

# PALMER STATION MONTHLY SCIENCE REPORT

DECEMBER 2018



**A chinstrap penguin sits atop a large bergy bit near Cormorant Island.** *Image Credit: Randy Jones*

## NEWS FROM THE LAB

Randy Jones, Summer Laboratory Supervisor

The labs are in full swing this month, especially with the arrival of LMG18-11 on 13 Dec. With the ARSV *Laurence M. Gould* at Palmer for a few days, we welcomed Schuyler Nardelli of the C-019-P (Schofield) group, and Bruce Hungate, Kelly McMillen, and Natasja van Gestel of the B-086-P (van Gestel) group. Dr. Ben Van Mooy's group (B-032-L) wrapped up their research at Palmer after a successful cruise and Palmer field season.

Many groups have been taking to the waters, the islands, and the Palmer Backyard with the improving weather conditions throughout December. Greater snow cover across the local islands and regional brash ice to the south along the Antarctic Peninsula have put only a small dent in the din that is field science. Lastly, the summer solstice on 21 December was celebrated by many with a ceremonial dip in the ocean.

## DECEMBER 2018 WEATHER

Marissa Goerke, Research Associate

### Palmer Monthly Met summary for December, 2018

<b>Temperature</b>
<b>Average:</b> 0.5 °C / 32.9 °F
<b>Maximum:</b> 5.9 °C / 42.6 °F on 29 Dec 23:13
<b>Minimum:</b> -3.7 °C / 25.3 °F on 8 Dec 08:57
<b>Air Pressure</b>
<b>Average:</b> 975.6 mb
<b>Maximum:</b> 999.6 mb on 4 Dec 17:31
<b>Minimum:</b> 953 mb on 7 Dec 02:17
<b>Wind</b>
<b>Average:</b> 11.3 knots / 13.0 mph
<b>Peak (5 Sec Gust):</b> 51 knots / 59 mph on 6 Dec 12:11 from NNE (22 deg)
<b>Prevailing Direction for Month:</b> NW
<b>Surface</b>
<b>Total Rainfall:</b> 73.9 mm / 2.91 in
<b>Total Snowfall:</b> 28.0 cm / 10.9 in
<b>Greatest Depth at Snow Stake:</b> 107.6 cm / 42.0 in
<b>WMO Sea Ice Observation:</b> Sea ice concentration are <3/10 with 1-5 ice bergs and bergy bits.
<b>Average Sea Surface Temperature:</b> 0.07 °C / 32.1 °F

Temperatures peaked at 42.0 °F on 29 December and reached a low of 25.0 °F on 8 December. The wind peaked at 59 mph on the 6<sup>th</sup> and averaged 13 mph for the month. The prevailing wind direction for the month was from the northwest. We had several snow storms move through bringing our monthly snow fall to 10.9 inches and our total accumulation has dropped to 42 inches. Sea ice conditions have been 3/10 at most and all fast ice in Hero Inlet has melted out. There are several large icebergs in the area.

## **B-032-L: PRODUCTION AND FATE OF OXYLIPINS IN WATERS OF THE WESTERN ANTARCTIC PENINSULA: LINKAGES BETWEEN UV RADIATION, LIPID PEROXIDATION, AND CARBON CYCLING**

Dr. Benjamin Van Mooy, Principal Investigator, Woods Hole Oceanographic Institution

Personnel on Station: Henry Holm and Kharis Schrage

The B-032-L (Van Mooy) lab departed Palmer Station on 16 December, but accomplished a great deal of research in the first half of the month. In addition to continuing the processing of samples collected in November aboard the ARSV *Laurence M. Gould* (LMG), we conducted four new experiments on station that built on previous experiments.

For our first experiment, we conducted additional incubations exposing diatoms to ultraviolet (UV) and non-UV light. This incubation examined the different effects when seawater is shielded using two different materials. The plexiglass used as a cover for the “no-UV” incubations blocks all wavelengths of UV light, while Mylar plastic blocks the high intensity UV-A wavelengths. This was confirmed using a spectrophotometer in our lab. Given this, the two materials are likely to lower Reactive Oxygen Species (ROS) production by different amounts in seawater. Understanding how this transfers to oxylipin production, one of the groups of chemicals of interest to our group, is useful information and informs our other UV experiments. To carry out the experiment, triplicate seawater filled buckets were exposed to sunlight for a full 24 hours (Fig. 1) under four conditions – mylar-shielded, plexiglass shielded, no shielding, and a completely dark treatment. Lipids and chlorophyll were sampled for every 2 hours. Photo-chemical solutions were used measure ROS production and UV light levels. All samples will require processing back at Woods Hole Oceanographic Institute for results.

We also conducted two multi-day experiments in coordination with the C-020-P (Steinberg) group relating to krill predation. The experiments aimed to examine whether krill feed selectively when faced with different food abundances. It is possible that krill might feed selectively in low food conditions prioritizing the most nutritious cells, while in high food conditions will expend less effort encountering food and graze non-selectively. To test this, three treatments of seawater were created with differing amounts of filtered and unfiltered seawater (100% seawater or SW, 30% SW, and 10% SW), and krill were allowed to graze in each for 24 hours. Buckets without krill were run for all treatments as controls. Lipid



**Fig. 1** – Members of the B-032-L and C-020-P groups breaking down a 24-h krill experiment. Lipid information will be a valuable addition to understand krill grazing behaviors.

samples were collected in seawater, from krill stomachs, and from krill fecal pellets. Lipids and other biomarkers detectable by our lab processes will be useful in assessing the prey community make-up in addition to nutrient quality present in all locations.

Our final experiment looked at exploring ice-diatom lipidome changes at varying melt temperatures (the lipidome refers to the entire collection of lipid molecules in an organism). It is well known that ice-adapted diatoms change their lipid membrane to accommodate a variety of temperature conditions particularly as it relates to desaturations. However, a comprehensive look at membrane temperature changes over melting conditions has not been conducted with modern tools. Diatom filled ice was incubated for 24 hours at varying temp conditions from -5 to 5°C. Ice was rapidly melted (< 10 minutes) and filtered for lipids at temperatures under 5°C. To complement the lipid data, Flow-Cytobot samples were taken of melted ice.

