

PALMER STATION MONTHLY SCIENCE REPORT

August 2018



Detrich and Amsler Islands from the Marr Ice Piedmont. *Image Credit: Jacob Grondin*

NEWS FROM THE LAB

Jason Johns, Winter Laboratory Supervisor

The sun is really beginning to return to the Palmer area which is nice to see, but also allows longer boating hours that grantees will be taking advantage of very soon. August has seen the Detrich Team B-037-P celebrate the successful hatching of many fish eggs that they have been incubating carefully since May. Little is known about this species of fish at this stage of life especially when they have been subjected to different incubating temperature profiles than they would experience in their natural habitat. It is very exciting for them to have reached this goal and exciting for everyone that has helped them to do so.

The new science storage vans have been successfully setup and instruments and science supplies were moved back into them. This has already been a big help to the scientists on station allowing them to easily acquire supplies to set up new experiments and run existing experiments.

The weather has been unpredictable as usual this month alternating between calm periods often with light snow and days of wind and rain or sleet. Conditions around the area have been really good overall for snowshoeing and skiing as the snowbanks are quite high in many areas and the coverage of snow encapsulates nearly every rock now.

Palmer Monthly Met summary for August, 2018

Temperature
Average: -6.3 °C / 20.7 °F
Maximum: 3.4 °C / 38.12 °F on 9 Aug 22:20
Minimum: -21.9 °C / -7.42 °F on 7 Aug 12:58
Air Pressure
Average: 983.1 mb
Maximum: 1017.9 mb on 8 Aug 12:19
Minimum: 943.2 mb on 4 Aug 10:06

Wind
Average: 11.9 knots / 13.7 mph
Peak (5 Sec Gust): 76 knots / 88 mph on 19 Aug 02:55 from NNE (29 deg)
Prevailing Direction for Month: NNE
Surface
Total Rainfall: 76.7 mm / 3.02 in
Total Snowfall: 50 cm / 19.5 in
Greatest Depth at Snow Stake: 90.2 cm / 35.2 in
WMO Sea Ice Observation: 1-5 icebergs with growlers and bergy bits
Average Sea Surface Temperature: -1.62 °C / 29.1 °F

Temperatures peaked at 38.1° F on August 9th and reached a low of -7.4° F on August 7th. The winds peaked at 88 mph on the 19th and averaged 13.7 mph. The prevailing wind direction for the month was from the North-North-East. We had several warm systems that passed through bringing rain and 19.5 inches of snow raising our total accumulation to over 35 inches. There has been some grease and pancake ice and 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), Jake Grondin, and Maggie Streeter

During August, B-037 focused on: 1) sampling *N. coriiceps* embryos from experiments I and II; 2) maintaining and sampling *N. coriiceps* experiment III; 3) preparing for hatching of *N. coriiceps* embryos from experiments I and II.

- 1) Experiments I and II examine the effects of elevated temperatures on *N. coriiceps* embryonic development. Experiment I compares embryos raised continuously at 4°C to control embryos raised at ambient temperature (~0°C). Experiment II examines the effect of temperature elevation to 4°C at different life history stages [0, 60, 90 days post fertilization groups (dpf)] vs. control embryos raised at ambient temperature. We continue to sample and fix embryos from EXP I and II for future analysis at our home institutions. We are also regularly disinfecting our embryo cultures to prevent potentially harmful growth of bacteria and fungi. Ninety dpf has been reached this month and we have witnessed the beginning of hatching in heated groups (I and II). We are considering first-feeding strategies to study larval behavior and post-hatch activity. Little is known regarding the early larval stages of notothen.
- 2) Experiment III examines the thermal resilience of *N. coriiceps* embryos at 70 dpf that are shifted from 0°C to more extreme temperatures. Groups include controls maintained at 0°C, experimentals with jumps to +4, +6 and +8°C, and temperature down-shift experimentals, +4 to 0°C. Using these embryos, 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 encoding enzymes involved in controlling reactive oxygen species (ROS). Embryos will be sampled every 5 days from 70 dpf to 100 dpf and every 10 days thereafter. We have sampled 5 time points so far, reaching 95 dpf this month.
- 3) Microbial activity (bacteria, fungi) in the embryo cultures has a major impact on embryo survival. We are implementing a microbiome experiment to investigate the microbiomes that live on the surface of *N. coriiceps* eggs (i.e., the chorion) under our cultivation conditions (different temperatures) and in our culture system. Our plan is to analyze water samples from the water inflow (pre-filtration) and after UV treatment to evaluate the impact of filtering and UV treatment on the bacterial load. Beginning in September, filtered water samples will be taken by sampling water prior to UV disinfection and after UV disinfection. Embryos from EXP I (both ambient and heated groups) will be sampled for a genomic analysis of the microbiome in collaboration with Dr. Nicolas Derôme of Université Laval (QC, Canada).
- 4) Heated *N. coriiceps* eggs from experiment I were hypothesized to hatch around 110-120 dpf. However, hatching occurred much earlier, ~90-100 dpf. Fish larvae are surviving and beginning to swim in a coordinated fashion. In the coming weeks, science personnel will create a rearing unit to observe hatchlings to document their swimming and feeding behavior.

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



Jacob Grondin filters seawater for the characterization of the microbiome. Image Credit: Maggie Streeter

PALMER STATION

RESEARCH ASSOCIATE MONTHLY REPORT

August 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.

All 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 calibrations were completed as necessary.

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 had to be rebooted to restore Ethernet connection but operated normally 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 system operated normally throughout the month with an occasional reboot of the system. Working on an upgrade that will take place this summer.

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. The spare cooler began warming and is no longer operational.

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 was moved to a new location on the pier. It is now possible to connect remotely to the Smartguard system on the pier.

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 AWS on the Joubins is now operational. Observations are archived on the AMRC website: <ftp://amrc.ssec.wisc.edu/pub/palmer/>