

PALMER STATION MONTHLY SCIENCE REPORT

NOVEMBER 2016



Seals and penguins eye each other in Arthur Harbor. *Image Credit: Randy Jones*

NEWS FROM THE LAB

Randy Jones, Summer Laboratory Supervisor

This past month has been transformative for science at Palmer Station. We had the arrival of Yuan Gao's group (O-231-P) from Rutgers University, the ramping up of regular small boat sampling/field work in the boating area, and a busy RV *Laurence M. Gould* schedule of port calls and movements. Perhaps not surprisingly, brash ice conditions continued throughout the month, which often limited sampling by small boat. And, Palmerites pondered whether a collection of local icebergs might limit entry by the RV *Gould* to the pier.

Preparations are underway for a visit from Colin Harris and Katharina Lorenz (ERA), who will be assessing whether policies in the Antarctic Conservation Act plan are working, and whether there is a need to alter approaches and/or designated areas. They will be on station during the LMG16-12 port call, and will travel to the surrounding islands. Also, arrangements are being made for the arrival of the B-028-P (Countway) and B-256-P (Lee) grantee groups who will also arrive on LMG16-12.

NOVEMBER 2016 WEATHER

Liz Widen, Research Associate

Palmer Monthly Met summary for November, 2016

| |
|-----------------------------------------------------------------------------------------------------------|
| Temperature |
| Average: -1.3 °C / 29.7 °F |
| Maximum: 6.1 °C / 42.98 °F on 30 Nov 19:39 |
| Minimum: -8.2 °C / 17.24 °F on 10 Nov 07:41 |
| Air Pressure |
| Average: 980.7 mb |
| Maximum: 1010.8 mb on 19 Nov 23:35 |
| Minimum: 950.3 mb on 3 Nov 13:28 |
| Wind |
| Average: 7.8 knots / 9 mph |
| Peak (5 Sec Gust): 51 knots / 59 mph on 1 Nov 12:13 from NNE (22 deg) |
| Prevailing Direction for Month: NW |
| Surface |
| Total Rainfall: 35.1 mm / 1.38 in |
| Total Snowfall: 26 cm / 10.1 in |
| Greatest Depth at Snow Stake: 84 cm / 32.8 in |
| WMO Sea Ice Observation: 6/10 open pack ice with more than 20 bergs, with growlers and bergy bits. |
| Average Sea Surface Temperature: -.91 °C / 30.4 °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. Both 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.

