

PALMER STATION MONTHLY SCIENCE REPORT

DECEMBER 2014



Image of a pteropod (*Limacina helicina antarctica*). Ocean acidification is known to affect the formation of the aragonite shell of pteropods. An interdisciplinary group of scientists, led by Professor Jeannette Yen, is working to understand how ocean acidification can affect their swimming behavior. (Image Credit: Deepak Adhikari)

NEWS FROM THE LAB

Carolyn Lipke, Summer Laboratory Supervisor

December in the Palmer Labs was busy as usual. The phytoplankton bloomed this month, followed promptly by a return of the sea ice (which thankfully left again after 11 days). Three group members of the Kohut field team (B-005-P) arrived on station and began their krill survey work and deployed one autonomous underwater vehicle that is currently collecting data in the Palmer Deep. The Yen group (B-048-P) departed station after a successful field season, leaving all at Palmer with a greater appreciation for pteropods and some new dance moves. We celebrated the longest day of the year, and enjoyed a spirited station-wide relay race hosted by the Waste Department over the Christmas weekend. We're half way through the summer season now, but there is still much science to be done in the New Year. Happy holidays to all from Palmer Station.

DECEMBER 2014 WEATHER

Mark Dalberth, Research Associate

December was primarily characterized by calm conditions. The average wind speed was 6 knots which is below the 26 year average of 8 knots. On the 10th we saw a 5 second wind gust of 41 knots which proved to be the maximum for the month. It was associated with a system that brought winds from the south and west that pushed sea ice back into Palmer's boating limits. The ice lingered until we received strong winds from the east on the 23rd which pushed the ice away.

Melted precipitation is measured by the rain bucket on Gamage Point. The total for 2014 has been only 357 mm. This is lower than the 26 year average of 629 mm. Interestingly, we still have snow on the ground. The depth at the snow stake was 26 cm on December 31. Most years, the snow has melted away by this date.

The beginning of December gave us the coldest temperatures with a minimum of -4.5 C on the 3rd. The average temperature for the month was 0.4 C, colder than the 26 year average of 1.2 C. In fact, the average temperature for October and November was also colder on average. This might explain the snow stake measurements. Sea water temperatures averaged -0.8 C and rose above zero only a handful of times.

B-005-P: COLLABORATIVE RESEARCH: IMPACTS OF LOCAL OCEANOGRAPHIC PROCESSES ON ADÉLIE PENGUIN FORAGING ECOLOGY

Dr. Josh Kohut, Principal Investigator, Rutgers University, Institute for Marine and Coastal Sciences; Dr. William R. Fraser, Co-PI, Polar Oceans Research Group; Dr. Kim Bernard, Co-PI, Oregon State University; Chris Linder, Co-PI; Dr. Matt Oliver, Co-PI, University of Delaware; Hank Statscewich, Co-PI, University of Alaska Fairbanks; Dr. Peter Winsor, Co-PI, University of Alaska Fairbanks

Personnel on Station: Kim Bernard, Megan Cimino, and Shenandoah Raycroft

Small Boat Acoustics:

We arrived at Palmer Station on December 2 and received our Boating II training from Carmen Greto (Marine Tech) within the first few days. Juliet Alla (Instrument Tech) had already tested and calibrated the Biosonics DT-X echo sounder for us and it appeared to be working well. We were able to complete one full acoustic survey grid (43 km in length) on December 8 and attempted a second one a few days later that would have included our additional instruments, the Turner Designs C3 Fluorometer and the SeaBird Microcat CTD. However, the sea ice pushed back in and we were not able to conduct that day's survey. The sea ice remained tightly packed for the next 2 weeks and we were unable to sample during that time. We were able to conduct a second full acoustic grid survey as well as a targeted survey on December 24. The targeted survey was to an area within the boating limits that the HF Radar systems had detected as being divergent. We conducted a second targeted survey on December 25, this time to an area of convergence and one of divergence. On December 29 we attempted another full acoustic grid

