

PALMER STATION MONTHLY SCIENCE REPORT
September 2018



Palmer Station in the early morning with nacreous clouds. Image Credit: Steve Allarding

NEWS FROM THE LAB

Jason Johns, Winter Laboratory Supervisor

September has been an interesting month at Palmer Station. We observed the arrival of the spring equinox this month which signals the official end of winter. There is now plenty of sun for outside scientific activities, maintenance and construction work, and recreation.

The Detrich Team B-037-P is beginning to wrap up some of their experiments and planning for the shipment of many scientific samples on the soon to arrive R/V Laurence M. Gould. It has been quite a successful season for them. The abundance of good quality eggs and fish they were able to acquire in the beginning of their season meant that many different experiments could be conducted in the attempt to gain lots of scientific knowledge about a variety of fish species that live in the southern ocean. They have now raised one of these species of fish all the way from unfertilized eggs to swimming and eating hatchlings; and been able to observe, document, and also preserve them at many points in between so that they can further study them in their home institutions.

The winter crew continues to get everything ready for the turnover cruise which will arrive very soon. This cruise will bring a fresh summer crew, to take over responsibilities on station, and also members of the Schofield science group C-019-P. The labs received a nice fresh coat of wax on their floors thanks to the FMC department. This will allow them to last longer, look a lot better, and be safer. The general mood on station is one of a very successful season that is nearly complete.

Palmer Monthly Met summary for September, 2018

Temperature
Average: -5.6 °C / 21.9 °F
Maximum: 3.8 °C / 38.84 °F on 11 Sep 00:00
Minimum: -16.5 °C / 2.3 °F on 18 Sep 00:46
Air Pressure
Average: 985.3 mb
Maximum: 1013.2 mb on 20 Sep 02:24
Minimum: 938.4 mb on 13 Sep 17:08

Wind
Average: 13.8 knots / 15.9 mph
Peak (5 Sec Gust): 62 knots / 72 mph on 13 Sep 15:53 from N (1 deg)
Prevailing Direction for Month: NNE
Surface
Total Rainfall: 92.7 mm / 3.65 in
Total Snowfall: 52 cm / 20.3 in
Greatest Depth at Snow Stake: 317.4 cm / 123.8 in
WMO Sea Ice Observation: 7/10 close pack ice with icebergs bergy bits.
Average Sea Surface Temperature: -1.68 °C / 29 °F

Temperatures peaked at 38.8° F on September 11th and reached a low of 2.3° F on September 18th. The wind peaked at 72 mph on the 13th and averaged 15.9 mph. The prevailing wind direction for the month was from the North-North-East. We had several warm systems that passed through bringing snow bringing our monthly accumulation up to 20.3 inches and our total accumulation to over 123.8 inches. Sea ice condition slowly evolved from minimal grease and pancake ice to thick pack ice covering 8/10 of the inlet several large icebergs in the area.

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: Nathalie R. Le François (Biodôme de Montréal), Jacob Grondin, and Margaret Streeter



Notothenia coriiceps hatchling Image Credit: Maggie Streeter

During September, B-037 focused on: 1) final samplings for Experiments III and VI; 2) observation and sampling of hatchling *Notothenia coriiceps* from Experiments I, II, and III; 3) Experiment VIII, an analysis of glucocorticoids as an indicator of chronic stress in *N. coriiceps*; and 4) laboratory reallocation and sample/chemical inventorying.

1) Experiment III examines the thermal resilience of *N. coriiceps* embryos at 70 dpf after shifting from 0°C to more extreme temperatures. Groups include controls maintained at 0°C, experimentals subjected to temperature jumps to +4, +6 and +8°C, and reciprocal temperature-shifted experimentals, 0 to +4 and +4 to 0°C. At Palmer Station and our home institutions, we will examine the effect of the temperature shifts on embryonic survival, metabolic and antioxidant enzyme activities, oxidative damage (lipid peroxidation), and the induction of transcription factors that regulate the expression of genes that encode enzymes involved in generating or quenching reactive oxygen species.

The microbiome experiment (EXP VI) was concluded as well. Filtrates of Arthur Harbor seawater (pre-sand-filtration, pre-UV, and post-UV treatments) and embryos from both temperature treatments (Ambient and Heated) were sampled for microbiome characterization. This experiment is being conducted in collaboration with Dr. Nicolas Derôme of Université Laval (QC, Canada).