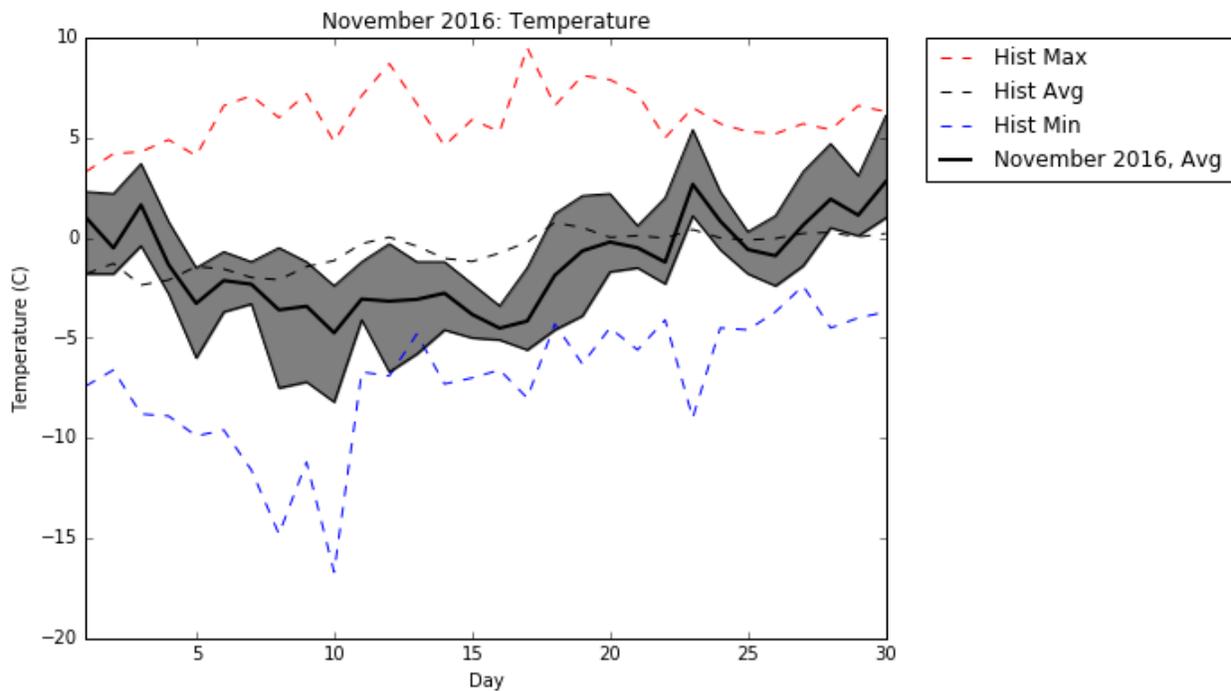


Fig. 1 – Plot of daily temperature in November 2016. Shown in black/shaded gray are the daily average, the minimum, and the maximum for this year. The dotted lines on the graph indicate average, minimum, and maximum values for “historical values” for 2002 to 2016. (We thank Liz Widen for providing this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

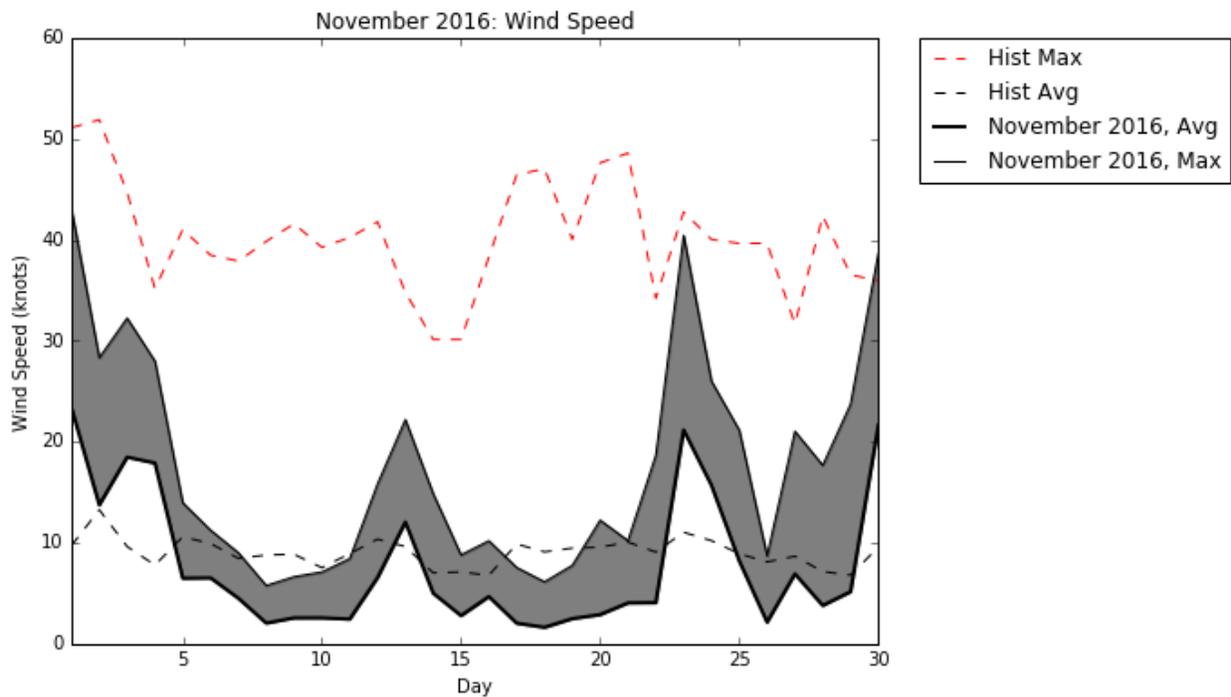


Fig. 2 – Plot of daily wind speed in November 2016. Shown in black/shaded gray are the daily average, the minimum, and the maximum for this year. The dotted lines on the graph indicate average and maximum values for “historical values” for 2002 to 2016. (We thank Liz Widen for providing this data and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

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 and Mike Brown

This month has been a productive month here at Palmer Station for the Schofield group. The ice remained in the Palmer boating area for most of the month, but we were fortunate enough to have a couple of ice-free days to complete Boating II and to begin water sampling for the season at Stations B and E. On weeks when we could not get to Stations B and E, we sampled water from the seawater intake at Station instead.