In addition to these experiments, we processed, packed, and shipped all B-032-L samples home. Of note were the successful dissections of ~100 krill stomachs. Being able to sample krill stomachs contents for lipids with a consistent method is essential to all our krill experiments. The whole of the B-032-L team had an amazing and productive season at Palmer station this year. We are look forward to processing this season's samples and continuing to work on collaborations with other groups on station.

## **B-086-P: ANTARCTICA AS A MODEL SYSTEM FOR RESPONSES OF TERRESTRIAL CARBON BALANCE TO WARMING**

Dr. Natasja van Gestel, Principal Investigator, Texas Tech University

Personnel on Station: Kelly McMillen and Natasja van Gestel

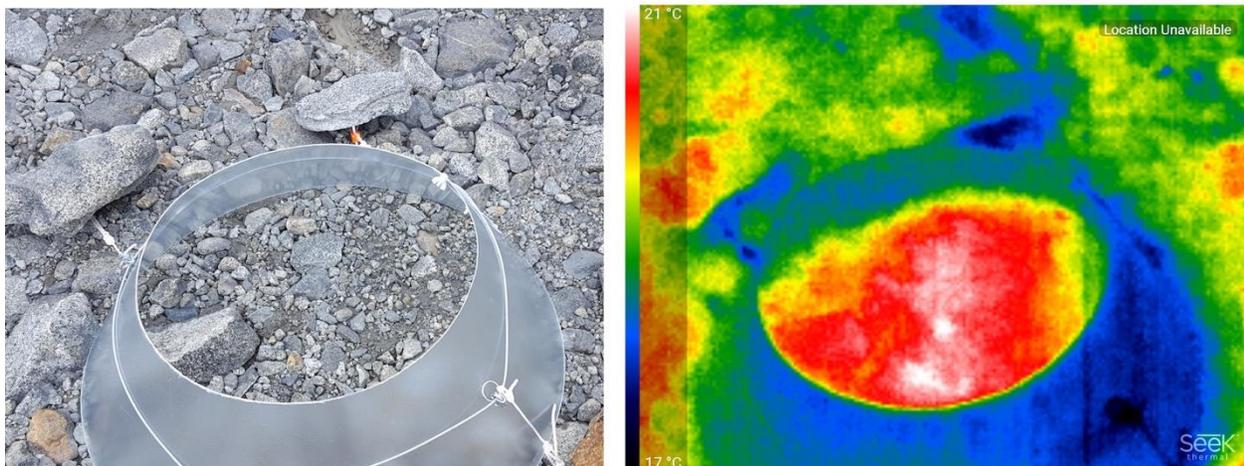
Three members of B-086-P (van Gestel) arrived at Palmer Station on 13 December 2018. Dr. Bruce Hungate, a co-PI on the grant, remained on the ARSV *Laurence M. Gould* as he was returning with the *Gould* to Punta Arenas. We unpacked, set up our lab, and started assembling our twenty cone-chambers, which will be used for our warming experiment. We are using a plant productivity gradient; three of our sites are in the Palmer Backyard and one site is on Litchfield Island. On 28 December, we completed our plot selections at the four productivity sites. We have a total of forty plots (ten at each site).

One of our measurements includes the rates of carbon fluxes (in our case, CO<sub>2</sub> uptake by the vegetation through photosynthesis and CO<sub>2</sub> release through respiration). One of the goals of our project is to better understand how carbon fluxes, in particular the net carbon flux, is impacted by warming. To do so, we need good seals between our chamber and our soils. We inserted 12-inch diameter stainless steel in all plots (Fig. 2). These collars will ensure a tight seal when we place our custom flux chamber on them. To minimize disturbance, we will leave these in place until the end of the summer. Additionally, we are collecting continuous data on soil moisture and soil temperature inside each plot (EM50 Loggers with TM5 sensors, Meter Group, Inc., Pullman, WA).



**Fig. 2** – (A) Twelve-inch stainless steel collars were inserted into the soil (see central collar within each ring made of glow sticks). These glow stick rings were made to help with plot selection. Open-top chambers will be placed after we obtain pre-treatment carbon fluxes. (B) Soil temperature and moisture sensors were installed in all forty plots and Kelly is ensuring the readings look good.

We tested a prototype open-top chamber to test whether it warms the area inside the chamber. We used a thermal camera to test it on a cloudy day. This design is used in other polar environments (e.g., McMurdo). The image shows that it indeed is effective in warming the inside (Fig. 3).



**Fig. 3** – Demonstration that the open-top chambers warm inside the chamber. The thermal image (right photo) shows highest temperatures in white are found inside the chamber.

The open-top chambers will be placed after we measure pre-treatment carbon fluxes. We selected sites such that a control is paired with a warming treatment (i.e., the percent cover/composition inside each set of paired plots matches as close as possible, with ideally all plots at a given site being similar to each other).

For updates on our research, please visit my daily blog: <https://natasjavgstel.github.io/blog/>  
 This blog has had 107 unique users since 20 December 2018 (when number of users was first tracked) from seven countries.

**C-013-P: PALMER, ANTARCTICA LONG TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCED PELAGIC ECOSYSTEM – APEX PREDATOR COMPONENT**

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

Personnel on Station: Darren Roberts and Megan Roberts

Wind conditions improved throughout December allowing for boat-based field work on 21 days of the month. We continued the daily monitoring of nesting Adélie penguins on Humble and Torgersen Islands as well as maintaining regular censuses of all local Adélie colonies. We completed several trips to Dream Island to conduct Adélie and chinstrap penguin counts and to Biscoe Island for Adélie and gentoo penguin counts. Additionally we conducted Adélie, gentoo, and chinstrap penguin surveys at the Joubin Islands.

A peak egg census was completed during December for chinstrap penguins on Dream Island and for gentoo penguins on Biscoe Island. Preparations for the Humble Island Adélie penguin radio transmitter project continued; equipment was installed on Humble Island and remote data collection and transfer was tested. We also prepared for the deployment of satellite transmitters and dive depth recorders on Adélie and gentoo penguins which will begin in early January.