2) We hypothesized that heat-treated *N. coriiceps* embryos from experiments I and II would hatch around 110-120 dpf. However, hatching occurred much earlier, ~90-100 dpf in both experiments. Coordinated swimmers from these hatchings were seen to

eat just a few days post-hatching. We continue to observe and care for the hatchlings, as well as collect new hatchlings from other experimental treatments.

3) This month, we started sampling for experiment VIII, which focuses on glucocorticoids (GC) in bony structures as indicators of chronic stress in *N. coriiceps*. GC levels in scales, otoliths and fin rays of fish are considered to be better indicators of chronic stress than blood cortisol levels. We are determining the baseline chronic stress levels of locally caught, wild fish to compare to fish held under long-term captive conditions, which can be considered a “stressful situation.” Unfortunately, sampling for the wild cohort has “hit a wall,” because sea ice remains trapped in Hero Inlet. At present, we have a minimal number of wild specimens in our aquarium tanks. This preliminary study is being conducted in collaboration with Dr. Johan Aerts (Ghent University, Belgium).

4) As the arrival of LMG18-08 approaches, B-037 has shifted to changing labs and packing samples for retrograde transport.

We heartily thank the personnel of the Antarctic Support Contractor for their excellent support during our winter experimentation.

PALMER STATION

RESEARCH ASSOCIATE MONTHLY REPORT

September 2018

W. Lance Roth

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-111-P: THE NEXT GENERATION OF GEOSPACE RESEARCH FACILITIES AT PALMER STATION

Andrew Gerrard, Principal Investigator, New Jersey Institute of Technology

The ionosphere-thermosphere-magnetosphere (ITM) region of Earth's atmosphere, which is part of the larger geospace environment, is the portal through which the solar wind can enter and impact our planetary system. Though space weather research over the past decades has greatly increased our understanding of a wide variety of phenomena associated with ITM physics, the sum of these individual processes occurring in the geospace environment does not replicate the rich diversity and scope of this complex region. Thus, a more holistic approach to ITM research is necessary, one that integrates clustered instrumentation at multiple locations to simultaneously look at the interactions within the entire system. Using coordinated and collaborative instrumentation currently installed in Antarctica, researchers will study interrelated ITM phenomena observed at high latitudes. The goal of this research effort is a better understanding of the energy transfer and modulation of the geospace system.

The C:\ drive on the VLF/ELF computer filled up with data causing the software to crash. The issue was resolved once the data was moved to the external raid system. All other systems operated normally throughout the month.

A-119-P: CONTINENTAL-SCALE STUDIES OF MESOSPHERIC DYNAMICS USING THE ANTARCTIC GRAVITY WAVE INSTRUMENT NETWORK (ANGWIN)

Michael Taylor, Principal Investigator, Utah State University

The Antarctic Gravity Wave Imaging Network (ANGWIN) is a cooperative effort of six international Antarctic programs to collect continent-wide gravity wave measurements. This network capitalizes on existing optical and radar measurement capabilities at McMurdo, Palmer, South Pole, and six other research stations: Halley (UK), Syowa (Japan), Davis (Australia), Rothera (UK), and Ferraz (Brazil). Infrared (IR) all-sky mesospheric OH (hydroxyl) imagers are installed at Davis, McMurdo, and Halley stations. The network quantifies the properties, variability, and momentum fluxes of short-period (less than one hour) mesospheric gravity waves and their dominant sources and effects over the Antarctic continent. An all-sky near-IR imager is also installed at Palmer Station to augment the existing instrumentation and create a capability for studying gravity wave properties at each site.

The system operated normally throughout the 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.

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 once a week during favorable winds and HATS Air samples were taken every other week.

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. Bi-weekly absolute scans were completed as necessary.

R-938-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 system operated normally throughout the month with an occasional reboot of the system.

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 normally 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 has operated normally throughout the month. Filters were prepared and are ready for shipment.

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 has operated normally 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 and emailed to the National Weather Service for entry into the Global Telecommunications System.

The local weather station (PAWS) is working well. The aspirating fan on the temperature/humidity sensor was replaced. The Joubins AWS came back offline at the end of the month. Observations are archived on the AMRC website: <ftp://amrc.ssec.wisc.edu/pub/palmer/>