survey, but part way through the first grid line, the echo sounder stopped working. We were able to get it back up and running, but the quality of data collection had very clearly deteriorated. The echo sounder seemed no longer able to detect the sea floor. We attempted to trouble-shoot while out on the water, but after 45 minutes without success we decided to return to station and attempt to fix it back on land. Juliet Alla, Mark Dalberth (Research Associate and previous Instrument Tech) and Carolyn Lipke (Lab Assistant) have been working on getting the echo sounder up and running again. Biosonics has been contacted and the issue has been reported to them. At present we have not had any success in identifying the problem. Our current plan is to test out the deck unit from the LM Gould Biosonics system with our own to see if that is where the issue lies. While the Palmer echo sounder was back at Biosonics for calibration and general maintenance following the 2013-2014 season, problems were detected with the transducer itself and Biosonics replaced those parts that had deteriorated. We have been in contact with Dr. Debbie Steinberg (Chief Scientist on LMG1501) to find out if we can share use of the LM Gould Biosonics echo sounder. She has very generously offered to help by leaving the echo sounder with us once the Palmer Deep has been surveyed on the first day of the LTER cruise. We are extremely appreciative of everyone's efforts to help us fix the echo sounder, particularly Juliet.

Gliders:

Megan Cimino has been preparing all 4 gliders that are currently at Palmer Station for launch. The first glider launch (RU26) was planned originally for December 18, but due to the extensive sea ice cover the launch was delayed until December 25. Over the last 9 days, RU26 has traveled a total of 245 km and is currently 100 km NW of Palmer Station. The remaining three gliders on station and an additional glider arriving on the Gould will be deployed on January 5. Thanks to everyone who helped move gliders in and out of Bio Lab and special thanks to Jason O'Brien and Bob Wood (ASC) for helping with the first glider launch!

HF Radar:

With all three HF Radar sites up and running we are now getting high-resolution surface current data in real-time. These data are being made available at <http://marine.rutgers.edu/~codaradm/palmerTotals.php>. In addition to the hourly current data, divergence and vorticity data are also being produced in real-time. Trends in divergence (and convergence) are being detected and as soon as the echo sounder is fully functional again, we will be targeting these areas to assess krill biomass.

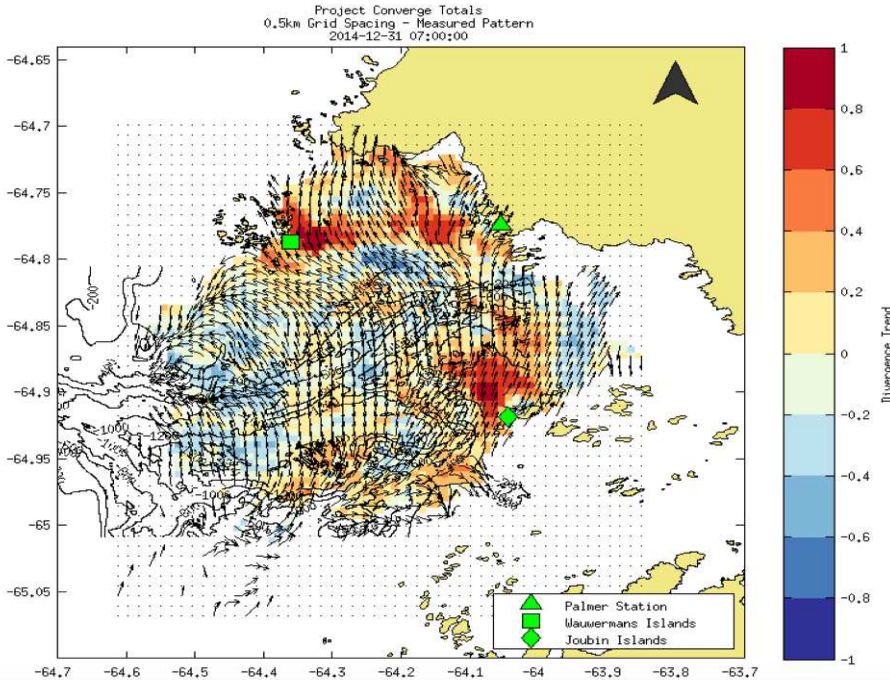


Figure 1. Divergence trends (over a 3-day period). Positive values (oranges and reds) indicate divergence, while negative values (blues) indicate convergence. Divergence is measured as vertical velocity in meters per day.

