

PALMER STATION MONTHLY SCIENCE REPORT

June 2016



Palmer Station amid icebergs and seaice. *Image Credit: Bo Hosticka*

NEWS FROM THE LAB

Ben Cournoyer, Winter Laboratory Supervisor

We're past the mid-winter hump and still going strong. With June came the last fishing cruise for the B-037-P Detrich Group. They are studying the physiological effects of increased water temperature on various icefish species. A bad day fishing is still better than a good day in the office, if you play your cards right you never have to compare the two. No matter the weather, Dr. Detrich and crew were all smiles. Though the number of adult fish on station is waning, our aquaria have been taken over by embryos in custom made incubation chambers. We're eagerly awaiting the first fry!

After a relaxing mid-winter, science support buckled down to prepare the labs for the Manahan Group (B-301). Sixteen students from around the world will get hands on experience learning about the Antarctic Peninsula and what it takes to perform research in this a remote location.

June 2016 WEATHER

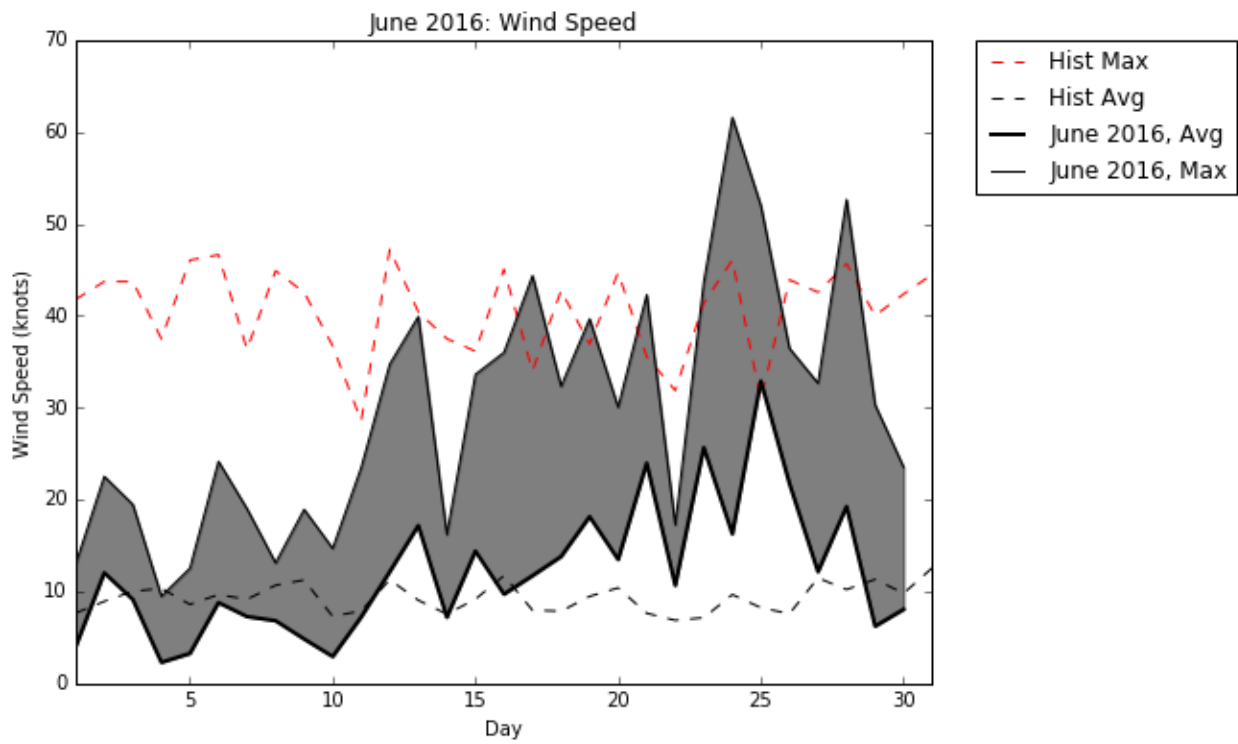
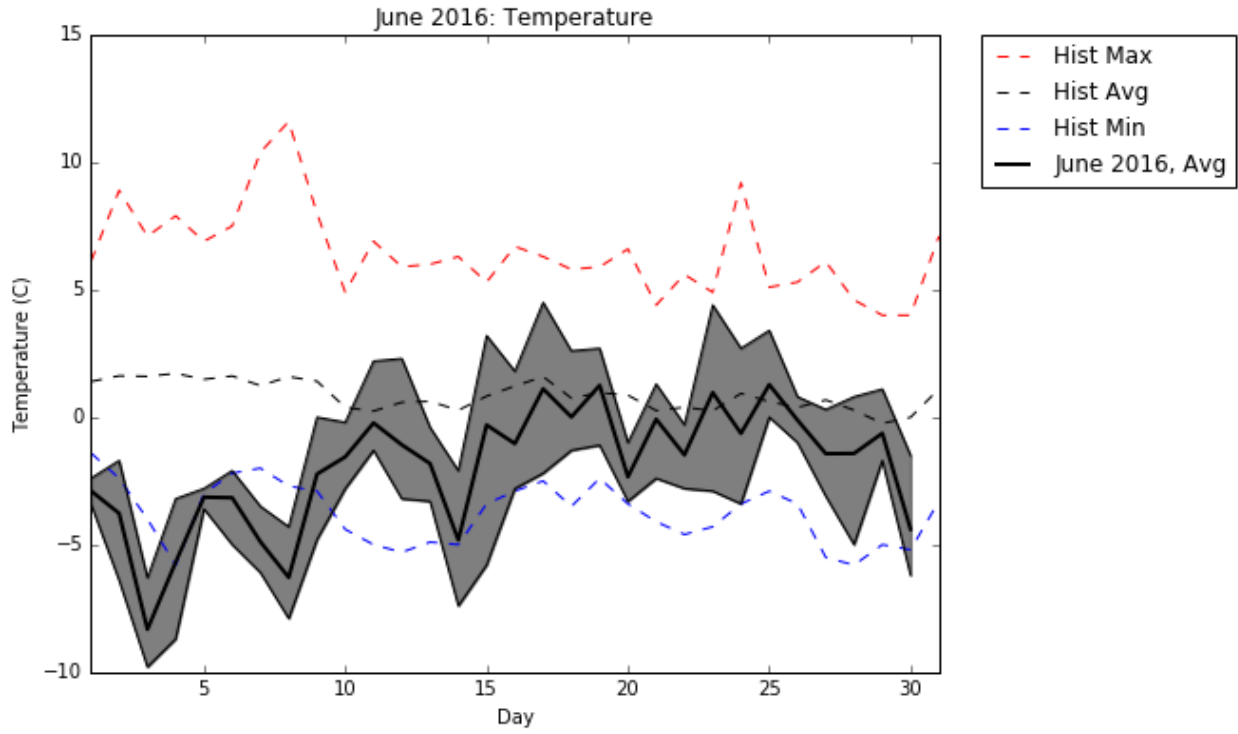
Lance Roth, Research Associate

