BIOCHEM – OXYGEN DATA

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# Moored CTD Oxygen Data

Out of 323 archived moored CTD data files, 41 include measurements of oxygen. These files have been recently converted to a standard netCDF format which allows for easy access and consistent metadata parameters. They were transferred from ODFs using the package ncTemplates, available on GCcode.

Moored current meters (model RCM-11) may also sometimes have an oxygen sensor. Diana has specific examples of this from HUD2009011\_1727, however of the MCM files available on the archive, none of them contain oxygen measurements.

The oxygen data contained in these files is in ml/L under the variable name DOXY, typically appended with \_01 or \_02 if there are multiple sensors. Each file has approximately 1500 records, depending on length of mooring, at a specific depth specified in the global attributes of the file.

NetCDF file format may be beneficial to the BIOCHEM oxygen project if the goal is to clean and concentrate specifically oxygen data for another project or analysis. The file format can be easily read in any programming language and follows a consistent format. It would be easy to pull oxygen variables from multiple MCTD or CTD files and combine them into a netCDF library in which each file is self-describing and complete with metadata. netCDF might also be used to condense oxygen data from various cruises into larger files where each variable represents a single oxygen sampling event, metadata could be contained in variable attributes and data could extend along an unlimited dimension. This may take some trials before it is a viable option but I do think it is possible.

Table 1 Archived moored CTD files which contain oxygen data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| filename | Cruise start date | Cruise end date | latitude | longitude |
| MCTD\_BCD2011901\_HFX008\_0081\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2011901\_HFX008B\_0095\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2011902\_HFX008\_0090\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2011902\_HFX028\_0099\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2011902\_HFX048\_0089\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2011902\_HFX069\_0092\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2012903\_HFX180\_0095\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2012903\_HFX212\_0096\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2012903\_HFX245\_0091\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2012904\_SBXPODLB\_0114\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2012904\_SBXPODNL\_0115\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2012905\_HFX126\_0116\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2012905\_HFX153\_0118\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2012906\_HFX097\_0094\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2012907\_HFX028\_0121\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2012908\_HFX048\_0119\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2012908\_HFX069\_0123\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2012909\_HFX097\_0117\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2013903\_HFX126\_0092\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2014903\_HFX126\_0093\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2014903\_HFX153\_0119\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2014903\_HFX180\_0117\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_BCD2014903\_HFX245\_0098\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_HUD2013004\_1845\_10515\_1800.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_HUD2014004\_1866\_11689\_900.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_HUD2015006\_1897\_11688\_1800.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_HUD2015030\_1899\_11689\_1800.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_HUD2016027\_1996\_10471\_1800.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_HUD2016027\_1998\_9411\_1800.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_PER2013010\_HFX153\_0099\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_PER2013010\_HFX180\_0094\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_PER2013010\_HFX245\_0090\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_PER2013039\_HFX008\_0081\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_PER2013039\_HFX028\_0151\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_PER2013039\_HFX048\_0096\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_PER2013039\_HFX069\_0116\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_PER2013039\_HFX097\_0152\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_PER2015036\_HFX028\_0163\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_PER2015036\_HFX048\_0115\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_PER2015036\_HFX069\_0094\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |
| MCTD\_PER2015036\_HFX097\_0092\_3600.nc | 2011-03-29T15:00:00+0000 | 2011-06-08T16:00:00+0000 | 44.43784 | -63.4879 |

# Questions about BIOCHEM and project goals:

1. What is the final data format goal?
2. Is the goal to reload data into BIOCHEM or to isolate and clean oxygen data for use on other projects?
3. Has Gordana finished comparison plots/ text files for all of the oxygen data? What programs did she use to run this?
4. Has moored CTD data been looked at or only profile CTD and bottle data? Is moored data of interest?

* Both AZMP and historical oxygen data should be included in the data clean-up, focusing on bottle data. If oxygen sensor profile data can be ground-truthed with reliable Winkler data, they would also be included in the analysis. Moored oxygen measurements would be the lowest priority and were not considered in the proposal. (Catherine)

1. A lot of the raw data in Gordana’s directory is in .csv format rather than ODF, what was the purpose of this? Are there ODF copies of the same files?
2. How can I open a QAT file? What is contained in them?

* Using notepad
* Seems to be columns including cruise, date, lon/lat, time, then series of ???values with no headers

1. How can I open a .btl file? What is contained in them?
2. How can I open a .hdr file? What is contained in them?
3. At what stage in processing/loading was unit conversion applied? If it was consistent?
4. What is BiolSum?
5. I notice quite a few mentioned of CTD oxygen sensor calibration drift? Is this something that can be corrected in QC process or is this just something that should be explained to the user so they can take it into account in analysis?
6. Are winkler titration values being compared with up or down cast CTD values?
   * <https://www.researchgate.net/publication/228408948_CTD_oxygen_sensor_calibration_procedures>
   * <https://journals.ametsoc.org/doi/pdf/10.1175/2009JTECHO693.1>
   * Describing hysteresis and hours long memory of oxygen sensor membranes (from high pressure) resulting in significant offsets in upcast oxygen values
   * From Andrew: Winkler values are used in combination with upcast values (from QAT) to calibrate downcast oxygen sensor measurements (using a coefficient- he will show scripts to me at some point)
7. What is the most reliable source of data? Which file format?
8. Other than general metadata (time, date, depth, location, ship, scientist) are there any specific parameters that are key to the investigation (temperature?)?
9. Where are the raw files for Winkler data? Are they mostly in excel sheets?
10. The format of Winkler data seems highly variable, is there an ideal format that should be used to preserve raw data? Would it be possible to see an ideal example file so that I can mimic it?
11. Is the goal to combine oxygen data into larger “chunk” files eg. By year, or is it to load individual events into BIOCHEM?
12. In investigating how to begin pulling raw data, I’ve found there are sometimes multiple source files for a single cruise, sometimes values may differ between these files. Eg. 2008 > TEL2008815 where MFD\_biolsums\_2008815.xls and TEL2008815\_Biolsum.xls appear to have the same values except for the Oxygen ml/l column which is rounded to one decimal place in MFD… and 3 decimal places in the other file. Are these inconsistencies common? Why are there duplicates of raw values and how should they be identified/ distinguished in choosing values to pull from the archive?
13. Units seem to be a major issue within the data, is the decision that data should be left in original units to avoid confusion? Who can I speak with if I have questions about original units or measurement techniques?