PALMER STATION MONTHLY SCIENCE REPORT

JANUARY 2017

The Countway (B-028-P) group prepares for a rosette deployment from the Landing Craft.
Image Credit: Randy Jones

NEWS FROM THE LAB

Randy Jones, Summer Laboratory Supervisor

The start of the month kicked off with the 25th annual Palmer Long Term Ecological Research (LTER) cruise on the ARSV *Laurence M. Gould*. After leaving the Palmer pier, the ship remained relatively close to station, and worked closely with the newly disembarked Friedlaender group (C-024-P). This addition brought the number of science groups on station to seven, and the pace of laboratory and boating operations to a frenzied pitch.

While the *Gould* was out, the science groups on station made good use of the weather, which was remarkably pleasant, sunny, and mild. The Schofield (C-019-P) group successfully deployed one of their gliders, RU24, on their second attempt. They retrieved it again prior to the end of the month, due to a housing or oil bladder leak, but not after collecting two weeks of data in the deeper Palmer Basin. Michael Brown (C-019-P) completed the first of three incubation experiments utilizing glacial meltwater collected in the backyard to study phytoplankton community composition. As well, Pete Countway's group (B-028-P) completed their second and third incubation experiments in their EcoStat chamber with great success.

The lack of rain did make for agreeable sampling conditions for most, though it did make the Lee group (B-256-P) work extra hard to extract their critters, most having headed towards available moisture deep down. A slew of rainy, windy days towards the end of the month limited groups ability to get out on Zodiacs, but it brought needed precipitation to soils on the islands. It was during a drier afternoon of this rainy period that Yuan Gao's group (O-231-P) decommissioned

her experiment in preparation for the return of the LTER cruise. Many thanks to all the grantees and community members who helped or contributed to science grantee operations this month.

JANUARY 2017 WEATHER
Liz Widen, Research Associate

Palmer Monthly Met summary for January, 2017

Temperature
Average: 2.6 °C / 36.7 °F
Maximum: 7.4 °C / 45.32 °F on 26 Jan 17:46
Minimum: -1.5 °C / 29.3 °F on 17 Jan 06:57
Air Pressure
Average: 984.1 mb
Maximum: 997.5 mb on 4 Jan 02:24
Minimum: 968.8 mb on 28 Jan 19:11
Wind
Average: 8.6 knots / 9.9 mph
Peak (5 Sec Gust): 44 knots / 51 mph on 28 Jan 19:16 from N (10 deg)
Prevailing Direction for Month: ESE
Surface
Total Rainfall: 25.4 mm / 1 in
Total Snowfall: 0 cm / 0 in
Greatest Depth at Snow Stake: 0 cm / 0 in
WMO Sea Ice Observation: No Sea Ice in sight, only ice of land origin, 11-20 bergs, with growlers and bergy bits.
Average Sea Surface Temperature: 2 °C / 35.6 °F

The following two plots (Figs. 1 and 2) show the month's average temperature and wind speed plotted against the historical average (where the historical average goes back to November 30, 2001). Both temperature and wind speed were consistent with historical averages. Arthur Harbor and Hero Inlet have been clear of sea ice, but have been occasionally filled with growlers and bergy bits.

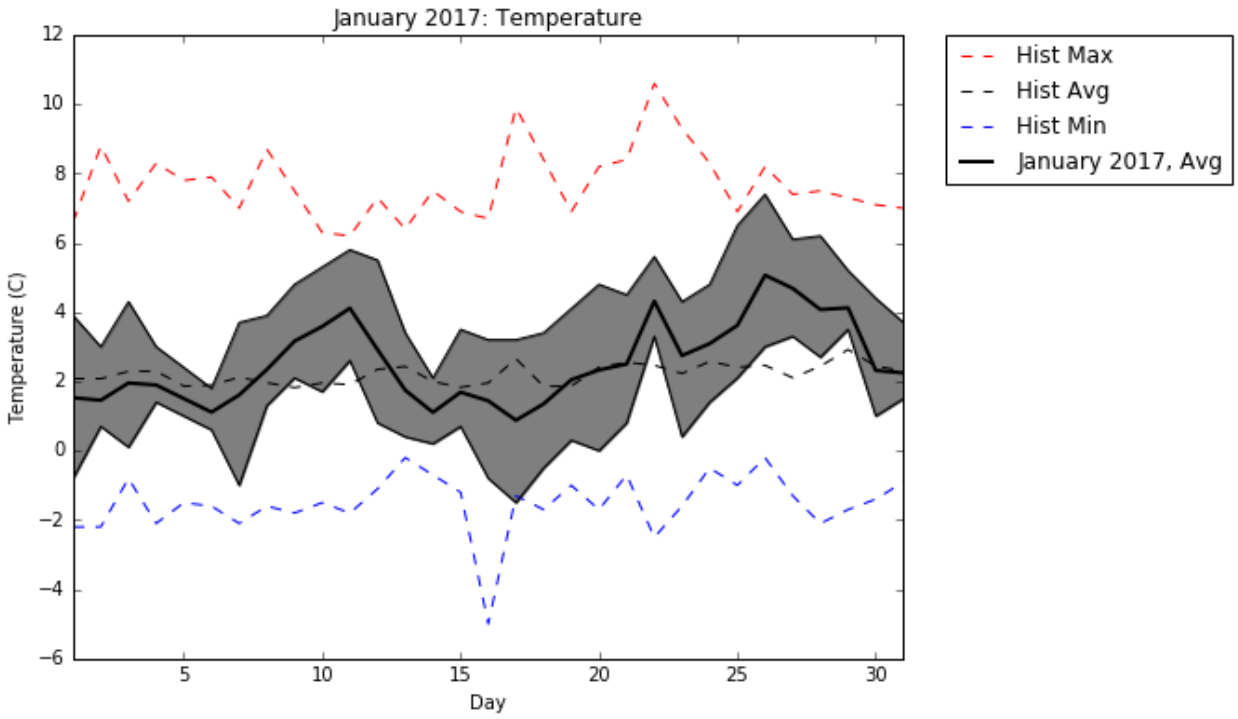


Fig. 1 – Plot of daily temperature in January 2017. Shown in black/shaded gray are the daily average, the minimum, and the maximum for this year. The dotted lines on the graph indicate average, minimum, and maximum values for "historical values" for 2002 to 2016. (We thank Liz Widen for providing this data and the figure.)

