

# PALMER STATION MONTHLY SCIENCE REPORT

OCTOBER 2013



Several hundred cormorants were seen flocking in the Palmer area at the beginning of October.  
(Image Credit: Glenn Grant)

## NEWS FROM THE LAB

By Carolyn Lipke, Assistant Supervisor of Laboratory Operations

October was a bit of a crazy month here at Palmer Station. The Postlethwait (B-029-P) group completed their winter work and departed mid-month. Several summer science groups arrived, including the Ducklow (B-045-P) and Schofield (B-019-P) LTER groups. The Roberts group (O-215-P) also arrived to install a new aerosol sampling instrument in the backyard, the first study of this kind since 1994. The arrival of new groups coincided with the government shutdown and subsequent decision to suspend scientific operations at Palmer Station. Over a stressful eight days station staff and grantees prepared to close the Bio Lab and boathouse for the season. Government funding was restored mid-month, and the NSF directed that science operations at Palmer Station should resume. Meanwhile, the sea ice had set up again around station, prohibiting any sampling from zodiacs. Lingering effects of the shutdown will likely be felt throughout the season, but lots of hard work and enthusiasm by grantees and ASC staff have mitigated its impacts here at Palmer Station.

Throughout the month there were frequent sightings of Adélie penguins walking across the sea ice towards Torgersen Island. Science groups conducted aquarium based incubation experiments while the sea ice persisted through the end of October.

## **OCTOBER 2013 WEATHER**

**By Glenn Grant, Research Associate**

Mild temperatures and blustery conditions at the beginning of October gave way to frigid south winds at mid-month, locking the station in sea ice. Only at the end of the month did the weather pattern switch to more spring-like conditions. The average temperature was -2.8 C (27 F), close to the historical average of -2.3 C. The high temperature of 5.7 C (42 F) was early in the month, on the 3<sup>rd</sup>, dipping to -13.3 C (8 F) on the 16<sup>th</sup>. An exceptionally low pressure of 948 mb was seen on the 14<sup>th</sup>, coinciding with the sudden drop in temperatures. The average wind speed was 10 knots, peaking to a building-shaking gust of 75 knots on day 29.

Total melted precipitation was 26.9 mm, less than half the monthly average of 58.7 mm, falling (or rather, blowing sideways) as both rain and snow or snow pellets. Total snowfall was 34 cm, all of which melted rapidly. The peak measured accumulation at the snow stake was 52 cm on the 4<sup>th</sup>, diminishing to 37 cm by the end of the month. For most of October the station was surrounded by fast ice. Significant leads started forming around the 29<sup>th</sup>, helped by the strong north winds, although the station itself remained beset by sea ice past the end of the month.

### **B-019-P: PALMER LONG TERM ECOLOGICAL RESEARCH (LTER): LOOKING BACK IN TIME THROUGH MARINE ECOSYSTEM SPACE, PHYTOPLANKTON COMPONENT**

Dr. Oscar Schofield, Principal Investigator, Rutgers University, Institute for Marine and Coastal Sciences

Personnel on station: Christina Haskins, Oliver Ho, and Austin Melillo

Government shutdown woes delayed progress initially, however copious amounts of sea ice have prevented us from finishing boating 2 as well as sampling at stations B & E. We have moved forward with lab setup, instrument troubleshooting, and instrument calibration. Jeff Otten helped resolve numerous comms issue with our Hyper Pro (Spear). Mark the instrument tech on station helped address issues with the Turner Fluorometer. We have reached the point where we are happily awaiting open water to continue sampling.

