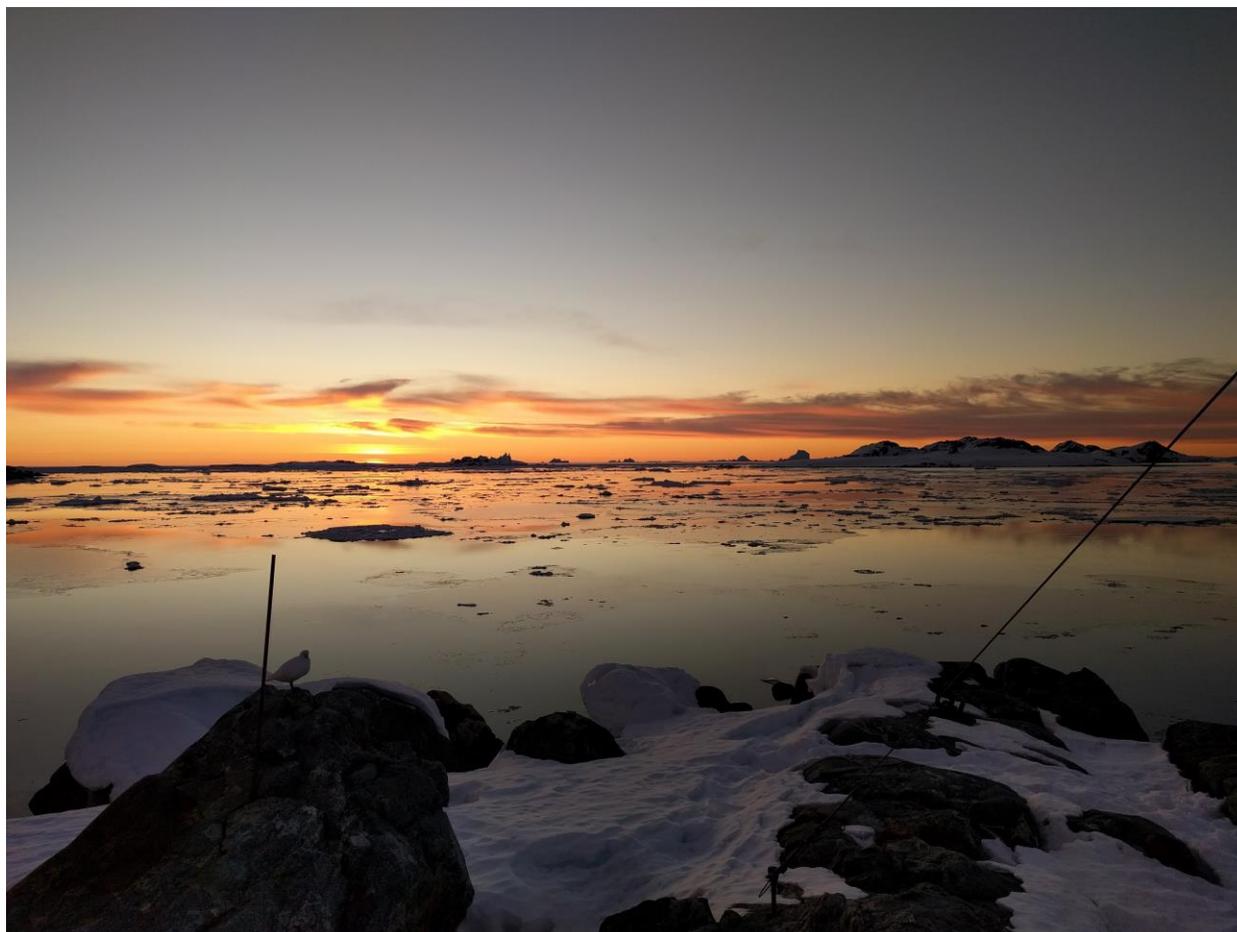


PALMER STATION MONTHLY SCIENCE REPORT

OCTOBER 2016



A sunset and a single sheathbill. *Image Credit: Randy Jones*

NEWS FROM THE LAB

Randy Jones, Summer Laboratory Supervisor

Winter transitioned into spring during the month of October with the arrival of the summer ASC staff and a small group of eager scientists. We have remained fairly busy with two *ARSV Laurence M. Gould* (LMG) port calls; visits from UTMB, ASC, and NSF members; and an ongoing hazardous waste run. The Detrich group (B-037-P) concluded their very successful winter field season at Palmer Station, and the Ducklow (C-045-P) and Schofield (C-019-P) groups arrived at the beginning of the month.