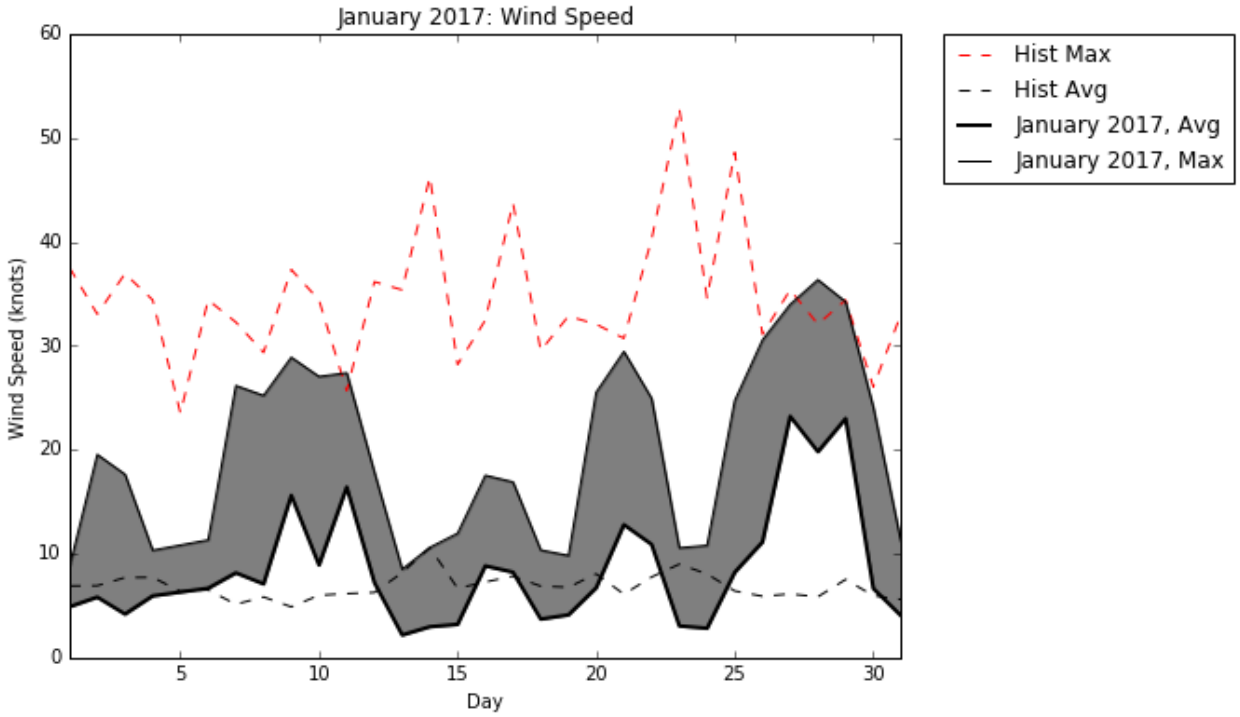


Fig. 2 – Plot of daily wind speed in January 2017. The daily averages are shown in black with grey shading indicating gusts. The dotted lines on the graph indicate average and maximum values for "historical values" for 2002 to 2016. (We thank Liz Widen for providing this data and the figure.)

B-028-P: ANTARCTIC MICROBIAL NETWORKS AND DMSP: LINKING DIVERSITY, BIOGEOCHEMISTRY, AND FUNCTIONAL GENE EXPRESSION

Dr. Peter D. Countway and Dr. Patricia A. Matrai, Principal Investigators, Bigelow Laboratory for Ocean Sciences, East Boothbay, Maine

Personnel on Station: Peter Countway, Patricia Matrai, and Carlton Rauschenberg

Incubation Experiments in the 'Antarctic Ecostat'

The Bigelow Laboratory research team conducted two 'Ecostat' experiments (Fig. 3) during January of 2017 – for a total of three experiments conducted during our field season, which was exactly the number we had planned. These experiments were designed to test the effects of the phytoplankton metabolite Dimethysulfoniopropionate (DMSP) on the structure of the microbial community (via 16S and 18S gene sequencing), the expression of bacterial genes related to DMSP degradation, and the biogeochemistry of microbial DMSP transformations. Water for both of the experiments was collected from Station 'E' and returned to Palmer Station for experimental setup using the Palmer Station Landing Craft. The Eco-Rosette was deployed from the Landing Craft approximately six times on each of two successive dates to collect the required amounts of water. Experiments lasted for approximately 10 days, during which time the natural plankton community was provided with a continuous supply of DMSP and inorganic nutrients at two different supply rates. Experimental controls for these 'continuous' incubations included 'batch' treatments both with and without DMSP addition. The first of the two experiments conducted in January of 2017 was characterized by relatively high phytoplankton biomass – contrasting with the one experiment that we conducted in December of 2016. Phytoplankton biomass at the beginning of our third experiment (2nd January experiment) was lower than the second experiment and slightly higher than our first experiment in December. As expected, the different supply rates of DMSP and nutrients led to differences in phytoplankton biomass and bacterial productivity among the treatments. Furthermore, the dilution of the experimental treatments by the continuous-flow system led to substantially lower biomass in these bottles compared to batch controls.

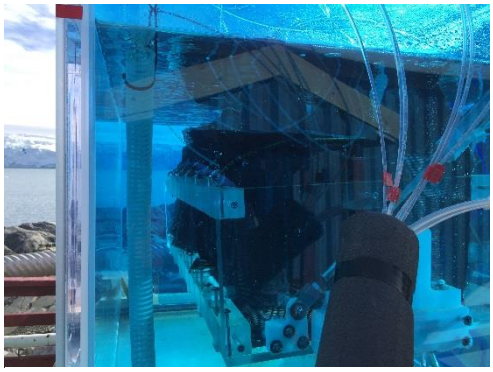


Fig. 3 – The Ecostat loaded with sample bottles

Analysis of DMS(P)(O) Biogeochemistry Samples

DMSP and some of the products resulting from the microbial transformation of DMSP were measured shortly after our experiments were sampled and included both dissolved and particulate DMSP, DMS, and DMSO. These measurements of biogenic sulfur compounds were obtained on a gas chromatograph and all of the samples were processed during our time at Palmer Station. In general, DMSP appeared to be utilized rapidly by the Antarctic bacterial community at Station 'E'.

Arrival and Phytoplankton Community Structure

Microscopy was conducted on the >20 µm size-fraction of phytoplankton at the start of each experiment to provide a qualitative assessment of the community structure. Although the three experiments varied with respect to the starting amounts of phytoplankton biomass, the dominant types of phytoplankton (almost exclusively diatoms) were remarkably similar from mid-December of 2016 through the end of January, and included *Thalassiosira*, *Corethron*, *Coscinodiscus*, *Fragilariopsis*, *Rhizosolenia*, and *Pseudo-nitzschia*. A plankton tow that was conducted in Arthur Harbor in mid-December yielded colonies of the DMSP-producing alga, *Phaeocystis Antarctica* (Fig. 4). Individual colonies were isolated to provide clonal cultures of this species. The cultures of *Phaeocystis* provided a source of DNA (via crude cell extraction) that was used to validate a *Phaeocystis* qPCR assay (that we designed previously) to test a hand-held PCR device (Fig. 5). Although we never observed colonies of *Phaeocystis* in our experimental bottles or freshly collected seawater, we were able to confirm the presence of *Phaeocystis* (likely single cells, <5 µm in diameter) using this next-generation qPCR technology. Additionally, we conducted qPCR for several of the bacterial genes involved with the degradation and transformation of DMSP in near real-time. The capability to detect the presence of these specific DMSP degradation genes enhances our understanding of the fate of DMSP in the Antarctic marine environment and provides clues to the dominant pathways and some of the bacterial taxa involved with these processes. Future work with the samples from our Ecostat experiments will involve sequencing the bacterial mRNA transcripts that are activated in response to DMSP addition.

