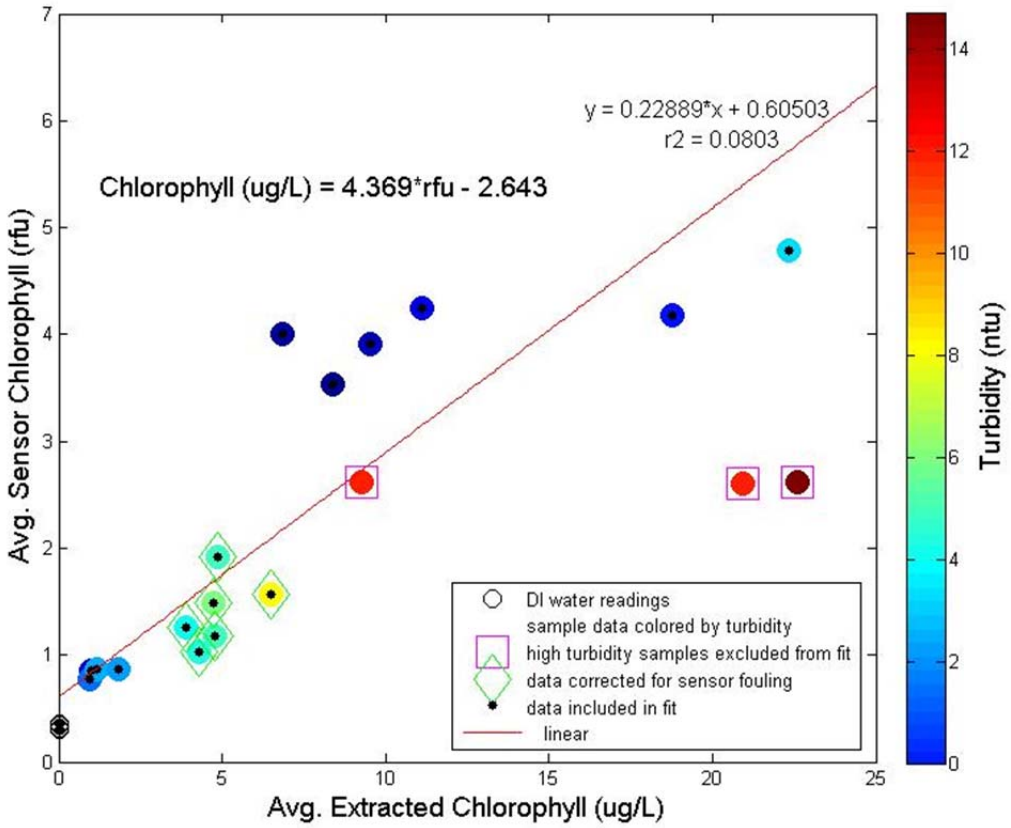
SATURN-03 Chlorophyll Sensor Field Calibration (Oct.2010 – Sept.2011)

Update Notice, July 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.

