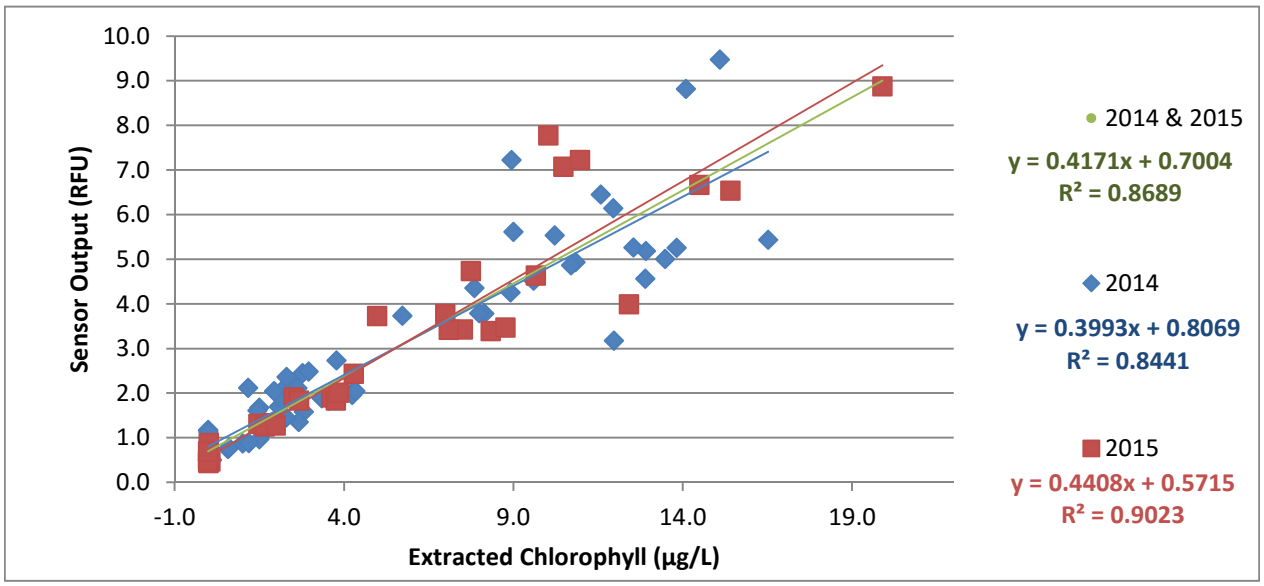
SATURN-04 Chlorophyll Sensor Field Calibration (January 2014 – December 2015)

Update Notice, August 2016:

The calibration has been updated from the previously released version of data. See the end of this document for a description of changes made and the resulting changes in final data values.

Note: these changes affect only previously released quality controlled data between January 2014 & March 1st 2015.



Calibration Details:

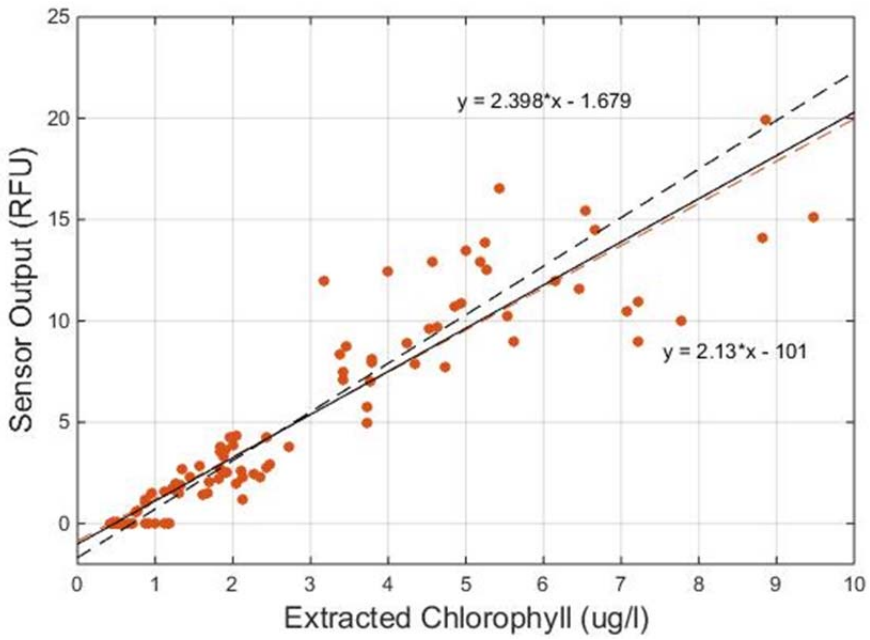
Data from field samples collected during 2014 and 2015 were compared with the chlorophyll sensor output at SATURN-04 (see table at the end of this document). Data from 2014 and from 2015 (blue and red, respectively, in the figure above) indicate that the sensor response was stable over these two years. The difference in the data regressions between the two years was small and likely within the range of error associated with these measurements. The data set was therefore treated as a whole and the relationship between sensor output and chlorophyll concentration was determined (green line in figure above). The resulting relationship was used to calibrate sensor output in relative fluorescence units (RFU) to chlorophyll concentration (µg/L): Chlorophyll (µg/L) = 2.398*rfu – 1.679.

