PALMER STATION MONTHLY SCIENCE REPORT

FEBRUARY 2021

An elephant seal bull and female on Amsler Island. *Image Credit: Marissa Goerke*

NEWS FROM THE LAB

Randy Jones, Summer Laboratory Supervisor

During the month of February, weather (both wind and precipitation) greatly influenced field efforts and outdoor activities. January was especially wet with a great deal of precipitation, and February turned out to have even more precipitation in store. The second and third weeks of the month were especially windy, with large low pressure systems moving over the Antarctic Peninsula bringing 25-40kt winds for sustained periods of several days in a row.

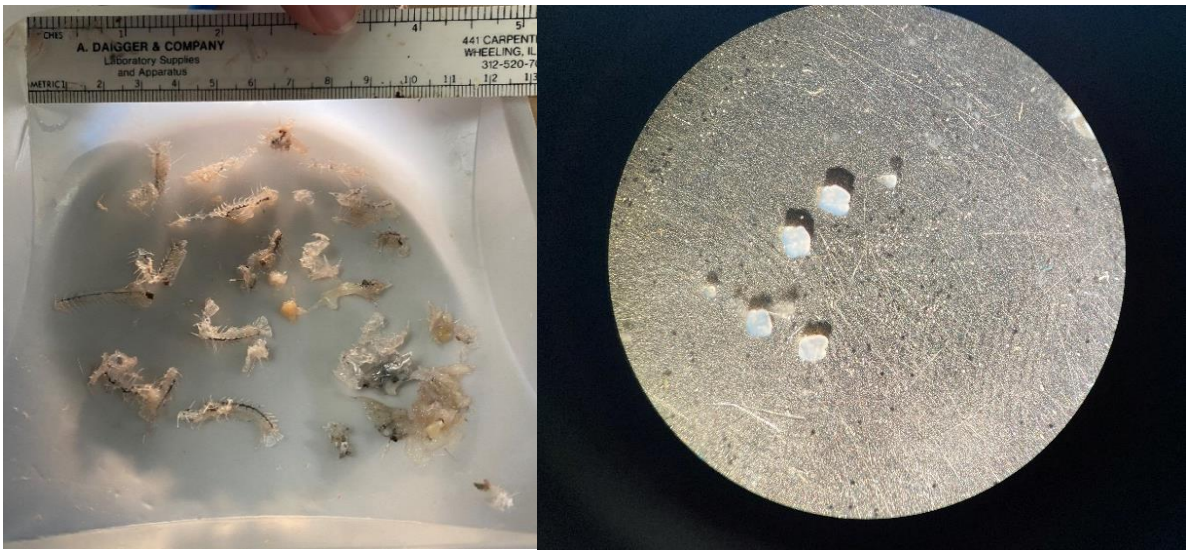
The height of the summer season is waning quickly as many indicators of the arrival of March are starting to arrive. Fur seals were reported in the region, but not yet in great numbers around station. Many of the local penguin colonies have cleared of fledglings, though fledging continues at more distant colonies, such as the Joubin Islands. Whale sightings have been rare in the local Boating area (there was a minke whale sighted during a trip to the Wauwermans Islands). We have had a few light snowfalls with little accumulation, but that will change in the near future. The temperatures are trending back towards the freezing point. The snowfall on the glacier has fully melted and the lattice work of exposed glacial ice is showing. Fall weather is around the corner.

C-013-P and C-024-P: PALMER, ANTARCTICA LONG TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCED PELAGIC ECOSYSTEM – APEX PREDATOR COMPONENT

Personnel on station: Darren Roberts and Megan Roberts

High winds and precipitation made field work difficult this month. We were able to conduct boating field work on 18 days in February.

In February, the Adélie penguin portion of our study was mostly concluded with beach counts and measurements of Adélie fledglings. The presence absence study of Adélie penguins at Humble Island will continue into March to better understand when breeding adults return to the area to molt. Gentoo penguin satellite tag deployments and diet sampling were concluded this month on Biscoe Point. Fledgling measurements will continue into March at Biscoe. In the Joubin Islands fledgling measurements and diet samples were collected. The penguin phenology in the Joubins is slightly behind Biscoe and the local area, allowing diet sampling to continue into March.



Fish skulls and other fish parts from a gentoo penguin diet collected in the Joubin Islands (left panel). A dissecting microscope view of otoliths extracted from fish skulls found in diets (right panel). *Image Credit: Cimino group*

Adélie penguins nearing fully fledged stage at Humble Island. *Image Credit: Dr. Steve Allerding*

Skua work continued through February with monitoring and banding of brown skua chicks on local islands as well as at Dream Island and Biscoe Point. South polar skua reproductive monitoring on Shortcut Island continued throughout February as did the monitoring of the blue-eyed shag colony on Cormorant Island. Kelp gull surveys and chick counts were completed in all of the local islands. Growth measurements of giant petrel chicks on Humble Island continued during February and will continue until chick fledging in April. The final GPS tags were deployed and recovered from giant petrels in February.


A giant petrel with a GPS tag at Shortcut Island. *Image Credit: Cimino group*

Penguin sediment traps from the local area, Biscoe Point, Dream Island, and Joubin Islands were collected and processed in February. These traps produce annual presence/absence data of fish and other prey in penguin diets. Each trap will often collect hundreds of otoliths over the course of a year. We would like to thank Lab Supervisor, Randy Jones, and FMC staff for facilitating the processing of those traps.

Cleaned rocks redeployed to a sediment trap. *Image Credit: Cimino group*

Monitoring of marine mammals continued in February. Fur seal numbers remained fairly steady, while elephant seal numbers declined slightly in the area. The number of humpback whales observed in the area declined since January, and minke whale observations increased from January numbers.

A blonde fur seal at Dream Island. *Image Credit: Cimino group*

Our whaling efforts continued collecting more humpback whale biopsies for the C-024-P (Friedlaender) group.

Special thanks to all the ASC and grantee field volunteers who assisted with Adélie fledgling measurements. Special thanks to Food Supervisor, Francis Sheil, for his incredible work in the Galley.

C-019-P: PALMER, ANTARCTICA LONG TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCED PELAGIC ECOSYSTEM – PHYTOPLANKTON COMPONENT

Dr. Oscar Schofield, Principal Investigator, Rutgers University, Institute for Earth, Ocean, and Atmospheric Sciences, Department of Marine and Coastal Sciences

Personnel on station: Rachael Young

While February was full of harsh weather and boating issues, science persevered to collect some exciting data. As planned, LTER Station E was sampled once per week on 1, 8, and 16 February, with an abbreviated sampling via Zodiac on 26 February. Instead of sampling on the RHIB *Rigil* with a CTD rosette, Go-Flo bottles were used to collect water samples to 35m, while a depth sensor recorder (DST) attached to the bottle gathered temperature data.

As seen in the Palmer Station wind data (Fig. 1) from Research Associate, Marissa Goerke, winds were relatively high for the month of February. In the first week (1-8 February), winds were low allowing the water column to stratify and produce a small bloom (4.7 µg L^{-1}) at 5-10m (Fig. 2). In contrast, from approximately 11-15 February, the wind averages were around 30 knots. Increased winds resulted in a well-mixed water column as seen in the 16 February CTD data (Fig. 3) and in the chlorophyll abundance (2.5 µg L^{-1}) maintained from 0-35m.

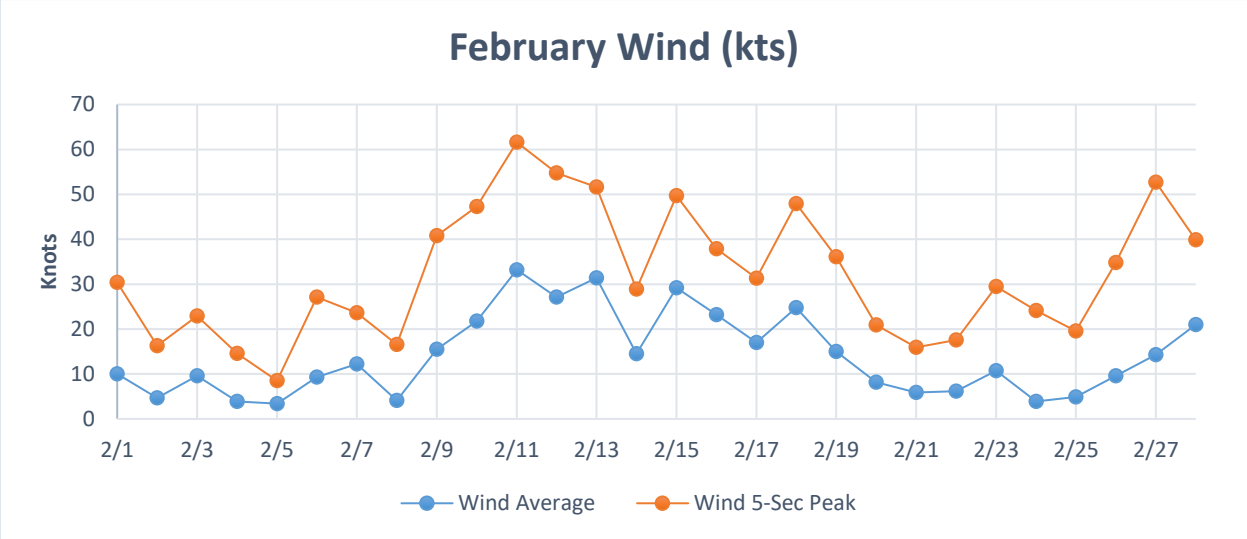


Fig. 1 – Average wind speed (blue line) and wind 5-sec peak (orange line) in knots for the month of February. Wind data from Research Associate, Marissa Goerke.