### **B-029-P: DEVELOPMENTAL MECHANISMS FOR THE EVOLUTION OF BONE LOSS**

Dr. John H. Postlethwait, Principal Investigator, Institute of Neuroscience, University of Oregon, Eugene, and Dr. H. William Detrich, Co-PI, Northeastern University

Personnel on station: Ashley Nelson

Our goal is to understand the molecular genetic mechanisms for the evolution of bone loss in the icefish lineage of Antarctic Notothenioid fish. To investigate the developmental origins of these differences, we made matings for several species Notothenioid species; currently only *N. coriiceps*, a robustly mineralized species, are still developing at Palmer. A second goal is to understand how embryos of Antarctic fish respond to increasing temperature. As the Southern Ocean begins to warm, what will happen to embryonic development of

Antarctic fish? Any of several possibilities suggest themselves. 1) Embryos might just die, unable to cope with the increasing temperature. 2) Embryos will develop more rapidly and immediately hatch in the Austral winter or too early in the Spring before sufficient returning sunlight allows phytoplankton to proliferate to provide food for the larvae. 3) Embryos will develop more rapidly but will delay hatching until the lengthening photoperiod signals the historically normal time for hatching. To distinguish these possibilities, we are growing a group of animals at higher temperature, as described below.

## October Summary

October was dedicated to finishing experiments, preparing samples for sending to the home lab, and tearing down and cleaning our labs.

At time of tear-down, *N. coriiceps* cross #7/8 embryos were approximately 129dpf (as of October 14<sup>th</sup>, 2013). *N. coriiceps* cross #12 embryos were at 111dpf (as of October 14<sup>th</sup>, 2013). The Cascade tank in Environmental Room #1 was drained and stored.

*N. coriiceps* cross #7/8 was transferred to the floating incubator in the indoor tank closest to the lab vestibule to continue growth until the last possible moment prior to tear-down.

On October 7<sup>th</sup>, we discovered an extensive fungal infection during embryo transfer resulting in heavy casualties. The indoor tank by lab vestibule was drained and cleaned.

The embryos in floating incubators (*N. coriiceps* cross #7/8 and #12) were transferred to disinfected 2000mL beakers in the Lab 1 incubator refrigerator.

The warm temperature (+4°C) experiment using embryos from *N. coriiceps* cross #7/8 terminated in two lab incubators: the control incubator at -0.5°C, and the experimental incubator at +4.0°C (300 embryos each).

Embryo samples (n=2/4) were taken once a week for whole mount in situs and RNA-seq studies. Embryo fixations were completed for RNA-seq, Bouin's, in situs (whole and sections), Alcian/alizarin staining, and von Kossa's stain, including unfertilized eggs, "sphere" stage, "shield" stage, 60-80% epiboly, 10-15 somites, 60 dpf, and 100+ dpf.

Photos of the embryos under the dissecting scope were completed.

Date(s) of significance: October 7, 2013 – Fungal infection noted in cascade tank in Environmental Room #1 during embryo transfer. Numerous dead embryos were detected on the bottom of the tank after aerators were removed and most were covered in fungus. Remaining live embryos (*N. coriiceps* cross #7/8) were immediately disinfected with ~500 ppm glutaraldehyde solution. Embryos were observed closely until the time of departure. Unfortunately, many embryos expired over the next week.

The consequences were severe: we were unable to bring any live embryos back to the lab in Oregon. Only 52 embryos were alive by the time of tear-down and departure.

October 18<sup>th</sup>, 2013 - LMG departed Palmer Station with all embryo samples ((RNA-seq, in situs, ABAR, Bouin's, and von Kossa's), cargo, and Ashley Nelson, the sole surviving team member of B-029.

A huge thanks from the dearly departed B-029 members to the crews at Palmer Station and the LMG. You make our work possible and enjoyable.

## **B-045-P: PALMER, ANTARCTICA LONG-TERM ECOLOGICAL RESEARCH (LTER) STUDY, MICROBIAL / BIOGEOCHEMICAL COMPONENT**

Dr. Hugh Ducklow, Principal Investigator, Lamont-Doherty Earth Observatory, Columbia University, New York, NY

Personnel on station: Jamie Collins and Sebastian Vivancos

The overall goal of this project is quantitatively evaluating the roles of marine bacteria as agents in biogeochemical cycling within the Antarctic marine foodweb. The B-045 component measures vertical distributions of dissolved inorganic nutrients, particulate carbon and nitrogen, dissolved organic carbon, and bacterial abundance and production twice weekly at LTER Stations B and E off Palmer Station.