Fig 3. – Heading out on the Landing Craft with the new rosette for our first sampling day of the 2016-2017 summer season. *Image Credit: Dave Moore*

Instead of our zodiac platform Bruiser, this year we are using the Landing Craft to conduct sampling – equipped with a new rosette for the CTD and Niskin Bottles – which makes collecting water samples much easier (Figure 3). We had a successful first ‘shake-down’ trip at the beginning of the month on the Landing Craft to test out the new set-up and sampling procedures. Along with the Ducklow group, we sampled three times at Station B and twice at Station E. Phytoplankton populations (fluorescence) are still low (less than 1 mg m^{-3} ; Fig. 4b), though have increased slightly from the beginning of the month (Fig. 4a), with a relatively well-mixed water column still present (Fig. 4).

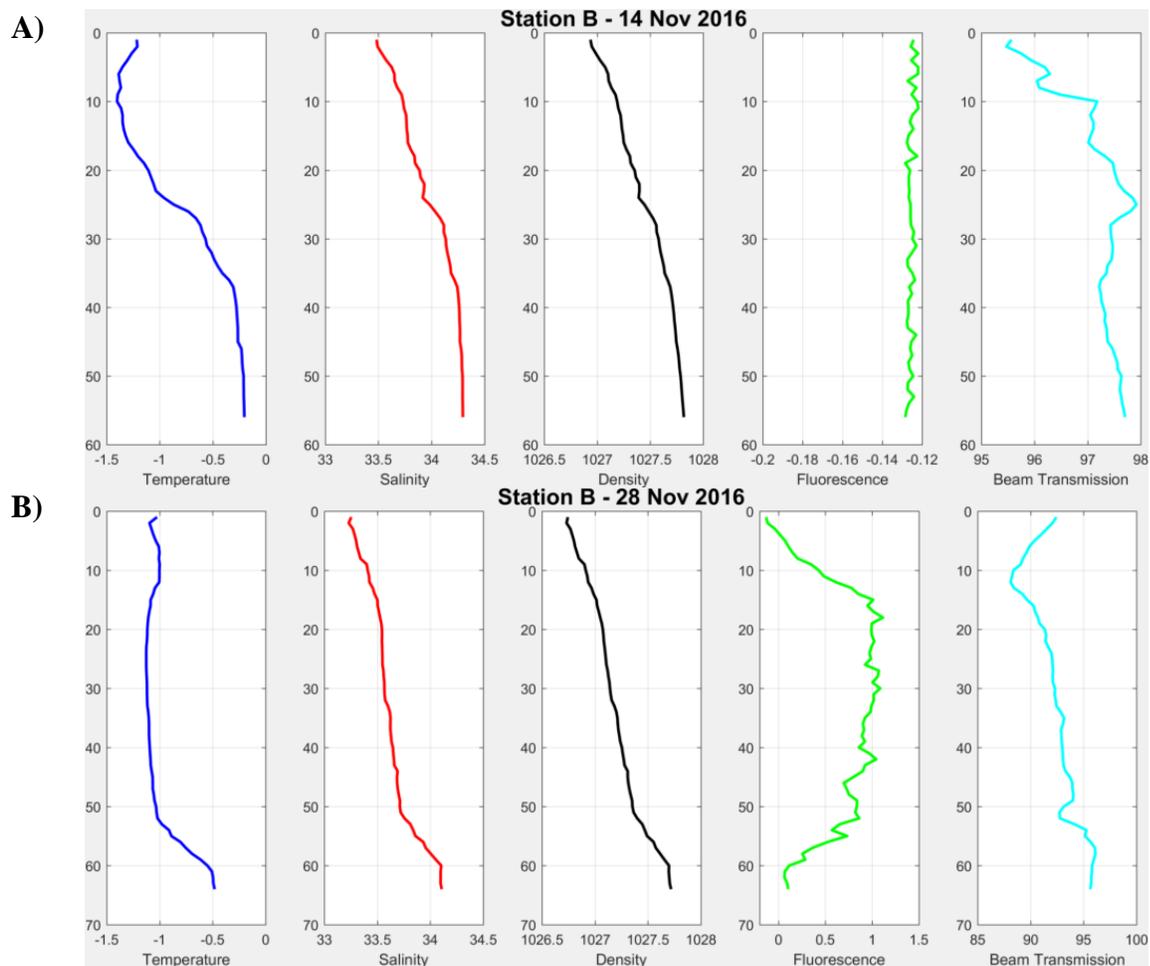


Fig. 4 – CTD profiles at Station B from (A) November 14 and (B) November 28. Temperature, salinity, and density show a relatively well-mixed water column. Fluorescence increases from November 14 to November 28 but remains less than 1 mg m^{-3} .

