

Evaluation and Correction of SATURN-04 Dissolved Oxygen (DO) Measurements (7/1/20 – 12/1/20)

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*.

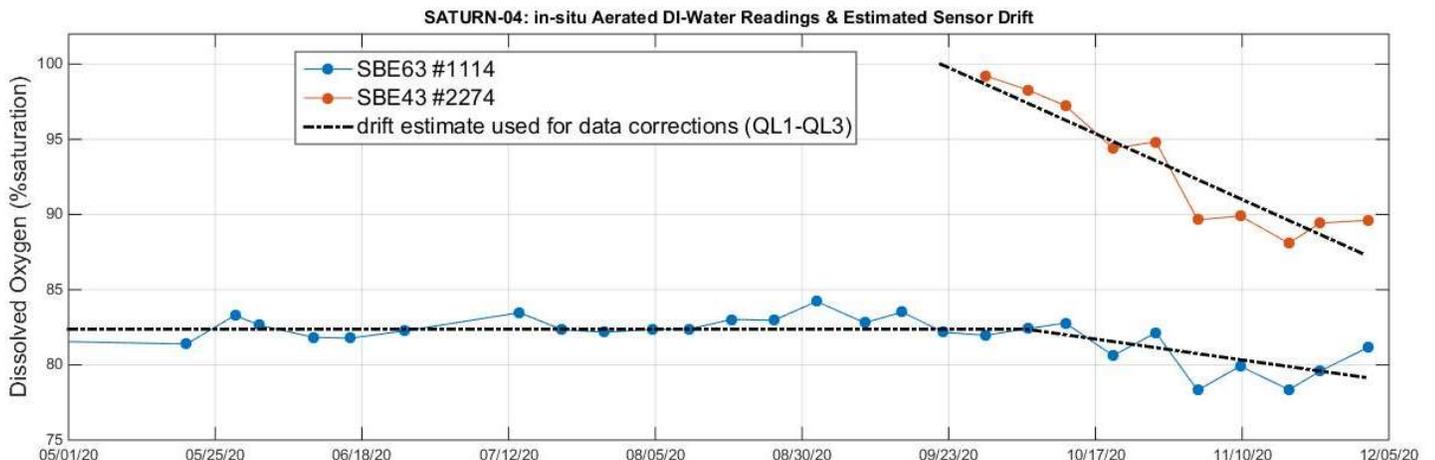
Data Evaluation & Correction Details:

The following sensors were deployed during this time period:

- **SBE63 #1114:** 4/14/18 – CURRENT (as of 12/1/20)
- **SBE43 #2274:** 9/22/20 – CURRENT (as of 12/1/20)

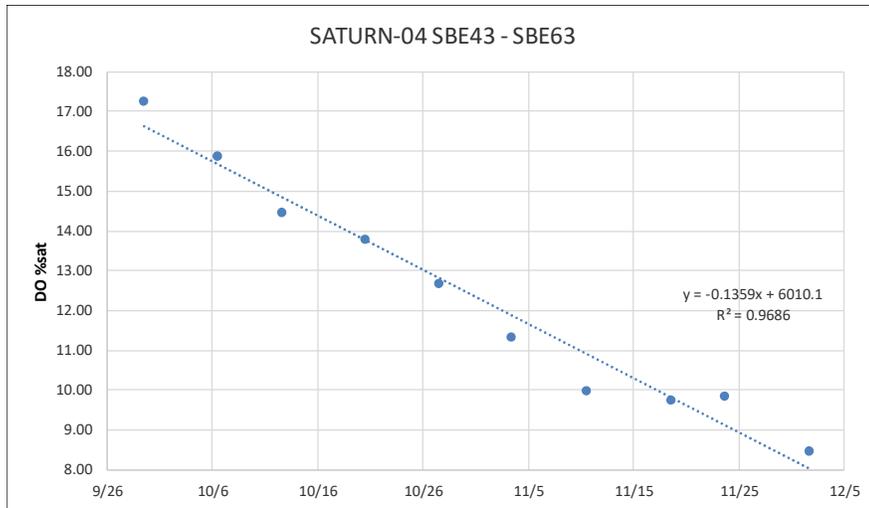
Drift Evaluation:

The optical dissolved oxygen sensor has been deployed at SATURN-04 since 2018. Quality control of the data from this sensor through 7/1/20 is covered in the previous QC document. While there had been periods of drift with the sensor reading significantly low by the summer of 2020, it was left in place and a second sensor was co-deployed with it. The drift of these sensors was monitored with weekly DI readings and was thus well captured.



As can be seen in the figure above, the optical sensor (SBE63# 1114; plotted in blue) remained stable for several months and only began further drift in early October 2020. The second sensor deployed at the station was an SBE43 (#2274; plotted in orange) and this sensor began drifting immediately following deployment and in a more rapid fashion than the optical sensor.