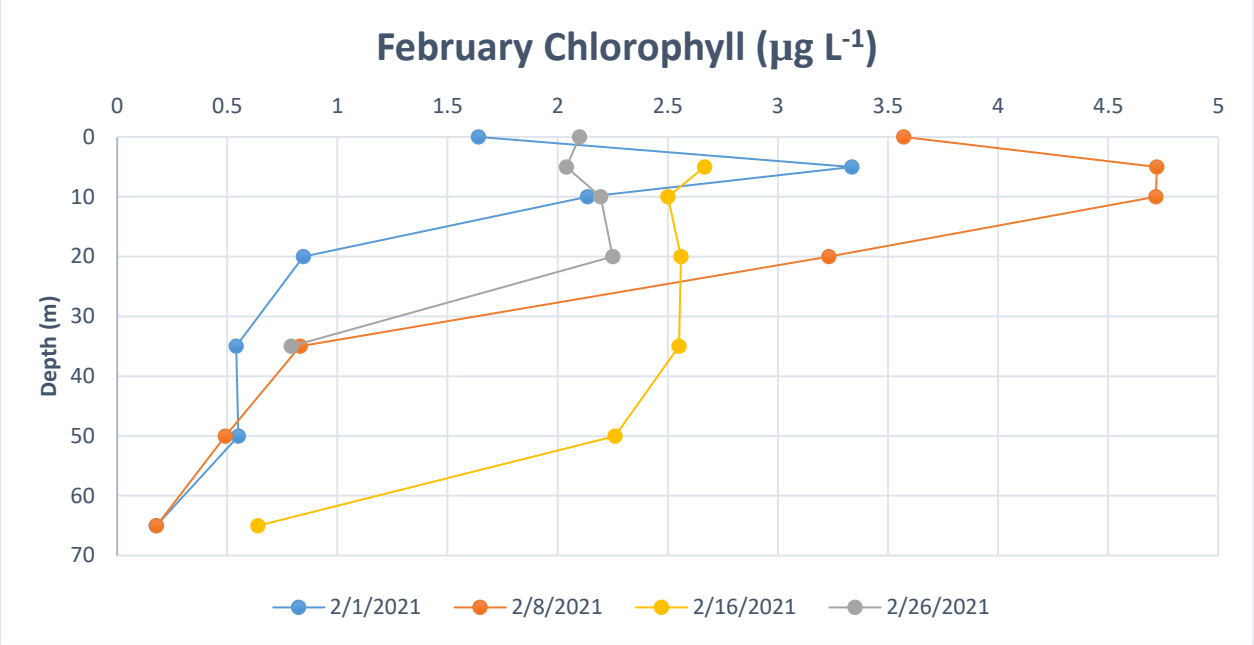


Fig. 2 – Station E chlorophyll data on 1 February (blue line), 8 February (orange line), 16 February (yellow line), and 26 February (grey line). There was a slight bloom from 5-10m (4.7 µg L^{-1}) on 8 February.

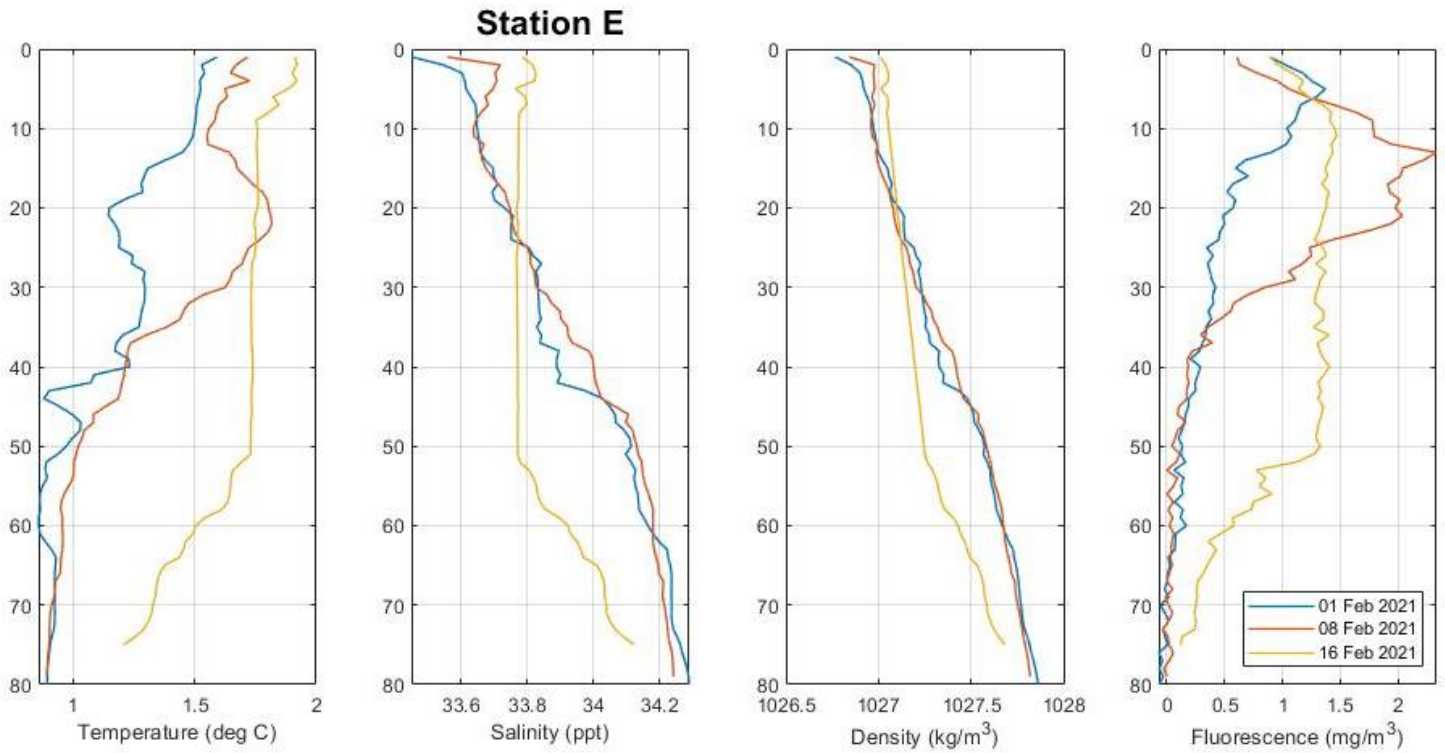


Fig. 3 – CTD data at Station E on 1 February (blue line), 8 February (orange line), and 16 February (yellow line). Temperature, salinity, density, and fluorescence show a well-mixed water column on 16 February, and a chlorophyll maximum around 10m on 8 February.

Due to RHIB engine and electrical systems issues, there was a two-week pause in RHIB operations this month to conduct troubleshooting and maintenance. As a result, only one acoustic survey was completed across the Adélie and Gentoo Transects for the month of February. Even

though the routine science missions could not be performed during that time, Zodiac operations continued to support the collection of surface water for three 24-hour incubations and one 7-day incubation. The first 24-hour incubation was performed with Station E water from 5m, the second was performed with surface water from Station E, and the third was performed with five different surface phytoplankton blooms sampled throughout the Local Boating Area. The first 7-day incubation was completed with Station E surface water from 23 February to 1 March. As shown in the left panel of Figure 4, two carboys were placed in a tank with one mesh layer, while two carboys were placed in a tank with five mesh layers. These layers filter light levels of 5% and 50%, respectively, of full irradiance/sunlight. To evaluate phytoplankton responses to these different light levels, samples for metagenomics, metatranscriptomics, IFCB, FIRe, and nutrients were collected.