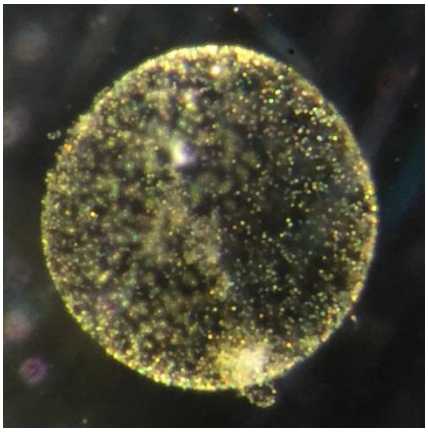


Fig. 4 – *Phaeocystis antarctica*, a copious producer of DMSP, was isolated from Arthur Harbor.

Fig. 5 – Genes for *Phaeocystis* and some of the genes involved with bacterial DMSP degradation were detected on a portable hand-held PCR device in near real-time.

Concluding remarks

We feel that we have had a highly successful initial field-season and are grateful to the entire Palmer Station community and the other grantees for their support of our project and interesting scientific discussions. We expect to have a busy year back at Bigelow Laboratory – focused on the processing of samples for molecular analyses and beginning to analyze the large amounts of biogeochemical data that we have already generated. We are looking forward to coming back to Palmer Station in 2018 and expect that we will have learned a great deal about the effects of DMSP on the structure of Antarctic microbial communities and their functional gene expression.

B-256-P: COLLABORATIVE RESEARCH: WINTER SURVIVAL MECHANISMS AND ADAPTIVE GENETIC VARIATION IN AN ANTARCTIC INSECT

Dr. Richard E. Lee, Jr. and Dr. David L. Denlinger, Principal Investigators, Miami University, Oxford, Ohio and Ohio State University, Columbus, Ohio.

Personnel on Station: Richard Lee, Josh Benoit, Natalie Ylizarde, J.D. Gantz, and Drew Spacht

Survival of terrestrial polar organisms depends on a coordinated transition from feeding, growth, and reproduction during short summers to an energy-conserving state coupled with enhanced resistance to environmental extremes during long, severe winters. Our recent work detailed molecular and physiological mechanisms that enable the midge, *Belgica antarctica*, to survive seasonal changes in temperature, dehydration, and osmotic stress. Combined with our recent sequencing of the midge's genome, these data provide a firm foundation for our current project that focuses in three areas: 1) the role of aquaporin water channels during dehydration and freezing; 2) metabolic depression and survival during an extended winter dormancy; and 3) population structure, gene flow, and adaptive genetic variation in diverse larval microhabitats.

During January we made numerous collecting trips for adults and larvae for a seasonal profile of larval metabolism and stress tolerance, and for a comparative study of genetic and physiological variation among different microhabitats used by fly larvae. Larvae are found in diverse terrestrial microhabitats ranging from moss beds to grass to mats of terrestrial algae (*Prasiola crispa*) to guano-rich sites adjacent to penguin rookeries.

Our outreach efforts seek to connect the science activities of our team and other research projects on station with teachers and their students. Spearheaded by Natalie Ylizarde, *A Fly on the Pole* (www.aflyonthepole.com) is the official outreach program for the 2017 Antarctic research expedition. Throughout January Natalie has connected PreK-16 schools, informal educators, and the general public with Palmer Station by using video and teleconferencing, blogging, and various social media outlets. As part of the NSF-MADE-CLEAR grant (NSF DUE 1043262) she is also leading an exploratory study using real-time polar research at Palmer Station as a vehicle to teach climate change in classrooms, grades 4-12.

A second website (www.units.muohio.edu/cryolab/) at Miami University provides K-12 classroom activities based on national and state standards. Natalie communicated via Skype with 200 students and staff at a high school using a combination of prerecorded video and real-time discussions. Children were able to ask questions during this live interactive session.

We are grateful to station personnel for their support and helpfulness during our second field season on this project. Randy Jones and Carly Quisenberry provided efficient and prompt assistance in support of research. Rosemary McGuire and TR Tepper-Rasmussen were especially helpful supporting our boating needs. Jeff Otten and Michiel Gitzels and provided excellent assistance with computer set-up and a distance learning sessions.

C-013-P PALMER LONG TERM ECOLOGICAL RESEARCH (LTER): LOOKING BACK IN TIME THROUGH MARINE ECOSYSTEM SPACE, APEX PREDATOR COMPONENT

Dr. William R. Fraser, Principal Investigator, Polar Oceans Research Group, Sheridan, MT

Personnel on station: Bill Fraser, Shawn Farry, Ben Cook, Carrie McAtee, and Darren Roberts

The arrival of Principal Investigator Dr. Bill Fraser and new LTER cruise assistant Megan Roberts in early January briefly increased C-013-P/L personnel at Palmer Station to six. However, on January 6, 2017, Darren Roberts and Megan Roberts departed on the annual LTER cruise leaving four birders at Palmer Station for the remainder of January.

Calm weather conditions throughout most of January 2017 allowed boating field work on all but four days this month. Monitoring of Adélie, Gentoo, and Chinstrap penguin breeding chronology continued this month with indicator colony counts as well as an all-colony chick census on local islands as well as on Dream and Biscoe Islands. Adélie chick measurements also occurred in conjunction with our LTER cruise team's measurements on Avian Island. Foraging ecology studies of Adélie and Gentoo penguins continued this month with the deployment of presence/absence radio transmitters, satellite transmitters, and dive depth recorders. In addition to satellite tag deployments on Adélie penguins on Torgersen Island and Gentoo penguins on Biscoe Island, we deployed and recovered satellite tags and dive depth recorders on Gentoo penguins in the Joubin Islands. We also began diet sampling Adélie penguins on Torgersen Island.

Adélie penguin pair with chicks (adult on right with satellite tag) *Image Credit: Fraser Group*

Skua work continued this month documenting hatches and monitoring chick growth of brown skuas on local islands as well as on Dream and Biscoe Islands and south polar skuas on Shortcut Island. Monitoring of the blue-eyed shag colony on Cormorant Island also continued this month. In January we also began deploying satellite tags on giant petrels and completed our local island giant petrel census and banding project that was initiated in December. Our annual Humble

Island giant petrel study also began in January which closely records petrel chick survival and growth from hatching through fledging.

Brown Skua chicks

Giant Petrel adult and chick

Image Credits: Fraser Group

Monitoring of marine mammals continued in January with large numbers of molting elephant seals and increasing numbers of Antarctic fur seals. Lab work this month was dominated by penguin diet sample processing.

January was a busy month for C-013-P and our field work was only possible due to the efforts and dedication of ASC personnel. Special thanks to Palmer Station Marine Technicians Michael Tepper-Rasmussen and Rosemary McGuire for keeping us the water.

C-019-P: PALMER, ANTARCTICA LONG TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCES PELAGIC ECOSYSTEM, PHYTOPLANKTON COMPONENT

Dr. Oscar Schofield, Principal Investigator, Rutgers University, Institute for Earth, Ocean, and Atmospheric Sciences, Department of Marine and Coastal Sciences

Personnel on Station: Nicole Waite, Mike Brown, and Colette Feehan

Our LTER bi-weekly sampling continued successfully throughout the month. Chlorophyll concentrations remained low, but increased steadily throughout the month. Depth integrated chlorophyll concentrations increased 2-fold throughout the month (Fig. 6) to approximately 20 mg m^{-2} by the end of the month. Sampling for HPLC pigment analysis and Carbon-14 primary production experiments also occurred regularly.