The rest of the CONVERGE team arrives on LMG1501 and we look forward to a very busy and productive January.

B-018-P: MOLECULAR ASSESSMENT OF PHYTOPLANKTON COMMUNITY DYNAMICS AND METABOLISM IN THE WEST ANTARCTIC PENINSULA

Dr. Shellie Bench, Principal Investigator, Stanford University, CA

Personnel on station: Shellie Bench (PI and Post-Doctoral Research Fellow) until 12/17/14 - with and support from other groups to collect samples the rest of the month

Conditions were favorable to allow consistent sampling for nearly two weeks at the beginning of the month. During that time, I collected and processed 4 samples from station B, which corresponded to LTER sampling days. Nicole Waite (C-019 group) provided valuable CTD data on sampling days, which allowed me to sample from the depth with the highest chlorophyll (i.e. chlorophyll max). Thick sea ice prevented sampling in the middle of the month, and I left station on 12/17. When the sea ice moved back out, Rachel Kaplan and Conor Sullivan (the B-045 personnel on station), were able to collect and process samples on four more days before the end of the month, three of which were LTER sampling days. So a total of 8 samples were collected during the month for my project. All samples were processed in multiple replicates for RNA and DNA, as well as microscopy and flow cytometry (run by the C-045-P group).

ASC support staff helped support the boating needs on sampling days while I was on station. For the time that my project does not have dedicated team members on station, the lab manager Carolyn Lipke has arranged for volunteers (including ASC staff and members of other science

groups) to help with collecting samples on the days that Rachel and Conor will be busy collecting samples for their LTER work

Prior to departing Palmer Station on 12/17, I packed and prepared an inventory for all lab supplies that will be needed during the LTER cruise. I discussed the supplies and provided a copy of the inventory to Carolyn Lipke and to Rachel and Conor, who will be setting up the equipment on the L. M. Gould while it is docked at Palmer Station in early January. I also spent a day with Rachel and Conor training them in all of my sample processing procedures. Carolyn and Juliet (the instrument technician) observed the training so they can provide support on station for Rachel and Conor if any issues arise.

For all the samples I processed during the first two weeks of the month, there was high phytoplankton biomass (based on their dark color and slow filtering). The sample collected on 12/8 was the slowest to filter, suggesting the annual bloom may have peaked near that time. Alternatively, this could be an initial bloom, with a larger bloom to follow later in the summer. The sea ice moving in during the third week of the month could also have had a significant impact on the local phytoplankton community. It will be interesting to compare the samples from the first week of the month, to those collected in the last week of the month to see if the phytoplankton community changed with the shift in sea conditions.

B-048-P: COLLABORATIVE RESEARCH: PTEROPOD SWIMMING BEHAVIOR AS A BIO ASSAY FOR OCEAN ACIDIFICATION

Dr. Jeannette Yen, Principal Investigator, Georgia Institute of Technology, School of Biology; Dr. Don Webster, Co-PI, School of Civil and Environmental Engineering, Georgia Tech; Dr. Rajat Mittal, Co-PI, Mechanical Engineering, Johns Hopkins University

Personnel on Station: Deepak Adkighari, David Fields, Marc Weissburg, Jeannette Yen, and Jun Zhang

No report submitted.

C-013-P: PALMER LONG TERM ECOLOGICAL RESEARCH (LTER): LOOKING BACK IN TIME THROUGH MARINE ECOSYSTEM SPACE, APEX PREDATOR COMPONENT

Dr. William R. Fraser, Principal Investigator, Polar Oceans Research Group, Sheridan, MT

Personnel on Station: Ben Cook, Shawn Farry, and Carrie McAtee

The return of heavy ice to the Palmer area impacted field work during mid-December preventing all boating for eleven days. However, on days when boating was possible we continued to monitor the breeding chronology of Adélie penguin nests on Humble and Torgersen Islands as well as maintaining regular censuses of local Adélie colonies. We were also able to continue trips to Dream and Biscoe Islands to continue penguin, petrel and skua studies.