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

Temperature
Average: -2 °C / 28.5 °F
Maximum: 4.5 °C / 40.1 °F on 17 Jun 08:22
Minimum: -9.8 °C / 14.36 °F on 3 Jun 04:41
Air Pressure
Average: 985.7 mb
Maximum: 1004.4 mb on 6 Jun 23:56
Minimum: 955.7 mb on 13 Jun 12:48
Wind
Average: 12.1 knots / 13.9 mph
Peak (5 Sec Gust): 71 knots / 82 mph on 24 Jun 21:58 from N (8 deg)
Prevailing Direction for Month: ESE
Surface
Total Rainfall: 81.8 mm / 3.22 in
Total Snowfall: 43 cm / 16.8 in
Greatest Depth at Snow Stake: 71 cm / 27.7 in
WMO Sea Ice Observation: More than 20 icebergs with growlers and bergy bits.
Average Sea Surface Temperature: -1.59 °C / 29.1 °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 cooler at the beginning of the month, but agreed well with the historical average toward the end of the month. June was extremely windy with gusts over 80 mph on June 24th exceeding the historical maximum. The average wind speed was also above average for most of the month.



B-037 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

Personnel on Station:

1-17 June: Thomas Desvignes, Nathalie Le François, Carmen Elenberger, Laura Goetz, and Sierra Smith

18-30 June: Nathalie Le François, Laura Goetz, 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 stenotherms 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 this 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 *Chionocephalus aceratus*, respectfully).

Fishing on board the ARSV Laurence M. Gould (LMG) – To obtain further fish specimens necessary to support research, team members Desvignes, Elenberger, and Goetz sailed on board the *LMG* at 09:30 local time (LT) on Monday, 6 June, for a four day fishing trip to grounds north of Palmer Station. They successfully fished south of Snow Island during the night of 7-8 June, collecting numerous fish, including one of our target species, *C. aceratus*. By 04:00 LT of 8 June, wind and sea states deteriorated, which necessitated a change in locale. Heavy seas precluded fishing operations northwest of Brabant Island, so the Captain, MPC, and Chief Scientist Desvignes decided to head into southern Dallmann Bay, where fishing operations were successfully conducted from 16:00 LT until 04:00 in the morning of 9 June. Given continued difficult wind and sea states at unprotected sites (e.g., Low Island), the decision was made to leave Dallmann Bay and to transit to station with, en route, a night of fishing in the Gerlache Strait (15:00 9 June – 04:00 10 June). As before, a diversity of notothenioid species was sampled at that site. The *LMG* tied up at the Palmer Station pier at 10:00 LT on 10 June. Fish were off-loaded and placed in the Palmer Station aquaria and passengers debarked. We greatly appreciated the assistance of *LMG* and ASC personnel during this rough fishing trip!

Palmer Station Science – Throughout the month of June, Desvignes, Elenberger, and Goetz sampled the tissues of fish that were not part of our reproductive broodstock populations. Meanwhile, Le François, Goetz, and Smith concentrated on maintaining and sampling the 11 clutches of *N. coriiceps* embryos that we produced (eight in late May and three in early June) by *in vitro* fertilization. The embryos have been placed in our Aquamerik incubator system, with control embryos incubated at -1°C and experimentals ramped slowly to $+5^{\circ}\text{C}$ followed by continuous incubation at that temperature. Embryos

are being sampled at fixed intervals of 15 days, as well as when key developmental stages are achieved (e.g., pigmented eye stage), during the 6-7 months required to reach the hatching stage. Micrographs are being recorded to document developmental morphology and rate under the two thermal regimes. To maximize embryo survival, Le François has implemented a disinfection protocol, involving alternating treatments with Zep Perosan® and glutaraldehyde at two week intervals, to prevent bacterial and fungal overgrowth of the cultures. Embryos for RNA sequencing (RNAseq) are preserved in RNAlater, whereas those for *in situ* hybridization (ISH) studies are fixed in paraformaldehyde and stored in methanol. Control and experimental embryos will be analyzed for potential perturbation of gene expression by RNAseq and ISH at our home institutions.

Personnel Deployments – Team members Desvignes and Elenberger departed Palmer Station at 09:00 LT on 17 June on board the *LMG* en route to Punta Arenas, Chile. Le François, Goetz, and Smith continue the work at Palmer Station while awaiting the arrival of team member Kathleen Shusdock on *LMG* Cruise 16-06.

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



A Bullhead Notothen (*Notothenia coriiceps*) embryo thirty five days after fertilization. The fry is still within its egg. Image Credit: Laura Goetz

**PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT**

June 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 20s 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 address during clear night skies only.

**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 is working well and the filters have been changed weekly. The WD collected data while the LMG was not at the pier. TD bucket and instrumentation was damaged during a high wind event. Working on replacing parts before future sampling can take place.

**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, samples were not taken regularly.

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 fine 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. The Trimble Controller was used to map out a Skiway on the Glacier. The project name is Skiway 2016.

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.

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 though 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. Swapped out a hard drive and sent it to Grantee.

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 operated normally throughout the month. Grantee is currently here onsite to upgrade system.

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. A ten pin connector was added to the data cable in order to communicate directly with the SmartGuard data logger. A 120 ohm resistor is necessary out at the data to complete the process.

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. Replacement parts and instrumentation have been purchased. Two of the three remote stations are no longer working do to the lack of sunlight.