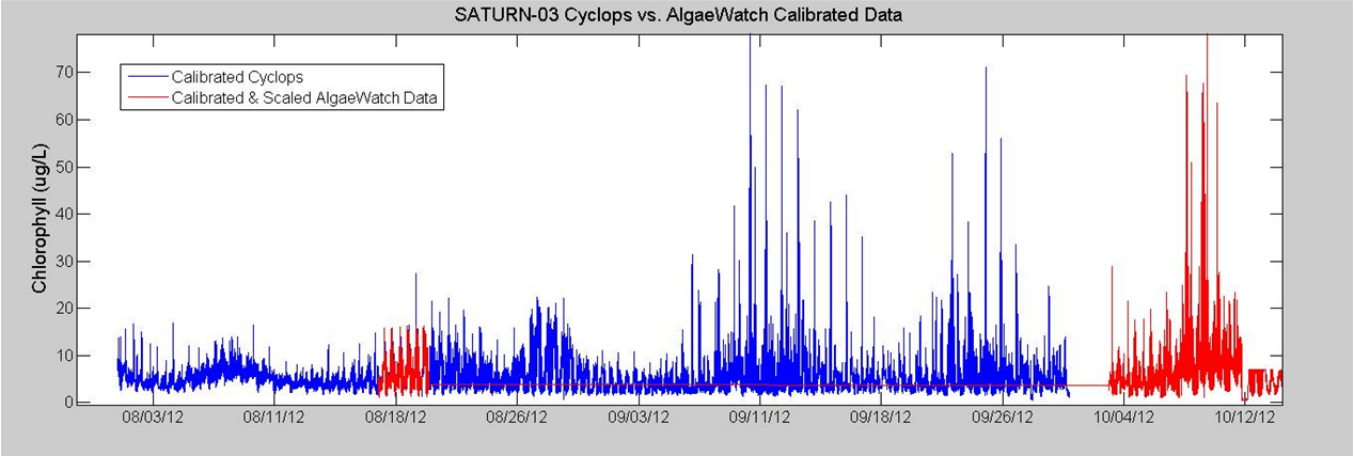


Calibration Details:

This sensor was calibrated against extracted chlorophyll samples taken from periodic field samples collected between October 2010 and September 2011. Field samples prior to January 2011 were analyzed for extracted chlorophyll using the acidification method for chlorophyll determination, while samples after this date were analyzed using the Welschmeyer non-acidification method of chlorophyll determination. The corresponding sensor reading was determined by interpolating the *in situ* sensor data to the grab sample time point. Three samples (points enclosed in squares on the plot above) were excluded from the calibration due to high turbidity levels at the time of sampling (known to have an effect on the sensor chlorophyll readings). In

addition, the sensor data for 6 time points are taken from periods when the data were corrected for sensor fouling using frequent DI measurements (see note s3-chl02). Several sensor DI measurements were also included in the calibration (see table below). The resulting calibration equation is: Chlorophyll (ug/L) = 4.369 * rfu – 2.643. The calibration quality has been flagged as less than good (QL3) because it lacks samples from periods of high biomass, is based on only 17 samples from 6 sampling times, and because some of the sensor data is from periods where the data was corrected for fouling.

This calibration was extended to the end of the sensor's deployment in September 2012. Comparison to field calibrated data from the AlgaeWatch which was deployed in August 2012 show that the calibrated data from the two sensors are in close agreement (see figure below), lending support to extending the Cyclops calibration past the sampling period.



Field Sample Data included in Calibration:

Sample Date	depth (cm)	sensor RFU	Avg. Sample Chl (rfu)	st.dev	#samples
10/22/2010	240	3.53	8.38	0.93	2
1/10/2011	240		1.44	0.02	3
4/28/2011	240	4.24	11.10	2.50	3
7/26/2011	240	1.92	4.85	0.32	3
9/7/2011	240	1.26	3.89	0.00	1
10/22/2010	820	4.00	6.84	0.17	2
12/22/2010	820	0.85	1.00	0.05	3
12/22/2010	820	0.78	0.95	0.04	3
1/10/2011	820	0.87	1.17	0.10	3
4/28/2011	820	4.18	18.79	6.00	3
7/26/2011	820	1.18	4.77	0.69	3
9/7/2011	820	1.04	4.31	0.00	1
10/22/2010	1300	3.91	9.54	3.93	2
1/10/2011	1300	0.87	1.84	0.11	3
4/28/2011	1300	4.79	22.33	7.50	3
7/26/2011	1300	1.48	4.74	0.05	3
9/7/2011	1300	1.57	6.51	0.00	1
7/11/2011	DI	0.36	0.00		
10/18/2011	DI	0.30	0.00		
10/24/2011	DI	0.32	0.00		
10/26/2011	DI	0.35	0.00		
10/28/2011	DI	0.32	0.00		

Sample Collection: Whole water samples were collected from the pump at the station. The samples were stored in amber HDPE bottles and shipped overnight on blue ice to the Peterson/Needoba lab at OGI in Beaverton. The samples were then stored refrigerated until processing within 24 hours of receipt.