No field samples were collected for extracted chlorophyll measurement during 2012 & 2013. This calibration based on 2014 data is very similar to the calibration based on 2010 and 2011 data, indicating that the sensor has remained stable (aside from shifts in baseline which have been corrected for separately) . This calibration was applied to data in 2013 while the previous calibration was applied to the 2012 data.

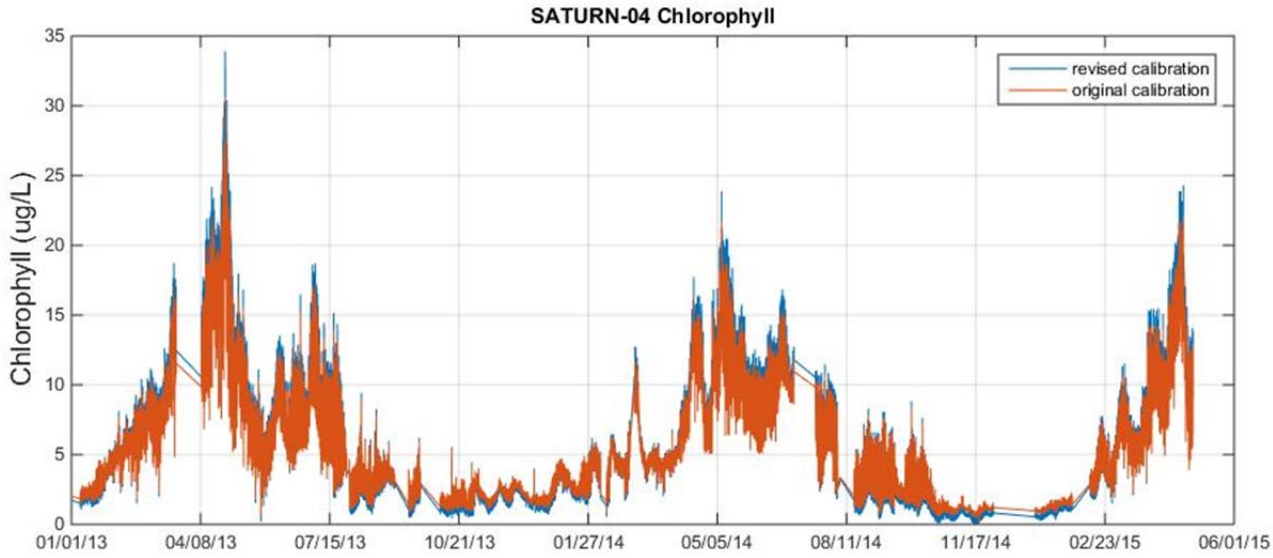
Revised Calibration vs. Previous Calibration:

only relevant to previously released quality controlled data between January 2014 & February 2015. Data after February 2015 were not previously calibrated