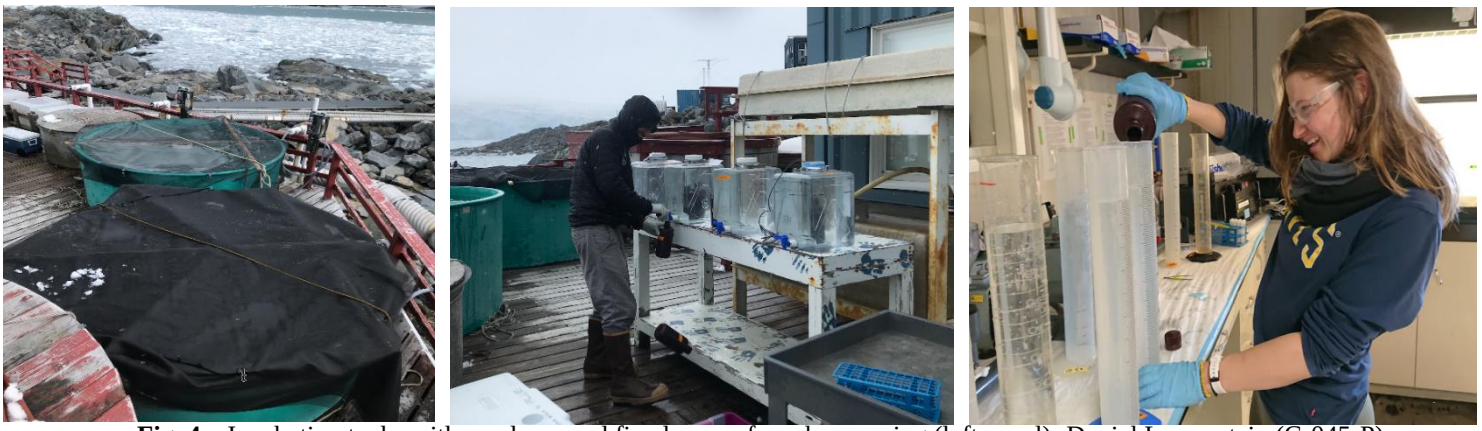


Fig. 4 – Incubation tanks with one layer and five layers of mesh screening (left panel); Daniel Lowenstein (C-045-P) assisting with water sampling (center panel), and Rachael Young (C-019-P) measuring water to filter for eDNA (metagenomics) and RNA (metatranscriptomics; right panel).

All of this science would not be possible without every single person here at Palmer Station. A special thank you goes to our Lab Manager, Randy Jones, as well as our Marine Technicians, Ken Block and Mike Burns, for endlessly supporting science.

C-045-P: PALMER, ANTARCTICA LONG TERM ECOLOGICAL RESEARCH (LTER): LAND-SHELF-OCEAN CONNECTIVITY, ECOSYSTEM RESILIENCE, AND TRANSFORMATION IN A SEA-ICE INFLUENCED PELAGIC ECOSYSTEM – MICROBIAL, BIOGEOCHEMICAL COMPONENT

Personnel on station: Daniel Lowenstein

Despite logistical challenges and weather delays, this has been a productive month for research at Palmer. We have been able to keep up the LTER weekly water column sampling at Station E, run three 24-hour time series experiments, and are currently running another week-long time-series experiment in collaboration with the Schofield Lab (C-019-P).

Station E cell counts in February (Figs. 5 and 6) show a stratified phytoplankton bloom around 8 February (corroborated by daily cell counts in Arthur Harbor, Fig. X), followed by a deep mixing event that overturned the water column, likely caused by a week of unseasonably high winds in the middle of the month. Since then, phytoplankton cell counts have dropped significantly, concomitant with a spike in bacterial cell counts (Fig X).

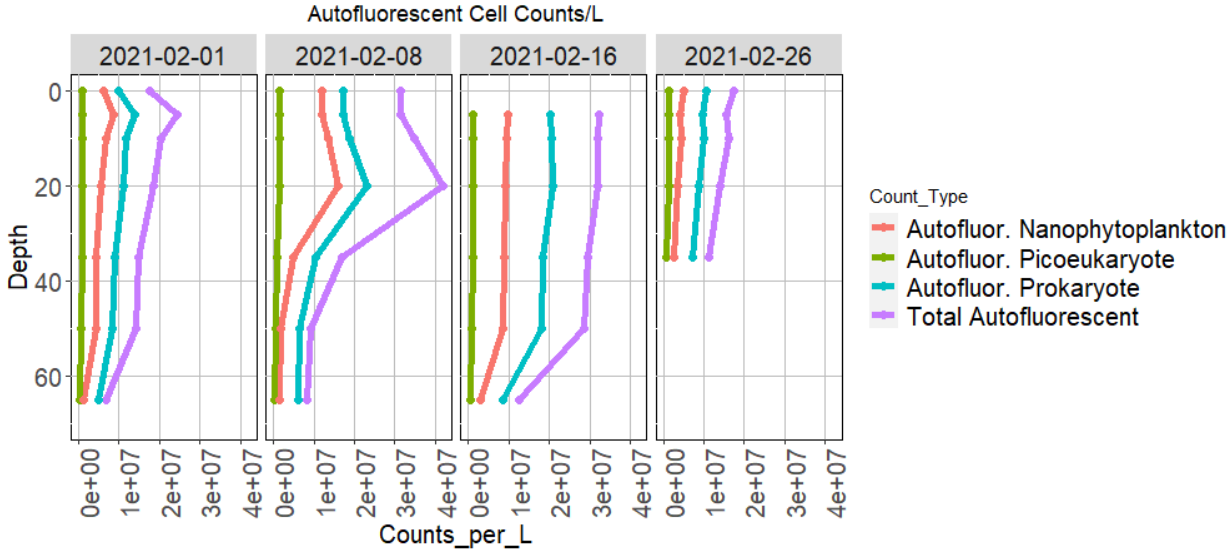


Fig. 5 – Autofluorescent phytoplankton cell counts at Station E in February. Missing surface sample on 16 February due to RHIB *Rigil* engine and electrical problem which necessitated prompt return to Palmer Station. Hand-line Go-Flo bottle sampling via zodiac on 26 February stopped at 35m due to Marine Technician safety concerns.

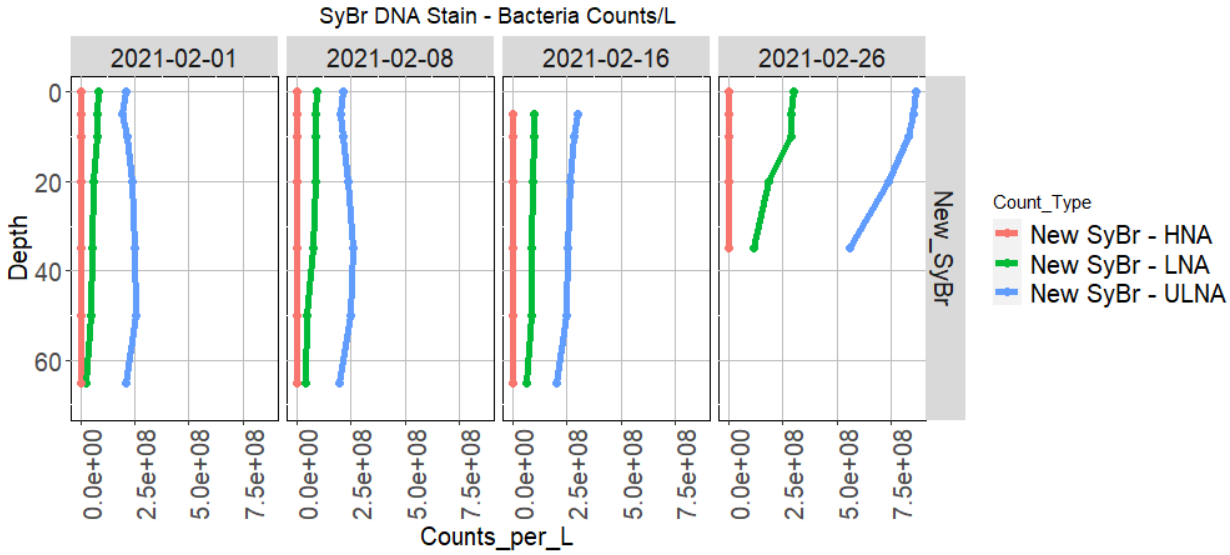


Fig. 6 – Bacterial cell counts at Station E in February, showing a bacterial population increase in the weeks following the early-February phytoplankton bloom (see Figure 5).

Our first two incubations focused on light level effects on diel microbial processes. Though the analytical heart of this research will be completed back in the lab in Woods Hole, preliminary results show how light levels are a primary control on microbial populations (Fig. 7). Phytoplankton in the light treatment (Figure 7, green line; 50% Photosynthetically Active Radiation [PAR]) treatments exhibit clear periodicity between Timepoints 0 (solar noon at the beginning of the experiment) and 4 (solar noon at the end) in experiments 22 and 27 (Fig. 7). In contrast, the dark treatment (Figure 7, red line; ~ 0.1% PAR) showed slightly less periodicity in experiment 27, and in experiment 22, the oscillation disappeared completely. Shade treatment (Figure 7, blue line; ~5% PAR) showed similarly mixed results. Imaging Flow CytoBot analyses by the Schofield lab (C-019-P) will hopefully indicate whether community structure influenced these differences in response.