A peak egg census was completed during December for chinstrap penguins on Dream Island and for gentoo penguins on Biscoe Island. Preparations for the Humble Island Adélie penguin radio transmitter project continued; equipment was installed on Humble Island and remote data collection and transfer was tested. We also prepared for the deployment of satellite transmitters and dive depth recorders on Adélie and gentoo penguins which will begin in early January.

Skua work continued this month as we began checking nests for newly hatched brown skua chicks on local islands as well as on Dream and Biscoe Islands. Our south polar skua mark-recapture and breeding monitoring study on Shortcut Island continued with nest initiation checks, band resighting, and scat collection. Our censuses of the Blue-eyed shag colony on Cormorant Island continued with the first chicks of the season observed in early December. A gull survey was completed at all local kelp gull colonies as well as on Dream Island. Our all-island census of giant petrels began in early December; new nests were identified and new breeders were banded.

Our monitoring of marine mammals continued this month with periodic sighting of humpback and minke whales as well as increasing numbers of molting elephant seals. Lab work continued during December, especially while iced in and focused largely on searching sediment trap samples from penguin colonies for otoliths. LTER cruise preparations also continued throughout the month.

C-019-P: PALMER LONG TERM ECOLOGICAL RESEARCH (LTER): LOOKING BACK IN TIME THROUGH MARINE ECOSYSTEM SPACE, PHYTOPLANKTON COMPONENT

Dr. Oscar Schofield, Principal Investigator, Rutgers University, Institute for Marine and Coastal Sciences

Personnel on Station: Frank McQuarrie and Nicole Waite

December was an interesting month here at Palmer Station. We started off the month continuing our bi-weekly sampling efforts at stations B and E. The approach of summer brought more phytoplankton and warmer temperatures to the Palmer Station area. We started to see a bloom in the phytoplankton, occurring about 4 days earlier at station E (our “offshore” site) than at station B (our “inshore” site) (Figures 1 and 2). However, on December 11th, sea ice loomed on the horizon, slowly working its way to Palmer Station. By the afternoon on the 11th, we were iced in once again, unable to get out on the zodiacs to sample. The ice remained, keeping us from sampling, for 11 days, finally retreating on December 22nd. When we resumed sampling, the water was noticeably bluer and clearer.

Fluorescence (Figure 3) and chlorophyll-a concentrations decreased significantly during the period of ice at station B. In Figure 1 below, there was a distinct rise in chlorophyll-a concentrations at station B leading up to December 11th. The last week of December had concentrations back down to those in early November. One possible hypothesis for the observed decline in chlorophyll-a is the presence of the sea ice, which would limit light penetration, slowing phytoplankton growth. However, samples were not collected at station E on the day of

sea ice advance or the day after sea ice retreat, so we cannot determine if a similar pattern occurred there and a decline in chlorophyll concentrations on December 8th may suggest that there was another factor depressing the bloom other than sea ice.