**Heavy snow conditions at the Joubin Islands** *Image Credit: Fraser group*

Skua work continued this month as we began checking nests for newly hatched brown skua chicks on local islands as well as on Dream and Biscoe Islands. Our south polar skua mark-recapture and breeding monitoring study on Shortcut Island continued with nest initiation checks and band recording. Our census of the blue-eyed shag colony on Cormorant Island continued with the first chicks of the season observed in early December. A gull survey was completed at all local kelp gull colonies as well as on Dream Island.



**Giant Petrel on Stepping Stones** *Image Credit: Fraser group*

Our all-island census of giant petrel nests was started in December; breeding pairs were identified and new breeders were banded. Foraging ecology studies of giant petrels were also conducted in December with satellite transmitter deployments at Shortcut and Humble Islands.

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

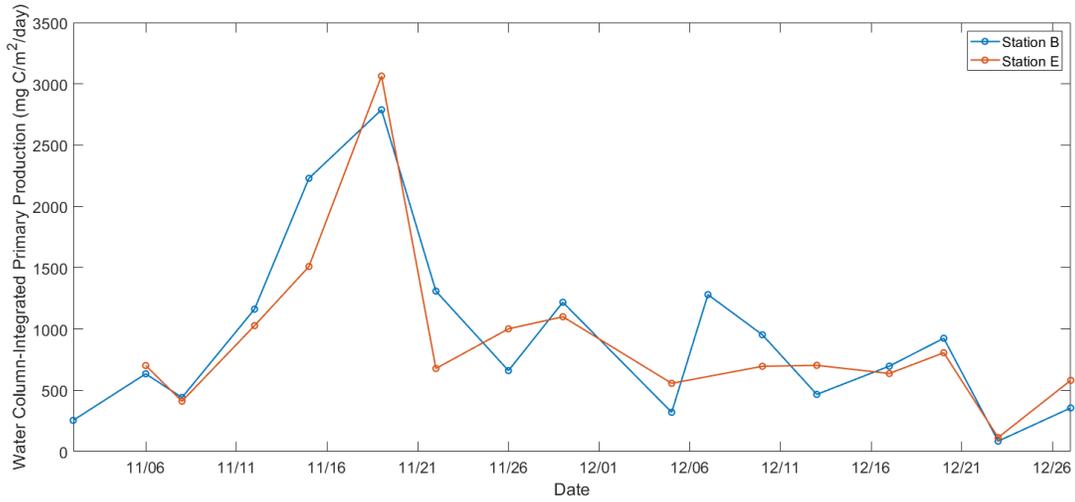
Dr. Oscar Schofield, Principal Investigator, Rutgers University, Institute for Earth, Ocean, and Atmospheric Sciences

Personnel on Station: Anna Bashkirova, Schuyler Nardelli, and Marie Zahn

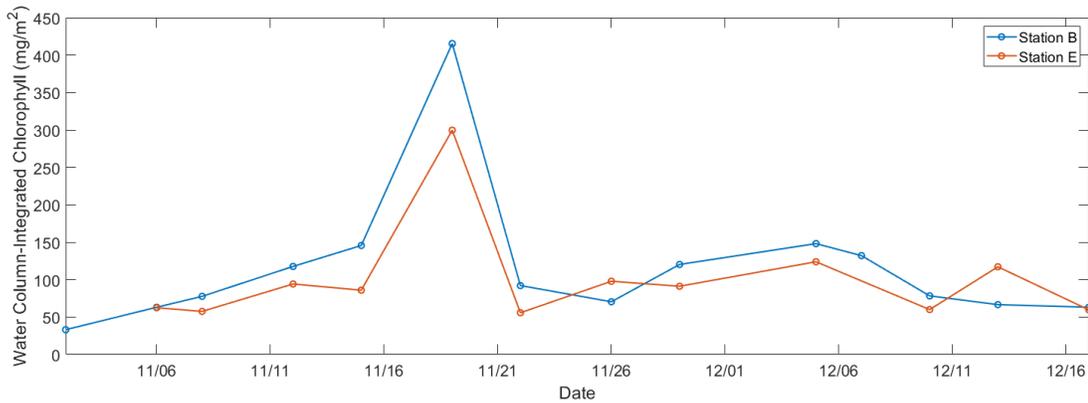
It was another successful month of sampling in the C-019-P (Schofield) lab! This month we said goodbye to Anna as she departed and welcomed Schuyler Nardelli, a PhD student in oceanography at Rutgers University, supervised by Dr. Schofield, who returns for her third season at Palmer Station. Routine bi-weekly sampling and analysis proceeded throughout the month with only one day missed due to bad weather. Additionally, our collaborative work with the C-013-P (Fraser), C-020-P (Steinberg), C-024-P (Friedlaender), and C-045-P (Ducklow) labs continued as we spent a day conducting acoustic transects and CTD casts in the gentoo penguin foraging region from the Wauwermans Islands to Biscoe Point. Finally, we ballasted our Slocum glider (Serial# RU32) in preparation for deployment.

Values of primary production ( $\text{mg C m}^{-2} \text{ day}^{-1}$ ; Fig. 4) and chlorophyll concentrations ( $\text{mg m}^{-2}$ ; Fig. 5) dropped after the spring phytoplankton bloom around 19 November 2018 and have remained steady since. Fluorescence profiles also reflect the spring bloom (reaching nearly  $10 \text{ mg m}^{-3}$  at the chlorophyll maximum) and subsequent leveling-off to  $\sim 3 \text{ mg m}^{-3}$  for both Stations B and E (Fig. 6). Seawater temperatures gradually increased, warming from below  $-1^\circ\text{C}$  to