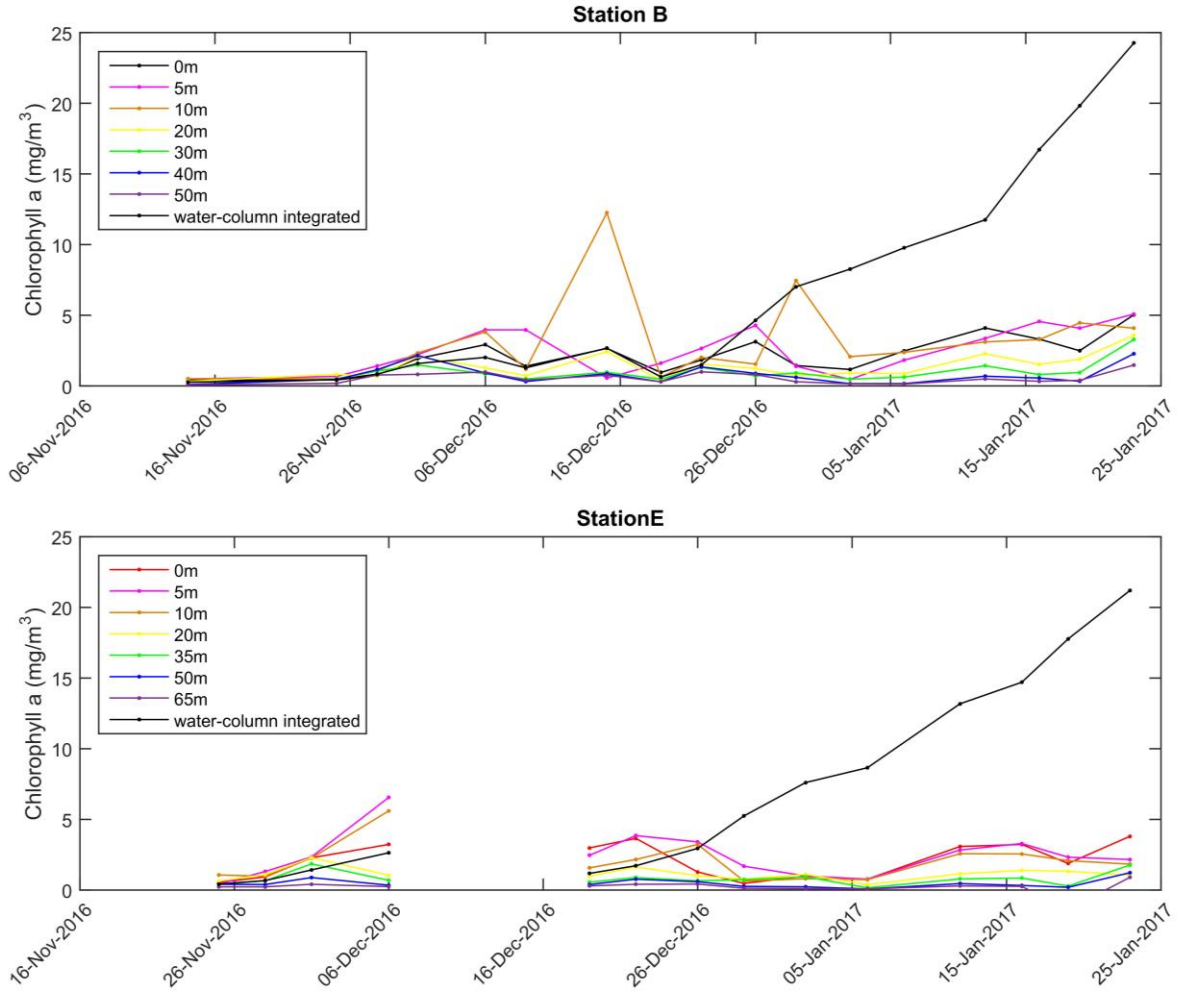


Fig. 6 – Chlorophyll concentrations at Stations B and E at each depth sampled (mg m^{-3}) and total water-column integrated chlorophyll (mg m^{-2}) from mid-November 2016 until late January 2017.

We also deployed one of our gliders, RU24, this month (Fig. 7). RU24 was deployed on January 17, 2017 and is equipped with a CTD; an optics puck measuring backscatter, chlorophyll, and CDOM; a dissolved oxygen optode; and a FIRe fluorometer. The FIRe (Fluorescence Induction

and Relaxation) fluorometer measures the efficiency of phytoplankton photosystems – allowing us to measure how healthy they are. RU24 spent several days traveling back and forth along the 'Endurance' line at the head of the Palmer Deep Canyon between the Joubin and Wauwermans Islands, as it has done the last few years (Fig. 8).

Fig. 7 –The autonomous underwater glider, RU24, at deployment.

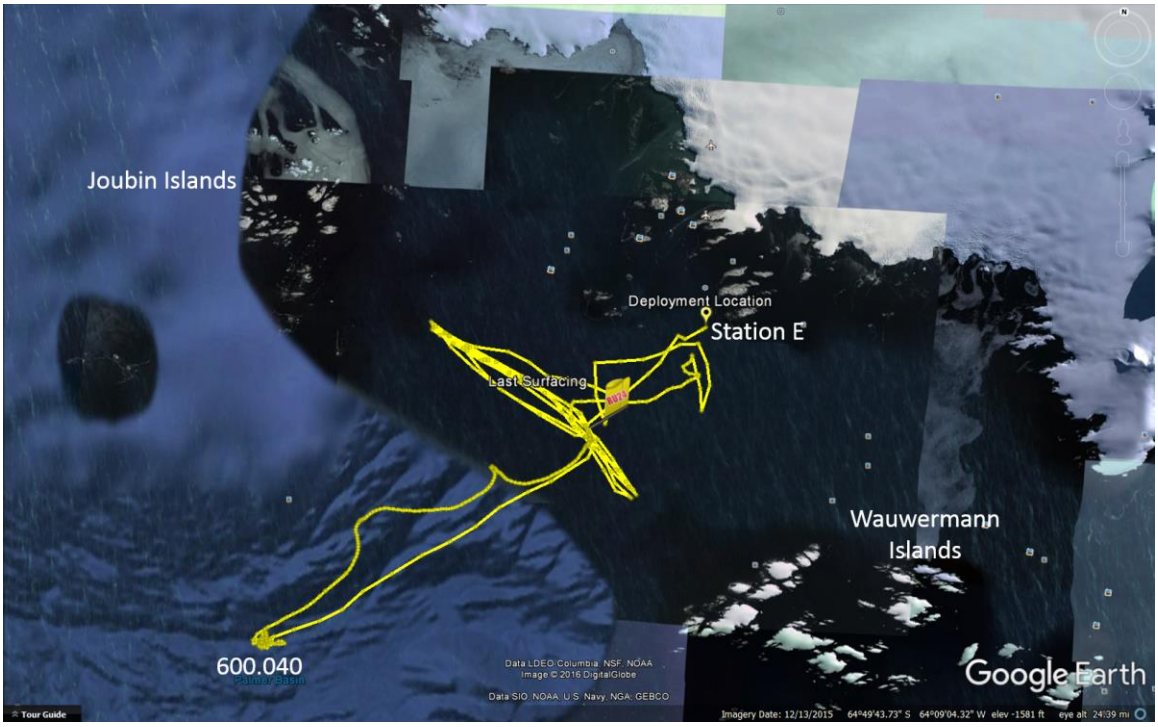


Fig. 8 – Map of autonomous underwater glider RU24's deployment. RU24 was deployed at Station E on Jan. 17, 2017. Between Jan. 18 and Jan 25, 2017, RU24 traveled back and forth along the sampling line between the Joubin and Wauwermans Islands. RU24 sampled at LTER station 600.040 between Jan 26 and Jan 30, 2017, before heading back towards Palmer Station for recovery on Jan. 31, 2017.

