

PALMER STATION MONTHLY SCIENCE REPORT
June 2018



Pancake Ice with the sun far away somewhere. *Images Credit: Steve Allering*

NEWS FROM THE LAB

Jason Johns, Winter Laboratory Supervisor

Winter has certainly set in on Palmer Station but the labs are still humming with activity. The Detrich Team B-037-P steadily decreased the number of fish that they are harboring and their need for aquarium tank space decreased accordingly, allowing all the outside tanks to get winterized and some of the inside tanks to get cleaned out as well. Significant progress was made by them setting up their new experiments as well as continuing to monitor the experiments that are still in progress. They are very active counting and preserving fish sperm and eggs of which they have an impressive amount.

There were several storms this month bringing snow, wind, and rain but the temperature of the seawater and the air temperature has trended downward as the snowbanks and the daily light hours increase steadily. The sea ice is beginning to solidify especially in places such as the back of Hero inlet where the ice tends to accumulate and build up with the cold temperatures, lack of current, and more protection from the shifting winds. The glacier is also much quieter than it was months ago as there is a lot less water coming in to undercut it.

Outside work has to be a little more carefully planned, executed and sometimes aborted in windy conditions. However, there is still plenty happening, including the setup of the new science storage vans which are nearly completed, thanks to the excellent FMC crew. It will be a relief to everyone once we can store science instruments and consumables in these vans again and it will open up a lot of space in the labs in time for the summer rush.

Palmer Monthly Met summary for July, 2018

Temperature
Average: -4.9 °C / 23.2 °F
Maximum: 3.6 °C / 38.48 °F on 9 Jul 21:50
Minimum: -14.8 °C / 5.36 °F on 11 Jul 23:44

Air Pressure
Average: 989 mb
Maximum: 1017.1 mb on 3 Jul 20:22
Minimum: 958.6 mb on 11 Jul 00:20
Wind
Average: 14.1 knots / 16.2 mph
Peak (5 Sec Gust): 66 knots / 76 mph on 26 Jul 20:38 from N (7°)
Prevailing Direction for Month: N
Surface
Total Rainfall: 91.4 mm / 3.6 in
Total Snowfall: 45 cm / 17.6 in
Greatest Depth at Snow Stake: 66 cm / 25.7 in
WMO Sea Ice Observation: 1-5 icebergs with growlers and bergy bits
Average Sea Surface Temperature: -1.66 °C / 29 °F

Temperatures peaked at 38.5° F on July 9th and reached a low of 5.4° F on July 11th. The winds peaked at 76 mph on the 26th and averaged 16.2 mph. The prevailing wind direction for the month was from the north. There were several warm systems that passed through bringing 17.6 more inches of snow raising our total accumulation to over 2 feet. There has been some grease and pancake ice and several large icebergs in the area. During the last week, the sea is present in concentration of 9/10th with ice less than 10 cm thick.

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 Le François, Jake Grondin, and Maggie Streeter

During July, B-037 focused on: 1) sampling *N. coriiceps* embryos from experiments I and II; 2) preparation for *N. coriiceps* embryo experiment III, which will begin in August; 3) efforts to obtain embryos of the icefish *Pseudochaenichthys georgianus*; and 4) characterization and preservation of sperm from the bullhead notothen *Notothenia coriiceps*. The following paragraphs describe progress in these areas.

- 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), whereas 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 I and II for future experimentation at our home institutions. We are also regularly disinfecting our embryo cultures to prevent potentially harmful growth of bacteria and fungi.
- 2) Experiment III will examine the thermal resilience of *N. coriiceps* embryos at 70 dpf that are exposed to more extreme temperatures. This experiment will have groups at 0, +4, +6 and +8°C. For this experiment, we will examine the effect of elevated temperature 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). Preparation for this experiment was assisted by the personnel of Palmer Station, who helped us to resolve thermal control issues in the aquarium environmental rooms.
- 3) Females of the icefish species *P. georgianus*, which we have been maintaining in the aquarium, produced viable eggs this month. We characterized the eggs and sought a mature male for fertilization, unfortunately without success. We are surprised that our specimens of this icefish are so heavily biased toward females
- 4) Finally, we have been studying the sperm of *N. coriiceps* in an effort to achieve successful cryopreservation – this work complements previous studies from 2014 and 2016. We have evaluated hormonal stimulation of spermatogenesis and the effect of various extenders and cryoprotective diluents during July.

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



WARNING: NOT DESIGNED FOR...



Previous page: Close up of some of the eggs in Experiment III. This page: One of the instruments of Experiment III.

PALMER STATION

RESEARCH ASSOCIATE MONTHLY REPORT

July 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 in 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 has 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.

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. There was some sort of brief power outage that caused an issue with the RASA GUI software.

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.

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. Both remote AWS systems are no longer operational due to the lack of sunlight. Observations are archived on the AMRC website:

<ftp://amrc.ssec.wisc.edu/pub/palmer/>