The originally released calibration has been revised to include additional samples from 2015. Four DI water samples were also excluded as they were duplicates samples made with a different filter type (GF/F filters vs. HAWP filters). In addition, the regression was corrected so that extracted chlorophyll concentration (µg/L) was defined as the independent variable and sensor output (RFU) as the dependent variable. Revising the regression to the one shown at the top of this document (with sensor output as the dependent variable) changed the resulting equation from: Chl(µg/L) = 2.13 * rfu – 1.01 to Chl(µg/L) = 2.398*rfu -1.679. The plot below shows the original calibration and fit as the black solid line. The minimal change in fit based on the addition of samples from 2015 and removal of duplicate DI samples is shown as the dashed red line. The final revised fit is shown as the dashed black line. This fit includes both the change in sample data and the change in regression (fitting sensor output as the dependent variable). The largest changes in final data values will be seen at high chlorophyll levels.



After revising the calibration, greater than 99% of the changes in final chlorophyll values are within ± 2 µg/L and the maximum change in values is 5.25 µg/L. The figure below shows the data calibrated with both the previous and revised calibrations:



Field Sample Data Used in Calibration:

Filter Type	*Sample Time*	*Level (cm)*	*Sample Chl (µg/L)*	*Station Chl*
GF/F	1/9/14 15:01	8.6	1.177	2.118
GF/F	1/9/14 15:12	0.3	2.268	2.128
GF/F	1/15/14 16:50	0.3	2.082	1.690
GF/F	1/15/14 17:05	8.6	1.505	1.670
GF/F	1/23/14 16:50	0.3	2.781	2.440
GF/F	1/23/14 17:05	8.6	2.433	2.260
GF/F	1/28/14 16:31	8.6	2.627	2.110
GF/F	1/28/14 16:34	0.3	2.307	2.360
GF/F	2/4/14 13:32	0.3	2.537	1.920
GF/F	2/4/14 13:35	8.6	2.955	2.480
GF/F	2/11/14 15:52	0.3	1.936	2.040
GF/F	2/11/14 15:57	8.6	1.443	1.610
GF/F	4/14/14 12:40	8.6	16.526	5.430
GF/F	4/14/14 12:55	0.3	12.898	4.560
GF/F	4/24/14 13:48	0.3	10.222	5.530
GF/F	4/24/14 14:01	8.6	11.587	6.450
GF/F	4/25/14 0:00	0	-0.005	0.524
GF/F	4/30/14 0:00	0	0.045	0.472
GF/F	5/1/14 12:43	8.6	9.009	5.610
GF/F	5/1/14 12:53	0.3	8.144	3.780
GF/F	5/8/14 12:52	8.6	14.097	8.810
GF/F	5/8/14 13:02	0.3	15.102	9.470

GF/F	5/14/14 10:38	8.6	8.945	7.220
GF/F	5/14/14 10:51	0.3	10.835	4.930
GF/F	5/22/14 12:10	0.3	11.956	6.140
GF/F	5/30/14 13:21	8.6	8.920	4.250
GF/F	5/30/14 13:30	0.3	7.994	3.790
GF/F	6/6/14 13:41	0.3	10.708	4.860
GF/F	6/6/14 13:45	8.6	9.601	4.520
GF/F	6/12/14 15:22	0.3	13.488	5.000
GF/F	6/12/14 15:24	8.6	12.920	5.180
GF/F	6/17/14 10:52	0.3	13.827	5.250
GF/F	6/17/14 11:01	8.6	12.550	5.260
GF/F	7/16/14 0:00	0	-0.007	1.171
GF/F	7/24/14 0:00	0	0.106	0.501
GF/F	7/24/14 15:04	8.6	5.728	3.730
GF/F	7/24/14 15:14	0.3	11.970	3.170
GF/F	7/29/14 0:00	0	0.045	0.569
GF/F	7/29/14 14:10	0.3	7.856	4.350
HAWP	8/18/14 0:00	0	-0.010	0.470
HAWP	8/19/14 9:22	0.3	4.232	2.010
HAWP	8/19/14 9:25	8.6	1.762	1.220
HAWP	8/27/14 0:00	0	-0.006	1.157
HAWP	8/28/14 10:03	8.6	3.556	1.830
HAWP	8/28/14 10:11	0.3	3.785	2.730
HAWP	9/4/14 0:00	0	-0.009	0.995
HAWP	9/4/14 15:43	8.6	2.820	1.580
HAWP	9/4/14 15:55	0.3	4.241	1.960
HAWP	9/16/14 0:00	0	-0.006	0.653
HAWP	9/16/14 10:12	0.3	3.347	1.880
HAWP	9/16/14 10:14	8.6	1.579	1.110
GF/F	9/24/14 0:00	0	-0.002	1.120
HAWP	9/24/14 12:24	8.6	2.666	1.350
HAWP	9/30/14 0:00	0	-0.014	0.508
HAWP	10/1/14 9:04	8.6	2.226	1.820
HAWP	10/1/14 9:10	0.3	4.341	2.040
HAWP	10/17/14 13:25	0.3	2.293	1.450
HAWP	10/17/14 13:30	8.6	1.010	0.870
HAWP	10/23/14 0:00	0	-0.003	0.491
HAWP	10/23/14 14:25	0.3	1.502	0.960
HAWP	10/23/14 14:35	8.6	1.197	0.880
HAWP	11/18/14 0:00	0	-0.002	0.910
HAWP	11/18/14 12:16	0.3	0.580	0.740
HAWP	11/18/14 12:20	8.6	0.604	0.770
HAWP	12/3/14 0:00	0	0.004	0.508
HAWP	1/20/15 0:00	0	0.003	0.477
HAWP	2/11/15 15:30	0.3	2.513	1.900
HAWP	2/11/15 15:30	0.3	3.632	1.900
HAWP	2/11/15 15:33	8.6	2.677	1.830