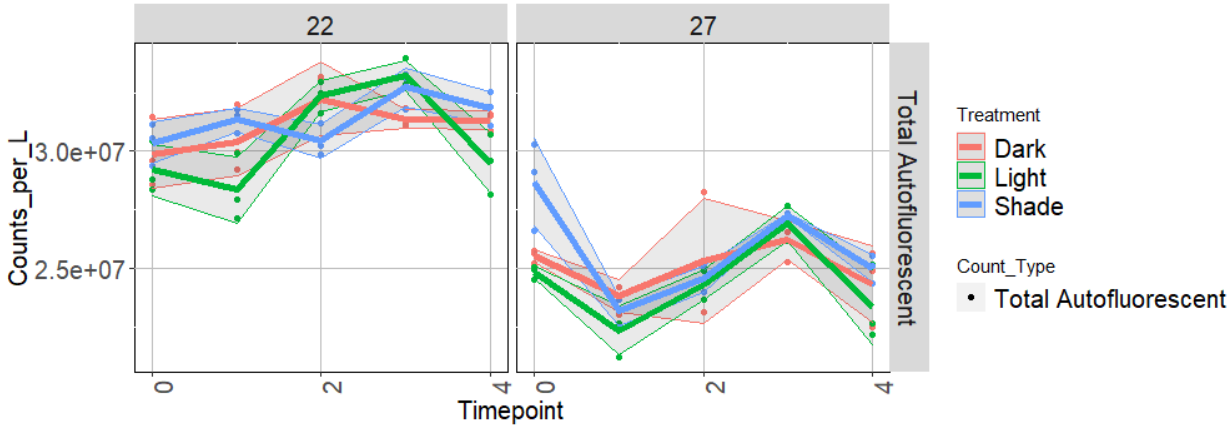


Fig. 7 – Autofluorescent cell counts during two 24-hour incubation experiments (experiment 22, left panel; experiment 27, right panel). Timepoints 0 and 4 correspond to solar noon on consecutive days and Timepoint 2 corresponds to solar mid-night.

Our most recent incubation followed the progression of five separate *Phaeocystis antarctica* blooms collected in the local boating area, which were then incubated at full light levels. This high-resolution data will help constrain models the contribution of *Phaeocystis* to regional macronutrient, carbon, and energy budgets, as there exists little *in situ* lipidomic and

carbohydrate data on these blooms, which significantly impact ocean chemistry and export throughout the Southern Ocean.

C-045-P lab member Daniel Lowenstein and C-019-P lab member Rachael Young sample water from incubation carboys at 1:30 am during a 24 hour time-series experiment. *Image Credit: Van Mooy group*

We have also maintained daily water sampling of Arthur Harbor in conjunction with the Schofield lab's daily Imaging Flow CytoBot samples. These daily samples corroborate Station E cell counts, which show a phytoplankton bloom around 8-10 February, followed by a heterotrophic bacterial abundance peak two weeks later (Fig. 8).

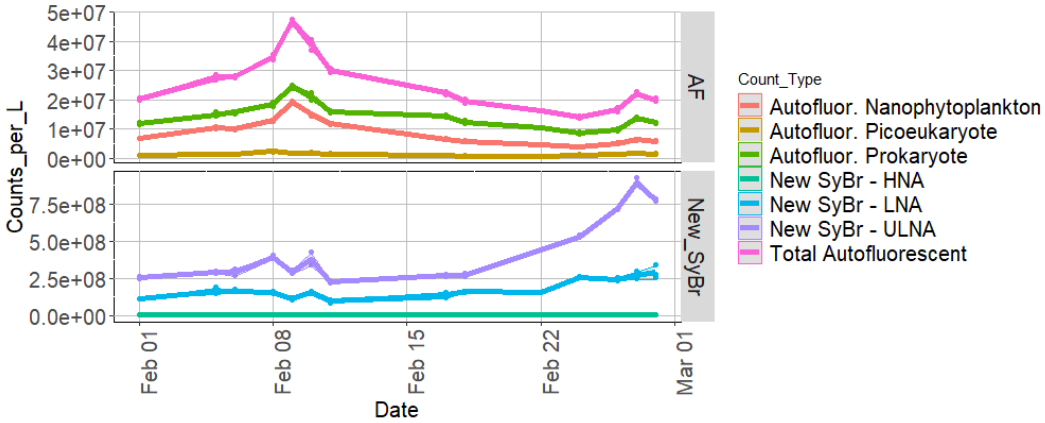


Fig. 8 – Autofluorescent phytoplankton (AF; top panel) and bacterial (New_SyBr DNA Stain; bottom panel) cell counts during February in Arthur Harbor.

We have made two trips out to the Joubin Islands in collaboration with the C-013-P (Cimino) and (C-019-P) groups. These support trips facilitated C-013-P penguin colony assessment and diet sampling; repair and upkeep of the B-005-N/P Kohut CODAR stations and USAP Automated Weather Stations on Joubin Island 1 by Research Associate Marissa Goerke; and installation of a landing pin at Joubin Island 12 and a mooring at Joubin Island 8 by Marine Technicians Ken Block and Mike Burns.

Outreach efforts: During February, we were able to initiate video outreach with 3rd graders at IC Imagine public charter school in Asheville, NC. They loved hearing about the glacier and about animals around station, and asked many questions about our oceanographic equipment and what we're studying.

We would like to especially thank the Marine Technicians, Mike Burns and Ken Block, who have worked tirelessly to keep us out sampling the ocean despite uncooperative weather.

PALMER STATION RESEARCH ASSOCIATE MONTHLY REPORT
February 2021
Marissa Goerke

A-111-P: THE NEXT GENERATION OF GEOSPACE RESEARCH FACILITIES AT PALMER STATION: ELF/VLF RADIO WAVE OBSERVATIONS

Dr. Andrew Gerrard, Principal Investigator, New Jersey Institute of Technology

Extremely Low Frequency/Very Low Frequency (ELF/VLF) radio wave observations at Palmer Station (Fig. 9) are used to provide a deeper understanding of lightning and its effects on the Earth's inner radiation belt. Lightning source currents are estimated or directly measured by experimental observations of individual natural and rocket−triggered lightning flashes in North America. Together, the North American and Antarctic data sets are used to experimentally identify and analyze the components of lightning and the effects of lightning, such as lightning−induced electron precipitation (LEP), that are observed in the Antarctic, more than 10,000 km away.

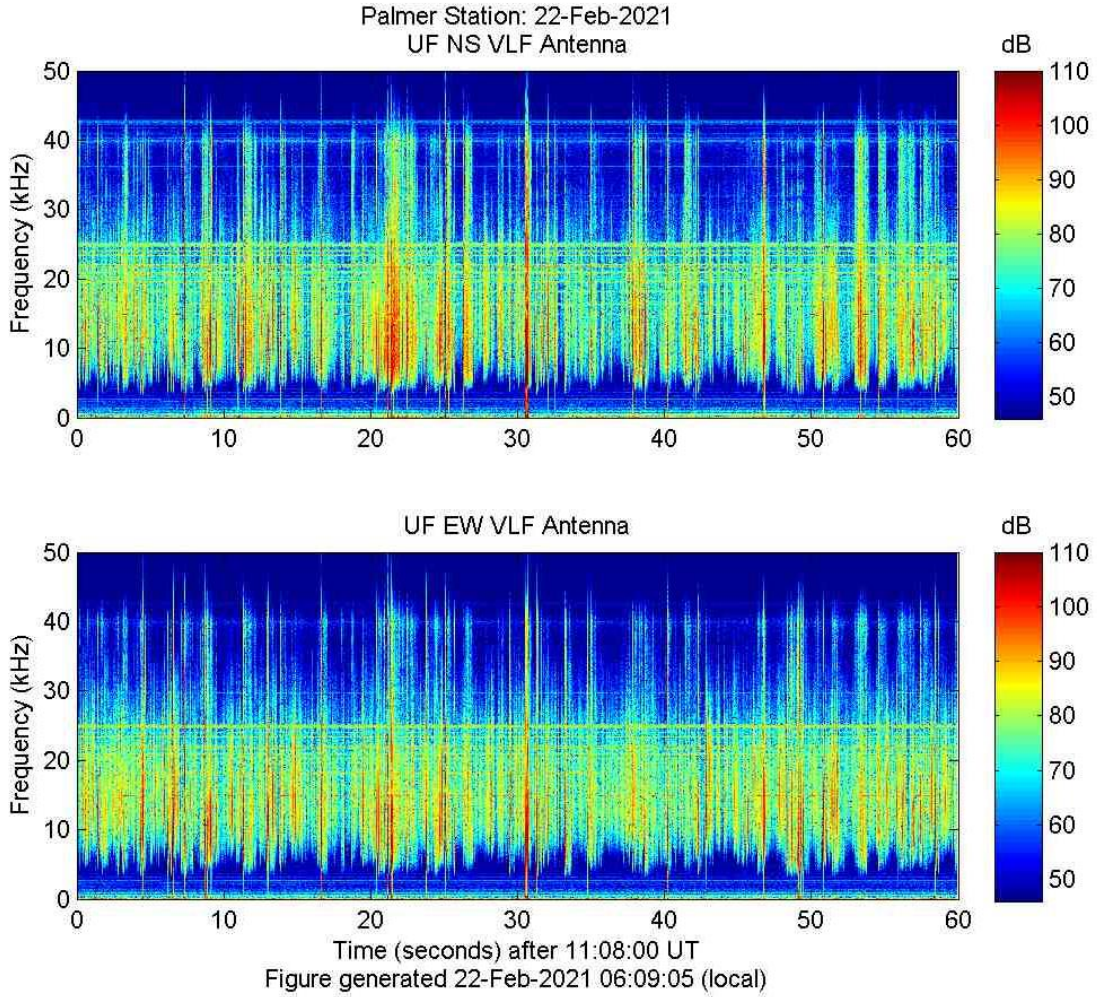


Fig. 9 – Real-time broadband ELF/VLF spectrogram from 22 February 2021. *Image Credit: University of Florida*

Both the Extremely Low Frequency and Very Low Frequency systems operated well this month. The spectrograms were reviewed daily and bi-weekly antennas inspections were done as weather allowed. The grounding cable annual cleaning was performed on 23 February and a corroded part of the cable was removed. Both the VLF and ELF were powered off during the cleaning between 1223 and 1407 (UTC−03:00).