Following that, the glider traveled out to LTER grid station 600.040 in the center of the Palmer Canyon for 3.5 days and we were able to collect data over many diel (24 hour)

cycles to investigate how the conditions change and the photosystems of the phytoplankton change throughout a day-night period (Fig. 9). RU24 was recovered on January 31, 2017.

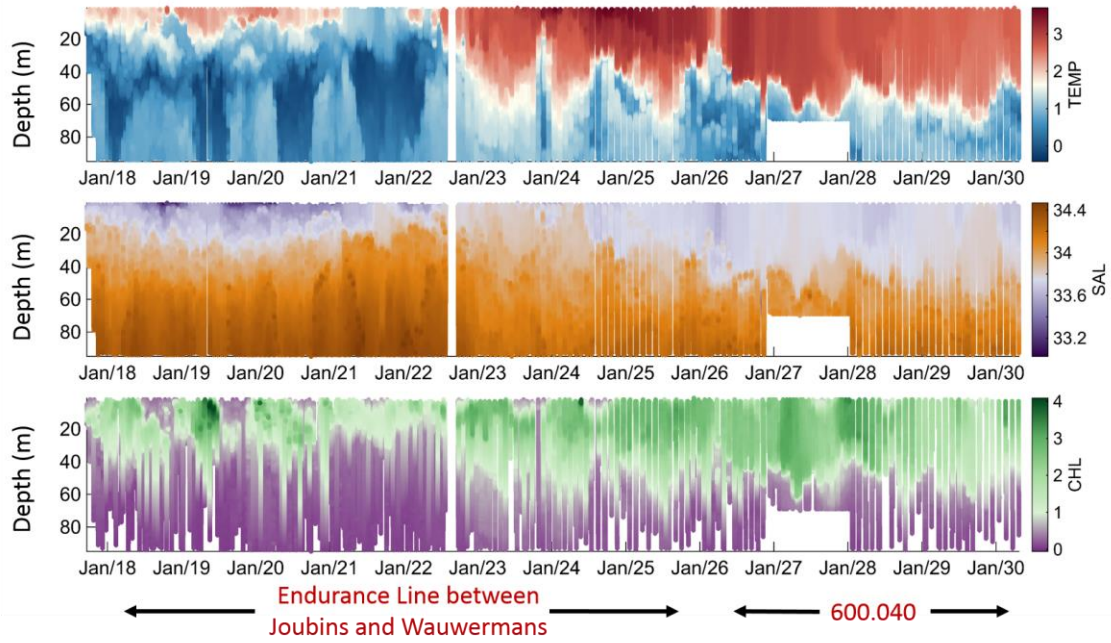


Fig. 9 – Temperature (°C), Salinity (practical salinity units), and Chlorophyll (µg L^{-1}) data from RU24.

Additional work this month included a successful run of Mike Brown's incubation experiment examining the impact of glacial meltwater on phytoplankton community composition (Fig. 10). This experiment will be repeated a few more times during the remainder of the season. Many thanks to the support and science members who made running this experiment possible!

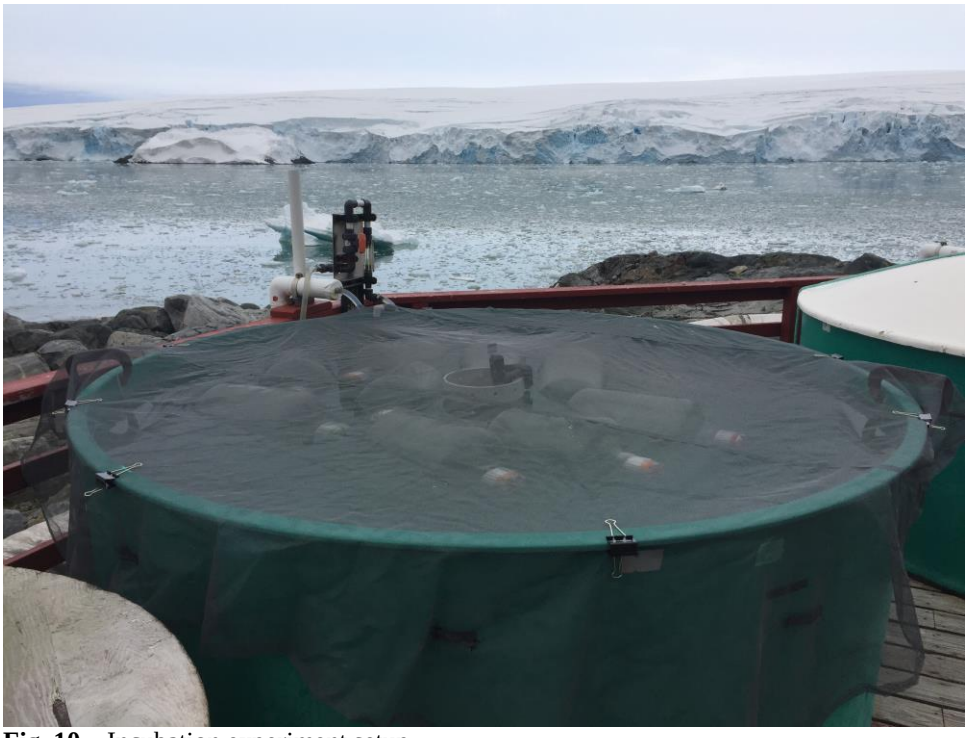


Fig. 10 – Incubation experiment setup.

Thanks to all the help from ASC folks over the month. A special shout out to Randy Jones, Leigh West, and Adrian Jaycox who helped with the glider deployment and with incubation water collection, and to the bird and whale researchers who helped recover RU24!

C-024-P: PALMER, ANTARCTICA LONG-TERM ECOLOGICAL RESEARCH (LTER): CLIMATE MIGRATION, ECOSYSTEM RESPONSE AND TELECONNECTIONS IN AN ICE-DOMINATED ENVIRONMENT, WHALE COMPONENT

Dr. Ari Friedlaender, Principal Investigator, Oregon State University, Newport, OR

Personnel on Station: Logan Pallin and James Fahlbusch

For the month of January, the whale researchers (James Fahlbusch and Logan Pallin) stationed at Palmer Station as part of the LTER project, have continued our two primary projects that involve humpback whale photo identification/biopsy sampling and acoustic-based prey mapping. Our two additional whale researchers on the ARSV *Laurence M. Gould* (Dr. Dave Johnston and Julian Dale) have also been collecting biopsy samples, as well as using unmanned aerial vehicles (UAVs) to image whales from the sky to assess body condition and thus health. Compared to last year, whale numbers and krill biomass seem to be way up, something likely a result of the varying sea ice conditions this year. This month we have spent a total of 119 hours on the water surveying and to date, James and Logan have collected 52 skin blubber biopsy samples that will be used for genetic and hormone analyses to assess changes in humpback whale population demography. Of these 52 whales, we have been able to collect 45 high quality fluke photos that will be used for further photo identification (Fig. 11).