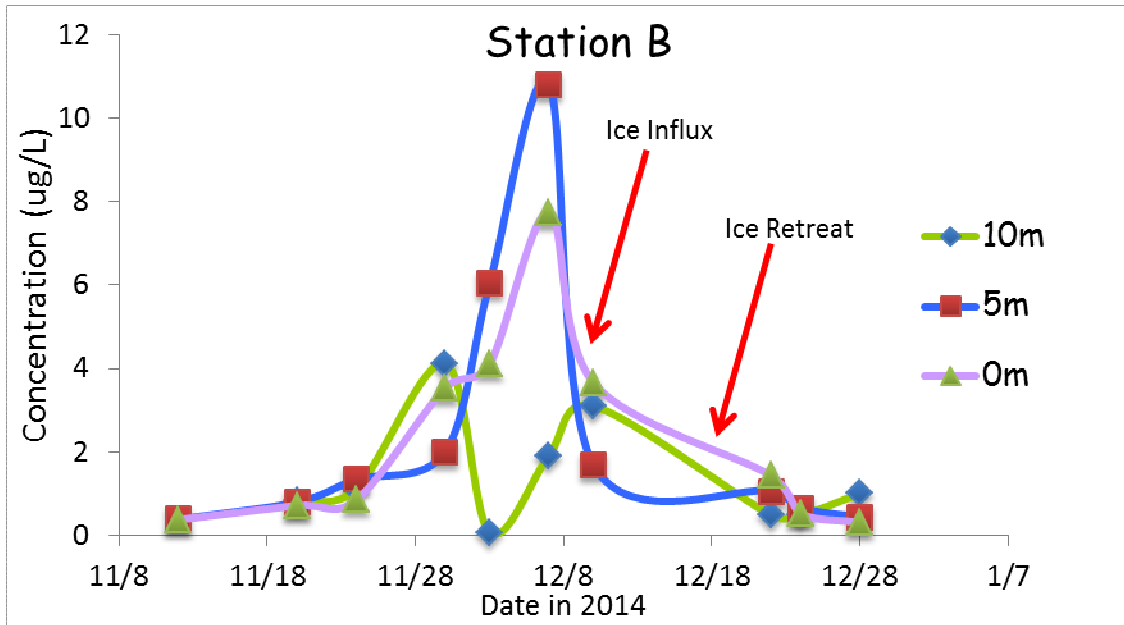


Figure 1. Chlorophyll-a concentrations ($\mu\text{g/L}$) at station B from November through December 2014 at 0m, 5m, and 10m depths.