In the following figure the difference between the readings on the two sensors is plotted. The more rapid drift of the SBE43 resulted in a continuous decrease in the difference between the two sensors:



Correction Details:

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 :

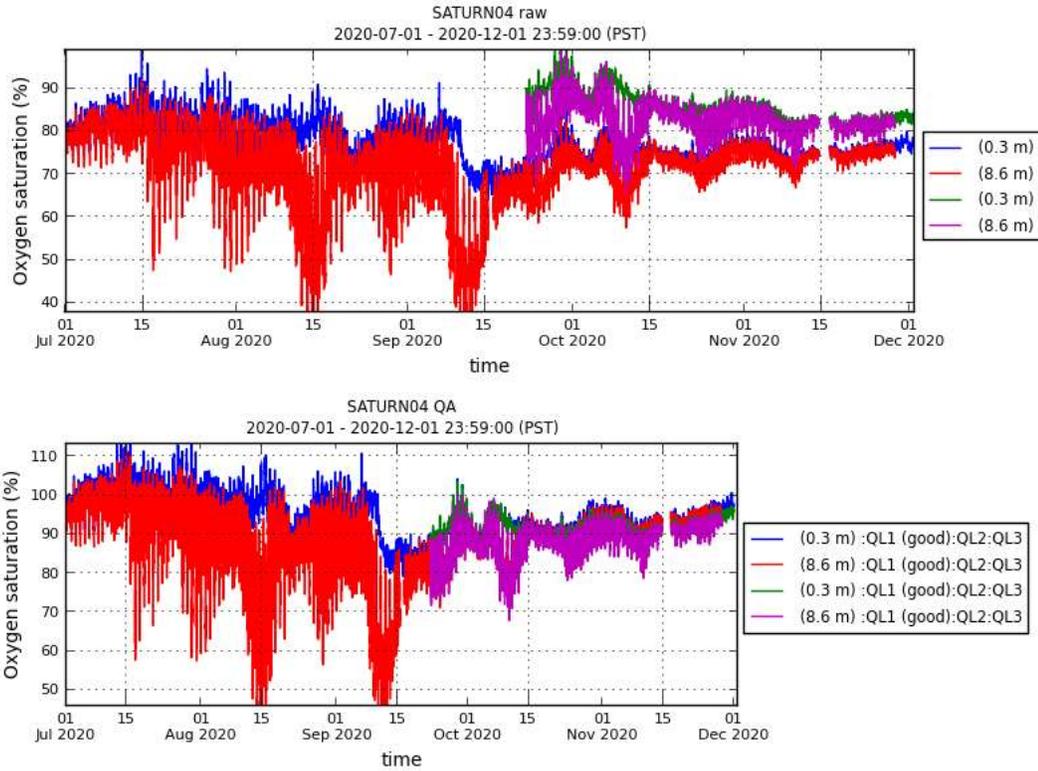
$$CF = 100\% / (\text{reading in 100\% aerated DI}) ; \quad \text{Corrected data} = \text{raw data} * CF.$$

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

Based on the DI data (provided at the end of this document), the following corrections were applied to the dissolved oxygen data. These corrections should be considered approximate the data used accordingly:

Sensor	Correction Start	Correction End	Starting Drift	Ending Drift	Starting CF	Ending CF	Quality Level
SBE #1114	5/1/2020	10/6/2020	-17.60%	-17.60%	1.214	1.214	QL3
SBE #1114	10/6/2020	12/1/2020	-17.60%	-20.80%	1.214	1.263	QL3
SBE63 #2274	9/22/2020	12/1/2020	0%	-12.60%	1.000	1.145	QL3

The following figures show the raw (top plot) and corrected (bottom plot) data from both sensors as plotted by the CMOP data explorer (http://www.stccmop.org/datamart/observation_network/dataexplorer):



Station DI readings

<i>SATURN-04 on-station aerated DI readings</i>				
Date	SBE63 #1114	Date	SBE63 #1114	SBE43 #2274
6/25/20 10:04	82.26	9/29/20 11:04	81.97	99.21
7/14/20 11:10	83.47	10/6/20 10:29	82.41	98.27
7/21/20 11:24	82.34	10/12/20 13:48	82.79	97.24
7/28/20 10:21	82.18	10/20/20 10:59	80.62	94.41
8/5/20 12:09	82.36	10/27/20 12:48	82.14	94.83
8/11/20 11:11	82.38	11/3/20 9:59	78.31	89.65
8/18/20 11:10	83.02	11/10/20 10:40	79.92	89.90
8/25/20 11:30	82.96	11/18/20 11:39	78.35	88.09
9/1/20 12:17	84.22	11/23/20 14:39	79.57	89.42
9/9/20 10:50	82.80	12/1/20 14:09	81.16	89.60
9/15/20 14:49	83.51	12/10/20 11:11	77.98	85.30
9/22/20 11:28	82.17			