HAWP	2/11/15 15:33	8.6	3.764	1.830
HAWP	2/12/15 0:00	0	-0.001	0.450
HAWP	2/24/15 0:00	0	0.055	0.466
HAWP	2/25/15 11:08	0.3	4.289	2.430
HAWP	2/25/15 11:12	8.6	3.857	2.010
HAWP	3/3/15 0:00	0	-0.001	0.461
HAWP	3/4/15 0:00	0	0.010	0.460
HAWP	3/12/15 9:40	8.6	4.980	3.721
HAWP	3/13/15 0:00	0	0.000	0.540
HAWP	3/19/15 0:00	0	0.000	0.430
HAWP	3/24/15 12:50	8.6	6.990	3.769
HAWP	3/24/15 12:56	0.3	7.510	3.425
HAWP	4/7/15 8:31	8.6	7.750	4.729
HAWP	4/16/15 0:00	0	0.000	0.490
HAWP	4/17/15 13:10	8.6	10.040	7.771
HAWP	4/20/15 0:00	0	0.000	0.450
HAWP	4/20/15 13:05	0.3	19.900	8.869
HAWP	5/1/15 0:00	0	0.000	0.540
HAWP	5/1/15 11:15	0.3	8.340	3.388
HAWP	5/1/15 11:21	8.6	12.420	3.985
HAWP	5/18/15 0:00	0	0.010	0.880
HAWP	5/18/15 8:50	0.3	10.480	7.070
HAWP	5/18/15 9:08	8.6	10.970	7.220
HAWP	5/28/15 0:00	0	0.010	0.490
HAWP	5/28/15 10:30	0.3	15.410	6.530
HAWP	5/28/15 10:35	8.6	14.500	6.660
HAWP	6/2/15 0:00	0	0.010	0.530
HAWP	6/3/15 9:05	0.3	8.770	3.468
HAWP	6/3/15 9:10	8.6	7.100	3.412
HAWP	6/7/15 0:00	0	0.000	0.460
HAWP	6/8/15 10:03	8.6	9.670	4.632
HAWP	6/17/2015 15:18	0	-0.0086	0.52
HAWP	6/24/2015 11:51	0	-0.0086	0.47
HAWP	7/1/2015 14:43	0	-0.0102	0.46
HAWP	7/28/2015 9:24	0	-0.0083	0.7
HAWP	7/28/2015 9:27	0.3	1.8953	1.32
HAWP	7/28/2015 9:32	8.6	1.4728	1.31
HAWP	8/20/2015 14:06	0	-0.0043	0.68
HAWP	8/20/2015 12:55	0.3	1.6695	1.25
HAWP	8/20/2015 13:02	8.6	1.9888	1.27