Grounding cable terminus before returning to the bottom of Hero Inlet. *Image Credit: Randy Jones*

Current VLF/ELF data from Palmer Station can be observed at:
http://halo.ece.ufl.edu/realtime_palmer_nb.php and
http://halo.ece.ufl.edu/realtime_palmer_bb.php.

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

Dr. Andrew Gerrard, Principal Investigator, New Jersey Institute of Technology

The three-axis fluxgate magnetometer at Palmer is one in a chain of eleven longitudinal, ground-based magnetometers extending down though South America and into Antarctica. The primary scientific goals are the study of Ultra Low Frequency (ULF) waves and the remote sensing of mass density in the inner magnetosphere during geomagnetically active periods. Palmer's magnetometer is also a conjugate to the Canadian Poste de-la-Baleine Station, allowing the study of conjugate differences in geomagnetic substorms and general auroral activity.

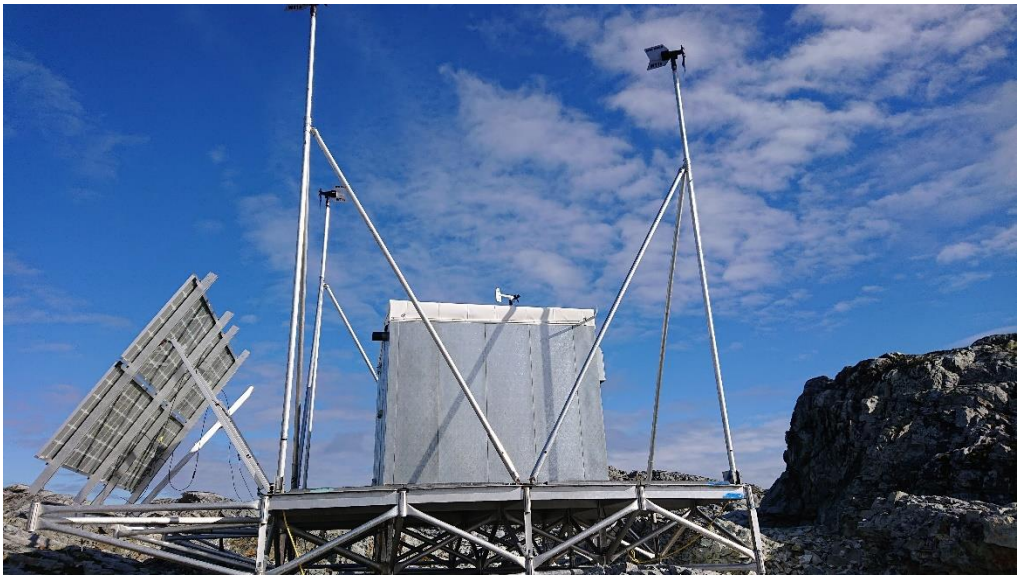
SAMBA stands for South American Meridional B-field Array. The sites are approximately along the 0° geomagnetic longitude and ranging from -5° to -48° geomagnetic latitude. In combination with other magnetometer chains, including the AGO (Automated Geophysical Observatory) systems elsewhere in Antarctica, the stations create an almost complete, cusp-to-cusp-long meridional chain at approximately 0° magnetic meridian.

The magnetometer was originally installed at Palmer in 2005, and a replacement installed in April of 2008. In 2017 the project was taken over by Andrew Gerrard. On 27 February 2017, USAP IT blocked all northbound VPN magnetometer traffic, as the magnetometer was determined to be a security vulnerability. The Research Associate has been working with the home institution at the University of California, Los Angeles to resolve this issue. As of 30 September 2020 at 0745 local (UTC−03:00), the magnetometer was removed from the network

fully. The instrumentation and computer are still operational. Data will continue to be collected and stored locally. The RA is working with the IT department to send out the data to UCLA. More information can be found at: http://magnetometers.bc.edu/index.php/palmer.

B-005-N/P: COASTAL OCEAN DYNAMICS APPLICATIONS RADAR (CODAR)
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; Dr. Harper Simmons, Co-PI, University of Alaska, Fairbanks; Dr. Matthew Oliver, Co-PI, University of Delaware; Dr. John Klinck, Co-PI, Old Dominion University

Coastal Ocean Dynamics Applications RADAR (CODAR) was developed between 1973 and 1983 by NOAA's Wave Propagation Laboratory. It is a high frequency radar that operates at 12 MHz so can receive signals from over the horizon. There are CODAR antennas at Palmer (just below Terra Lab near Hero Inlet) and also at the Joubin and the Wauwermans Islands. Each system measures the radial component of ocean wave velocity by transmitting a fundamental frequency at 12 MHz and receiving a reflected signal at twice the fundamental frequency (half the wavelength). By combining the measured velocity components from the three stations, the total wave velocity can be determined. The Doppler shifts of the reflected signals can be used to measure surface currents. Wave velocity can be affected by currents at depths of 1 meter and shallower and thus a measureable with CODAR.



Joubin Islands 1 CODAR Site on 28 February 2021. *Image Credit: Marissa Goerke*

The Joubin site was visited twice this month. During the first visit, an assessment was made of the damage the system sustained during this past winter. All wind turbines were found to be inoperable and two solar panels were broken and recovered 10m from the hut. The communications pole had torn free of the hut and was on the ground. Communications were restored and the site was cleaned up. The CODAR was fully operational for about an hour before it was decided to recover the Mac Mini, external hard drives, and flash card from the weather datalogger. The second trip winterized the site and recovered the SeaSonde from the field.

Data will be available in the future at: https://marine.rutgers.edu/~codaradm/.

G-090-P: GLOBAL SEISMOGRAPH NETWORK (GSN) SITE AT PALMER STATION
Mr. Kent Anderson, Principal Investigator, Incorporated Research Institutions for Seismology (IRIS)

Palmer's seismic station, code named PMSA, is part of the Global Seismic Network (GSN), a collection of 150+ sites worldwide, operating under the aegis of the Incorporated Research Institutions for Seismology (IRIS), and managed by the United States Geological Survey's Albuquerque Seismological Laboratory (ASL). The site was installed in March 1993. As of August 2006, PMSA is also used as an ancillary seismic system for the CTBTO/IMS installation; CTBTO-specific protocols for the seismic system are covered in the CTBTO (T-998) section this document.

A standard seismic station consists of three seismometers oriented to detect ground motion along three mutually perpendicular lines. Most of the time the directions chosen are north-south, east-west, and up-down. The seismometers in the Palmer Station installation are “forced balanced” instruments, which means that they work by keeping an inertial mass stationary with respect to the instrument (and the earth). When a seismic wave arrives, the ground moves, carrying along the housing of the seismometer. The inertial mass tends to remain stationary and not move with the instrument, but it is electronically “forced” to travel along with the instrument (and the earth). The amount of “force” necessary to make it move with the rest of the instrument is proportional to the ground acceleration and is recorded as the raw data from the seismometer.

By examining time of arrival, azimuth, magnitude, frequency and wave type of the incoming waves, seismologists can determine the location, depth of focus, magnitude, type of faulting that occurred, ground acceleration in gravitational force, and the structure of the medium (the earth) through which the waves traveled to reach the station. The Research Associate operates and maintains on-site equipment for the project.

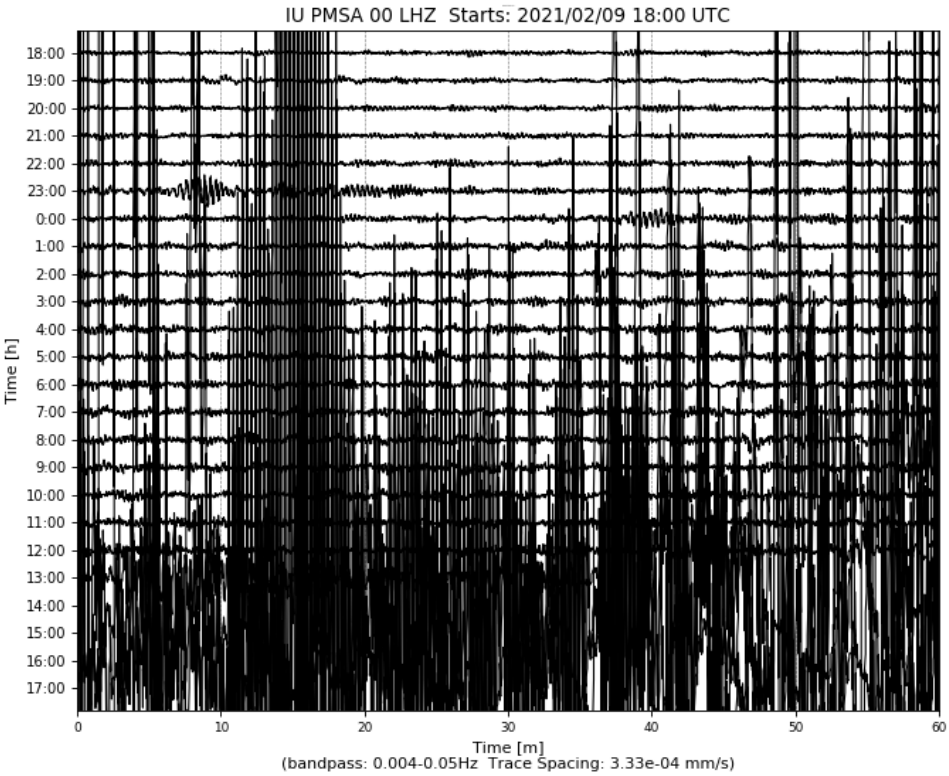


Fig. 10 – A 7.0 magnitude earthquake southeast of the Loyalty Islands 10 February 2021. *Image Credit: NASA Earthquake Hazards Program*

The system operated consistently throughout the month. The time stamp and seismic activity found on the heliplot was checked daily; see example in Figure 10. Current data from Palmer station can be found on the USGS site: https://earthquake.usgs.gov/monitoring/operations/stations/IU/PMSA/#heliplot.

