PALMER STATION MONTHLY SCIENCE REPORT

February 2020

PROJECT SWARM
B-005-P: COLLABORATIVE RESEARCH: IMPACTS OF LOCAL OCEANOGRAPHIC PROCESSES ON ADÉLIE PENGUIN FORAGING ECOLOGY.

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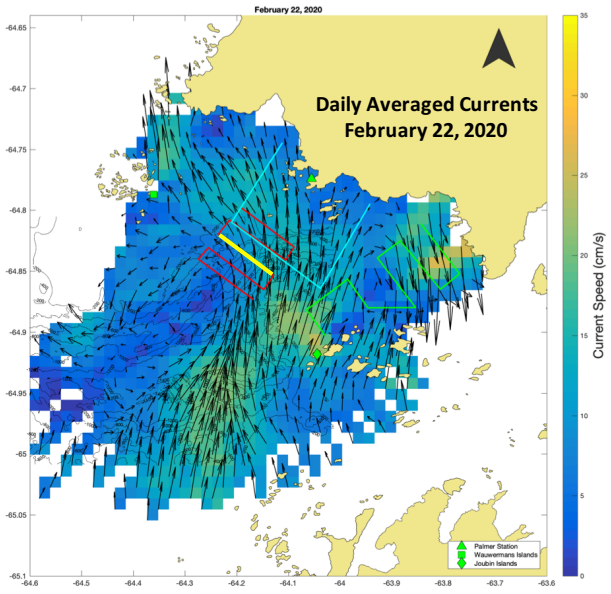
This past month at Palmer Station we have continued the operation of our polar ocean observing system. This network includes, autonomous underwater gliders, moorings, High Frequency radar stations, RHiB surveys and a profiling LISST holographic imaging sensor. With this ocean observatory, we are able to track the distribution of phytoplankton, zooplankton and predators relative to the physical oceanographic features captured by the integrated network of platforms. Each resolving scales necessary to test our hypotheses. A summary of the activity across this effort follows in this report.

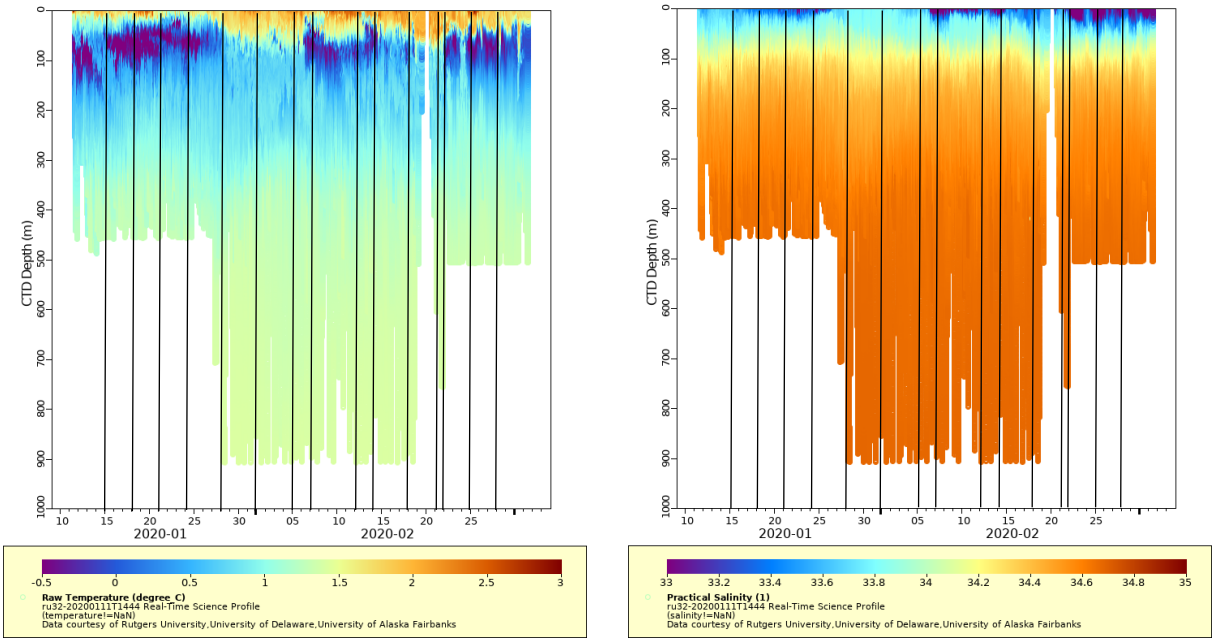
The month of February began with a first here at Palmer station. Through an awesome collaborative effort between our local scientists, ASC, and NSF, we were able to recover one of our moorings with a RHiB deployed out of Palmer Station. This is the first time a RHiB has been tasked with a mooring recovery and shows another example of how the RHiB enhances the Palmer Station based science support. We have been very impressed with the capabilities of these platforms, and they have been critical to the science goals of our project. A picture taken during the mooring recovery is above. Once recovered we were very excited to see the well resolved dataset including full water column velocities, full water column multi-frequency zooplankton acoustics, as well as bottom time series of temperature, salinity, pressure, and oxygen.



