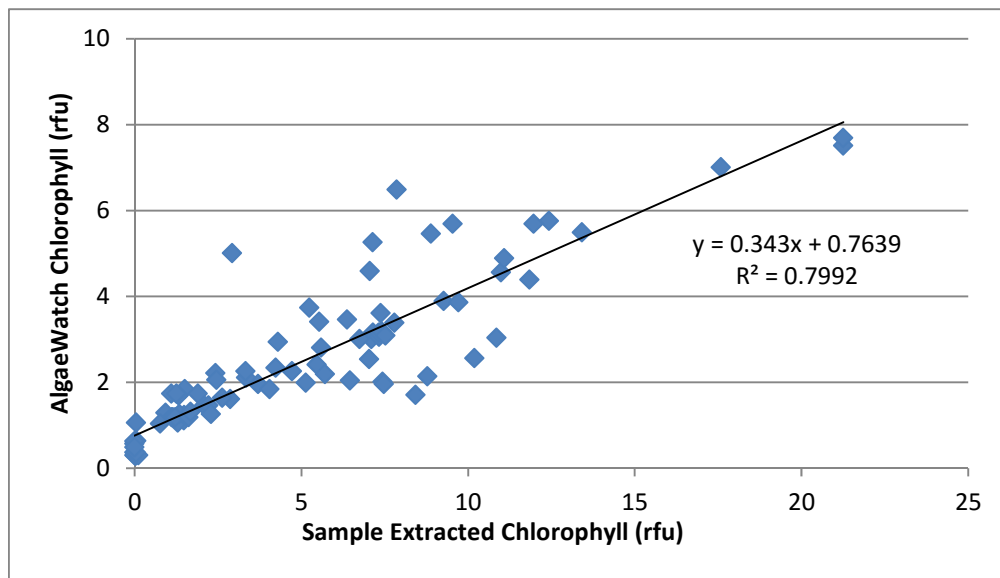


SATURN-03 Chlorophyll Sensor Field Calibration (January – December 2014)

**retroactively applied to data from August 2012 – Dec2013*

Update Notice, August 2016:

The calibration has been updated to fit the sensor readout against the extracted chlorophyll values, with sensor output at the dependent variable. The previous fit incorrectly used sensor output (rfu) as the independent variable. See the end of this document for figures of old vs. new calibration fits and the resulting change in final data values.



Calibration Details:

This sensor was calibrated against extracted chlorophyll samples taken from weekly field samples collected between January and December 2014. The corresponding sensor reading was determined by interpolating the *in situ* sensor data to the grab sample time point. Several samples were excluded because there was not corresponding station data. Data from 71 grab samples and 19 in-situ DI readings made at SATURN-03 were used to calculate the relationship between sensor response and extracted chlorophyll concentration (see table below). The resulting calibration equation is: Chlorophyll (ug/L) = 2.915 * rfu – 2.227. The calibration quality has been flagged as good (QL1).

Field Sample Data for calibration:

<i>Date & Time</i>	<i>Station Chl (rfu)</i>	<i>Sample Chl (ug/L)</i>	<i>Depth (m)</i>	<i>Filter Type</i>	<i>Turbidity</i>
1/9/2014 11:38	1.45	2.09	8	GF/F	2.42
1/9/2014 11:43	1.83	1.51	13	GF/F	2.81
1/9/2014 11:47	1.28	0.93	2	GF/F	2.31
1/15/2014 10:55	1.1	1.48	8	GF/F	3.06
1/15/2014 10:57	1.05	1.29	2	GF/F	2.66
1/15/2014 11:01	1.45	2.22	13	GF/F	4.04
1/23/2014 10:45	1.25	2.29	2	GF/F	2.61
1/23/2014 10:47	1.23	1.49	8	GF/F	2.73
1/23/2014 10:49	1.25	1.34	13	GF/F	3.12
2/4/2014 11:34	2.2	2.43	8	GF/F	2.89
2/4/2014 11:38	2.05	2.46	2	GF/F	2.83
2/4/2014 11:55	1.6	2.87	13	GF/F	2.98
2/11/2014 14:40	1.18	1.11	8	GF/F	2.47
2/11/2014 14:46	1.73	1.9	13	GF/F	3.03
4/14/2014 10:55	5.75	12.43	2	GF/F	3.76
4/14/2014 11:03	7.5	21.25	8	GF/F	5.89
4/23/2014 15:56	5.45	8.89	2	GF/F	2.78
4/23/2014 16:00	3.15	7.15	13	GF/F	2.69
4/23/2014 16:06	4.58	7.05	8	GF/F	2.81
4/30/2014 14:05	3.4	5.54	2	GF/F	2.59
4/30/2014 14:15	3.6	7.38	8	GF/F	2.91
4/30/2014 15:43	0.29	0.05	DI	GF/F	0
5/22/2014 9:26	3	7.1	13	GF/F	2.61
5/22/2014 9:29	2.53	7.03	8	GF/F	2.3
5/22/2014 9:32	5.68	9.54	2	GF/F	2.35
5/22/2014 10:37	0.29	0	DI	GF/F	0
6/6/2014 10:19	3	6.75	2	GF/F	2.26
6/6/2014 10:23	2.8	5.59	8	GF/F	2.28
6/6/2014 10:25	3.05	7.33	13	GF/F	2.81
6/6/2014 11:29	0.36	0	DI	GF/F	0
6/12/2014 13:00	3.15	7.32	2	GF/F	2.19
6/12/2014 13:01	4.38	11.84	13	GF/F	3
6/12/2014 13:05	3.88	9.27	8	GF/F	2.45
6/12/2014 14:53	0.28	0.03	DI	GF/F	0
6/16/2014 15:03	5.48	13.42	2	GF/F	2.99
6/16/2014 15:07	7	17.58	8	GF/F	3.96
6/16/2014 15:10	7.68	21.25	13	GF/F	4.64
6/16/2014 16:11	0.29	-0.01	DI	GF/F	0
7/1/2014 15:16	1.05	0.05	DI	GF/F	0
7/10/2014 15:03	1.95	3.7	2	GF/F	NaN
7/10/2014 15:05	2	7.44	13	GF/F	NaN
7/10/2014 15:07	2.4	5.46	8	GF/F	NaN
7/10/2014 16:06	0.63	0.06	DI	GF/F	0

7/16/2014 10:04	3.18	7.41	2	GF/F	NaN
7/16/2014 10:07	3.38	7.79	8	GF/F	3.68
7/16/2014 10:09	3.85	9.71	13	GF/F	4.06
7/16/2014 11:14	0.3	-0.01	DI	GF/F	0
7/24/2014 10:24	4.55	10.99	8	GF/F	3.06
7/24/2014 10:27	3.73	5.24	2	GF/F	2.58
7/24/2014 10:29	6.48	7.86	13	GF/F	4
7/24/2014 11:49	0.29	0.11	DI	GF/F	0
7/29/2014 12:00	3.03	10.85	2	GF/F	2.59
7/29/2014 13:07	0.35	0.05	DI	GF/F	0
7/29/2014 13:27	5.68	11.97	13	GF/F	4.99
8/6/2014 10:29	3.45	6.37	2	HAWP	2.13
8/6/2014 10:34	4.88	11.08	13	HAWP	2.72
8/13/2014 10:16	1.98	5.13	8	HAWP	2.83
8/13/2014 10:19	2.55	10.19	13	HAWP	2.93
8/13/2014 10:21	2.03	6.46	2	HAWP	2.79
8/13/2014 11:26	0.31	-0.01	DI	HAWP	0
8/18/2014 11:20	5	2.93	8	HAWP	2.14
8/18/2014 11:23	1.7	8.43	2	HAWP	2.02
8/18/2014 11:25	5.25	7.14	13	HAWP	2.3
8/18/2014 12:47	0.28	-0.01	DI	HAWP	0
8/27/2014 9:40	2.93	4.3	2	GF/F	2.41
8/27/2014 9:43	3.08	7.52	13	HAWP	2.86
8/27/2014 10:47	0.33	-0.01	DI	HAWP	0
9/9/2014 8:45	1.63	2.63	2	HAWP	2.24
9/9/2014 8:47	1.83	4.05	8	HAWP	2.26
9/9/2014 8:49	2.1	3.35	13	HAWP	NaN
9/9/2014 9:53	0.29	-0.01	DI	HAWP	0
9/18/2014 13:54	2.33	4.23	2	GF/F	2.1
9/18/2014 13:55	2.13	8.78	8	HAWP	2.14
9/18/2014 13:57	2.18	5.71	13	HAWP	2.18
9/18/2014 15:06	0.5	-0.01	DI	HAWP	0
9/25/2014 11:41	2.25	3.33	13	GF/F	3.05
9/25/2014 11:43	2.25	4.72	8	HAWP	2.84
9/25/2014 11:45	1.95	7.48	2	HAWP	2.47
9/25/2014 13:42	0.56	0	DI	GF/F	0
9/30/2014 14:24	1.18	1.15	2	HAWP	2.27
9/30/2014 14:26	1.18	1.22	8	HAWP	2.37
9/30/2014 14:28	1.18	1.62	13	HAWP	2.43
9/30/2014 15:44	0.91	-0.01	DI	HAWP	0
10/23/2014 9:15	1.3	1.68	2	HAWP	2.62
10/23/2014 9:19	1.73	1.1	8	HAWP	3.25
10/23/2014 10:22	0.62	0	DI	GF/F	0
11/18/2014 10:33	1.03	0.77	2	HAWP	2.37
11/18/2014 10:45	1.68	1.32	8	HAWP	2.43
11/18/2014 10:54	1.73	1.26	13	HAWP	2.38

