

PALMER STATION MONTHLY SCIENCE REPORT

May 2016



Sunset lit icebergs in Arthur Harbor. *Image Credit: Ben Cournoyer*

NEWS FROM THE LAB

Ben Cournoyer, Winter Laboratory Supervisor

It's been another fruitful month here at Palmer Station. The labs have had a constant hum of activity. For much of the month, the Detrich group was plugging along battling ice, wind, and waves to get their gear in the water. Their diligence paid off with the success of their most recent fishing trip. We welcomed a couple of groups to Terra Lab late in the month. Dr. Wu of the Taylor group will be installing an all-sky OH airglow imager and Dr. Hosticka will be servicing and calibrating the radionucleotide air-particulate monitoring system.

With the departure of The *ARSV Laurence M. Gould* (LMG) and many of the scientists during the middle of the month, Adina Scott and George Warren took the opportunity to install the water wall in the aquarium room. This instrument package is poised to provide Palmer with higher resolution sampling required to better understand seasonal and longitudinal changes in the waters of Arthur Harbor.

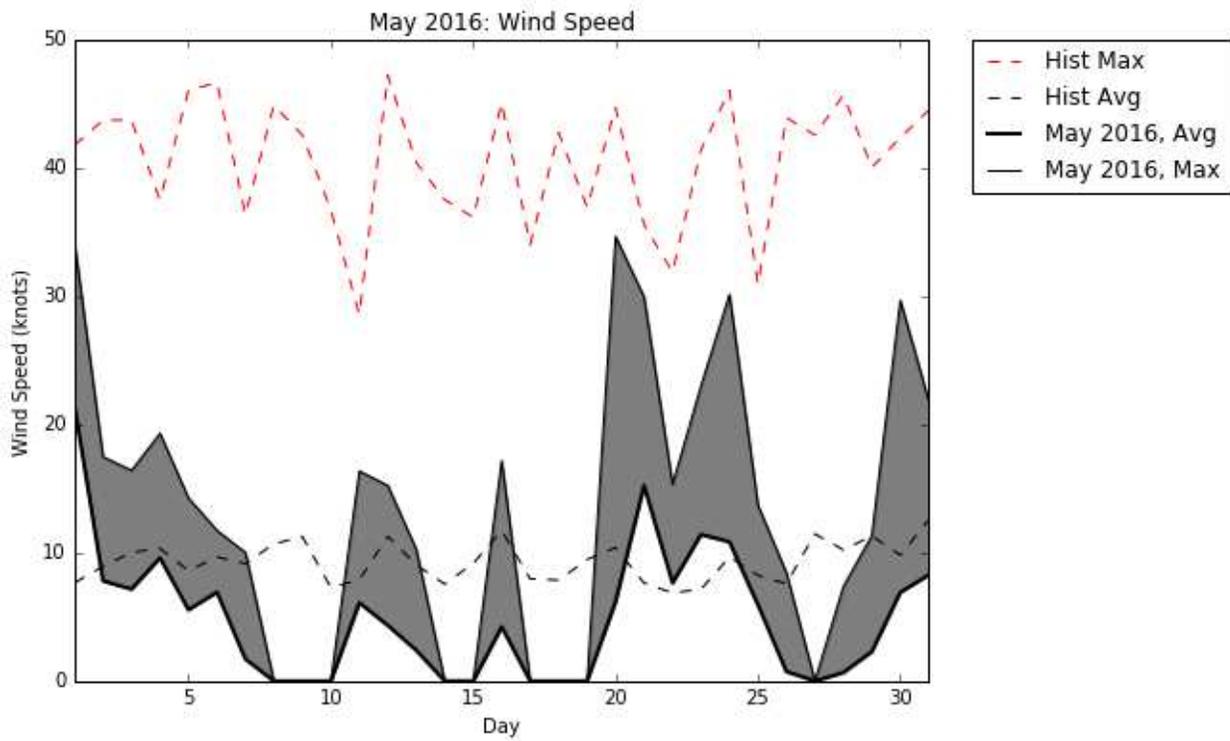
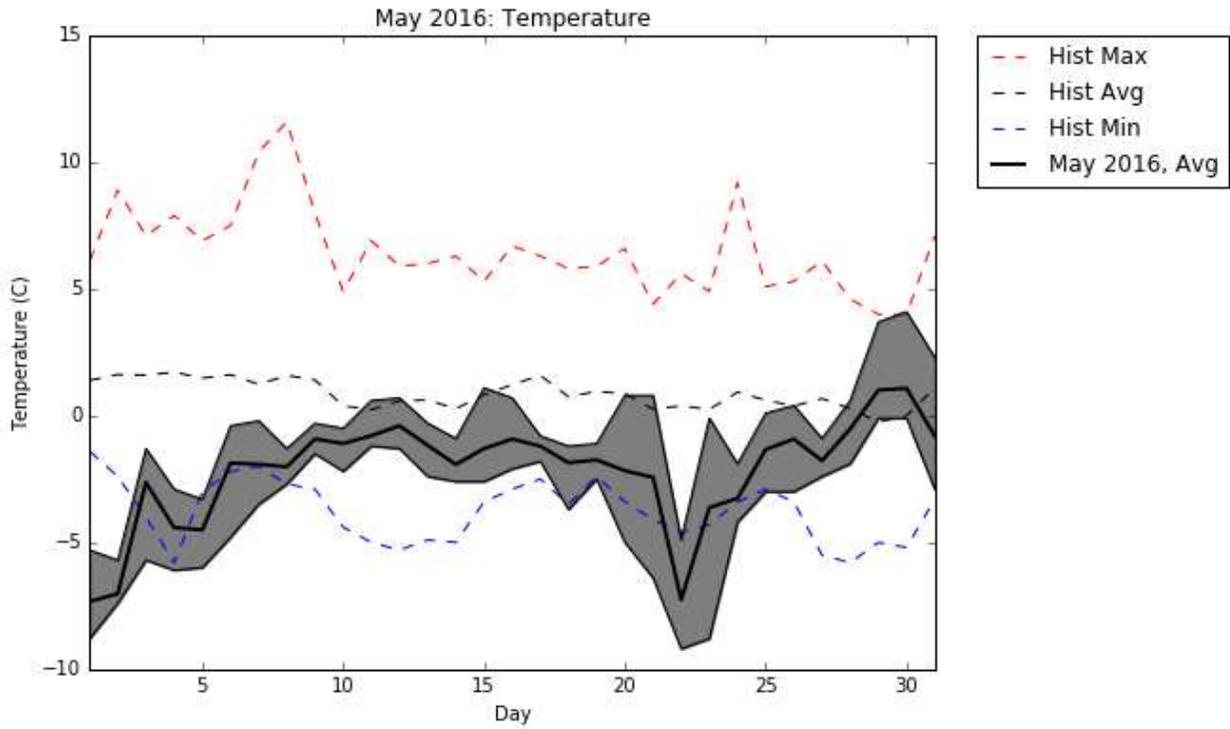
May 2016 WEATHER