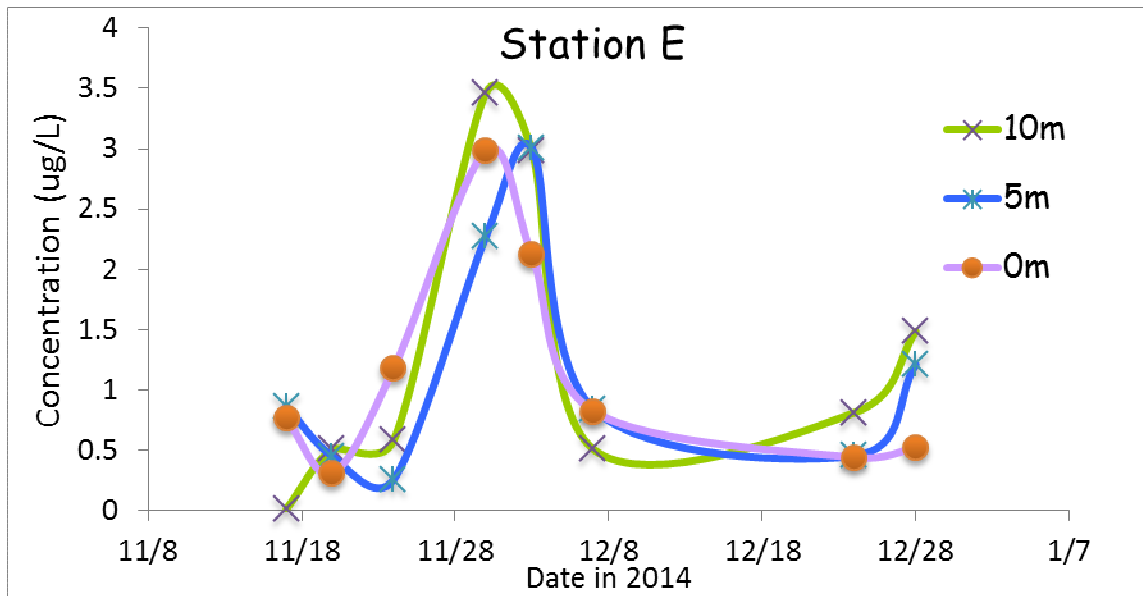
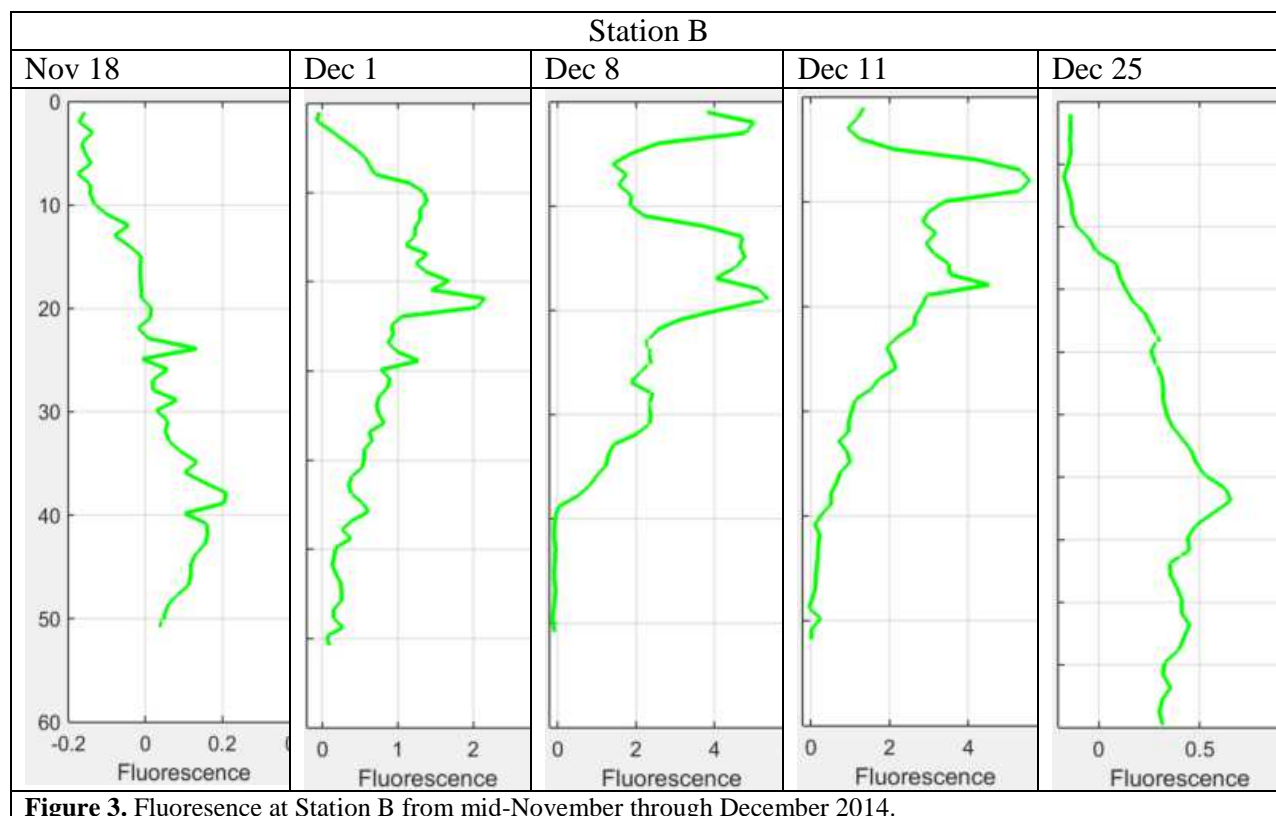


Figure 2. Chlorophyll-a concentrations ($\mu\text{g/L}$) at station E from November through December 2014 at 0m, 5m, and 10m depths.



On the personnel front, we said goodbye to Frank, who returned home on LMG 14-11, on December 17th, leaving Nicole alone on station for the remainder of the month. Thanks for all the help and hard work this season Frank! We hope you enjoyed Antarctica and Palmer Station. We'll miss you down here on Bruiser!

C-045-P: PALMER, ANTARCTICA LONG-TERM ECOLOGICAL RESEARCH (LTER): CLIMATE MIGRATION, ECOSYSTEM RESPONSE AND TELECONNECTIONS IN AN ICE-DOMINATED ENVIRONMENT: MICROBIAL / BIOGEOCHEMICAL COMPONENT

Dr. Hugh Ducklow, Principal Investigator, Columbia University, Lamont Doherty Earth Observatory

Personnel on Station: Rachel Kaplan and Conor Sullivan

December was a busy month, beginning with a period of steady sampling that suddenly halted when sea ice again enclosed Palmer on December 11. Fortunately, we were able to use the time to prepare materials for the LTER cruise in January.