Despite the early season ocean and weather conditions, scientists and support staff were treated to a few periods of clear skies and beautiful sunsets, affording ample opportunity for ventures into the backyard and up onto the glacier. Sea and local brash ice have remained persistent within the boating area and thus boating operations were not yet occurring. Snow and ice accumulations rapidly began melting and disappearing across station through the second half of the month, though snow squalls and storms continue to accumulate fresh snowfall over harder ice. With relatively heavy ice conditions and lower light levels, water clarity was high for the month of October. Seabirds remain the dominant animals in the local area, though sightings of Adélie and Gentoo penguins have been made along with Crabeater seals.

OCTOBER 2016 WEATHER

W. Lance Roth and Liz Widen, Offgoing and Oncoming Research Associates (respectively)

Palmer Monthly Met summary for October, 2016

Temperature
Average: -1.3 °C / 29.7 °F
Maximum: 5.6 °C / 42.08 °F on 7 Oct 12:01
Minimum: -9.5 °C / 14.9 °F on 17 Oct 07:18
Air Pressure
Average: 989.1 mb
Maximum: 1010.2 mb on 6 Oct 08:45
Minimum: 957.2 mb on 21 Oct 14:31
Wind
Average: 10 knots / 11.5 mph
Peak (5 Sec Gust): 55 knots / 63 mph on 31 Oct 04:26 from NNE (17 deg)
Prevailing Direction for Month: NW
Surface
Total Rainfall: 73.9 mm / 2.91 in
Total Snowfall: 66 cm / 25.7 in
Greatest Depth at Snow Stake: 135 cm / 52.7 in
WMO Sea Ice Observation: 6/10 open pack ice with more than 20 bergs, with growlers and bergy bits.
Average Sea Surface Temperature: -1.18 °C / 29.9 °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). Temperatures were below average for most of the month. The Arthur Harbor and Hero Inlet were full of sea ice for the entire month until the last few days when high wind speeds clear them and the area immediately around station of sea ice.