Lance Roth, Research Associate

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

Temperature
Average: -2.2 °C / 28.1 °F
Maximum: 4.1 °C / 39.38 °F on 30 May 16:59
Minimum: -9.2 °C / 15.44 °F on 22 May 21:30
Air Pressure
Average: 1000.5 mb
Maximum: 1019.2 mb on 15 May 03:54
Minimum: 962.9 mb on 21 May 09:17
Wind
Average: 5 knots / 5.7 mph
Peak (5 Sec Gust): 39 knots / 45 mph on 1 May 03:40 from SW (214 deg)
Prevailing Direction for Month: NW
Surface
Total Rainfall: 39.4 mm / 1.55 in
Total Snowfall: 45 cm / 17.6 in
Greatest Depth at Snow Stake: 63 cm / 24.6 in
WMO Sea Ice Observation: More than 20 icebergs with growlers and bergy bits.
Average Sea Surface Temperature: -1.61 °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.). The last half of May was quite warm reaching a high of 4.1 °C on May 30th. The average wind speed was well below the average historical wind speed with several days of zero winds.



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:

1-12 May: H. William Detrich, Jake Daane, Thomas Desvignes, Nathalie Le François, and John Postlethwait

13-26 May: Thomas Desvignes and Nathalie Le François

26-31 May: Thomas Desvignes, Nathalie Le François, Carmen Elenberger, Laura Goetz, and Sierra Smith

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 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.