After an auspicious arrival overshadowed by the U.S. government shutdown, the B-045 team spent the remainder of October preparing equipment and supplies for the upcoming field season. Sea ice covered Arthur Harbor throughout much of the month, preventing LTER grantees from conducting any of the normal twice-weekly sampling. With help from laboratory manager Carolyn Lipke, we continued collecting  $^{18}\text{O}$  water samples from the Palmer pumphouse for Dr. Mike Meredith of the British Antarctic Survey. Taking advantage of the sea ice-imposed sampling downtime, B-045 team member Jamie Collins ran a first experiment for his doctoral research using one of the aquaria on the Palmer deck. Collins is investigating the effects of ultraviolet radiation on lipid peroxidation in marine eukaryotes, and the associated impact on primary productivity and carbon export. We look forward to a productive season of scientific discovery with our LTER and other Palmer Station colleagues.

## **B-228-P: COLLABORATIVE RESEARCH: MICROBIAL COMMUNITY ASSEMBLY IN COASTAL WATERS OF THE WESTERN ANTARCTIC PENINSULA**

Dr. Linda Amaral-Zettler, Principal Investigator, Marine Biological Laboratory, Woods Hole, MA; Dr. Jeremy Rich, Co-PI, Brown University, Providence, RI

Personnel on station: Sean O'Neill and Monica Stegman



Collecting ice with visible microbial growth for the experiments

With the changing weather, Monica and Sean were able to collect sea ice with visible microbial growth and conduct a carboy experiment examining the effects of sea ice on the microbial communities in seawater. This experiment was similar to the previously mentioned DOM experiments. The experiment was conducted in 50 L carboys that were amended with sea-ice containing diatom biofilms. This experiment was originally designed to last for 10 days but had to stop on day 8 because of the government shutdown. The science support staff here at Palmer Station did an amazing job helping Monica and Sean complete as much science as possible before packing up the lab to transition into caretaker mode.

At the beginning of the month we were able to get out to Station B. The ice cleared out enough to allow for one sampling event before freezing over again. Since then the water has remained frozen but windy conditions at the end of the month will hopefully open the water up again allowing for weekly sampling again. The Sea Water Intake (SWI) is still being sampled by our team on a weekly basis.

After the government shutdown ended the team was able to start another DOM experiment. As mentioned before, we are examining controls on seasonal changes by conducting seawater carboy experiments (50 L) amended with diatom exudates and sea-ice containing diatom biofilms. This particular experiment has an additional control element. In addition to examining the effect of DOM on the microbial communities in seawater we are also looking at any potential impacts that the phytoplankton media might have on these microbial communities.

Overall we are excited to be able to continue the project relatively close to the original plan and continue creating this unique data set on the microbial communities in the waters around Palmer Station. In the next few months we hope to continue sampling Station B and the SWI on a weekly basis. Furthermore, we plan on conducting an additional sea ice experiment before it has all blown out to sea as well as a final DOM carboy experiment. Sean is excited to return to the states on LMG13-11 and we are very grateful for his contributions to the project overwinter and these last few months. We wish him the best of luck with his next big adventure. We will be welcoming Sharon Grim (M.S. U Del) to the research group on LMG13-11 for her first trip to the ice. We would like to thank the entire station support staff for their positive attitudes and support throughout the government shutdown and reopening of station. Without them we would have lost a lot more time and we are excited to continue working together over the next few months.