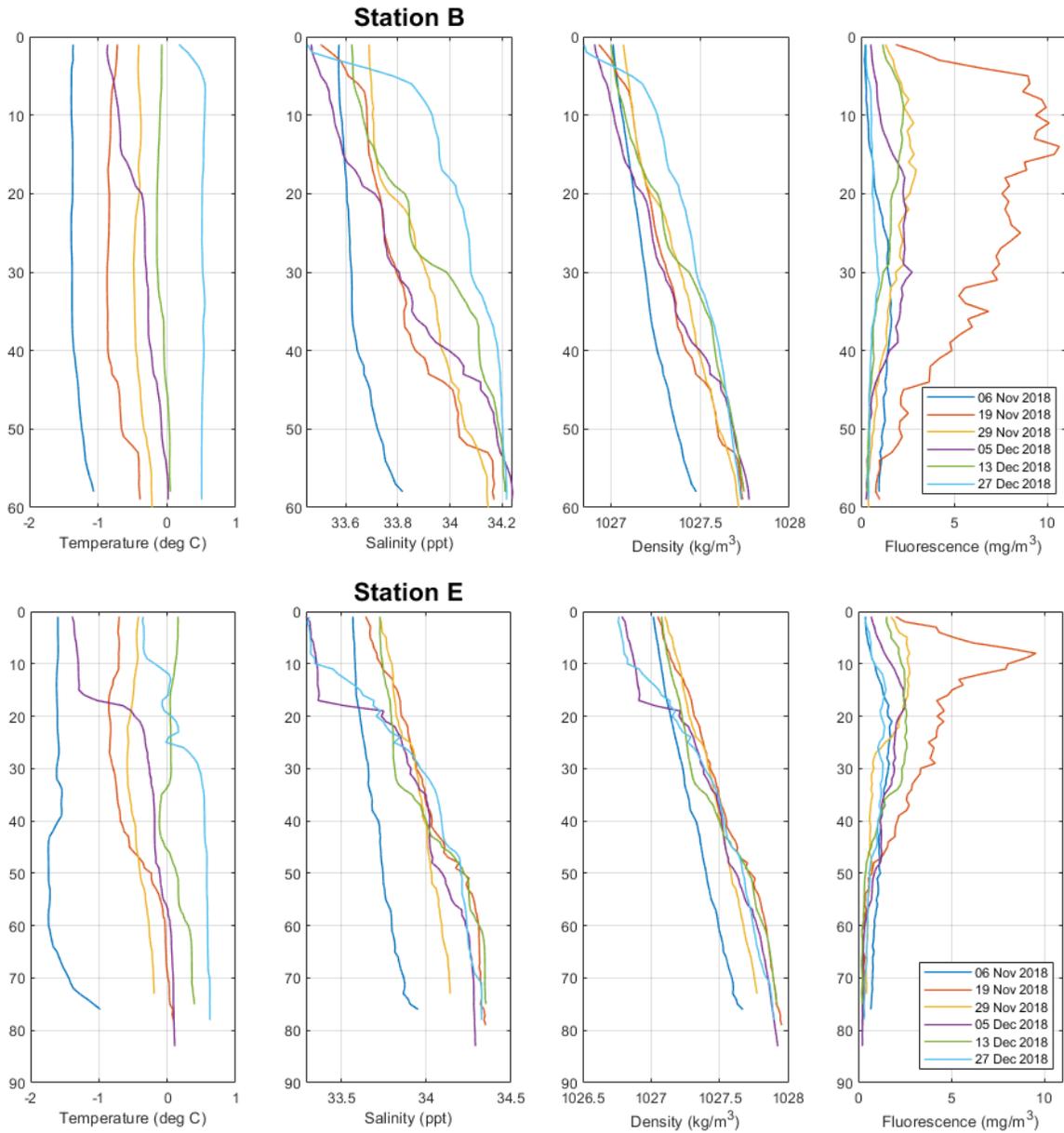
around 0.5°C (Fig. 6). Salinity and density profiles suggest the water columns at both stations appeared to be well mixed in early November and have stratified further going into December, most notably on 5 December at Station E (Fig. 6).



**Fig. 4** – Depth-integrated primary production ( $\text{mg C m}^{-2} \text{day}^{-1}$ ) values from Station B (blue line) and Station E (orange line) from 1 November through 27 December 2018.

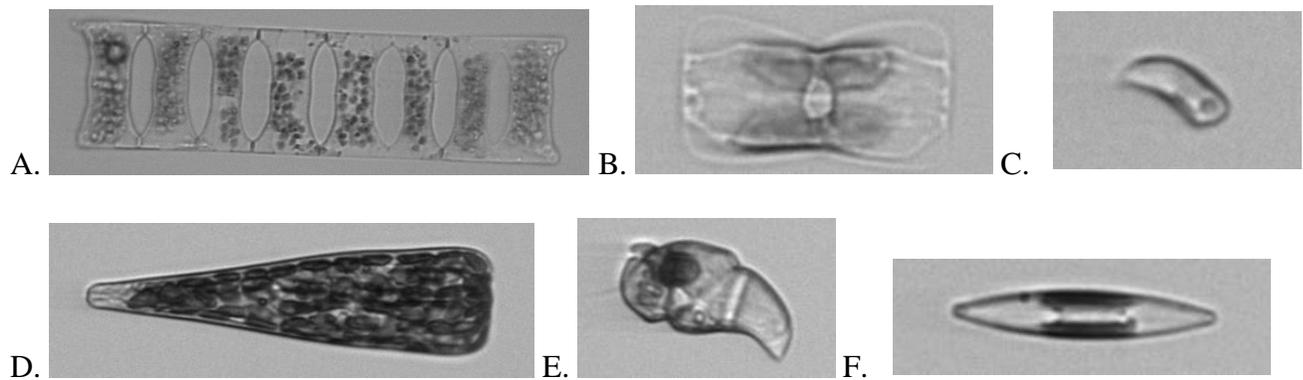


**Fig. 5** – Depth-integrated chlorophyll ( $\text{mg m}^{-2}$ ) values from Station B (blue line) and Station E (orange line) from 1 November through 17 December 2018.



**Fig. 6** – Temperature ( $^{\circ}\text{C}$ ), salinity (ppt), density ( $\text{kg m}^{-3}$ ), and fluorescence ( $\text{mg m}^{-3}$ ) profiles against depth in meters (L-R) for six November and December 2018 sampling events at Station B (top row) and Station E (bottom row).

Images captured by our Imaging Flow Cytobot (IFCB) reflect trends in our early season empirical data. During the spring bloom, we observed *Phaeocystis spp.*, *Corethron spp.*, and chain-forming diatoms (*Thalassiosira spp.*). Throughout December, we saw a decreasing number of these species and increasing numbers of *Amphiprora spp.*, *Licmophora spp.*, *Gyrodinium spp.*, and cryptophytes (Fig. 7). Detailed analysis of our IFCB data will yield quantifiable results for species counts, identification, size, and fluorescence levels.