Following sample removed from revised calibration

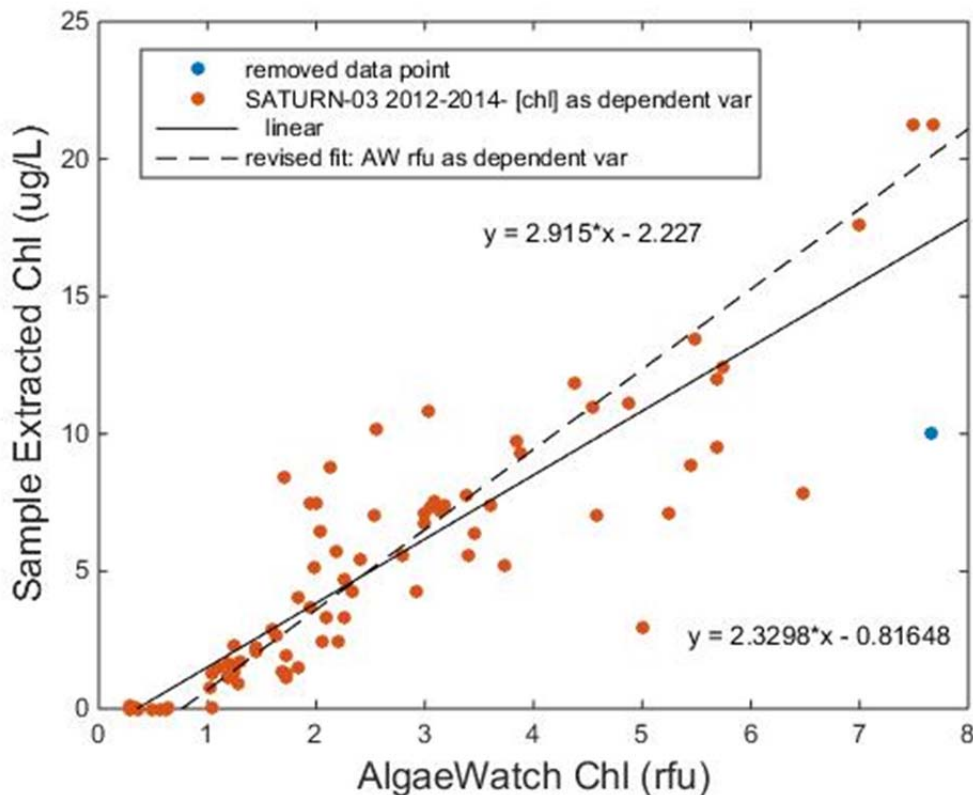
4/14/2014 11:08	7.65	9.99	13	GF/F	6.58
-----------------	------	------	----	------	------

Application of 2014 calibration to earlier data:

The sensor was deployed in mid-August 2012 when it replaced a Turner Designs Cyclops sensor previously deployed at the station. Field samples were not collected at the station until 2014. The calibration described here has been applied back to the beginning of the deployment in mid-2012. The early data using this calibration are in good agreement with independently calibrated data from the previously deployed cyclops sensor. In addition, we have seen small variation in the year to year changes in the SATURN-03 calibration since 2014.

2016 Revised Calibration vs. Previous Calibration:

A single 13m sample was removed due to high turbidity (see the table above). In addition, the original calibration fit incorrectly fit sensor output as the independent variable (shown as the solid line in the figure below). Revising the fit to the one shown at the top of this document, with sensor output as the dependent variable, changed the resulting equation and is shown on the plot below as the dashed line.



Approximately 92% of the change in chlorophyll values are within $\pm 2 \mu\text{g/L}$, however high chlorophyll values increased by close to 24% of their previous values. Changes to the chlorophyll data are summarized in the following figures.