Sample Processing Details:

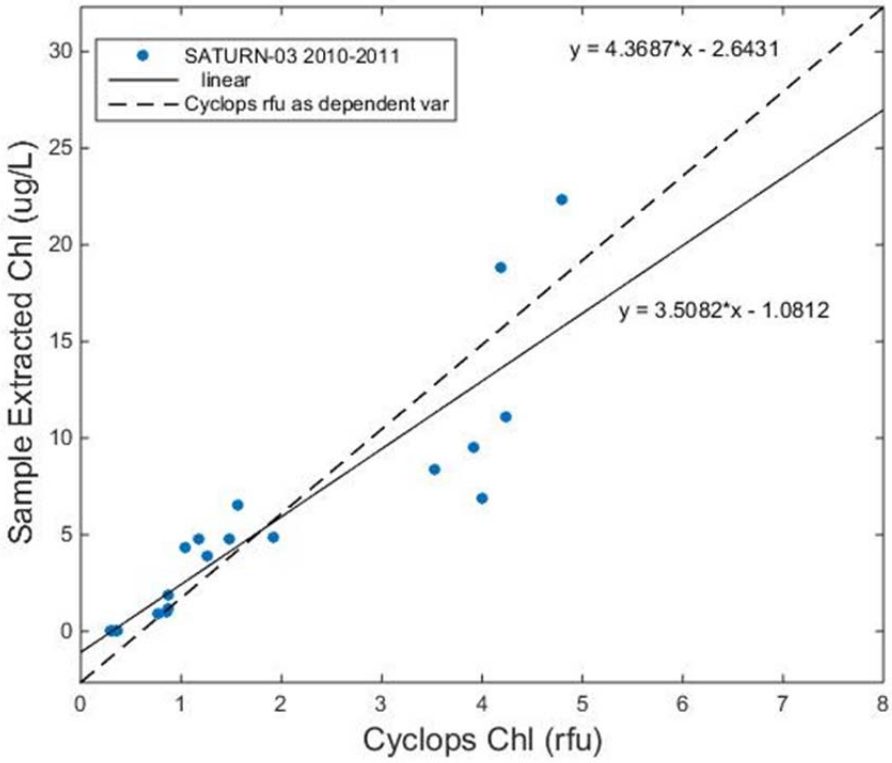
1. 100mL of sample is filtered onto a Whatman GF/F under low vacuum. The filter is folded, placed into a cryovial and stored at -80°C.
2. When ready to process the samples, the filters are placed in glass test tubes and 5mL of 90% acetone is added (under dimmed lights). Three acetone blank test tub are also prepared.
3. Samples are allowed to extract for 24 hours in the dark at -20°C.
4. After extracting, samples are allowed to warm to room temperature in the dark.
5. Measure the extracted sample on benchtop fluorometer:
    a. Non-Acidification Method (used after January 2011)
        - Vortex test tube.
        - Filter removed with forceps and discarded
        - Wipe test tube with kimwipe.
        - Measure Raw Fluorescence (F0).

- Measure the 3 acetone blanks

b. Acidification Method (used prior to January 2011)
   - Vortex test tube.
   - Filter removed with forceps and discarded
   - Wipe test tube with kimwipe.
   - Measure Raw Fluorescence (F0).
   - Add 3 drops 10% HCl.
   - Invert test tube.
   - Measure Raw Fluorescence (Fa = acidified)
   - Measure 3 Blanks without adding acid.

2016 Revised Calibration vs. Previous Calibration:

The original calibration fit, shown below as the solid line, incorrectly fitted sensor output as the independent variable. Revising the fit to the one shown at the top of this document changed the resulting equation and is shown below as the dashed line.



Approximately 90% of the change in chlorophyll values are within ± 2 µg/L, however high chlorophyll values increased by close to 23%. Changes to the chlorophyll data are summarized in the following figures.