In addition to our normal bulk chlorophyll, HPLC, and primary production measurements, Mike Brown has been working to incorporate DNA/RNA and size-fractionated chlorophyll and HPLC measurements to the routine LTER sampling. This data should allow greater insight into the seasonal dynamics of phytoplankton community composition, and insight regarding the mechanisms driving them. Mike Brown has also been working to get a new instrument, the Optical Phytoplankton Discriminator (OPD), up and running. The OPD was developed by Mote Marine Laboratory, and consists of a miniature spectrometer housed within a glider science bay. It is capable of measuring particulate absorbance at a high spectral resolution, and theoretically should allow for the discrimination of phytoplankton taxa based on their unique absorption characteristics. The goal for this season will be to generate a large database of coincident OPD and phytoplankton taxa measurements to set up a future glider mission mapping algal community composition.

A huge thanks to Dave Moore, Palmer Marine Technician, for working hard to get us set up on the Landing Craft, which has made sampling great so far! Also, thanks to Pete Lawrence, Carpenter, for making an awesome work table for the Landing Craft and to Carly Quisenberry, Instrument Technician, and Michael Tepper Rasmussen, Palmer Marine Technician, for sampling with us. Everyone has made the transition from Bruiser to the Landing Craft smooth

and very successful. We are looking forward to many more great sampling days throughout the 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

After much anticipation, the ice cleared out of Palmer's boating limits at the end of November and C-045-P was finally able to sample at Stations B and E! This season is the first that Palmer LTER will be using the Landing Craft and a CTD Rosette rather than Bruiser (the LTER's Zodiac), and Go-Flo bottles for fieldwork. Our first run went very well; we hope that these new resources will help us sample more efficiently. The more spacious landing craft fits all four field team members from C-045-P and C-019-P comfortably, and with a Marine Technician driving the boat, we have more hands to collect water. We will continue to adjust our procedures from our methods on Bruiser as we get more opportunities to go sampling.



C-045-P and C-019-P preparing the CTD Rosette for a cast. From left to right: Dave Moore, Adrian Jaycox, Leigh West, Nicole Waite, and Mike Brown. Image Credit: C-045-P

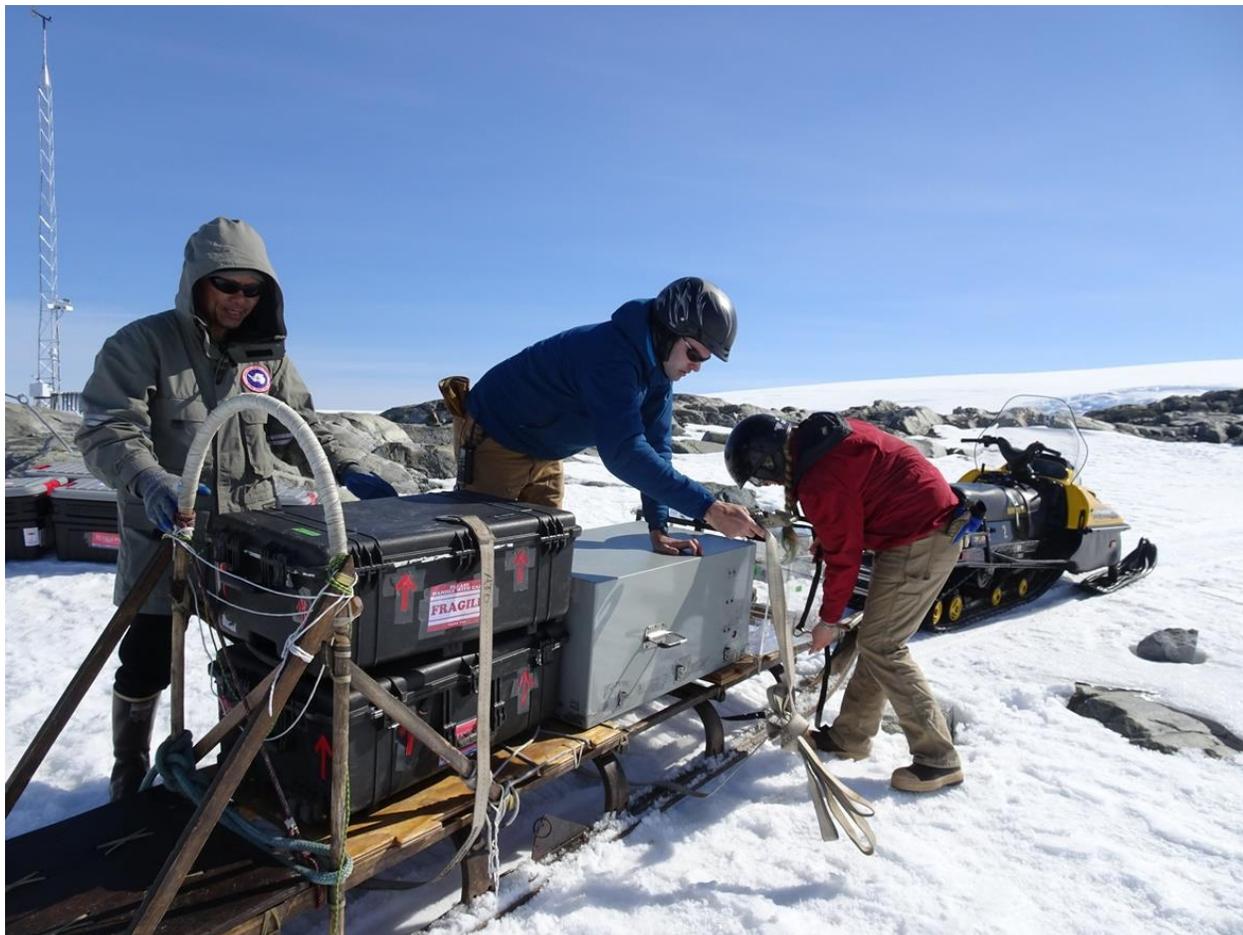
On days when the ice has been too thick for boating operations, C-045-P and C-019-P have been taking water samples from the seawater intake in the pump house on station. This is not ideal, as this only allows us to obtain information from 5.8 meters rather than from a range of depths, but it is still a valuable dataset. Hopefully, we'll have more cooperative ice and winds soon. We are excited to continue to sample from Stations B and E when conditions permit and begin observing seasonal trends.