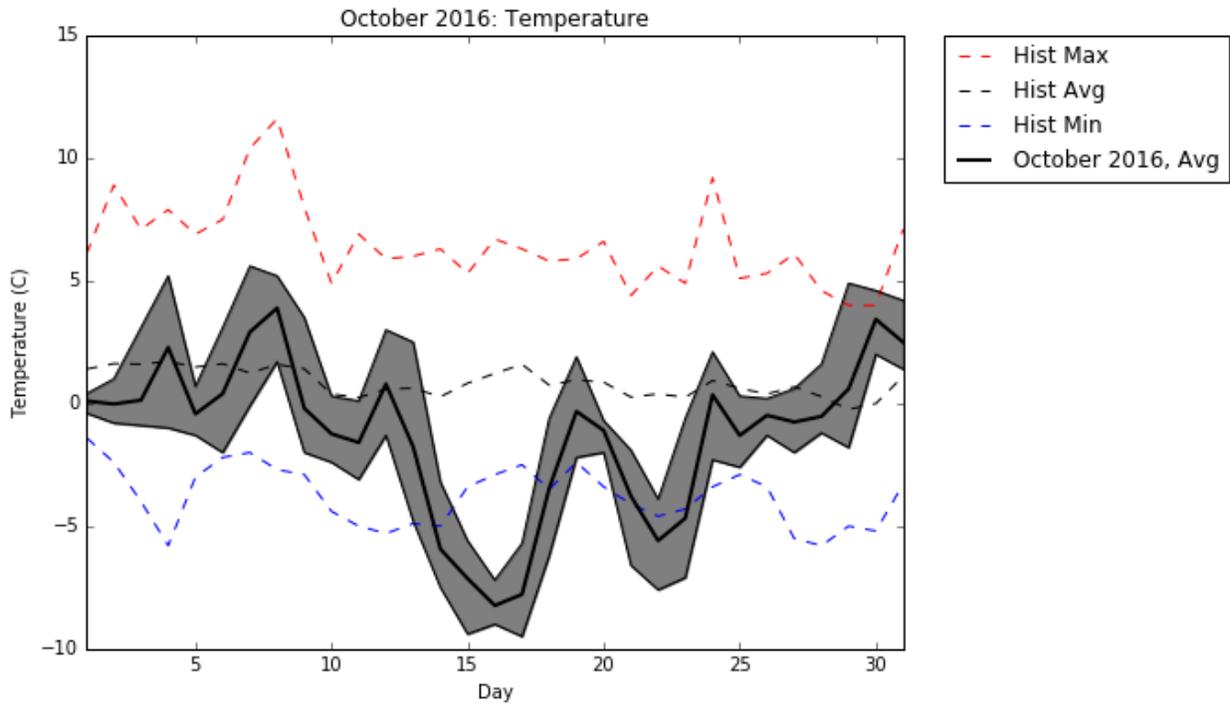


Fig. 1 – Plot of daily temperature in October 2016. Shown in black/shaded gray are the daily average, the minimum, and the maximum for this year. The dotted lines on the graph indicate average, minimum, and maximum values for “historical values” for 2002 to 2016. (We thank Liz Widen for providing this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

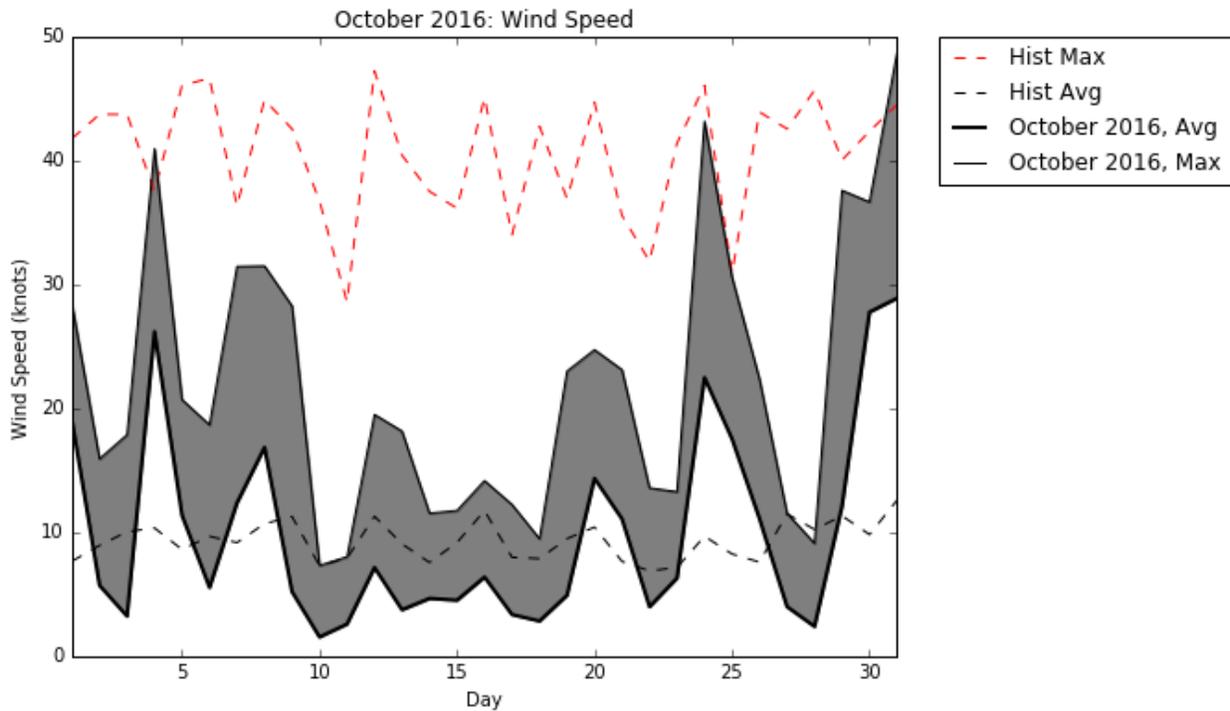


Fig. 2 – Plot of daily wind speed in October 2016. Shown in black/shaded gray are the daily average, the minimum, and the maximum for this year. The dotted lines on the graph indicate average and maximum values for “historical values” for 2002 to 2016. (We thank Liz Widen for providing this data and the figure.)

