



Facilitating Data Access for Educators

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Summer 2023

Keywords: GO-BGC, SOCCOM, Adopt A Float, Education, Biogeochemical, Data

ABSTRACT

The Global Ocean Biogeochemical (GO-BGC) array and Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM) programs deploy biogeochemical Argo floats in the global ocean to measure ocean health and the effects of climate change on the ocean. The data is freely available to researchers and scientists around the world. The Adopt A Float program is a part of outreach and education; its goal is to bring real time science data into the classroom. The focus of this project is to facilitate the access and utilization of educational resources for classroom teachers. Teachers completed a survey about how they use the GO-BGC data and content in their classroom as well as what prevents them from using it more. Based on data collected, improvements were made to the GO-BGC website, educational resources and data access platforms. Updated tutorials and instructions were posted on the website and shared in the newest newsletter.

INTRODUCTION

Global Ocean Biogeochemical (GO-BGC) array has received an NSF grant to deploy 500 more biogeochemical floats in the ocean. These autonomous underwater robots contain chemical sensors measuring the temperature, pressure salinity, oxygen, nitrate, pH, chlorophyll, and

particles in the ocean. Each float sinks to a depth of 1000m where it drifts for 10 days, then it sinks to 2000m before traveling up to the surface profiling data along the way. At the surface the float spends 15 minutes uploading its data to satellites before sinking to repeat the cycle again. Data is transferred immediately to the data bases at GO-BGC where scientists check its accuracy and make it accessible to the public. The data allows scientists to answer questions about ocean health, changes in the ocean resulting from a changing climate and to monitor carbon, oxygen and nitrogen cycling. This data helps scientists to understand ocean ecosystems and improve scientific models. Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM) deploys biogeochemical floats in the Southern Ocean, while GO-BGC covers the rest of the global ocean.

Both GO-BGC and SOCCOM participate in the Adopt A Float program. Adopt A float links marine scientists and engineers to K-12 and some college students bringing ocean science and technology into classrooms. Classes sign up to adopt a float, give it a name and follow its deployment in the ocean. The float is decorated giving students a connection to their own ocean robot. They can watch it move around the ocean and access its data profiles. Classrooms and teachers have access to all of the float data and resources whether they adopt a float or not. The program's goal is to get real time data into the classroom.

MBARI is a partner organization with GO-BGC. Floats are made in Seattle Washington then sent to MBARI for additional sensors and returned to Seattle to prepare for deployment. MBARI also hosts a teacher workshop each year called EARTH (Education and Research: Testing Hypothesis). Educators from around the world attend the workshop to learn about different platforms for using real science data in the classroom. They learn about GO-BGC data and resources as well as the Adopt A Float program. This year MBARI partnered with the Pacific Island Climate Adaptation Science Center (PICASC) in Honolulu, O'ahu. Teachers attended from American Samoa, Hawaiian Islands and the continental US. Scientists from UH Manoa, NOAA, Hawai'i Institute of Marine Biology, as well as Native Islanders presented to the group of educators about various scientific research and conservation projects. Teachers then used their databases to design STEM lessons which are now available on the MBARI and GO-BGC website.

MATERIALS AND METHODS (Heading 6, Times New Roman, 12 pt, bold)

PERSONAL RESEARCH

One of the requirements of the EARTH workshop is to teach an EARTH lesson before attending. I taught one of the lessons to my class. It was an excellent, comprehensive lesson yet, I found that it was a big jump for my students to access and understand the content. I wanted to have more basic ocean science resources for my students to connect the science concepts we learned in class with the float data. When I began my internship at MBARI, I spent a lot of time familiarizing myself with the GO-BGC website, reading articles, publications and journal articles. I read through all of the outreach sections one by one assessing the accessibility and usefulness of resources, lessons and data platforms. I could see where the resources were difficult to access and wanted to learn from other teachers who had adopted floats, or attended EARTH workshops if they felt the same. Additionally I met with members of the GO-BGC team including research and lab technicians, data scientists and engineers to learn more about their work with GO-BGC as well as their personal and professional goals in regards to ocean science. I also met with the Science Communications team here at MBARI to hear their ideas about how to make the Adopt A Float program and GO-BGC more accessible to teachers.

