Float 4900497: Dissolved Oxygen DMQC

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1 Introduction

The goal of this document is to summarize the results of oxygen gain calculations made using the newly developed python package, `bgcArgoDMQC`, as well as the previously established matlab package, `SAGEO2`. In the conclusion section I will present what I believe is the best course of action.

2 Current Status of Data

Oxygen data is currently all in real time files, but the data mode is set to "A" as the DOXY_ADJUSTED field is populated with values. The adjusted data uses a gain value of 1.02 - my initial instinct is this value came from the DOXY audit produced by Josh Plant. However, the
SCIENTIFIC_CALIB_COMMENT states the following:
"G determined from float measurements in air. See Johnson et al., 2015, doi:10.1175/JTECH-D-15-0101.1"

However, I don't find any usable in-air data in the trajectory file (a field for DOXY exists, but is only fillvalues), nor does the SAGE software.

In terms of flagging, any not-good DOXY data appears to be due to propogation of flags from the physical data:

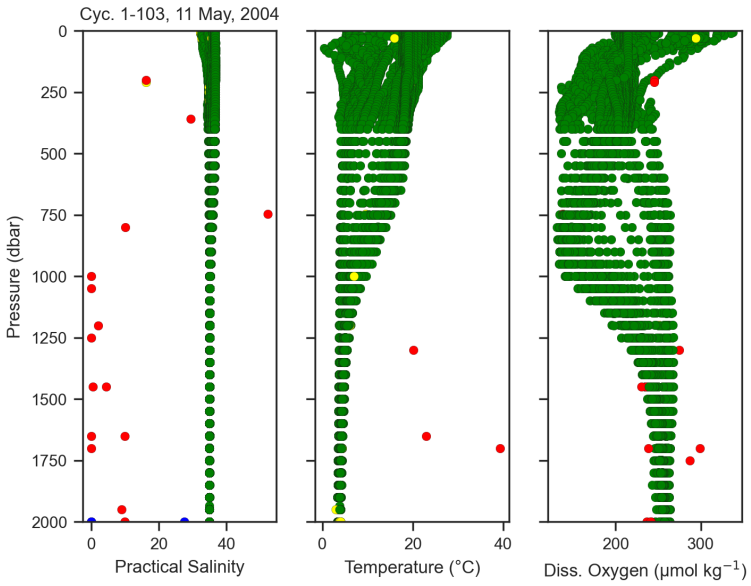

Figure 1: All float data, colour coded by quality flag

There are three points in the salinity data near the bottom of the profile that have their QC flag set to 8 (interpolated, blue points) that look incorrect to me. I think these values and the associated oxygen values should be set to 4. There are 2 points in cycle 96 and 1 in cycle 100. Also - cycles 1-100 have all gone through physical DMQC but cycles 101, 102, 103 are still in RT.

3 Gain

The gain calculation gives a mean gain value of 1.06.

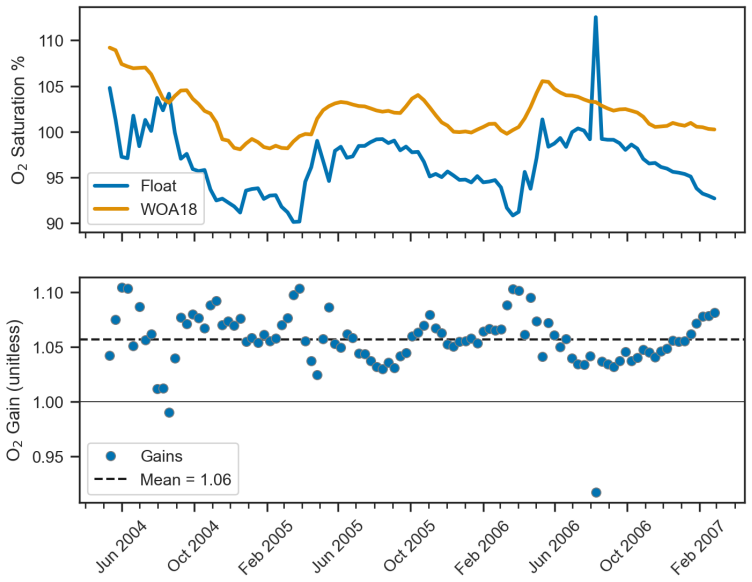

Figure 2: Gain plot produced by python package

The spike in August 2006 does not seem to go with the rest of the data. Upon inspection of the individual profile, the point appears anomalous with an oxygen saturation of 138%.

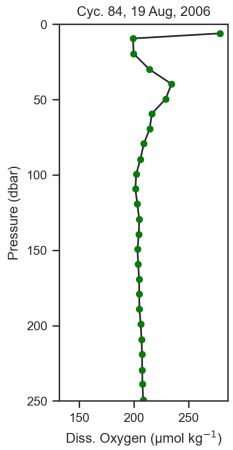

Figure 3: Upper ocean data for cycle 84

I believe the top point should have its QC flag set to 4. Removing this

point however does not change the mean gain value.

