A brief update/refresher on nitrate/pH sensor performance, QC/adjustments and algorithm updates

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Publications/Products

Deep-Sea DuraFET: A Pressure Tolerant pH Sensor Designed for Global Sensor Networks
Publication Date (Web): February 18, 2016 (Article)
DOI: 10.1021/acs.analchem.5b04653
Increasing atmospheric carbon dioxide is driving a long-term decrease in ocean pH which is superimposed on daily to seasonal variability. These changes impact ecosystem processes, and they serve as a record of ecosystem metabolism. However, the temporal …

Geophysical Research Letters

RESEARCH LETTER
10.1002/2016GL068539

Empirical algorithms to estimate water column pH in the Southern Ocean
N. L. Williams¹, L. W. Juranek¹, K. S. Johnson², R. A. Feely³, S. C. Riser⁴, L. D. Talley⁵, J. L. Russell⁶, J. L. Sarmiento⁷, and R. Wanninkhof⁸

Key Points:
• Algorithms are developed for estimation of pH from biogeochemical floats
## Year 2 Progress

<table>
<thead>
<tr>
<th></th>
<th>Oxygen</th>
<th>Nitrate</th>
<th>pH</th>
<th>Bio-optics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Bad</td>
<td>% Good</td>
<td>Total</td>
</tr>
<tr>
<td>EAGER Sensors</td>
<td>12</td>
<td>0</td>
<td>100</td>
<td>8</td>
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<tr>
<td>EAGER Profiles</td>
<td>1076</td>
<td>1</td>
<td>100</td>
<td>701</td>
</tr>
<tr>
<td>SOCCOM Sensors</td>
<td>41</td>
<td>0</td>
<td>100</td>
<td>41</td>
</tr>
<tr>
<td>SOCCOM Profiles</td>
<td>1179</td>
<td>0</td>
<td>100</td>
<td>1179</td>
</tr>
</tbody>
</table>

- Data from [http://soccom.ucsd.edu/floats/SOCCOM_float_stats.html](http://soccom.ucsd.edu/floats/SOCCOM_float_stats.html) and 5 floats not yet in QC process.
What’s working, what not, what’s next? (subjects for later Discussion)

- pH sensor calibration and drift largely corrected.

### Mean pH sensor drift

<table>
<thead>
<tr>
<th>Deployment</th>
<th>pH/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (P16S)</td>
<td>-0.084</td>
</tr>
<tr>
<td>2 (A12)</td>
<td>-0.028</td>
</tr>
<tr>
<td>3 (SOTS)</td>
<td>-0.014*</td>
</tr>
<tr>
<td>4 (2016)</td>
<td>0**</td>
</tr>
</tbody>
</table>

2016 floats with old calibration method

2016 floats with new calibration
Deep NO3 [1450 1550 meters]
Float NO3 slope = -2.8653
Regressed NO3 slope = -0.1760

NO3 anomaly (float - William's regression)
NO3 difference trend = -2.6892
Float 9313 adjusted data

Nitrate, 1, 1, 0, 0
Nitrate, 2, 1, -1, 0
Nitrate, 3, 1, -2.2, -3.4
Nitrate, 30, 1, 0, 0
Argue for a 2%/km pressure reduction in the bromide absorption spectrum of seawater.
$y = -2.38 \times 10^{-6}x + 1.06 \times 10^{-1}$

$R^2 = 9.75 \times 10^{-1}$

ESW @ 217 nm  1.8°C   240-260 nm baseline corrected
Processing Bio-Argo nitrate concentration at the DAC Level

Version 1.0
May 3\textsuperscript{rd} 2016

3.2 Pressure effect

Some studies conducted in low nutrient concentrations highlighted a possible pressure dependency of the bromide absorption spectrum (Pasquero, Fommervault et al., 2015). Some experiments in lab will be performed soon at MBARI.

The equation 4 is changed in:

\[
\text{ABSORBANCE}_{\text{COR NITRATE}}(R) = \text{ABSORBANCE}_{\text{SW}}(R) - (E_{\text{SWA INSITU}}(R) \times \text{PSAL})[1 - (0.02 \times \text{PRES} / 1000)]
\]

(Eq. 7)