**Fig. 7** – Images captured by our Imaging Flow Cytobot of (A) *Eucampia antarctica* spp., (B) *Amphiprora* spp., (C) a cryptophyte, (D) *Licmophora* spp., (E) *Gyrodinium* spp., and (F) a pinnate diatom.

Our research is not possible without the help and support of many people on station. We want to especially thank the Marine Technicians (Jakob Bueche, Mike Burns, and Dave Moore), Laboratory Supervisor Randy Jones, Instrument Technician Carolyn Lipke, Communications Technician PJ Charpentier, and Research Associate Marissa Goerke for ensuring safe and efficient operations for sampling and processing.

**C-020-P: PALMER, ANTARCTICA LONG-TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCED PELAGIC ECOSYSTEM – ZOOPLANKTON COMPONENT**

Dr. Deborah Steinberg, Principal Investigator, College of William & Mary, Virginia Institute of Marine Science

Personnel on Station: Jack Conroy and Leigh West



**Jack Conroy and Kharis Schrage taking water samples at the end of a successful experiment.**  
*Image Credit: Steinberg group*

The C-020-P (Steinberg) zooplankton team kept busy in December, completing 97 plankton tows over the course of 15 sampling days.

Antarctic krill (*Euphausia superba*) continued to dominate macrozooplankton abundance and biomass in December. A cohort of juvenile krill is prominent in the population, although adults were also abundant near Palmer Station in December. Larval fish continued to appear in net tows during December. Herbivorous copepods and their chaetognath predators were the most numerous zooplankton taxa. The calanoid *Metridia gerlachei* was notably more abundant than observed during the summer 2017-18 season.

We conducted three krill (*E. superba*) feeding selectivity experiments in December, two of which were in collaboration with Dr. Ben Van Mooy's lab (B-032-L). This work is investigating the (1) role of lipids in the Antarctic food web, (2) variability in krill trophic role, and (3) fate of krill fecal pellets with regards to carbon export. These experiments were truly a team effort with the B-032-L (Van Mooy), C-019-P (Schofield), C-020-P (Steinberg), and C-045-P (Ducklow) labs all joining forces to collect data on nutrients, lipids, phytoplankton, zooplankton, bacteria, krill, and krill fecal pellets.

We conducted our first survey from Biscoe Point to the Wauwermans Islands, covering the central foraging area of the local gentoo penguin population. These surveys include acoustic transects to estimate krill abundance and distribution, CTD casts to understand local ocean mixing and phytoplankton distribution, and vertebrate predator surveys. The surveys were designed with the C-013-P (Fraser) lab to improve our understanding of penguin foraging behavior.



**Fig. 8** – Mesh filters topped with zooplankton are dried and weighed in the lab in order to determine their mass.

Although foul weather keeps boats off the water, it allowed us to start processing our accumulation of frozen samples in December. Lab days were spent working up zooplankton biomass and gut fluorescence samples (to estimate grazing rate) as well as water samples from experiments (Fig. 8).

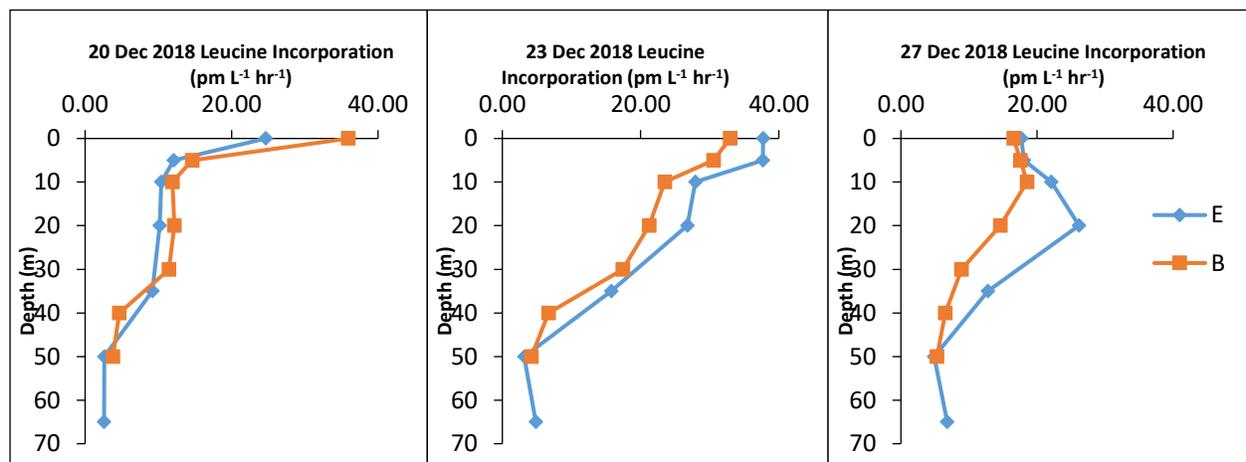
December was packed with successful science and holiday cheer. Thanks to our friends and colleagues for making Palmer Station a wonderful place to work.

**C-045-P: PALMER, ANTARCTICA LONG-TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCED PELAGIC ECOSYSTEM – MICROBIAL / BIOGEOCHEMICAL COMPONENT**