Fig. 11 – Fluke photo of humpback whale Mn17_102C-P.

So far, we have been able to identify at least one female that we sampled last year (Mn17_008A-P and Mn16_024A_P). This female was highly distinguishable due to a large propeller scar on her left side (Fig. 12). This female was accompanied by a young calf (~6 months old) last year, 2016, and we believe she was still with this same calf this year, 2017, who was likely in the process of being separated.

Fig. 12 – Female Mn16_024A_P and Mn17_008A_P with large propeller scar on left side.

In addition to whale surveys, we completed 13 active acoustic surveys this month to understand krill variability over time in the Palmer area, as well as an additional 3 opportunistic surveys around groups of feeding whales. Opportunistic surveys around feeding whales are important as we are able to assess the field (quantity and biomass of prey) that the whales are utilizing which becomes significant when we begin to look at presence and absence of these animals over time. Overall, we found that krill patches were sparsely distributed. Krill have been observed either on the bottom between 75 and 150 m, or at the surface in the top 25 m. When we found krill aggregated at the surface, whales tended to engage in surface lunge or bubble net feeding, something we did not witness last year (Fig. 13). During bubble net feeding, Humpback whales

Fig. 13 – Surface lunge feeding events of humpback whales.

expel air as they encircle their prey. This process serves to corral the prey into a higher density, thereby making each lunge more efficient. With each feeding attempt, Humpbacks are able to expand their throat pouch to engulf an enormous quantity of prey-laden water (~120% of their body mass; Fig. 13). It is sometimes done cooperatively, with several whales engaging in the behavior simultaneously, as we witnessed on the south side of Shortcut Island in mid-January

2017. Additionally, while conducting our opportunistic krill surveys, we were able to prey map within these feeding groups and pick up the concentrated biomass of krill on the echograms (Figure 14; red circles).

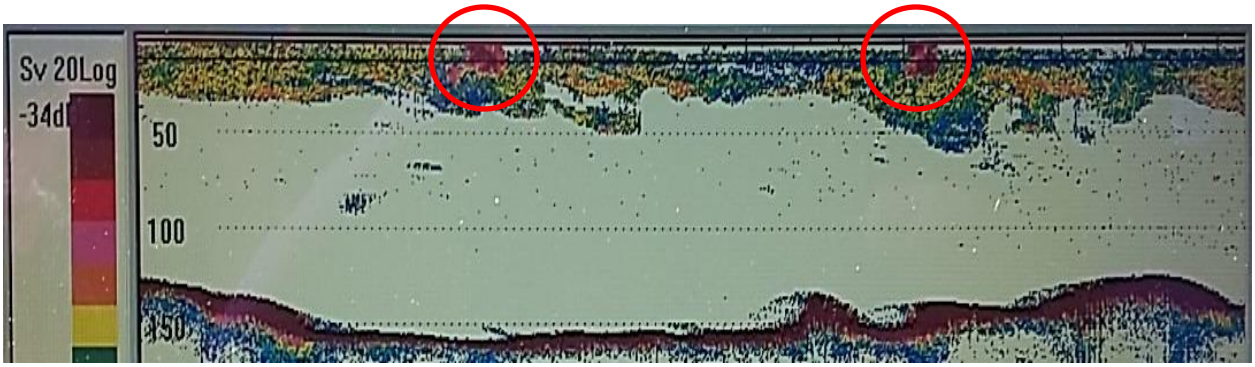


Fig. 14 – Krill echogram mapped using a 120 and 38 Khz Simrad echosounder. Notice the highly concentrated biomass of krill (dark red; red circles) in the first 10 m of the water column.

In addition to our main projects this month, we opportunistically collected two fecal samples that will be used for future crabeater seal diet studies. Finally, we both contributed to and benefitted from collaborative assistance with other LTER projects operating at Palmer; the collaboration between and among the projects was evident and helpful and we would like to thank all those who have helped guide us to whales in the area.

C-045-P: PALMER, ANTARCTICA LONG-TERM ECOLOGICAL RESEARCH (LTER): CLIMATE MIGRATION, ECOSYSTEM RESPONSE AND TELECONNECTIONS IN AN ICE-DOMINATED ENVIRONMENT, MICROBIAL / BIOGEOCHEMICAL COMPONENT

Dr. Hugh Ducklow, Principal Investigator, Columbia University, Lamont Doherty Earth Observatory

Personnel on Station: Adrian Jaycox, Leigh West

January was a busy month, beginning with a hectic port call. The ARSV *Laurence M. Gould* arrived for the annual Long Term Ecological Research (LTER) cruise in early January 2017, keeping Leigh West and Adrian Jaycox busy transferring supplies and instruments to the ship, setting up labs, and training first-time cruise participants. Our equilibrator inlet mass spectrometer (EIMS) had malfunctioned in late December 2016, so we replaced its burnt-out filament and set it up in the ARSV *Gould* Wet Lab upon the boat's arrival, allowing it to function properly for the majority of the cruise.

As our flow cytometer was on board the ARSV *Gould* this month, we preserved flow cytometry samples for analysis upon the ship's return. We also continued to measure bacterial production as a part of our twice-weekly seawater sampling. This month, the production rate of bacteria populations at Stations B and E continued to show high variability while trending upward (Fig. 15). The high rates in late January approach the highest measured in our record.