B-037-P: ANTARCTIC NOTOTHENIROID FISHES: SENTINEL TAXA FOR SOUTHERN OCEAN WARMING

H. William Detrich, Principal Investigator, Marine Science Center, Dept. of Marine and Environmental Sciences, Northeastern University



B-037-P (Detrich) grantee Sierra Smith samples icefish embryos. *Image Credit: Jamee Johnson*

Personnel on Station: Laura Goetz, Kathleen Shusdock, and Sierra Smith

Synopsis – Antarctic notothenioid fishes have evolved a remarkable suite of characters, including the acquisition of macromolecular antifreezes by most species and the loss of red blood cells and hemoglobin by the “white-blooded” icefish family, as the Southern Ocean (SO) cooled to the freezing point of seawater (-1.9°C) over the past 25-40 million years. Today, these cold-adapted fishes are threatened by rapid warming of the SO, the temperature of which is likely to increase by $2-4^{\circ}\text{C}$ over the next two centuries. The long-term goal of my research program is to assess the molecular and organismal consequences of this warming by analysis of the effects of elevated temperature regimes on gene expression in developing embryos of red- and white-blooded Antarctic notothenioids (the Bullhead notothen *Notothenia coriiceps* and the Blackfin icefish *Chaenocephalus aceratus*, respectively).

Fishing – None performed during this period. Team members worked with fish stocks and embryos already present in the Palmer Station aquarium.

Palmer Station Science and Other Activities – During October, the B-037 team wrapped up our scientific program on the effects of warming on the development of embryos of the Bullhead notothen *Notothenia coriiceps*. Goetz, Shusdock, and Smith sampled our *N. coriiceps* embryo clutches, which have been incubated at -1°C (controls) and at $+4^{\circ}\text{C}$ (experimentals), to almost 160 days postfertilization. Both experimental and control *N. coriiceps* embryos hatched during

October, although the latter were significantly delayed in development relative to the former. Critical tasks have included: 1) husbandry of hatched larvae; 2) preserving embryos and hatched larvae for future analyses of gene expression by high-throughput RNA sequencing (RNAseq) and in situ hybridization (ISH), and of bone development by ABAR (alcian blue/alizarin red) staining; 3) microscopic documentation of the development of control and experimental embryo/larval cohorts; 4) disinfection of embryos to enhance their long-term viability; 5) tracking embryo mortality to guide our efforts to develop new husbandry methods in the future; 6) packing up B-037 winterover chemicals; 7) packing of B-037 equipment for storage in the Damco warehouse in Punta Arenas; 8) preparation of sample transport paperwork; and 9) documentation of hazmats for future disposal via the USAP waste stream.

Palmer Station Outreach – October featured extensive public outreach by Goetz and Shusdock. Goetz continued recording short videos on work and life at Palmer Station for FlipGrid, an “EduOutreach” company that “broadcasts” over the Internet to more than 30,000 preK-12 classrooms around the world. Shusdock conducted Skype interview sessions with public participants at the Northeastern University Marine Science Center Open House on 15 October and with the second through fourth graders at the Johnson Elementary School in Nahant, MA, on 17 October. These outreach activities are intended to encourage students to become passionate about polar science and to inform the general public about the importance of the polar regions to our global biosphere.

Personnel Deployments – On 1 November, Goetz, Shusdock, and Smith are scheduled to depart Palmer Station, thus bring the B-037 2016 field season to a close.

We thank the ASC station personnel for their dedication and professionalism in support of B-037 at Palmer Station and the captains and crews of the ARSV *Laurence M. Gould* for outstanding fishing support during a season of often harsh weather. Your integrated “web of assistance” throughout the B-037 field season enabled us to achieve our goals during 2016.

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

The Schofield group is excited to be back at Palmer Station for our 9th season! Once again, we’ll be here for the austral summer monitoring and studying the phytoplankton that fuel the food web here. Nicole is a lab and field technician in the Schofield group as part of the Center for Ocean Observing Leadership (COOL) group at Rutgers. She was last at Palmer Station for the 2014-2015 summer season and is excited to be back! Nicole will be joined at the very end of October on LMG16-10 by Mike Brown, a Ph.D. student and later in the season on LMG16-12 by Colette Feehan, a post-doctoral researcher in the Marine Sciences department at Rutgers.

Since arriving to Palmer Station on LMG16-09, Nicole has been busy setting up the lab and getting ready for sampling to begin. The first week at Palmer Station was gorgeous, sunny, calm

days, providing a welcoming glimpse into summer. The boat ramp and pier were ice free – creating an illusion of ice-free water – but, for most of the month the ice lurked near Bonaparte Point, so no sampling or boating has occurred yet this season.

This year, we will be adding another valuable year of data to the LTER as we continue to study the phytoplankton communities at Stations B and E. Our goals are to further understand seasonal and interannual patterns and changes in the phytoplankton as well as the physical (temperature, salinity, light) properties that affect them. We will be deploying a CTD (conductivity, temperature, and depth sensor), AC9 (absorbency and attenuation meter), and a PRR (radiometer), as well as Niskin bottles to collect water throughout the water column twice per week. Mike will also be conducting some incubation experiments for his Ph.D. work – focusing on the impacts of glacial melt water on the phytoplankton communities.