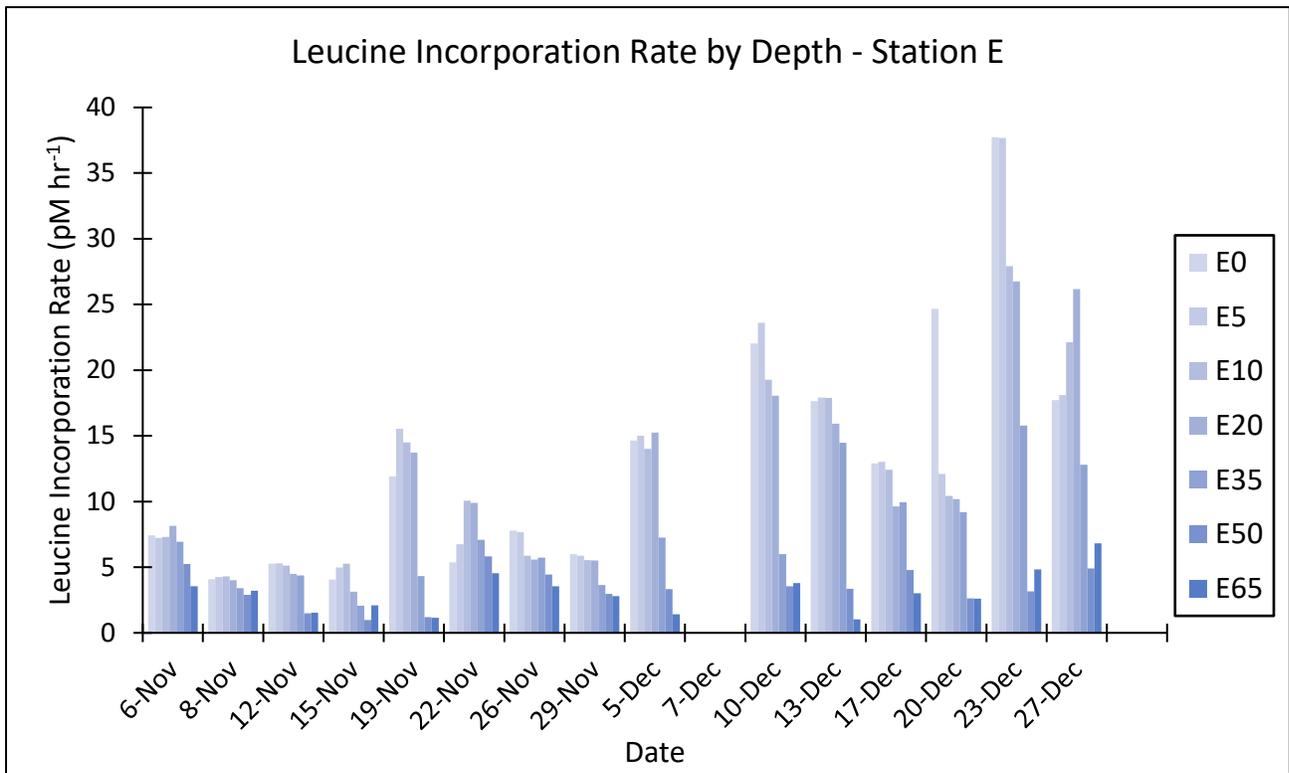
Dr. Hugh Ducklow, Principal Investigator, Columbia University, Lamont Doherty Earth Observatory

Personnel on Station: Shawnee Traylor and Rebecca Trinh

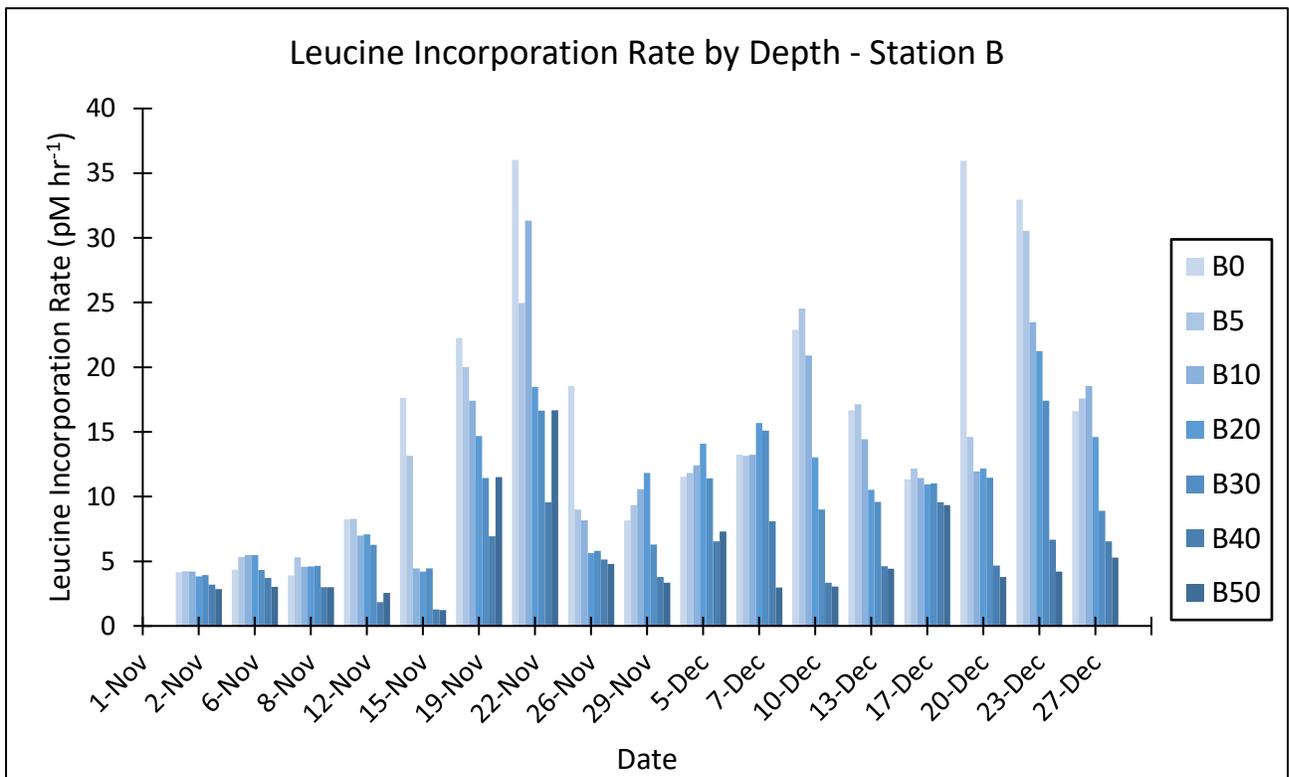
The month of December has been quite busy with our long-term Station E and Station B measurements of nutrients and microbial activity, as well as krill fecal pellet experiments for Rebecca Trinh's PhD thesis. As we headed into summer, we began to measure higher rates of bacterial production compared to November. Though the overall rates of bacterial production are higher this month, the depth distribution of bacterial production was highly variable from day to day, though relatively consistent between Station E and Station B (Figs. 9-11). These differences are likely due to wind mixing and sea ice being blown in, as on 20 December, the Palmer region contained heavy amounts of sea ice, 23 December there was a moderate amount of brash ice in the region, and on 27 December, there was open water around Station E and B. During the high ice days, our groups observed increased chlorophyll in the water column and an increase in abundance of krill *E. surperba*. Figures 10 and 11 detail the full time series of bacterial production rates at all depths at Station E and B, respectively.