On Saturday, 30 April, PI Detrich, Jake Daane, and Thomas Desvignes sailed on the *Laurence M. Gould (LMG)* to conduct three days of fishing operations at ASPAs 153 (Eastern Dallmann Bay) and 152 (Western Bransfield Strait). The goals of this trip were to set (and recover after 24 hours) baited traps near Astrolabe Needle (ASPA 153) to catch reproductive specimens of the Bullhead notothen, *Notothenia coriiceps*, and to trawl at night in the area southwest of Low Island (ASPA 152) to capture reproductive adults of the Blackfin icefish, *Chaenocephalus aceratus*. The weather forecast predicted high winds and seas out of the southwest, which were indeed encountered as the *LMG* entered the unprotected northern region of Dallmann Bay. After conferring with Captain Ernest Stelly and MPC Herb Baker, we deferred the deployment of the fish traps in Dallmann Bay on the evening of 30 April and proceeded to our trawling grounds at Low Island. Here the weather also proved inclement, with southwesterly winds blowing steadily at 30 knots and gusting over 55. We terminated trawling at Low after only two casts and returned to the relative shelter of southern Dallmann Bay. On the morning of 1 May, we chose to set our traps in a reasonably sheltered area north of Anvers Island, then headed in the afternoon to a fishing ground northwest of Dallmann Bay. Under moderate winds (20-35 knots), we made five trawl sets at depths between 180 and 190 m on 2 May. These trawls yielded several large specimens of *C. aceratus* and of *N. coriiceps*, as well as other species. We then returned to the Anvers Island site and retrieved our traps, which produced 10 fish, including four *N. coriiceps*. After trap recovery, we sailed for Palmer Station, in the process completing four tows in the Gerlache Strait during the early hours of 3 May that yielded a diversity of fish species but no *C. aceratus* or *N. coriiceps*. The *LMG* tied up at the Palmer Station pier (09:30, 3 May), and we off-loaded our fish to the Palmer Station Aquarium with the excellent assistance of *LMG* and ASC personnel. We greatly appreciate your professionalism in support of our project!

During this period, Nathalie Le François and John Postlethwait remained at Palmer Station to care for the broodstock fish caught during the southbound transit of the *LMG* at the start of Cruise 16-04. With the influx of new fish, we again injected male and female specimens of *N. coriiceps* (red-blooded) and *C. aceratus* (white-blooded) with gonadotropin to stimulate gametogenesis.

On 4 May, Postlethwait and Desvignes participated in live video presentations from Palmer Station to a high school in Eugene, Oregon, as part of the broader impact component of the project. On 19 May, Le François did the same for a primary school in Montréal, Quebec, Canada.

On 8 May, Desvignes, Le François and Daane departed Palmer Station on board the *LMG* to conduct the third fishing trip of Cruise 16-04. Unfortunately, the weather during this trip turned out to be as inclement as during the previous trip. Traps were set that afternoon northwest of Anvers Island, after which the ship proceeded to our Low Island fishing grounds (ASPA 152) to trawl in the early hours of 9 May. High winds and heavy seas limited our trawling operations [3 tows, modest yield of our target fish species (*N. coriiceps* and *C. aceratus*)], and the ship returned to the Anvers site to recover the traps during daylight on 9 May. A total of 11 fish specimens were caught in 16 traps. Considering the harsh conditions at our principal fishing sites (Low and Dallmann), the decision was made to return one day early to Palmer Station and, en route, to trawl in the Gerlache Strait during the early morning hours of 10 May. The *LMG* then arrived at Palmer Station, where she tied up at the pier at 10:30 LT (10 May). The fish were offloaded and placed in the Palmer Station aquaria. Kudos to the ASC and *LMG* personnel who assisted with the off-load!

On 12 May, the *LMG* departed Palmer Station northbound to Punta Arenas, Chile, with project members Detrich, Daane, and Postlethwait on board. Desvignes and Le François remained at Palmer Station to care for our fish and to await the arrival of new team members of *LMG* Cruise 16-05.

