

Correction of Dissolved Oxygen Measurements from Saturn03.

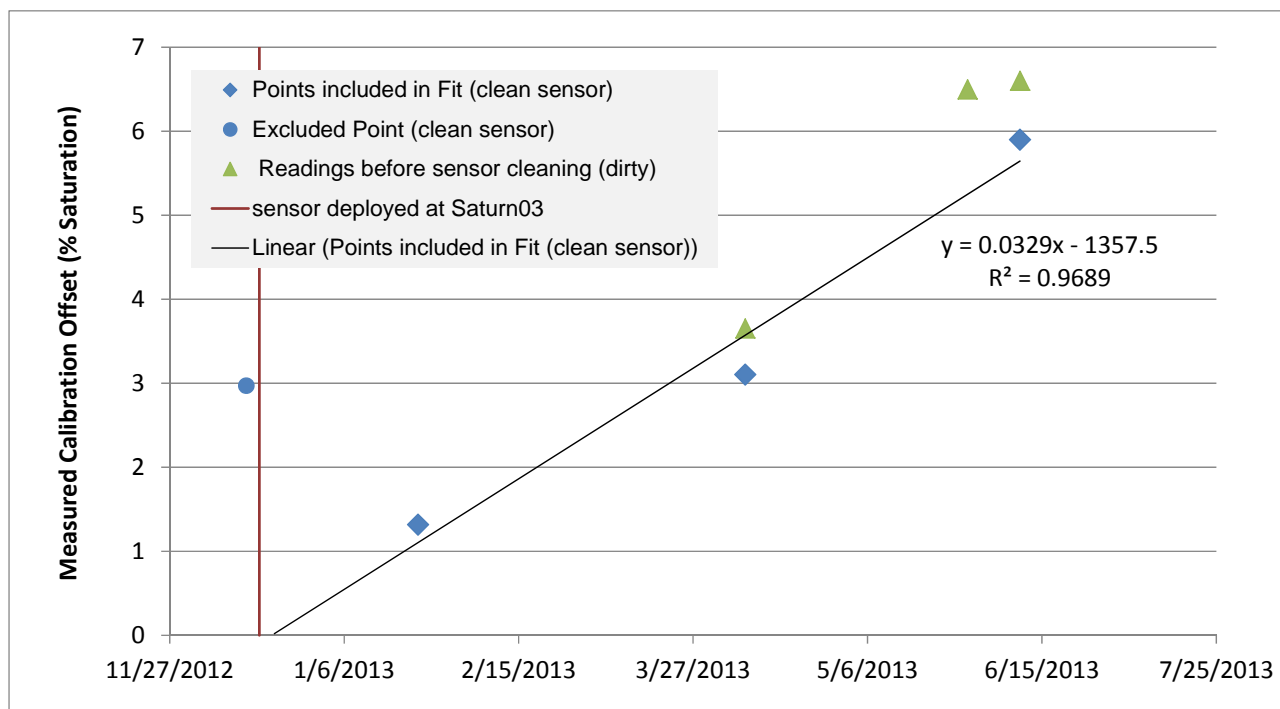
12/17/12 – 5/31/13

Summary:

The calibration was evaluated several times during the deployment of this sensor at Saturn03. There was a pre-deployment check on 12/14/12, mid-deployment checks on 1/23/13, 4/8/13, 5/29/13 and a post deployment check on 6/10/13. Typically, a reading of the sensor as recovered (“dirty”) and a reading following sensor cleaning (“clean”) is made to determine offset due to removable fouling vs. other offset. The table below shows the results of this sensor’s calibration evaluations. Offset indicates the difference, in percent saturation, between this sensor and the reference sensor(s) with good calibrations (or in other words, how low the sensor is reading).

Date	% offset	state	
12/14/2012	2.97	Clean	
12/17/2012	<i>sensor deployed at Saturn03</i>		
1/23/2013	1.32	Clean*	*only a single reading was made on 1/23/13. The sensor was not cleaned prior to the measurement but was deemed a clean reading because the sensor had not been deployed long and biological fouling in mid-winter is unlikely
4/8/2013	3.10	Clean	
4/8/2013	3.65	Dirty	
5/29/2013	6.49	Dirty	
6/10/2013	5.90	Clean	
6/10/2013	6.60	Dirty	

The following plot shows the “clean” readings in blue and the “dirty” readings in green. The “clean” readings (excluding the 12/14/12 reading) indicate that the sensor offset increased linearly over time. The 12/14/12 point is considered suspect and was excluded from the analysis because it is atypical for a sensor to recover or improve in subsequent calibration checks. Calibration checks always show that a sensor is stable or progressively deteriorating, and bad readings show the sensor to be reading low, not high.



The “dirty” data points show that in addition to the calibration drift, a small amount of fouling occurred. The fouling removed on 4/8/13 was reducing the sensor readings by an additional 0.5%, and the fouling removed at the end of the deployment was reducing the sensor readings by an additional 0.7%. No corrections for the effects of fouling have been applied to the data.

Calibration Correction Details:

The correction factor (CF) is the ratio of the known good reading/observed reading :

$$CF = 100\% / (100\% - \%offset)$$

$$\text{Corrected data} = \text{raw data} * CF.$$

The %offset on 5/31/13 was determined to be 5.38% using the linear fit shown above.

$$CF_{(5/31/13)} = 100 / (100 - 5.38) = 1.057$$

The estimated onset of drift (where CF = 1), calculated as the intercept of the linear fit shown above = 12/18/12 09:33, less than 24 hours after the deployment of the sensor at Saturn03.

A linear interpolation of the CF at the onset of drift to the maximum CF on 5/31/13 was used to correct the data. The corrected dissolved oxygen data (ml/l) are shown in yellow in the plot below with the raw data shown in grey. The data shown in green are from a newly calibrated sensor deployed at Saturn03 (and red data indicate bad data).