**Fig. 9** – Bacterial production profiles at Station E (blue line) and B (orange line) in late December. The two stations tend to have similar vertical profiles from day to day.

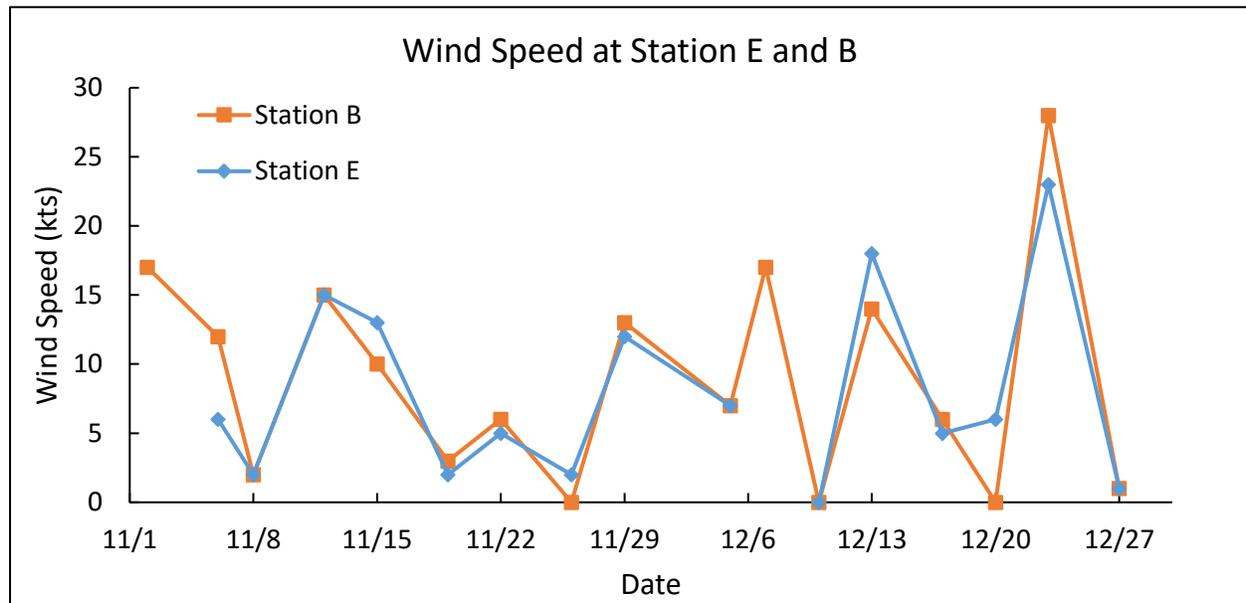


**Fig. 10** – Bacterial production at Station E at six depths (0m, 5m, 10m, 20m, 35m, 50m, and 65m) from 6 Nov through 27 Dec. There is increased bacterial production in December compared to November.



**Fig. 11** – Bacterial production at Station B at six depths (0m, 5m, 10m, 20m, 30m, 40m, and 50m) from 2 Nov through 27 Dec. The spring bloom occurred in late November, and another smaller peak occurred in mid-December.

The winds are typically similar at each station (Fig. 12), though Station E tends to have bigger swells and thus more mixing. The subsequent differences in stratification could contribute to the differences seen in the timing and extent of the productivity peaks at each station.



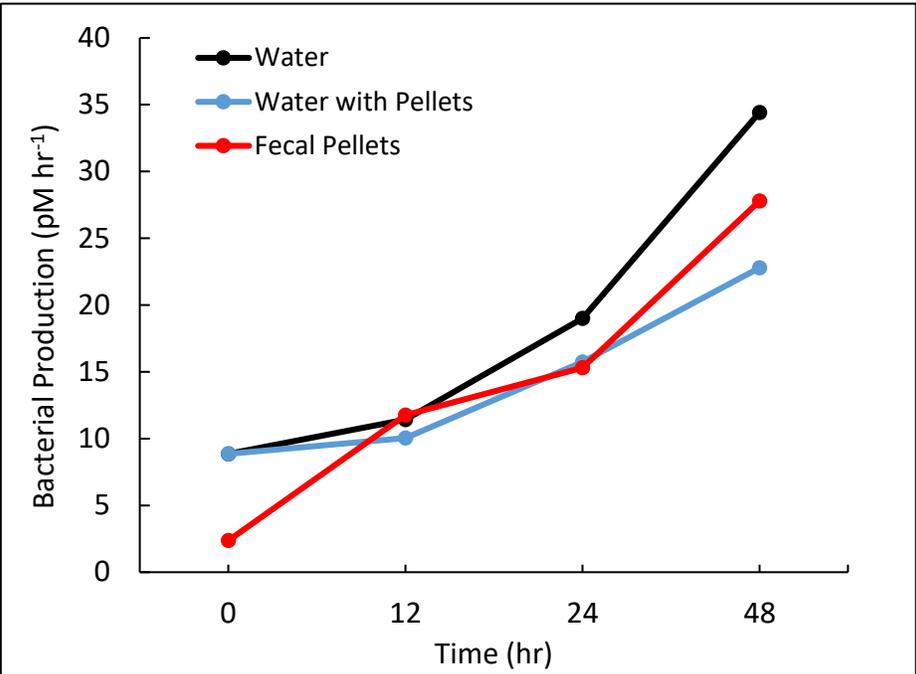
**Fig. 12** – Wind speed at Station E (blue line) and B (orange line) throughout the season from the Antarctic Mesoscale Prediction System (AMPS) weather model.

Figures 13 and 14 show data from one of Rebecca’s krill fecal pellet bacterial production experiments. Krill and whole seawater were collected from around Station E. The krill were subsequently transferred to a bucket of filtered seawater for a few hours to defecate (Fig. 13A). Initial bacterial production rates were measured on the whole seawater and on fresh fecal pellets (Fig. 13B). Then pellets were incubated in bottles of whole seawater for 12, 24, and 48 hours, after which pellets, whole seawater with pellets, and whole seawater alone were measured for bacterial production rates. Additionally, some pellets were stained with SyBr green to observe bacteria on the pellets under the microscope (Fig. 13C). Surprisingly, fecal pellet bacterial production rates (Fig. 14, red line) tend to be lower than that of the whole seawater without fecal pellets (Fig. 14, black line).