In addition to our bi-weekly water sampling, we'll have 2 gliders at Palmer this year – RU24 and RU26 – for one deployment each. RU24's will fly over Palmer Canyon, as we've done the last few years – providing us with another point in our time series – and important information about phytoplankton abundance and health in the region. RU26 has a big journey ahead of it, heading south to the British Rothera Station later in the season once the ice clears, collecting data along the Peninsula.

We'd like to thank everyone at Palmer and aboard the LMG for being so welcoming and helpful over the last month – especially amidst all the hustle and bustle of station turnover to the summer crew. We are looking forward to a productive, fun season here at Palmer this summer!

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

This year, Adrian Jaycox and Leigh West joined Dr. Hugh Ducklow's team for their first season on the ice! Adrian and Leigh graduated from Columbia University in May with undergraduate degrees in Environmental Science and Environmental Biology, and are excited to work together as Field Team Members at Palmer Station. During the 2016-2017 summer season, we will continue to study the bacteria and biogeochemical processes in the waters off Palmer Station, in collaboration with other PAL LTER scientists. Part of a 26-year history of this research, we will further our understanding of these remote waters and the life which depends on them, casting light on how ocean microbes, especially heterotrophic bacteria, drive carbon cycling.

We have been busy unpacking and setting up our lab since our arrival in early October. We began the process of getting one of our instruments up and running, an equilibrator inlet mass spectrometer (EIMS), which will be fully functional upon our receipt of a replacement part in mid-November. We will use the EIMS to continuously measure the biological dissolved oxygen (O₂) from the station's Seawater Intake throughout the season. This is of interest to our group's research because saturation of biological O₂ in the oceans is indicative of the water's

productivity, with supersaturated waters being highly productive and undersaturated waters hosting high levels of respiration.

Though the hectic nature of station opening was more than enough to keep us occupied for a few weeks, we were waiting on much of our gear to arrive on LMG 16-10 before we were fully operational. At the end of the month, the Gould came in carrying most everything else we needed to begin our science. We received our flow cytometer, which we will use to assess bacterial and nanoplankton abundance in Palmer's marine system, as well as supplies that we will use to study particulate carbon and nitrogen, dissolved organic carbon, oxygen-18, dissolved nutrients, bacterial community DNA, and bacterial production rates. This key information will contribute to Palmer LTER's overall goal of understanding and documenting climatic and environmental controls on marine ecosystem structure and dynamics.

In closing, we would like to extend a massive thank you to everyone at Palmer and on the LMG who has gone out of their way to make us feel welcome and prepared for the season. We are so excited for all that the summer has in store!



Snowy morning aquarium deck. *Image Credit: Randy Jones*

**PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT**

October 2016

W. Lance Roth and 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 CODAR seems to be working well, but one of the files is not updating. The grantee has been informed.

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 30s of a very faint emission originating from a layer located at ~55 miles of altitude. .

The system has operated well throughout the month. There is an issue with the focus that can be addressed only during clear night skies.

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 computer system has been operating normally all month.

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

Yuan Gao, Principal Investigator, Rutgers University

The primary goal of this project is to quantify atmospheric iron properties in the marine atmospheric boundary layer of the Western Antarctic Peninsula (WAP). The specific objectives are to identify the sources of atmospheric iron; determine iron solubility, aerosol composition, and the iron-sulfur relationships; and to measure the temporal and spatial variability of atmospheric iron/dust fluxes.

The HV has been removed from the platform. Only experiment currently running is the total deposition.

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 O₂ (detected through changes in O₂/N₂ 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 CO₂ 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

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.

Due to unfavorable winds, CCGG samples were not 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 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.

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. There are continued issues with the images. The dome was investigate and it was found that the azimuth pot was broken.

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

Efthya 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 through 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.



The ARSV Laurence M. Gould approaches Palmer Station amid brash and sea ice. *Image Credit: Randy Jones*

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.

One of the three antennas was compromised. The structure was repaired and is still getting a signal.

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 motor controller causing dead time in the data. The issue can only be resolved by cycling the power.

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 tidegauge worked well 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 (PalMOS) and emailed to the National Weather Service for entry into the Global Telecommunications System.

The local weather station (PAWS) is working fine. Both AWS systems in the Wauwermans and the Joubins are showing continuous data.