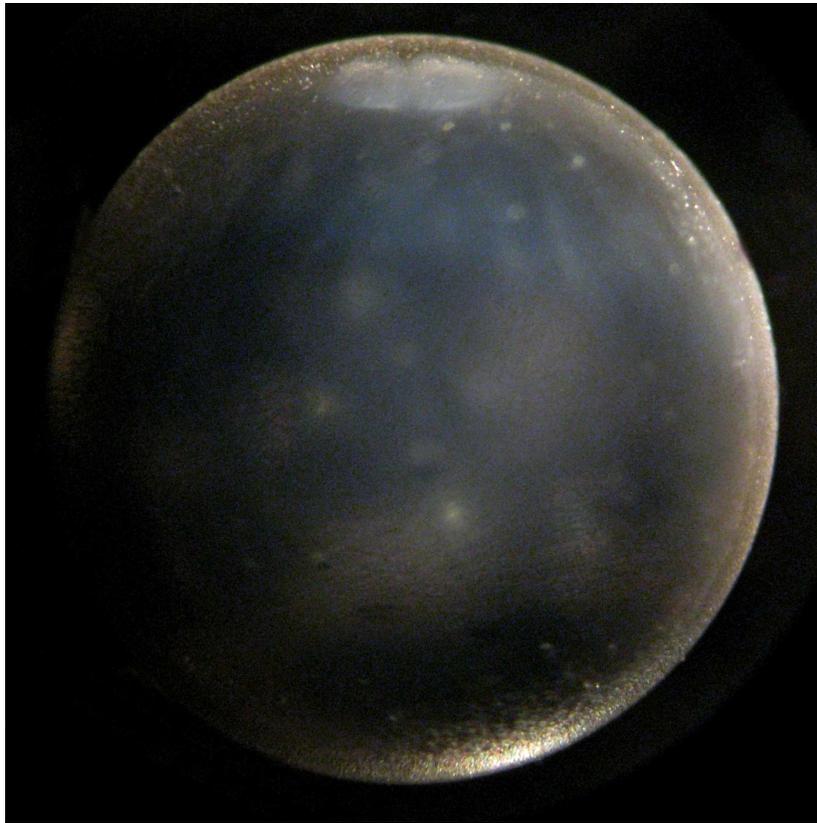
Throughout the month, team B-037 worked hard to sample fish that are not part of the reproductive broodstock population. Meanwhile, reproductive females were kept under close observation in order to monitor the occurrence of ovulation, which would confirm their readiness for *in vitro* fertilization; the most promising specimens were reinjected with gonadotropin. During the night of 23-24 May, a spontaneous reproductive event occurred in one of the Bullhead notothen tanks. Approximately 200 embryos were recovered and transferred into the Aquamerik incubators that were installed and running in Environmental Room 1. This spontaneous event augured well for the production of the embryos for our climate change studies. Successful *in vitro* fertilizations of *N. coriiceps* were achieved on 27 May (6 clutches) and 29 May (2 clutches). Woo hoo!

On 26 May, B-037 team members Carmen Elenberger, Laura Goetz, and Sierra Smith (all students from Northeastern University), arrived at Palmer Station after a brutal crossing of the Drake Passage – *LMG* Cruise 16-05 southbound will be longremembered. The *LMG* was unable to dock at the pier due to the accumulation of small icebergs, bergy bits, and brash ice in Hero Inlet. ASC personnel and the crew of the *LMG* had prepared for this possibility by activating the landing craft for passenger movements and limited cargo transfer.

Desvignes, Elenberger, and Goetz departed station on the *LMG* on the afternoon of 27 May for the first fishing trip of Cruise 16-05, transiting to Dallmann Bay (ASPA 153) to deploy fish traps at first light on 27 May, then to Low Island (ASPA 152) for trawling operations. Winds and sea state were calm, and seven Otter trawls over 11 hours (28-29 May) produced an

abundant catch, despite a back deck cluttered with three milvans. More than 20 large reproductive specimens of the *C. aceratus* were caught, as well as 22 specimens of *N. coriiceps*, in addition to other notothenioid species. Recovery of the traps, however, produced only five *N. coriiceps*. Nonetheless, the aquaria being close to full capacity, the *LMG* headed back to Palmer Station and conducted, en route to Palmer Station, three trawls in the early hours of 30 May in the Gerlache Strait. During the absence of the *LMG*, the ice in Hero Inlet cleared and the *LMG* managed to tie up at the Palmer Station pier at 10:00am local time on 30 May after a short delay due to icebergs and heavy fog. The precious reproductive fish were off-loaded and placed in the Palmer Station aquaria, passengers debarked, and full cargo operations commenced using the main *LMG* crane.

We express our sincere gratitude to the ship and station personnel for their exceptional help in making the month of May a great success for B-037.



A Bullhead Notothen (*Notothenia coriiceps*) egg fertilized at Palmer Station by Nathalie LeFrancois. The grey mass at the top of the sphere is the developing embryo. The rest of the sphere contains the energy rich yolk. Image Credit: Thomas Desvigne

PALMER STATION
RESEARCH ASSOCIATE MONTHLY REPORT
May 2016
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.

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 great and the filters have been changed weekly. The WD and TD are only operational when the LMG is not at the Pier.

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.

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 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. 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

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 aspirating fan on the temperature/humidity sensor did failed. A replacement is being purchased. Two of the three remote stations are no longer working do to the lack of sunlight.