O-264-P: A STUDY OF ATMOSPHERIC OXYGEN VARIABILITY IN RELATION TO ANNUAL DECADAL VARIATIONS IN TERRESTRIAL AND MARINE ECOSYSTEMS

Dr. Ralph Keeling, Principal Investigator, Scripps Institution of Oceanography

The goal of this project is to resolve seasonal and inter-annual variations in atmospheric O_2 (detected through changes in O_2/N_2 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 CO_2 sink. The program involves air sampling at a network of sites in both the Northern and Southern Hemispheres.

The Scripps Institution of Oceanography flask sampling project analyzes air samples to assess variations in the atmospheric oxygen content caused by exchanges of O_2 between the atmosphere and the southern ocean. The oceans tend to be a source of oxygen to the air in the spring and summer, and a sink for oxygen in the fall and winter. The spring emissions are mostly due to photosynthesis in the water, while the winter uptake is due to mixing process, which bring oxygen depleted waters from depth up to the surface. These exchanges lead to variations in the oxygen content of the air above the water, and these changes are rapidly mixed around the

latitude band by zonal winds. Measurements of the seasonal variations in oxygen content at Palmer and other sites may be valuable for documenting changes in the biological productivity of the southern oceans over time (Fig. 11).

The percentage changes in oxygen are very small. Relative to the 20.95% background, the summer-winter differences are only about 0.01%. Some special precautions are necessary so that the O_2 content of the samples isn't perturbed at this low level. Among these precautions are maintaining a constant pressure and temperature in the flasks during sampling. This dictates the installation of the sampling station indoors and the use of a pump module with a bypass valve for avoiding pressure buildup. The Research Associate collects samples fortnightly from Terra Lab. Due to a low flask inventory, the RA has been instructed by the Principal Investigator to only sample once a month starting this month.

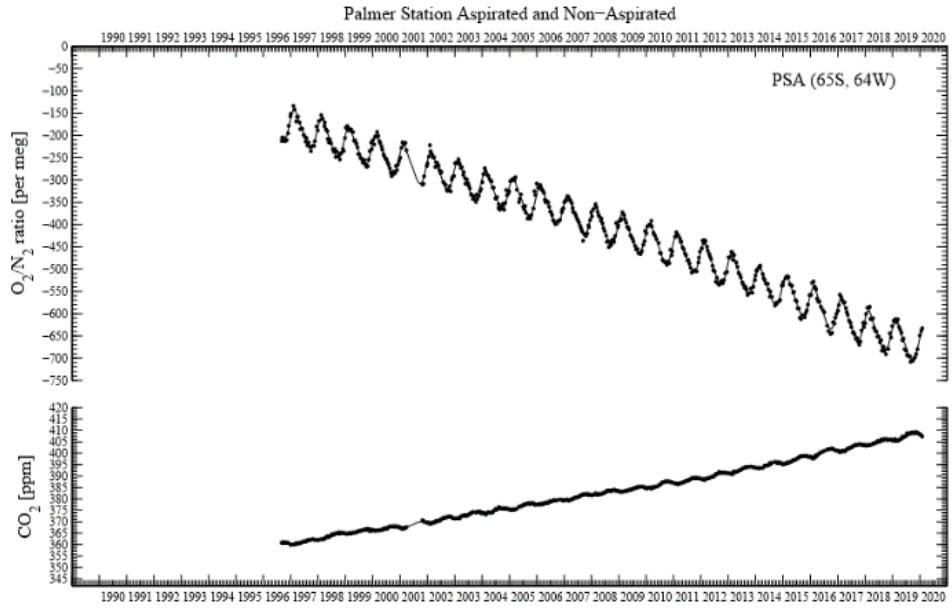


Fig. 11 – Historical plot of O_2/N_2 ratio per meg and CO_2 ppm updated on 29 July 2020. *Image Credit: UCSD Scripp's O_2 Program*

Air samples were collected on 12 February at 1418 local (UTC−03:00). Wind conditions must equal or exceed 5 knots from a direction between 5° to 205° constantly for over an hour with no interference from human traffic on foot or in vessels. Due to a low flask inventory, the grantee has asked for a single sample on or near the 15th of each month, beginning this month and continuing until cargo can be shipped more often than twice a year. These air samples will be shipped to Scripps Institution of Oceanography in California for analysis. More information and data can be found at: https://scrippso2.ucsd.edu/osub2sub-data.html.

This data was shared with the onsite LTER grantees because it has interesting collaboration potential.

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

Dr. James Butler, Principal Investigator, National Oceanic and Atmospheric Administration / Global Monitoring Division

Mr. Don Neff, and Dr. Steve Montzka, National Oceanic and Atmospheric Administration / Global Monitoring Division

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 (N_2O) and halogen containing compounds. The Research Associate collects weekly air samples for the CCGG group and fortnightly samples for the HATS group (Figs. 12 and 13). Wind must be between 5 and 15 knots and consistently blow from one sector with no people, equipment, or boats upwind of the sampling location.

Carbon Cycle Greenhouse Gases (CCGG) samples were collected on 1 February at 1330 local time, 8 February at 0814 local time, 16 February at 0818 local time, and 22 February at 0740 local time (all UTC−03:00) during favorable wind conditions. This data was shared with the onsite LTER grantees because it has interesting collaboration potential. More information and data for the Carbon Cycle group can be found at: https://www.esrl.noaa.gov/gmd/ccgg/trends/.

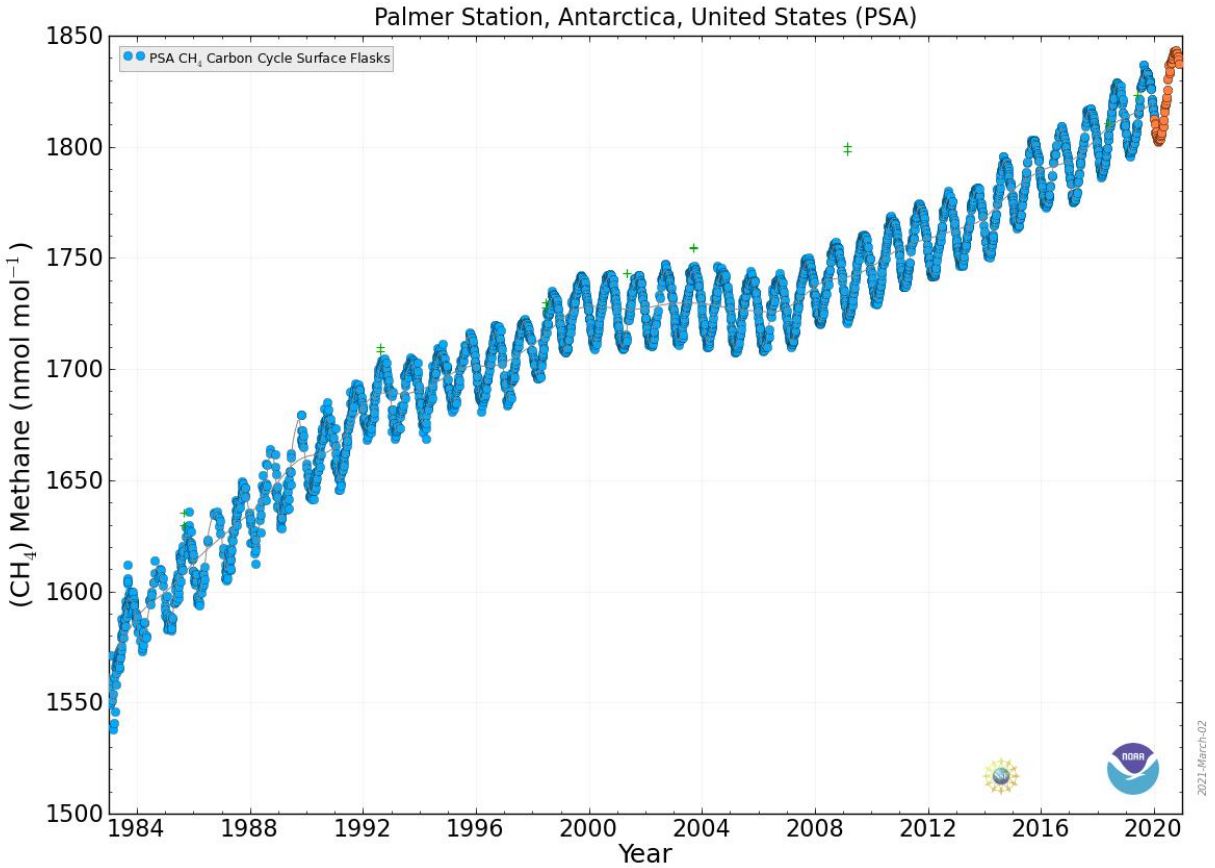


Fig. 12 – Historical CH_4 Levels at Palmer Station dating back to 1984. Orange dots are preliminary data. *Image Credit: NOAA Global Monitoring Laboratory*

The Halocarbons and other Atmospheric Trace Species (HATS) samples were collected on 8 February at 0854 local and 24 February at 0825 local (all UTC−03:00) during favorable wind

conditions. More information about the Halocarbons and other Atmospheric Trace Species group available at: https://www.esrl.noaa.gov/gmd/hats/.