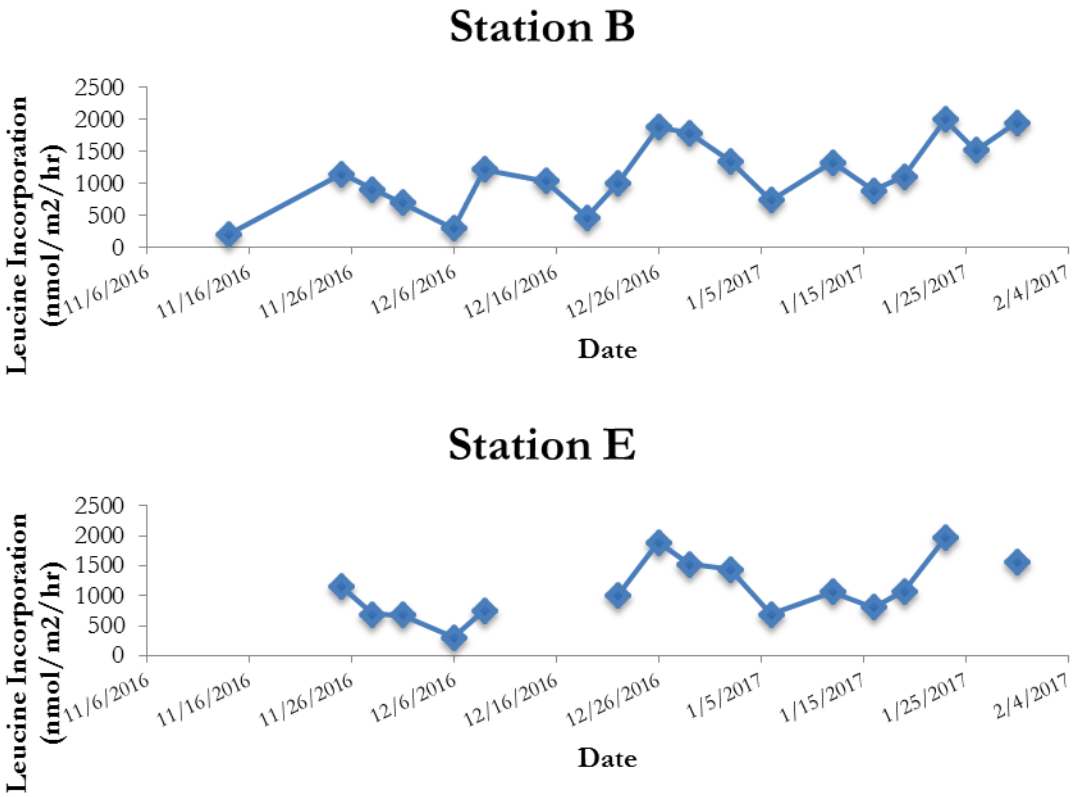
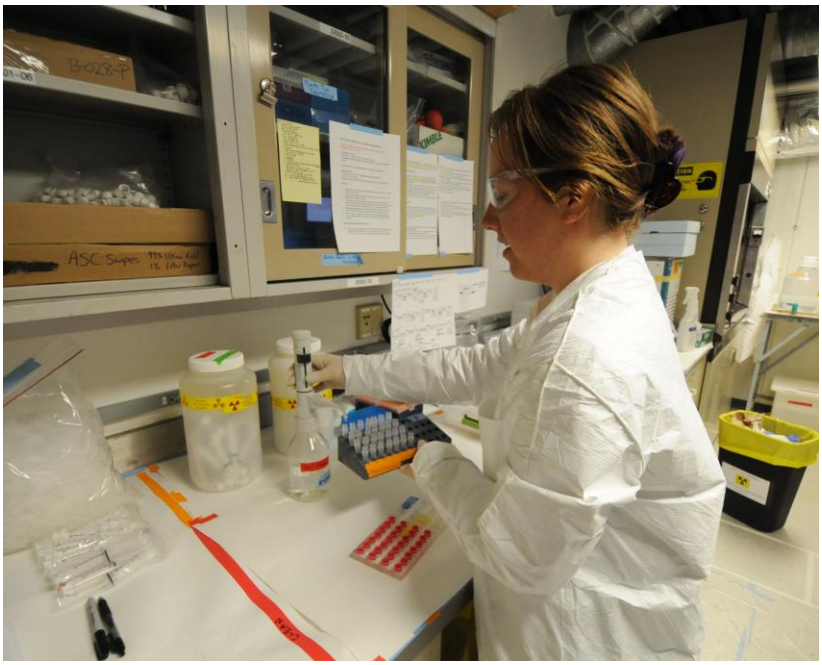


Fig. 15 – Bacterial production, as measured by leucine incorporation (nmol m^{-2} hr^{-1}) integrated across seven different depths at Stations B and E between November 14, 2016 and January 30, 2017.

C-019-P's (Schofield) primary production measurements generally paralleled bacterial production, with both exhibiting increasing trends. In addition, cycles of primary production roughly corresponded with the two-week periodicity we observed in bacterial production. Elevated bacterial production levels also tended to coincide with higher seawater temperatures as well as periods of precipitation and high winds in January.

We also assisted some of the other science groups with their work this month, helping C-019-P (Schofield) deploy one of their gliders for a mission in the Palmer Deep Canyon in mid-January.



Leigh West completing bacterial production measurements in Palmer's Radioactive Lab. *Image Credit: Ducklow Group*

O-231-P: QUANTIFYING ATMOSPHERIC IRON PROPERTIES OVER WEST ANTARCTIC PENINSULA

Dr. Yuan Gao, Principal Investigator, Rutgers University, Department of Earth and Environmental Sciences

Personnel on Station: Yuan Gao

Retrieving sampling gear from the Palmer Backyard. *Image Credit: Dr. Yuan Gao*

Air sampling for the 2016-2017 season at Palmer backyard was successfully finished by January 30, 2017, and all instruments and devices were uninstalled and packed in time for LMG17-01 departing northbound on Feb 6, 2017. During this season, bulk aerosol samples were collected by a high-volume aerosol sampler for the concentrations of a suite of atmospheric trace elements and ionic species. The size-segregated aerosol samples were also collected for mass-size distributions to constrain atmospheric dry deposition velocity, a key parameter for atmospheric dry deposition calculations. The operation of aerosol samplers was controlled by a wind sector to minimize local impact. Both total atmospheric deposition and wet deposition-only were sampled. Individual aerosol particles were also collected for chemical composition and particle morphology. Sampling of surface snow was made on the glacier and around Palmer earlier in the season, and later in January, rain samples were also collected. Samples and sampling devices were handled within a HEPA-filtered laminar flow 100-class clean-room bench in the lab.

Sincere thanks to everyone at Palmer Station for supporting this project and for hospitality and friendship, especially to Bill Burns for installing the fan that solved the heat problems in the enclosure on the platform, Pete Lawrence for making wood supporting shelf, Mike Stevenson for helping with every electronic issue, Rob Bergeron and Nandor Kovats for carefully coordinating waste treatment and sampling of this project – these efforts were critically important for maintaining normal operation of this project throughout this season. Many thanks to Rich Harper, Nandor Kovats, Keri Nelson, Jeff Otten, Carly Quisenberry, Liz Widen and of course Randy Jones for help with bringing heavy instrument from the platform in the backyard to the lab at the end of this season; a huge effort! Thanks Cedar Reimer for making our shipping a smooth process. Special thanks to Randy Jones, our lab manager, who was always on the top of everything and took care of every step during this project, and our success of this season couldn't have been achieved without Randy!

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
January 2017
Liz Widen

B-005-P: IMPACTS OF LOCAL OCEANOGRAPHIC PROCESSES ON ADELIE PENGUIN FORAGING OVER PALMER DEEP: COASTAL OCEAN DYNAMICS APPLICATIONS RADAR (CODAR)
Josh Kohut, Principal Investigator, Rutgers University

The CODAR system consists of three transmitters/receivers located on Anvers Island, Wauwerman Island, and on Howard Island in the Joubins. The data from all three transmitters is compiled on computers in Terra Lab and plots of the surface currents over the Palmer Deep are generated.

The system operated normally throughout the month.

In the Aquarium, vegetation and soil samples dry under incandescent lamps in setups designed to extract *Belgica antarctica* from the samples and into the trays below. *Image Credit: Randy Jones*

G-090-P: GLOBAL SEISMOGRAPH NETWORK (GSN) SITE AT PALMER STATION
Kent Anderson, Principal Investigator, Incorporated Research Institutions for Seismology (IRIS)

Station PMSA is one of more than 150+ sites in the GSN, monitoring seismic waves produced by events worldwide. Real-time telemetry data is sent to the U.S. Geological Survey (USGS). The Research Associate operates and maintains on-site equipment for the project.

The system operated normally throughout the month.

A-109-P: ANTARCTIC EXTREMELY LOW FREQUENCY/VERY LOW FREQUENCY (ELF/VLF) OBSERVATIONS OF LIGHTNING AND LIGHTNING-INDUCED ELECTRON PRECIPITATION (LEP)
Robert Moore, Principal Investigator, University of Florida

ELF/VLF radio wave observations at Palmer Station are used to provide a deeper understanding of lightning and its effects on the Earth's inner radiation belt. The Research Associate operates and maintains on-site equipment for the project.

