

PALMER STATION MONTHLY SCIENCE REPORT

August 2016



Sunrise over an ice covered Arthur Harbor. *Image Credit: Ken Keenan*

NEWS FROM THE LAB

Ben Cournoyer, Winter Laboratory Supervisor

The Bio Labs have been relatively quiet compared to last month. We were working hard preparing the aquarium and laboratories for the busy summer schedule that is quickly approaching. The Detrich group, our resident science group, continued to rear and sample their larval fish. They will continue to make progress through turnover in October.

August brought some of the most beautiful weather we have seen all winter. Colorful sunrises and sunsets ushered us toward the coming summer and were a welcome contrast to the blues and greys that dominate the area. Rapidly increasing sunlight also breathed life into some of the dormant weather stations on the surrounding islands. The waters around station were locked in sea ice for much of August until winds and warmer ocean temperatures cleared the water ways toward the end of the month. Loss of the ice cover brought about a revival of wildlife in the area. A group of over forty penguins was spotted on Boneparte Point. They have been seen porpoising around Detrich Island as well, possibly attempting to outmaneuver the leopard seal that has been patrolling the bay.

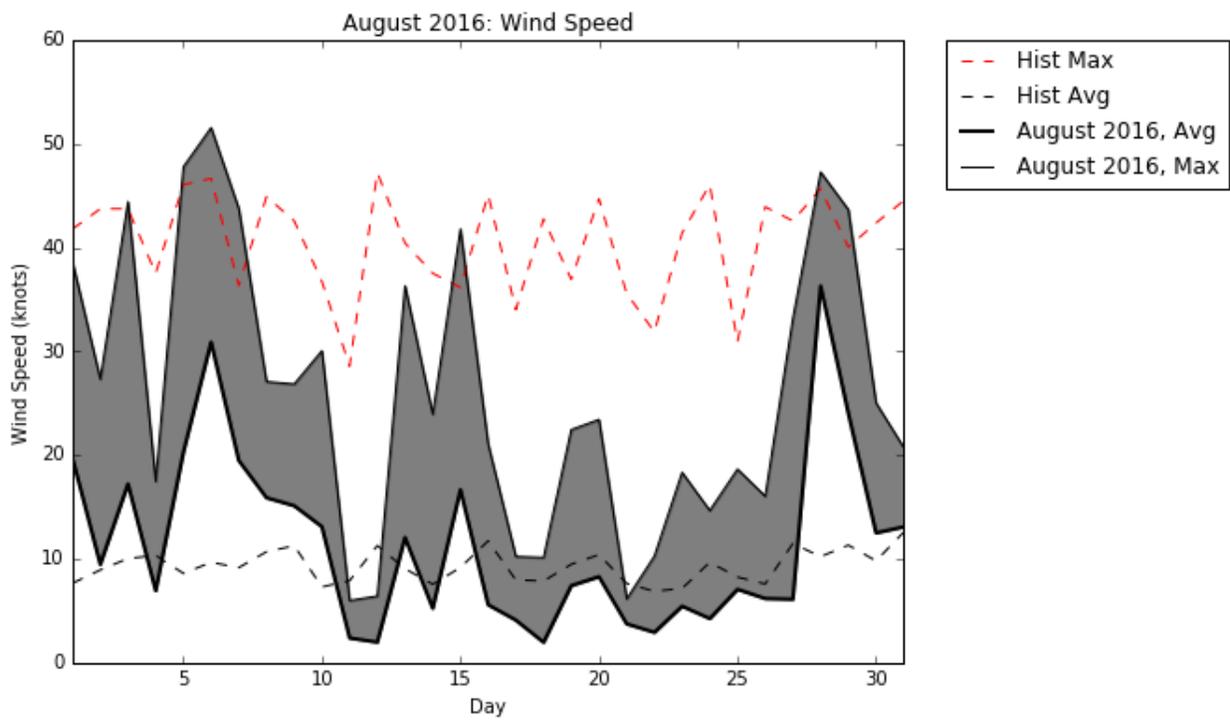
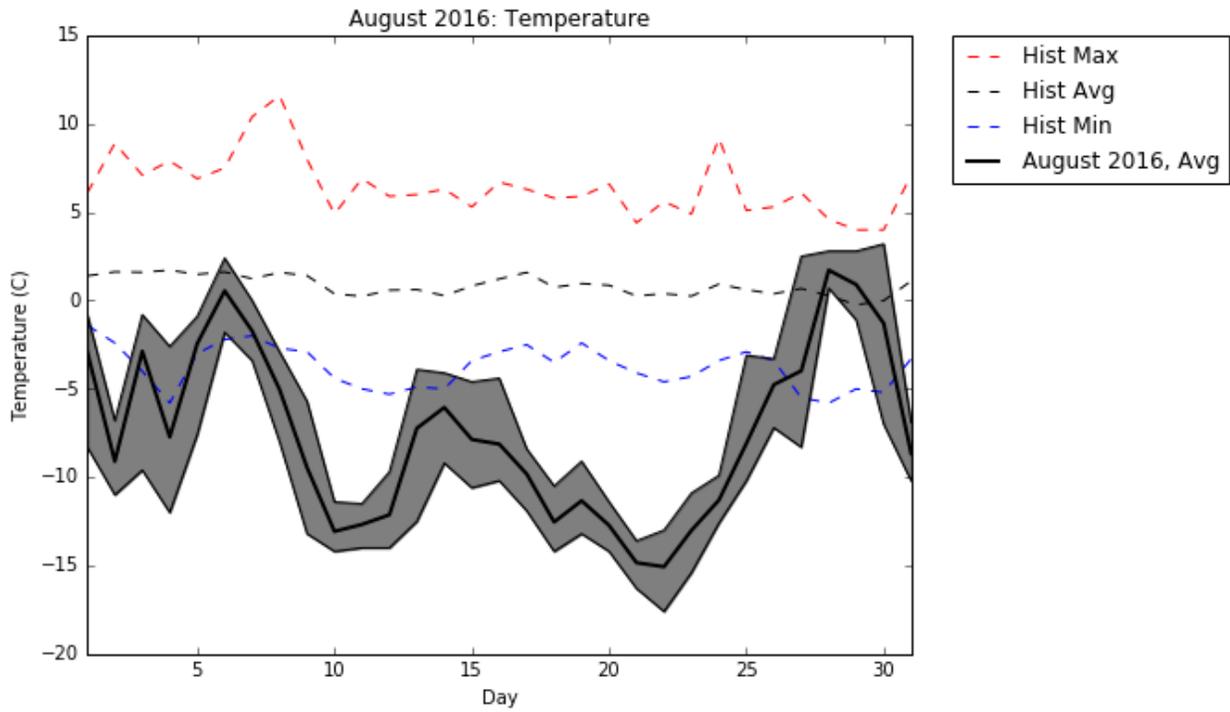
August 2016 WEATHER