**O-215-P: IN-SITU OBSERVATIONS OF MARITIME SOURCES/SINKS OF AEROSOL AND CLOUD CONDENSATION NUCLEI AT PALMER STATION, ANTARTICA: PAEROS PILOT PHASE**

Dr. Gregory Roberts, Principal Investigator, University of California San Diego, Scripps Institution of Oceanography

Personnel on station: Gregory Roberts and Craig Corrigan

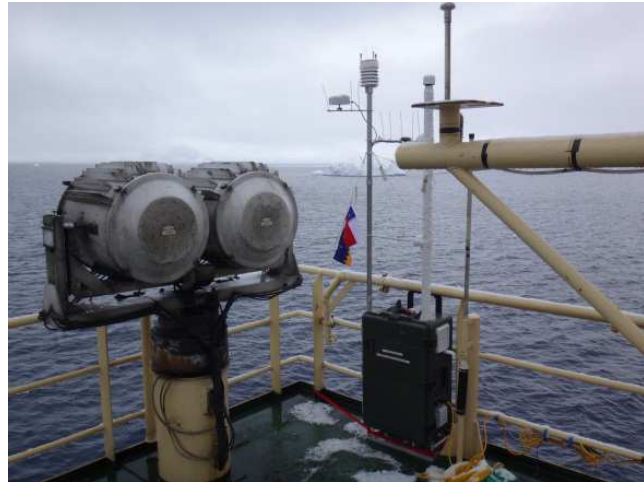
We have deployed a miniaturized aerosol package at Palmer Station, Antarctica to measure aerosol concentrations, number size distributions, hygroscopicity, cloud condensation nuclei, absorbing carbon, radiative fluxes and meteorological parameters. The aerosol package, called PAEROS for Portable AERosol Observing System, will be deployed in the 'Backyard' at Palmer Station from October 2013 to April 2014. This project addresses the following science objectives:

1. Characterize aerosol and cloud condensation nuclei (CCN) properties at Palmer Station with respect to atmospheric and marine conditions (e.g., wind speed, waves, sea ice, and biological activity).
  - a. Aerosol number size distribution and concentrations
  - b. CCN spectra and size distributions
  - c. Relate the aerosol to biogenic productivity (e.g., DMS precursors, chlorophyll)



2. Determine the contribution of sources (i.e., sea salt, biogenic, anthropogenic and long-range transport) to remote marine aerosol and their evolution.
  - a. Use hygroscopicity parameter as a proxy for aerosol chemistry for indirect assessment of aerosol sources.
  - b. Relate changes in aerosol size distributions and hygroscopicity to sea salt emissions, biogenic production, cloud processing and aerosol transport.

In Punta Arenas, the aerosol instruments were installed on the *ARSV Laurence M. Gould* (LMG) on the top deck (above the bridge; Figure 1). Based on expected wind patterns (predominantly from the west), we placed PAEROS on the starboard side as far forward and high as possible to minimize sampling of the ship's exhaust. Aerosol measurements were taken on the LMG as it transited from Punta Arenas across the Drake Passage to Palmer



**Figure 1:** PAEROS installed on the LMG.



**Figure 2:** PAEROS sites for aerosol observations at Palmer Station. BIO and GWR mark the location of the main local sources of aerosol. Red and blue line mark wind sectors when expect to sample air from the station. The inset image shows PAEROS on the ridge above the station.

Station. The instruments functioned well during this transit and a gradient in the aerosol concentrations was observed even though there was considerable sampling of the ship's exhaust.

When we arrived at Palmer Station, we identified possible locations to install PAEROS and installed PAEROS next to the Terra Lab for the first night to verify operations. The next day we installed PAEROS southeast of the Terra Lab towards Hero Inlet ('old location' in the Figure 2). After two weeks of measurements, we concluded that this sampling location was too often contaminated by the aerosol emitted at Palmer Station. We relocated our instruments to a ridge as far east of the station as possible. The instruments in the backyard have been working well --

survived a rain/snow storm with 70+ knots of wind -- and we are getting some interesting results. While we do still sample aerosol from the station, we have minimized the amount of contamination and are also able to sample marine air masses that often arrive from the northwest. Craig Corrigan will stay at Palmer Station for the next cycle to ensure that our instruments continue to function as we transition from the winter period into the phytoplankton blooms. We have also trained Glenn Grant (Station Research Associate) on maintenance of the instrumentation.