When the ice blew out December 22, we resumed sampling, and noted that leucine incorporation and bacterial abundance had decreased at station B, but not at station E. We observed ice covering station B December 11-21, but station E was not covered this entire time. This

difference in ice cover is one possible source of variation in microbial activity between the two stations.

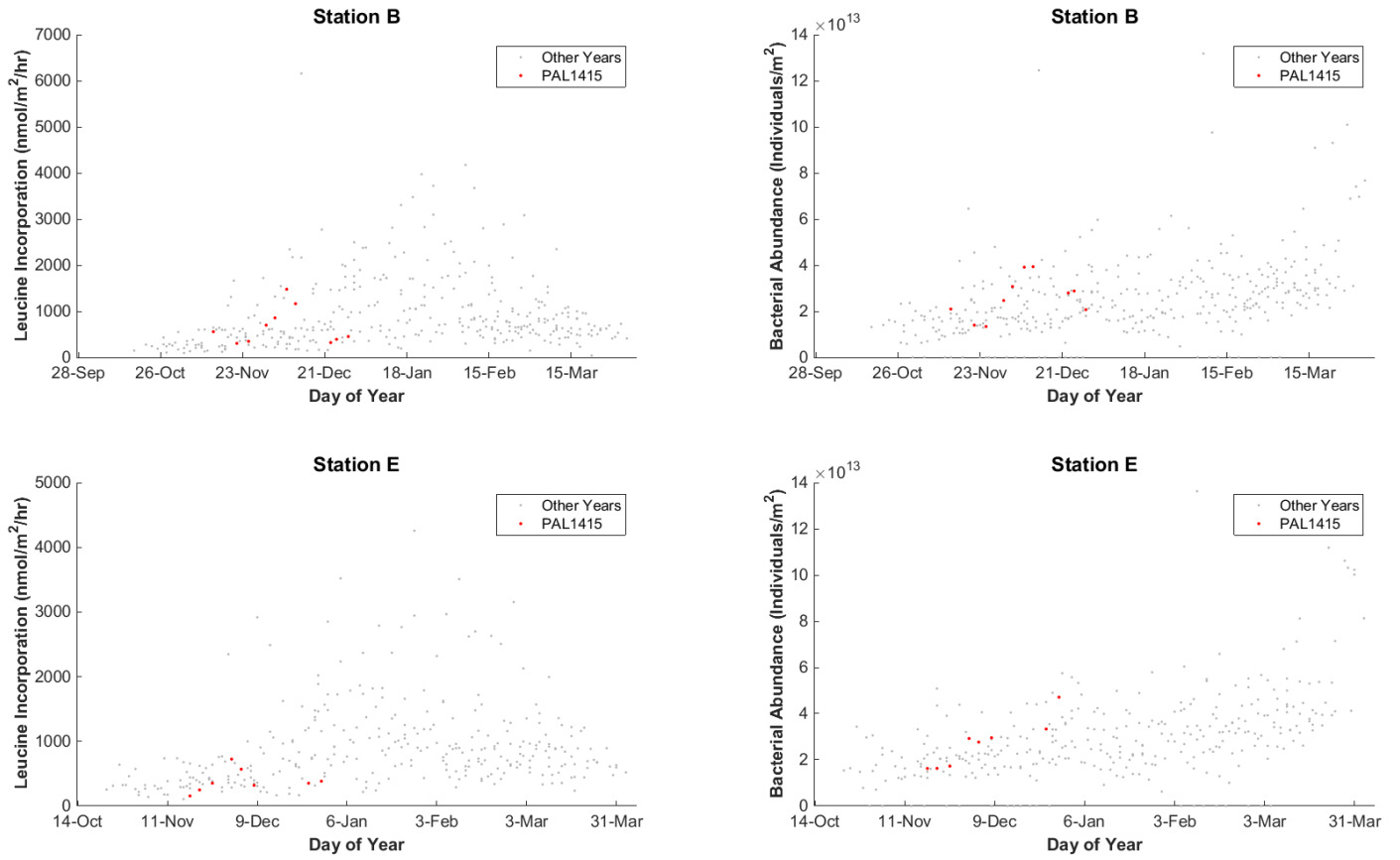


Figure 1. Integrated leucine incorporation (nanomoles/m²/hr) and bacterial abundance (cells/m²) data from the last thirteen years of sampling at Palmer. The rate of leucine incorporation indicates the productivity of the microbial communities sampled. This year's late December data shows some of the lowest leucine incorporation levels of the data set, and has returned to the low levels observed in early summer.

**PALMER STATION RESEARCH ASSOCIATE MONTHLY REPORT
DECEMBER 2014**

Mark Dalberth

There were no major issues with the data collection systems in Terra Lab this month.

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 are generated.

I have started performing daily checks of the Rutgers University website where surface current data is displayed. These plots are updated hourly.

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 seismograph station operated without any problems for the entire 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.

There were a couple of small issues with data archiving to the external drives, but they were easily corrected.

**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 operated normally throughout the month. Weather data was transferred to servers at AMRC on the first and the sixteenth of the month.

**O-204-P: A STUDY OF ATMOSPHERIC OXYGEN VARIABILITY IN RELATION TO
ANNUAL TO 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 collected every two weeks. The calm weather and winds from the west made it difficult to collect air samples on schedule this month.

**O-264-P: COLLECTION OF ATMOSPHERIC AIR FOR THE NOAA/GMD
WORLDWIDE FLASK SAMPLING NETWORK**

James Butler, Principal Investigator, 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.

Carbon Cycle and Halocarbon air samples were collected as close to the schedule as possible given the calm conditions during the month.

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. The bi-weekly absolute calibration scans were completed as scheduled.

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 although for a few days data was not updated at the AMRC. This was corrected on December 15. Daily quality checks of the downloaded data were performed as scheduled.