In other news, we received a replacement part for our Equilibrator Inlet Mass Spectrometers (EIMS) turbo pump, and are working to get it up and running. Once it is fully functioning, the EIMS will continuously sample seawater throughout the season to measure the oxygen to argon ratio and help us determine the net community production rates in the waters surrounding Palmer Station.

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: Shun Yu, Isatis Cintron Rodriguez, Yuan Gao



Transferring O-231-P (Gao) samplers to the backyard platform. *Image Credit: Yuan Gao*

The Gao group arrived at Palmer Station on November 14 on LMG16-11SB for the exciting second season! Besides the PI, the group includes Shun Yu, a research scientist from Rutgers Department of Marine Science who filled in the spot of a graduate student who didn't pass the PQ at last minute, and Isatis Cintron Rodriguez, a new graduate student who just started in the PI's lab in September. This year, in addition to carrying out the same sampling on the platform at Palmer backyard as last year, the group brought in a second aerosol sizing sampler that allows us to obtain more mass for better quantifying atmospheric trace elements, especially iron (Fe),

associated with aerosol particles at this location. In addition, surface snow sampling at selected sites around Palmer backyard and on the glacier are planned to assist with atmospheric deposition measurements on the platform.

Upon arrival, we were busy with unpacking 17 boxes brought in by the RV *Laurence M. Gould* – 11 boxes were shipped in early summer from Rutgers and stored in the Punta Arenas, Chile warehouse last year, plus an additional six boxes that were carried on air travel this time. Major instruments were checked and re-tested in BIO/Terra labs. By the afternoon of November 21, all instruments started running on the platform! One challenge we faced after then, however, was the high temperature in the enclosure that holds all electronic devices, which was caused by the extra heat generated by a large vacuum pump associated with the second aerosol sizing sampler. This situation was quickly improved after install a powerful fan, ten times stronger than the ones used previously, and the temperature inside the enclosure dropped from above 100°F to below 80°F most of the time! We'll be monitoring the temperature inside the enclosure carefully while entering the warmer season. During this month, the first set of surface snow samples was collected – luckily, it snowed once!

Many thanks to everyone at Palmer and on the Gould for being so friendly and helpful! We are extremely grateful for strong support from Palmer Station, especially for helping us to set up and to solve the heat problem. We look forward to having another productive season!

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
November 2016
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.

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 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 Total Deposition Sampler has been operational when the LMG is not at the Pier. Yuan Gao has arrived on station with replacement parts. The Wet Deposition Sampler and the High Volume Air Sampler are now operational.

**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.

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 290nm up to 605nm, four times per hour. A BSI GUV-511 filter radiometer, an Eppley PSP Pyranometer, and an Eppley TUVB 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. Original power supply was reinstalled, had been sent off continent for repairs.

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.



Icebergs at sunset. *Image Credit: Randy Jones*

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. The broken azimuth potentiometer was replaced and image quality has returned to normal.

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 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.

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 repaired antenna was re-orientated and the system is back to normal operation.

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.

Reset frequency of blower control. 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 tide gauge 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. Wind shield for the rain gauge was repaired.