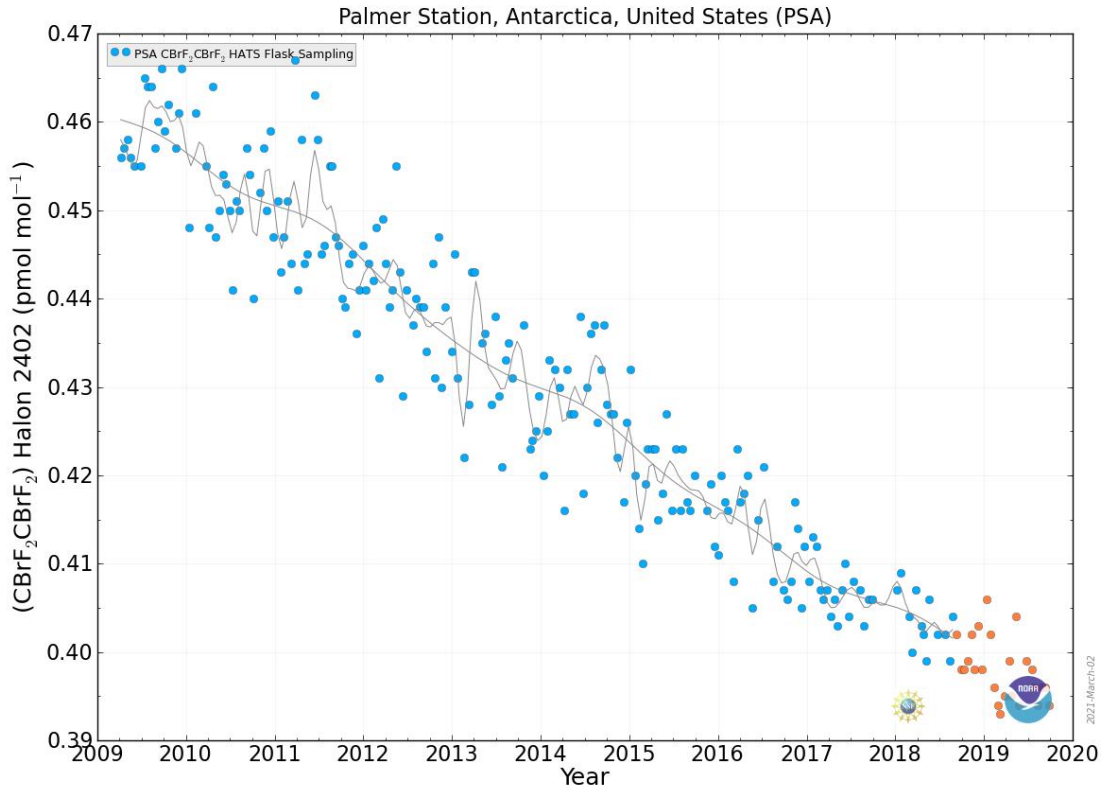


Fig. 13 – Historical measurements of Halon 2402 (CBRF2CBRF2), one of the halocarbon and trace gases measured at Palmer Station. Orange dots are preliminary data. *Image Credit: NOAA Global Monitoring Laboratory*

All samples collected on station are sent back to the Earth System Research Laboratories in Boulder, Colorado for analysis.

O-264-P: ULTRAVIOLET (UV) SPECTRAL IRRADIANCE MONITORING NETWORK

Dr. James Butler, Principal Investigator, National Oceanic and Atmospheric Administration / Global Monitoring Division
Mr. Scott Stierle, National Oceanic and Atmospheric Administration / Global Monitoring Division

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 Ground-based Ultraviolet (GUV-511) filter radiometer, an Eppley Precision Spectral Pyranometer (PSP), and an Eppley Total Ultra Violet Radiometer (TUVR) also continuously measure hemispheric solar flux within various spectral ranges. The Research Associate operates and maintains on-site equipment for the project (Fig. 14).

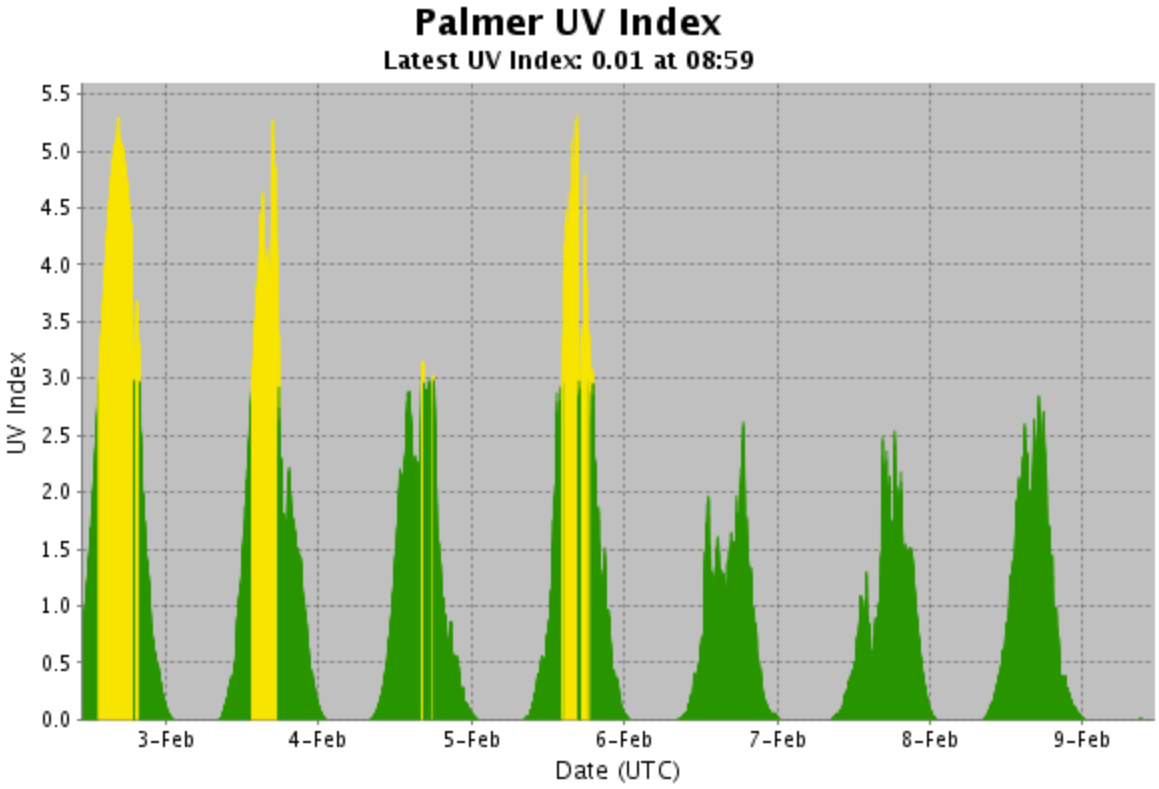


Fig. 14 – UV index generated from the GUV-511 radiometer in real time between 2 February and 9 February. *Image Credit: NOAA Earth Systems Research Laboratory*

The system is having issues with the wavelength offset on the SUV-100 UV spectroradiometer. The Principal Investigator is aware of the issue and has provided a procedure to follow when this occurs. The log was completed and collectors were cleaned on a daily basis. Weekly instrument level checks were performed to confirm that the instrumentation was within +/- 0.2 degrees. The weekly log was sent out each Monday and a bi-weekly SUV-100 UV absolute scans were performed on 12 and 26 February as scheduled without issues.

For more information visit: https://esrl.noaa.gov/gmd/grad/antuv/.

R-938-P: TERASCAN SATELLITE IMAGING SYSTEM

Mr. Kevin Bliss and Mr. Justin Maughmer, Principal Investigators, System Administrators, United States Antarctic Program

TeraScan is an integrated system of hardware and software designed for automated reception of data from meteorological/environmental satellites and for processing the data into images and data overlays. The system collects, processes, and archives DMSP and NOAA satellite telemetry, capturing approximately 25-30 passes per day. The data files for these images and overlays are of a special format called TeraScan Data Format (TDF). 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 (Fig. 15).