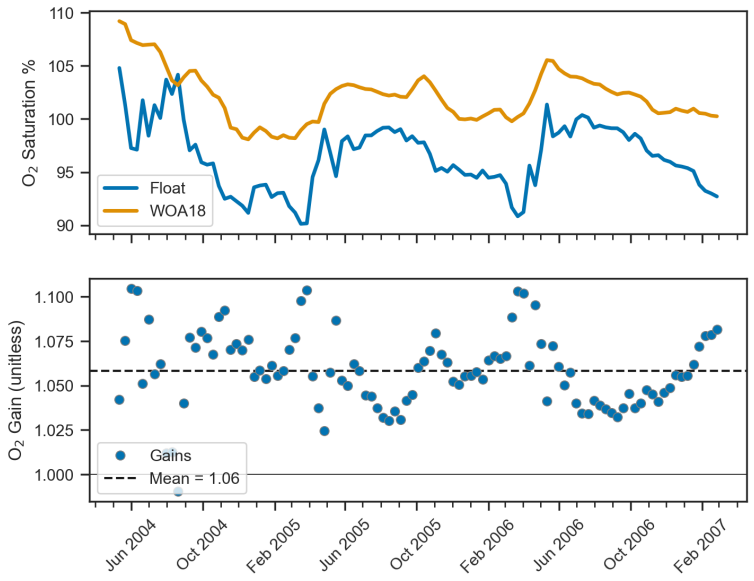

Figure 4: Gain plot repeated with anomalous point removed

Comparing the output of the python package to SAGE shows a very similar plot, but the mean gain value is SAGE is 1.03.

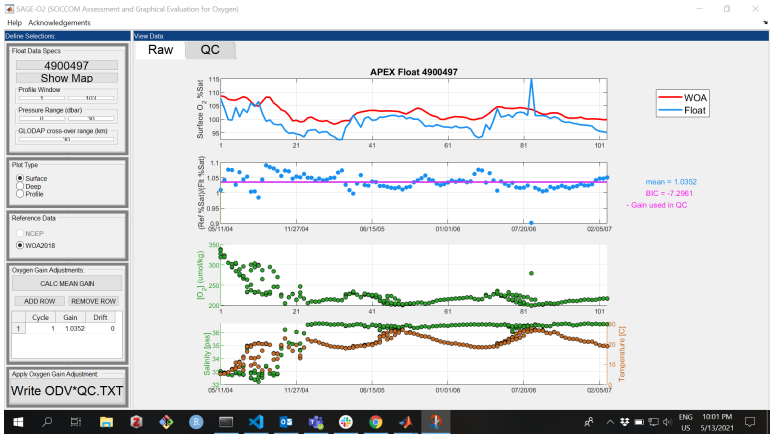

Figure 5: Screenshot of SAGE software

Upon further inspection, it is clear that this is due to an underestimation

of the float oxygen saturation by the python package. The most likely reason for this is a difference in the unit conversion from dissolved oxygen to percent saturation. There are slightly different coefficients used depending on the model of oxygen sensor. For now, the python package assumes an Aanderaa 4330, however where this is an older float, it has a 3830 on it. When I tried to re-calculate the saturation with the proper coefficients this exposed a bug in my code that I will need to fix.

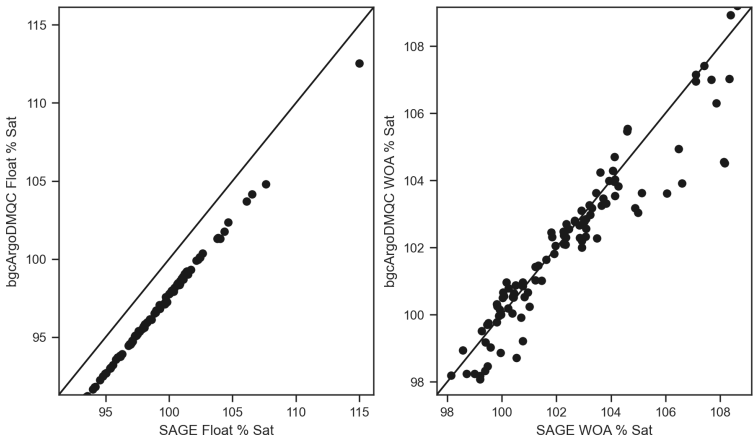

Figure 6: Comparison between matlab SAGE and python package.

There is also some differences in the interpolation of the WOA data, but these data surround the 1:1 line and so I believe this difference is a lower priority. Based on that I believe the SAGE code to calculate percent saturation is more correct than mine, adjusting the float data in python gives a final mean gain of 1.0333.

4 Conclusion

In conclusion I propose the following action items:

1. Change the two interpolated PSAL points from flag 8 to flag 4, change corresponding oxygen flags to 4 as well.

2. Set flag for the most shallow point in cycle 84 to 4.

3. Fill adjusted DOXY field with gain of 1.03, add appropriate comment SCIENTIFIC_CALIB_COMMENT, iterate dimension N_HISTORY

A final action item for the python package is to debug and fix the calcualtion of oxygen solubility for Aanderaa 3830 optodes, and to have the package automatically check the sensor model to do the appropriate calculation. There is currently an open issue on the package's github page for this change.