The VLF/ELF system has operated well throughout the month.

A-119-P: DEVELOPMENT OF ANTARCTIC GRAVITY WAVE IMAGER
Michael Taylor, Principal Investigator, Utah State University

The Gravity Wave Imager takes images of the night sky in the near infrared, observing the dynamics of the upper atmosphere. The camera takes one 20-s exposure image every 30 seconds of a very faint emission originating from a layer located at ~55 miles of altitude.

The system has finished operation for the winter season; system is off for the summer.

O-202-P: ANTARCTIC METEOROLOGICAL RESEARCH CENTER (AMRC) SATELLITE DATA INGESTOR
Mathew Lazzara, Principal Investigator, University of Wisconsin

The AMRC computer processes satellite telemetry received by the Palmer Station TeraScan system, extracting Automated Weather Station information and low-resolution infrared imagery and sends the results to AMRC headquarters in Madison, WI. The Research Associate operates and maintains on-site equipment for the project.

The data ingestor computer system has been operating normally all month.

O-264-P: A STUDY OF ATMOSPHERIC OXYGEN VARIABILITY IN RELATION TO ANNUAL DECADAL VARIATIONS IN TERRESTRIAL AND MARINE ECOSYSTEMS
Ralph Keeling, Principal Investigator, Scripps Institution of Oceanography

The goal of this project is to resolve seasonal and interannual variations in atmospheric O_2 (detected through changes in O_2/N_2 ratio), which can help to determine rates of marine biological productivity and ocean mixing as well as terrestrial and oceanic distribution of the global anthropogenic CO_2 sink. The program involves air sampling at a network of sites in both the Northern and Southern Hemispheres. The Research Associate collects samples fortnightly from Terra Lab.

Air samples were taken twice this month.

Looking across Bonaparte Point from the Palmer Backyard. *Image Credit: Randy Jones*

O-264-P: COLLECTION OF ATMOSPHERIC AIR FOR THE NOAA/GMD WORLDWIDE FLASK SAMPLING NETWORK

Don Neff and Steve Montzka, Principal Investigators, National Oceanic and Atmospheric Administration / Global Monitoring Division, Boulder, CO

The NOAA ESRL Carbon Cycle Greenhouse Gases (CCGG) group makes ongoing discrete measurements to document the spatial and temporal distributions of carbon-cycle gases and provide essential constraints to our understanding of the global carbon cycle. The Halocarbons and other Atmospheric Trace Species (HATS) group quantifies the distributions and magnitudes of the sources and sinks for atmospheric nitrous oxide (N2O) and halogen containing compounds. The Research Associate collects weekly air samples for the CCGG group and fortnightly samples for the HATS group.

CCGG samples were taken regularly and HATS Air samples were taken twice this month.

O-264-P: ULTRAVIOLET (UV) SPECTRAL IRRADIANCE MONITORING NETWORK
James Butler, Principal Investigator, National Oceanic and Atmospheric Administration / Global Monitoring Division, Boulder, CO

A Biospherical Instruments (BSI) SUV-100 UV spectroradiometer produces full sky irradiance spectra ranging from the atmospheric UV cutoff near 290 nm up to 605 nm, four times per hour. A BSI GUV-511 filter radiometer, an Eppley PSP Pyranometer, and an Eppley TUVR radiometer also continuously measure hemispheric solar flux within various spectral ranges. The Research Associate operates and maintains on-site equipment for the project.

The system operated normally throughout the month.

O-283-P: ANTARCTIC AUTOMATIC WEATHER STATIONS (AWS)
Mathew Lazzara, Principal Investigator, University of Wisconsin

AWS transmissions from Bonaparte Point are monitored using the TeraScan system and the University of Wisconsin's Data Ingestor system. Data collected from this station is freely available from the University of Wisconsin's Antarctic Meteorological Research Center (AMRC) website. The Research Associate monitors data transmissions for the project and performs quarterly maintenance on the station at Bonaparte Point.

The system operated normally throughout the month.

T-295-P: GPS CONTINUOUSLY OPERATING REFERENCE STATION
Joe Pettit, Principal Investigator, UNAVCO

Continuous 15-second epoch interval GPS data files are collected at station PALM, compressed, and transmitted to the NASA-JPL in Pasadena, CA. The Research Associate operates and maintains on-site equipment for the project.

The system operated well throughout the month.

T-312-P: TERASCAN SATELLITE IMAGING SYSTEM

The TeraScan system collects, processes, and archives DMSP and NOAA satellite telemetry, capturing approximately 25-30 passes per day. The Research Associate operates and maintains on-site equipment for the project. The TeraScan weather and ice imagery is used for both research and station operations.

The Terascan system worked well throughout the month.

A-357-P: EXTENDING THE SOUTH AMERICAN MERIDIONAL B-FIELD ARRAY (SAMBA) TO AURORAL LATITUDES IN ANTARCTICA

Eftyhia Zesta, Principal Investigator, University of California Los Angeles

The three-axis fluxgate magnetometer is one in a chain of longitudinal, ground-based magnetometers extending down though South America and into Antarctica. The primary scientific goals are the study of ULF (Ultra Low Frequency) waves and the remote sensing of mass density in the inner magnetosphere during geomagnetically active periods. The Research Associate maintains the on-site system.

The magnetometer was operational all month.

A-373-P: TROPOSPHERE-IONOSPHERE COUPLING VIA ATMOSPHERIC GRAVITY WAVES
Vadym Paznukhov, Principal Investigator, Boston College

The goal of this project is to enhance the comprehensive research understanding of troposphere-ionosphere coupling via Atmospheric Gravity Waves (AGWs) in the Antarctic region. Both experimental and modeling efforts will be used on the Antarctic Peninsula to investigate the efficiency and main characteristics of such coupling and will address several questions remaining in the current understanding of this coupling process.

The system operated well throughout the month.

T-998-P: INTERNATIONAL MONITORING STATION (IMS) FOR THE COMPREHENSIVE NUCLEAR TEST BAN TREATY ORGANIZATION (CTBTO)
Managed by General Dynamics

The IMS Radionuclide Aerosol Sampler and Analyzer (RASA) is part of the CTBTO verification regime. The automated RASA continually filters ambient air and tests for particulates with radioisotope signatures indicative of a nuclear weapons test. The Research Associate operates and maintains the instrument.

The system is having grounding issues with the blower causing dead time in the data, but has been stabilizing over the last month. The blower motor controller will be replaced in April.

OCEANOGRAPHY
Daily observations of sea ice extent and growth stage are also recorded, along with continuous tidal height, ocean temperature, and conductivity at Palmer's pier.

Observations of sea ice around station were made daily and the tide gauge worked well throughout the month. A ReadMe file was created for the Tide Gauge to assist users with reading the data.

METEOROLOGY
The Research Associate acts as chief weather observer, and compiles and distributes meteorological data. Weather data collected using the automated electronic system is archived

locally and forwarded once per month to the University of Wisconsin for archiving and further distribution. Synoptic reports are automatically generated every three hours by the Palmer Meteorological Observing System (PalMOS) and emailed to the National Weather Service for entry into the Global Telecommunications System.

The local weather station (PAWS) is working fine. At beginning of the year the Airport Weather Advisor software encountered a license error. The license was replaced and data resumed. The scripts for the boating map and the weather radio were updated to include the new Access Point Weather Station.