SURVEY

I created a survey to gather input from teachers about what is going well in the Adopt A Float program, how they are using GO-BGC content, and what are the biggest hindrances to actually using float data in the classroom. Teachers responded to questions about which resources they use, what would make the content more accessible to them, and how to improve the program.

The survey also addressed social media. Teachers responded to questions regarding what social media platforms they use personally and in the classroom in regards to GO-BGC, SOCCOM and MBARI. The survey investigated whether social media is a helpful way for teachers to access more content, data, and updates regarding Adopt A Float.

EARTH WORKSHOP

At the EARTH workshop I was able to collect both qualitative and quantitative data regarding the GO-BGC resources and EARTH lessons. Each teacher presented the strengths and challenges of the EARTH lesson that s/he had taught in the classroom. Through conversations and collaborations on lessons with teachers I learned what they enjoy about the Adopt A Float program and what prevents them from using more float data in the classroom. At the end of the EARTH workshop I designed a follow up survey investigating how teachers use float data in the classroom and what sort of tutorials would be most useful to them. Teachers also responded to questions regarding the length of video that would be most helpful to them.

RESULTS

ADOPT AND FLOAT AND GO-BGC DATA USE IN THE CLASSROOM

Thirty six teachers responded to the Adopt A Float survey. These teachers have either adopted a float, or attended at least one EARTH workshop, some have done both. Some teachers in this group teach more than one grade level or multiple content courses. Out of those who responded, the majority taught 7th through 12th grade, with 51% teaching 10th-12th grade and 46% teaching 7th-9th grade. The next largest group of students are 5th and 6th gradeclasses at 25% , followed by 3rd-4th grade classes at 17 % and Kindergarten- 2nd grade classes at 6%. There were also 2 college classes composing 8%. Of the teachers surveyed, 78% use the Adopt A Float program in their science class, and 19% use it in their math class. GO-BGC is also used in a variety of STEM, Robotics and Engineering classes. Overall teachers find the database, the newsletter and the lessons to be the most helpful parts of GO-BGC website in that order.

The majority of teachers report that they use the Adopt A Float program and GO-BGC to introduce ocean exploration, ROVs, and general float location. Many of the teachers surveyed have also used the EARTH lessons. The majority say that they have not yet used the data in the classroom; not everyone responded to this question. Teachers report that the largest obstacles to using float data in the classroom are time, how to fit it into their content and confusion about the website content. Teachers are very limited in prep and planning time. They reported that learning a new website takes time and that the GO-BGC website was “cumbersome and confusing”, taking a lot of time to figure out. Other teachers ran out of time in the school year or couldn't figure out how to fit it into the content they were teaching.

SUGGESTIONS FOR IMPROVING ADOPT A FLOAT AND GO-BGC CONTENT

Teachers gave many ideas for how to improve the Adopt A Float program and make the resources more user friendly. Their most common suggestions were a section on the website that was specifically “for teachers”, lessons aligned with content standards, background information and tutorials to help navigate resources.

Teachers were asked to choose which improvements would make the content more accessible to them. They could choose more than one method; 59% agreed that a video tutorial about how to use the website would be most helpful, 53% would like more background information about the data and how it connects to the standards, 47% requested more lessons or units and 38% agreed that more science videos would be helpful.

After my presentation, conversations and collaborations at EARTH, I created a second survey for teachers to better inform the kind of tutorials I should make. Only 7 responded: 100% of teachers wanted a tutorial explaining how to make data tables, and access correlated resources; 71% thought it would be helpful to have a tutorial comparing floats in different parts of the globe as well as comparing float data before and after a storm. In terms of the maximum length for a tutorial; 57% would watch a 5 minute tutorial; 43% would watch a 10 minute tutorial and one person would watch any length video.

SOCIAL MEDIA

Out of those surveyed, 84% of teachers use youtube in the classroom, and 22% use instagram. Only 18% of teachers thought that access to the GO-BGC content through social media would be helpful whereas 45% found the newsletter an extremely helpful component of the Adopt A Float program. In general many teachers thought it would be helpful to have announcements, and newsletters on social media, just to keep them updated. Some thought that students might like to follow GO-BGC, SOCCOM and MBARI as well. Overall this was not the largest concern out of those surveyed.