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. Again, I provided 15 second data to Juan Carlos Baez from the University of Chile. This should be the last time that he requires data.

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.

For about a week, the orbital elements were not updated. These are used to predict satellite positions. This was quickly fixed remotely by Andy Archer, Systems Analyst, Sr. I also had to switch to a different tape drive for archiving the satellite images. The previous drive was not functioning correctly. While working on the tape drives, I made a system back up.

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 has functioned normally this month.

B-466-P: FLUORESCENCE INDUCTION AND RELAXATION (FIRe) FAST REPETITION RATE FLUOROMETRY (FRRF)

Deneb Karentz, Joe Grzyski, Co-Principal Investigators, University of San Francisco

The focus of this project is to identify and evaluate changes that occur in genomic expression and physiology of phytoplankton during the transition from winter to spring, i.e., cellular responses to increasing light and temperature. A Fast Repetition Rate Fluorometer (FRRF) with a FIRe (Fluorescence Induction and Relaxation) sensor is installed in the Palmer Aquarium. The Research Associate downloads data and cleans the instrument on a weekly basis.

Daily instrument checks, weekly cleaning and data downloads were performed as scheduled.

T-998-P: INTERNATIONAL MONITORING STATION (IMS) FOR THE COMPREHENSIVE NUCLEAR TEST BAN TREATY ORG. (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 continued operating normally throughout the month. I asked for and received the inventory information for the filter archive boxes that we have on station.

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.

The tide gauge has been operating well. At the end of November, I made a script to automatically restart data collection every day at UTC midnight. Before I did this, data was stored in a file that frequently spanned multiple days. This month, I discovered a bug in the script that led to the loss of a couple of days of tide data. That bug has been fixed and the data is being successfully archived since then.

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 twice each 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 system operated normally during the month. The weather sensors have been inspected and cleaned according to the schedule. I changed the PalMOS Matlab code to correct a sporadic issue that stopped weather chart generation every three weeks or so. The code has been put into use, and I will monitor it to see if it works correctly.