Lance Roth, Research Associate

The following table gives the weather data for the month of July. The times are in UTC.

Temperature
Average: -7.5 °C / 18.5 °F
Maximum: 3.2 °C / 37.76 °F on 30 Aug 02:36
Minimum: -17.6 °C / 0.32 °F on 22 Aug 02:19
Air Pressure
Average: 990.1 mb
Maximum: 1014.2 mb on 12 Aug 13:19
Minimum: 959 mb on 30 Aug 09:39
Wind
Average: 11.5 knots / 13.2 mph
Peak (5 Sec Gust): 61 knots / 70 mph on 6 Aug 17:56 from NNE (12 deg)
Prevailing Direction for Month: NNE
Surface
Total Rainfall: 56.4 mm / 2.22 in
Total Snowfall: 51 cm / 19.9 in
Greatest Depth at Snow Stake: 102 cm / 39.8 in
WMO Sea Ice Observation: Ship in easily penetrable ice. More than 20 bergs, with growlers and bergy bits.
Average Sea Surface Temperature: -1.66 °C / 29 °F

The following two plots 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 much cooler on average this month and created sea ice in both Arthur Harbor and Hero Inlet. We also experienced high winds on two occasions with wind gusts over 50 mph. The wind events helped to break up some of the ice in the harbor. Currently the water around Palmer Station is free of ice.



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

H. William Detrich, Principal Investigator

Marine Science Center, Dept. of Marine and Environmental Sciences, Northeastern University

Personnel on Station:

1-31 August: 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 – During August, the B-037 team continued 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), as far as 90 days postfertilization. Critical tasks have included: 1) preserving embryos 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; 2) microscopic documentation of the development of control and experimental embryo cohorts; 3) evaluation of methods for the cryopreservation of sperm from several species – success in these endeavors would facilitate future reproductive studies by eliminating the need to catch synchronously fertile males and females; 4) disinfection of embryos to enhance their long-term viability; and 5) tracking embryo mortality to guide our efforts to develop new husbandry methods in the future. The team also prepared for ISH experiments on *N. coriiceps* embryos to be conducted at Palmer Station during September and October; antisense RNA probes for enzymes involved in the metabolism of reactive oxygen species will be used to localize the expression of the corresponding genes.

Personnel Deployments – None. Team members Goetz, Shusdock, and Smith remained on station to continue our over-winter embryological studies at Palmer Station.

We thank the ASC station personnel for their dedication and professionalism in support of B-037. Your tremendous assistance has helped B-037 to achieve its goals during the month of August.



The remaining members of the Detrich Group ready to start the day. From left: Katie Shusdock, Laura Goetz, and Sierra Smith. *Image Credit: Ben Cournoyer*

**PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
August 2016
W. Lance Roth**

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 high volume pump is working well and the filters have been changed weekly.

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. 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.

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 were issues with the images during the coldest period of the month, but as the temperatures warmed everything corrected itself. During an unplanned power outage we lost the video card. A new card was installed and the system is currently plugged into a different UPS unit which should last longer.

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 system operated well throughout the month.

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

Managed by General Dynamics

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

The system is having grounding issues with the blower causing dead time in the data. The issue can only be resolved by cycling the power on the blower motor controller.

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. The AWS on Howard Island in the Joubins is showing data only during direct solar periods.