 2012 revision for more information

Based on the DI data, the following corrections were applied to the dissolved oxygen data. These corrections should be considered approximate the data used accordingly:

Correction Start	Correction End	Starting % Drift	Ending % Drift	Starting CF	Ending CF	Quality Level
4/14/18 0:00	5/22/18 0:00	4.6	10.5	1.048	1.117	QL3
5/22/18 0:00	8/28/18 0:00	10.5	11.1	1.117	1.125	QL3
8/28/18 0:00	10/8/18 0:00	11.1	15.0	1.125	1.176	QL3
10/8/18 0:00	1/1/19 0:00	15.0	16.2	1.176	1.194	QL3
1/1/19 0:00	10/1/19 0:00	16.2	16.2	1.194	1.194	QL3
10/1/19 0:00	5/1/20 0:00	16.2	17.6	1.194	1.214	QL3
5/1/20 0:00	7/15/20 0:00	17.6	17.6	1.214	1.214	QL3

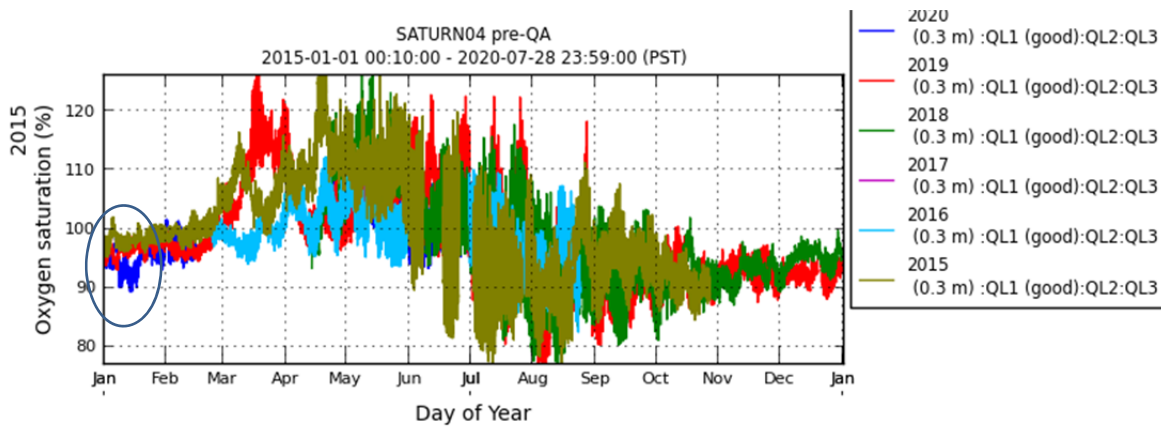
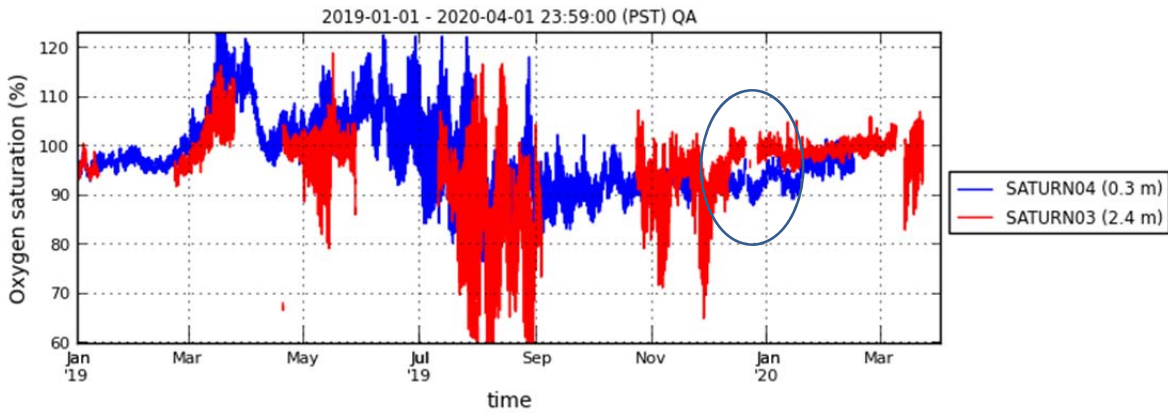
The following figure shows the corrected data for quality levels QL1-QL3 as plotted by the CMOP data explorer (http://www.stccmop.org/datamart/observation_network/dataexplorer):



Note:

Comparison with dissolved oxygen data from SATURN-03 during this time period and comparison with oxygen saturation data from previous years at SATURN-04 are shown below. These plots show that the corrected data are in general agreement with data from Saturn-03 and previous year's data. However, it is worth noting that a short period in January 2020 stands out as lower in both of these comparisons (noted with a circle on the plots). These data are during

a time period where we are lacking aerated DI readings from the station. We are there for unable to determine whether the observed data are accurately recording an anomaly in the pattern of DO at this station or whether, the assumption of linear drift and the correction applied to the data at this point are incorrect/insufficient.



Station DI readings

SATURN-04 on-station aerated DI readings						
Date	DO (%sat)		Date	DO (%sat)		
8/5/2020	82.36		9/4/2019	83.44	9/11/2018	86.19
7/28/2020	82.18		8/20/2019	84.48	8/27/2018	88.87
7/21/2020	82.34		8/13/2019	85.26	8/13/2018	89.38
7/14/2020	83.48		6/19/2019	84.11	8/6/2018	89.04
6/25/2020	82.26		6/19/2019	84.12	7/30/2018	88.48
6/16/2020	81.77		4/29/2019	83.37	7/23/2018	88.33
6/10/2020	81.83		2/21/2019	82.80	7/16/2018	89.38
6/1/2020	82.64		11/16/2018	84.21	6/6/2018	89.84
5/28/2020	83.30		10/9/2018	84.79	5/30/2018	88.95
5/20/2020	81.39		9/17/2018	87.50	5/22/2018	89.52