We owe a special 'thank you' to the hard-working ASC crew for their logistical support in helping set up our equipment on the ship and at Palmer Station. We look forward to working with them over the next several months.



**Figure 3:** The PAEROS aerosol sampler, currently installed in Palmer Station backyard, has successfully withstood a variety of weather conditions.

**PALMER STATION  
RESEARCH ASSOCIATE MONTHLY REPORT  
October 2013  
Glenn Grant**

**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 during the month. The interior of the seismic vault, as well as the electrical and fiber optic systems, were inspected.

**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 ELF/VLF system collected data normally. Hard drives were swapped on the RAID array to provide more data storage space.

**A-132-P: FABRY-PEROT INTERFEROMETER (FPI)**

Qian Wu, Principal Investigator, National Center for Atmospheric Research

The Fabry-Perot Interferometer observes mesospheric and thermospheric neutral winds and temperatures at Palmer Station by measuring the wind-induced Doppler shift in the air's nightglow emissions. The Research Associate operates and maintains on-site equipment for the project.

The system operated normally.

**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 sending the results to AMRC headquarters in Madison, WI. The Research Associate operates and maintains on-site equipment for the project.

The data ingestor operated normally throughout the month.

**O-204-P: A STUDY OF ATMOSPHERIC OXYGEN VARIABILITY IN RELATION TO ANNUAL TO 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<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 both Terra Lab and the VLF Building.

Air samples were collected as scheduled during the month.



**O-215-P: IN-SITU OBSERVATIONS OF MARITIME SOURCES/SINKS OF AEROSOL AND CLOUD CONDENSATION NUCLEI AT PALMER STATION, ANTARCTICA: PAEROS PILOT PHASE**

Gregory Roberts, Principal Investigator, Scripps Institution of Oceanography

A miniaturized aerosol package (PAEROS) has been deployed at Palmer Station Antarctica for the austral summer to measure aerosol physical properties, cloud condensation nuclei (CCN), radiative fluxes and meteorological parameters. The Research Associate assists the grantees with maintenance of the system.

The grantee team is on station. The Research Associate supported the installation and maintenance of the system.

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

James Butler, Principal Investigator, 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 (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.

Carbon Cycle and Halocarbon sampling were completed as scheduled.

**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 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.

Data was collected 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 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.

**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 GPS station collected data normally during 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.

Satellite passes were captured normally throughout the month.

**B-466-P: FLUORESCENCE INDUCTION AND RELAXATION (FIRe) FAST REPETITION RATE FLUOROMETRY (FRRF)**

Deneb Karentz, Joe Grzymalski, Co-Principal Investigators, University of San Francisco

The focus of this project is to identify and evaluate changes that occur in genomic expression and physiology of phytoplankton during the transition from winter to spring, i.e., cellular responses to increasing light and temperature. A Fast Repetition Rate Fluorometer (FRRF) with a FIRe (Fluorescence Induction and Relaxation) sensor is installed in the Palmer Aquarium. The Research Associate downloads data and cleans the instrument on a weekly basis.

Weekly cleaning of the instrument and data downloads were performed as scheduled. The instrument was restarted one time to correct a malfunction.

**T-998-P: INTERNATIONAL MONITORING STATION (IMS) FOR THE COMPREHENSIVE NUCLEAR TEST BAN TREATY ORG. (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.

Following the installation of a replacement cooler and detector during September, the system started October in calibration mode. The calibration was successful and the system returned to normal sampling for the remainder of the month.

### **OCEANOGRAPHY**

Pending the installation of a new tide gage system with salinity and sea water temperature sensors, the Research Associate takes daily readings of sea water temperature. Daily observations of sea ice extent and growth stage are also recorded.

### **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 twice each 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.

A replacement Present Weather Sensor was installed and is now operational.