DISCUSSION

The first challenge I encountered with GO-BGC was that I was unable to access the website when logged in as a guest at MBARI. There was a glitch blocking all guests from accessing the website. Eventually I was able to get that problem sorted through the server once I learned who was in charge of this department. I proceeded to make my way through the Outreach, Resources and Data sections of the website noting all of the helpful, outdated and difficult to locate resources, dead end links, and organizational questions I had.

I met with Jenfer Magnussen, GO-BGC's web designer to address the teachers' main concern which was website navigation and confusion. I made suggestions to reorganize the Outreach tab such that everything teachers could need was easily found in 2 clear subheadings. First is "Adopt A Float " where float tables, background information and the float adoption application are all easily found in order. There are resources for educators then recent newsletters covering deployment updates and news. The section is clear and concise. The next heading under Outreach is the new "For Educators" tab. Previously called lesson plans, this section has been completely reorganized. At the top is simple background information, videos and printable resources about floats that teachers can use with their class. Next is a section called "How To Access Data". I created new powerpoint slides explaining each of the 4 data tables in this section as well as updated video tutorials with examples about how to use the data for science and math classes. Finally, in order to clarify the changes that had been made and help teachers' navigation process, I updated the community through the most recent newsletter.

Teachers' second main concern was time: how to smoothly navigate float data tables and connect them to classroom content at various grade levels for science and math curriculum. I addressed this concern by reorganizing the Adopt A Float Viz table which teachers use to create customized graphs from float data. This Float Viz is very similar to the Float Viz that scientists use except only adopted floats are listed and floats can be searched by their float name as well as their WMO number. There were outdated instructions at the top of this page so I recreated both visual and video directions for how to use the data portal. The x and y axis had 30 possible variables to choose from with various units of measurement for each one. We simplified this to 8 variables plus latitude and longitude. I created an ocean science background information resource page in a printable pdf format for each of the variables; there is a basic level for middle

grades and an advanced level that is a basic oceanography textbook explanation. Each of these pages links several youtube videos explaining the ocean science content as well. Teachers can now view customized float data as a graph, with academic level appropriate resources for each variable they chose. The resources support different learning modalities including audio, visual and written text. Some of the variables lend to simpler science concepts, others to more advanced content allowing students of all ages to make sense of the float data. Additionally we wanted to create more resources for math teachers to connect math classwork to real world applications. Mathematics and Computational Thinking is an overlapping math, science and engineering practice according to the national standards. The powerpoint and video tutorials both demonstrate how to create customized text files from Adopt A Float Viz. There is also a tutorial specifically about how to use these text files to take a deeper dive into the data by importing it to google sheets for mathematical analysis.

At the EARTH conference I created a photo album for the social media team of teachers working on GO-BGC content. I also began to shoot a short film connecting the pH sensor in the GO-BGC lab and ocean acidification. I collaborated with the GO-BGC team to create a script and collect B roll but ran out of time to complete the video. I am passing content along to SciComm to continue the project.

CONCLUSIONS/RECOMMENDATIONS

Teachers have already sent positive feedback to George and I about how improvements to the website have helped them to navigate and use the resources. Teachers also report that the updated version of Adopt A Float Viz is much easier to use. I hope that these improvements and updates will facilitate more science data use in more classrooms and more students' enthusiasm about ocean science and technology.

I wanted to organize my project around each of the sensors as technological devices measuring scientific data. This allows students to see real STEM projects in action and to connect them to what they are learning at school. My idea was to create a short video clip for each of the sensors shot in the lab and make a connection to the science content. My vision is to make complete audio visual resources making the content available to all types of learners. Ultimately there would be a connection to climate change since the overarching goal of GO-

BGC is to measure changes to ocean health in the current age of climate change. I have passed these ideas as well as content that I created along to the SciComm team and look forward to future content at MBARI. I have also adopted a float and look forward to using the data with my class this year.

ACKNOWLEDGEMENTS (Normal, Times New Roman, 12 pt, bold)

BIG thanks to George Matsumoto for his mentorship and facilitating such a great summer internship and an excellent work trip to O'ahu.

Special thanks to the GO-BGC team for teaching and collaborating with me on various aspects of my project, especially Tanya Mauer for her work on Adopt A Float Viz; Ben Davis for the video collaboration and Gene Massion for bringing a focus on mathematics to Adopt A Float. A huge thanks to Jenn Magnussen for quick updates to the web design and a great EARTH workshop.