**Fig. 13** – (A) Antarctic krill *E. surperba* in bucket of filtered seawater to collect their fresh fecal pellets, (B) krill fecal pellet under microscope, and (C) epifluorescent stained bacteria on krill fecal pellet under microscope.

**Fig. 14** – Krill fecal pellet and whole seawater bacterial production experiment beginning on 20 December. Whole seawater without fecal pellets (black line) tends to have increased bacterial production rates over the majority of the incubation compared to water with fecal pellets (blue line) and the fecal pellets themselves (red line). Seawater, seawater with pellets, and the fecal pellets increase in bacterial activity the longer they are incubated.



In addition to all the field and laboratory work we have been doing, we had the opportunity to visit with guests of the *National Geographic Orion* tour ship and talk to them about the exciting work we do here in Antarctica. It was a wonderful experience to get out of the labs and talk to the guests and answer all of their questions. Many were fascinated by the important role krill fecal pellets play in the carbon cycle in Antarctica.



**Rebecca answering questions from guests of the *National Geographic Orion* cruise ship about the research our groups conduct at Palmer Station. Photo Credit: Ducklow group**

## **PALMER STATION RESEARCH ASSOCIATE MONTHLY REPORT**

**December 2018**

Marissa Goerke

### **G-090-P: GLOBAL SEISMOGRAPH NETWORK (GSN) SITE AT PALMER STATION**

Mr. 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. Data flow from the system was shut down briefly for the Terra Lab UPS install, but recovered within a half hour.

### **A-111-P: THE NEXT GENERATION OF GEOSPACE RESEARCH FACILITIES AT PALMER STATION**

Dr. Andrew Gerrard, Principal Investigator, New Jersey Institute of Technology

The ionosphere-thermosphere-magnetosphere (ITM) region of Earth's atmosphere, which is part of the larger geospace environment, is the portal through which the solar wind can enter and impact our planetary system. Though space weather research over the past decades has greatly increased our understanding of a wide variety of phenomena associated with ITM physics, the sum of these individual processes occurring in the geospace environment does not replicate the rich diversity and scope of this complex region. Thus, a more holistic approach to ITM research is necessary, one that integrates clustered instrumentation at multiple locations to simultaneously look at the interactions within the entire system. Using coordinated and collaborative instrumentation currently installed in Antarctica, researchers will study interrelated ITM phenomena observed at high latitudes. The goal of this research effort is a better understanding of the energy transfer and modulation of the geospace system.

The system operated normally throughout the month. System was shut down briefly for the Terra Lab UPS install. The VLF/ELF system remains on a separate circuit with its own dedicated ground as per PI wishes.

### **A-119-P: CONTINENTAL-SCALE STUDIES OF MESOSPHERIC DYNAMICS USING THE ANTARCTIC GRAVITY WAVE INSTRUMENT NETWORK (ANGWIN)**

Dr. Michael Taylor, Principal Investigator, Utah State University

The Antarctic Gravity Wave Imaging Network (ANGWIN) is a cooperative effort of six international Antarctic programs to collect continent-wide gravity wave measurements. This network capitalizes on existing optical and radar measurement capabilities at McMurdo, Palmer, South Pole, and six other research stations: Halley (UK), Syowa (Japan), Davis (Australia), Rothera (UK), and Ferraz (Brazil). Infrared (IR) all-sky mesospheric OH (hydroxyl) imagers are installed at Davis, McMurdo, and Halley stations. The network quantifies the properties,

variability, and momentum fluxes of short-period (less than one hour) mesospheric gravity waves and their dominant sources and effects over the Antarctic continent. An all-sky near-IR imager is also installed at Palmer Station to augment the existing instrumentation and create a capability for studying gravity wave properties at each site.

The system is shut down for the summer season.

### **A-373-P: TROPOSPHERE-IONOSPHERE COUPLING VIA ATMOSPHERIC GRAVITY WAVES**

Dr. 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. System was shut down briefly for the Terra Lab UPS install.

### **O-264-P: A STUDY OF ATMOSPHERIC OXYGEN VARIABILITY IN RELATION TO ANNUAL DECADAL VARIATIONS IN TERRESTRIAL AND MARINE ECOSYSTEMS**

Dr. Ralph Keeling, Principal Investigator, Scripps Institution of Oceanography

The goal of this project is to resolve seasonal and interannual variations in atmospheric O<sub>2</sub> (detected through changes in O<sub>2</sub>/N<sub>2</sub> 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<sub>2</sub> 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.

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

Mr. Don Neff and Dr. Steve Montzka, Principal Investigators, National Oceanic and Atmospheric Administration / Global Monitoring Division

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 (N<sub>2</sub>O) 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 once a week during favorable winds and HATS Air samples were taken every other week. One crate of CCGG flasks were shipped north.

#### **O-264-P: ULTRAVIOLET (UV) SPECTRAL IRRADIANCE MONITORING NETWORK**

Dr. James Butler, Principal Investigator, National Oceanic and Atmospheric Administration / Global Monitoring Division

A Biospherical Instruments (BSI) SUV-100 UV spectroradiometer produces full sky irradiance spectra ranging from the atmospheric UV cutoff near 290nm up to 605nm, 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. Bi-weekly absolute scans were completed as necessary. System was shut down for the Terra Lab UPS install and took several days to recover. The quarterly three lamp calibration was successfully run after recovery of the system.

#### **R-938-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 system operated normally throughout the month. System was shut down briefly for the Terra Lab UPS install.

#### **T-295-P: GPS CONTINUOUSLY OPERATING REFERENCE STATION.**

Mr. 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 normally 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 has operated normally throughout the month.

## **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 has operated normally throughout the month.

## **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 and emailed to the National Weather Service for entry into the Global Telecommunications System.

The local weather station (PAWS) is working well. The Joubins AWS is back online after servicing. The base AWS system was shut down briefly for the Terra Lab UPS install. Observations are archived on the AMRC website: <ftp://amrc.ssec.wisc.edu/pub/palmer/>.