The mooring equipment was provided by the

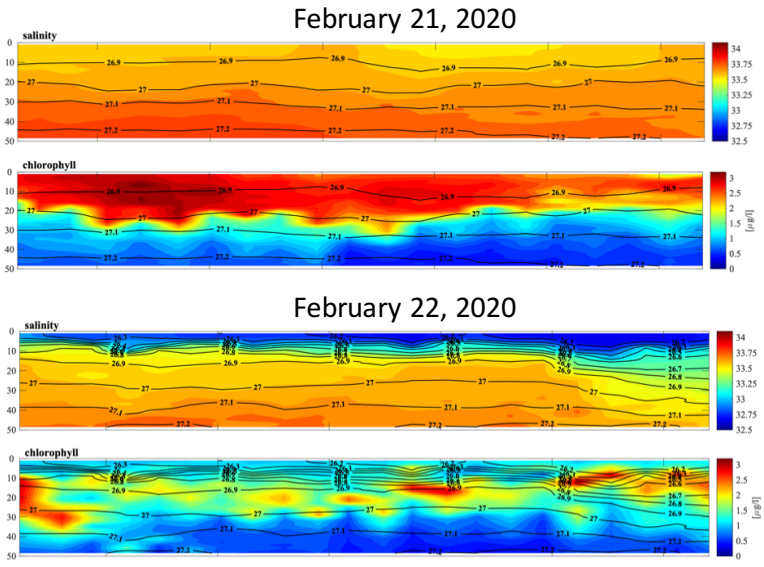
NOAA/AMLR team who have deployed 6 identical moorings further north on the peninsula. We look forward to working with them to integrate these two moored data streams.

HF Radar: The three site HF radar network has operated continuously throughout the month. Data were delivered in real time through the Palmer Station network to our central processing machine in Terra Lab. An example of the surface current maps generated through this network is shown for February 22, 2020 above. These data have been critical to understand some of the variability seeing in the glider and ACROBAT data summarized below.



Glider AUVs: All three gliders have continued to operate as planned along our survey grid over Palmer Deep. As of the draft of this report the three gliders have been deployed for 128 glider days sampling over 2,100 km throughout the Palmer Deep region. Over the last month, we were able to recover, repair, and redeploy one glider and recover the other two for brief 24 hour sampling breaks to download the acoustics datasets that are too big to send routinely over the satellite iridium connection. During these planned recoveries, we were able to gather all the raw data and inspect the gliders before sending them back out on their missions. The above transects show the variability captured throughout the water column throughout these multi-month missions. The vertical black lines indicate the timing of our coordinated RHiB surveys that complement these data with higher resolution near the surface.

RHiB surveys: Coordinating with the PAL-LTER and Palmer Station MTs, we have now conducted 15 surveys with the towed ACROBAT and EK-80 sampling totaling over 1,100 km of sampling. 12 of the 15 surveys have been over the complete grids covering much of our Palmer Deep study site (red and green survey grids in the HF radar map above). The others were modified surveys covering portions of these grids and one new survey line that included two cross shore transects east and west of the Palmer boating area (cyan line in the HF radar map above). The combination of the acoustics and towed system allow us to simultaneously map the hydrography, phytoplankton and zooplankton structure along the transects. Over these 15 surveys we have captured remarkable variability in both time and space. An example of this variability is seen in two sections of surveys repeated within 24 hours of each other (thick yellow line in HF radar map above). In less than a day, freshwater advected over Palmer Deep, dramatically stratifying the surface ocean. Referring to the CODAR surface current map averaged over the same time period (above), we can see that this freshwater came from the south and was limited to a well-defined jet



in the current map. In addition to these surveys, the SWARM/PAL-LTER teams have used the RHiB to support multiple adaptive activities including net tows to ground truth the acoustics, the mooring recovery described above, and along canyon LISST HOLO surveys to image particles below the mixed layer. Working with the PAL-LTER whale team, we were also able to deploy a camera system on the zooplankton net survey to document the density of krill aggregations targeted by the net and to get a better understanding of how effectively different species avoid the net. Licorice

Penguin Telemetry: In collaboration with the PAL-LTER project, a total of 66 penguins were tagged in the Palmer Deep region this season. These tagged animals include GPS positioned tags (52 Adélie and Gentoo) and presence/absence radio tags (14 Adélie). As of the draft of this report, there will be no additional penguin tagging as most of the chicks have fledged. An initial review of the penguin foraging tracks indicates great overlap with the CODAR and other platform sampling within our coastal observatory.

Broader Impacts: To date we have published four data swarm activities. These activities are designed to engage the middle and high school students in Delaware, New Jersey, and New York to investigate the same data plots we are looking at here at Palmer. These activities have focused on the NBP transect of Palmer Deep conducted during our November 2019 cruise, the HF radar surface current maps, our autonomous glider generated data, and finally the acoustics data collected by our moorings. The students following the data swarm activities have also interacted directly with the scientist through three 30-minute blackboard session VTCs.

We would like to thank all station staff for their support of our project. We recognize the significant logistical support required for our project, including boating, cargo, and information technology. We would also like to thank the PAL-LTER science team for their partnership and collaboration. This success we have accomplished so far this season would not have been possible without the coordination with the PAL-LTER team and ASC. This season we have been hosting science meetings every Sunday afternoon in which we discuss logistics for the upcoming week and share exciting results from all the groups. This is an open meeting in which we have had great participation from both the grantees and station support. All involved have been able to find every efficiency that enable the science objectives to be met. We are very happy to work in this collaborative environment and are seeing the direct benefits in what we have collectively accomplished. Through all the planning, the communication has been critical to this success.