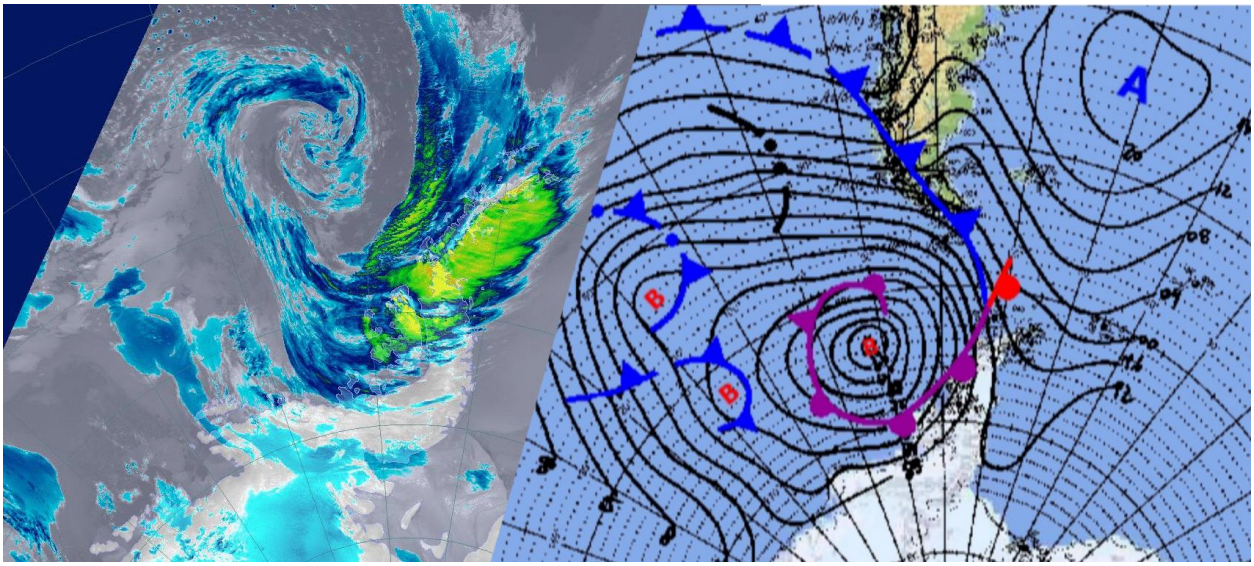


Fig. 15 – NOAA-19 satellite pass from 22 February 2021 (left panel) compared with an occluded front passing over Palmer Station (right panel; Chilean Army Meteorological Chart).

The imagery was checked daily. Data from the NOAA satellites appears normal, while the data from the DMSP drops out. The TeraScan team is aware of the excessive noise, missing data, and anomalies of the DMSP passes and are trying to resolve the issue.

T-295-P: GPS CONTINUOUSLY OPERATING REFERENCE STATION.
Mr. Joe Pettit, Principal Investigator, UNAVCO

The National Science Foundation (NSF) tasked and funded the USGS Antarctic Program to establish a Global Positioning System (GPS) Continuous Operation Reference Station (CORS) at Palmer to serve a variety of scientific investigations in Antarctica. A permanent GPS CORS known as PALM (1003) was established during April and early May of 1997. Four reference marks were set and, along with 10 existing survey marks, PALM was tied in by differential GPS methods.

The GPS data collected supports the International GPS Service (IGS). This system is used for global geophysical studies such as crustal motion monitoring and determination of the global frame. PALM also provides Palmer scientists with real-time differential GPS positioning capabilities. Continuous 15-second epoch interval GPS data files are collected at station PALM, compressed, and transmitted to the NASA-JPL in Pasadena, CA.

The NASA Jet Propulsion Laboratory (JPL/NASA) is contracted to maintain the system, and sub-contracts to UNAVCO. While operation and maintenance of the GPS/CORS base station is the responsibility of the Research Associate, it is available for grantees who wish to use the roving systems and/or differential post-processing using data from the fixed reference station. Users are expected to have proper training prior to deployment to Palmer. The Research Associate may offer training and support to visiting grantees at their discretion.

The system operated consistently throughout the month. The lights on the Trimble, Javad, and Ashtech Receivers were all illuminated in the correct pattern and showed no signs of interruption. Data flow was monitored and was normal throughout the month. More information

can be found at the following website: https://www.unavco.org/projects/project-support/polar/base_stations_and_survey_systems/palmer/base.html.

The roving GPS system was used to map the terminus and profile of the glacier in February (Fig. 16). The highest recorded elevation of the safe area of glacier was found to be 130.5 meters, a 1.82 meter vertical loss from February 2020. The terminus line has retreated on average 8.2 meters horizontally since February 2020, not including the area of greater retreat in the northern terminus.

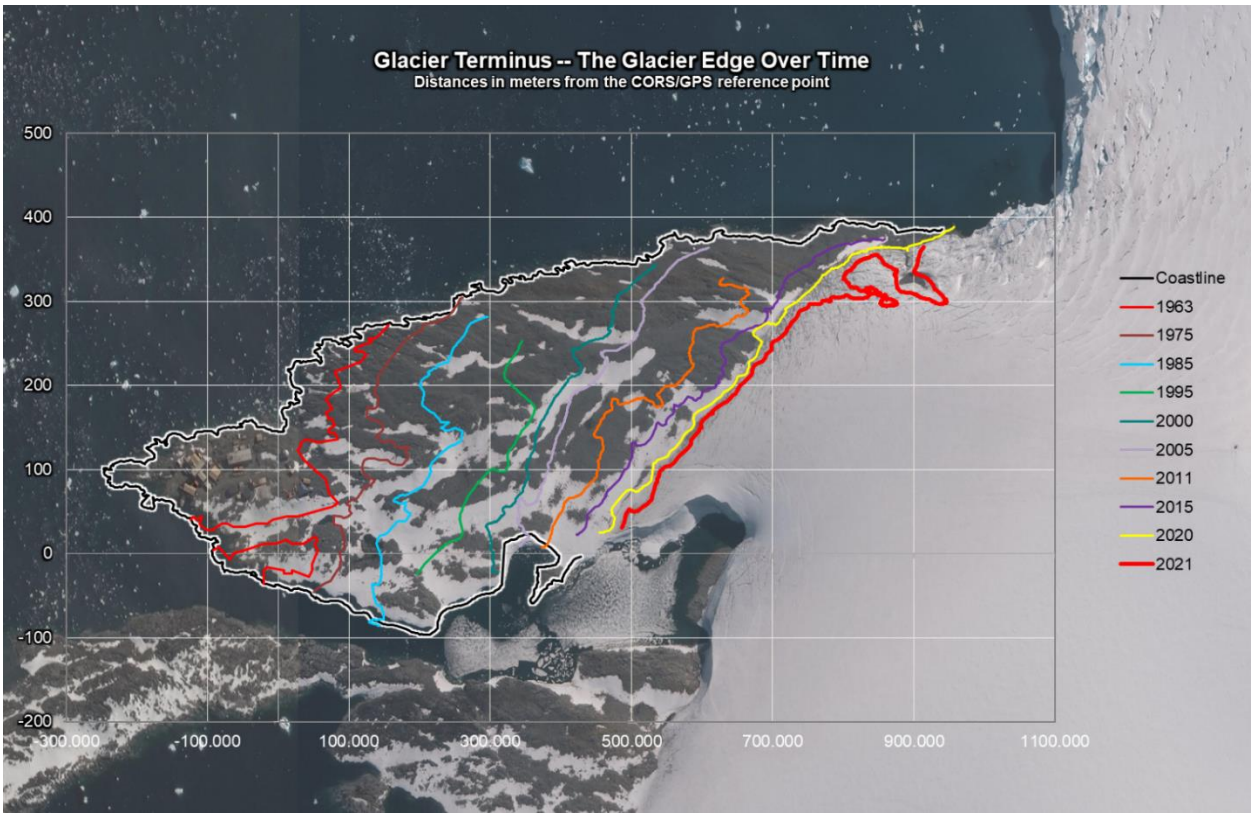


Fig. 16 – Glacier terminus GPS survey data from 1963 through 2021 (colored lines). *Image Credit: DigitalGlobe, Inc.*

T-998-P: INTERNATIONAL MONITORING STATION (IMS) FOR THE COMPREHENSIVE NUCLEAR TEST BAN TREATY ORGANIZATION (CTBTO)

Managed by General Dynamics

The Comprehensive Nuclear Test Ban Treaty (CTBT) bans all nuclear explosions. Although not ratified, the U.S.A. is following through with the treaty, including the installation of monitoring stations around the world. The global verification regime for monitoring compliance is called the International Monitoring System (IMS). The radionuclide air particulate sampling station was installed at Palmer in October 2005. Palmer's radionuclide sampler/analyzer (RASA) is a primary station in the IMS, known by its treaty code USP73 (and RN73). The pre-existing USGS seismic system is an auxiliary station, treaty code AS106.

Data collected by Palmer's RASA unit is relayed in real-time via a virtual private network (VPN) back to the CTBT Organization (CTBTO) in Vienna. As of August 2006, both the RASA

and seismic systems have been certified by CTBTO. Palmer is now officially part of the IMS. 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.

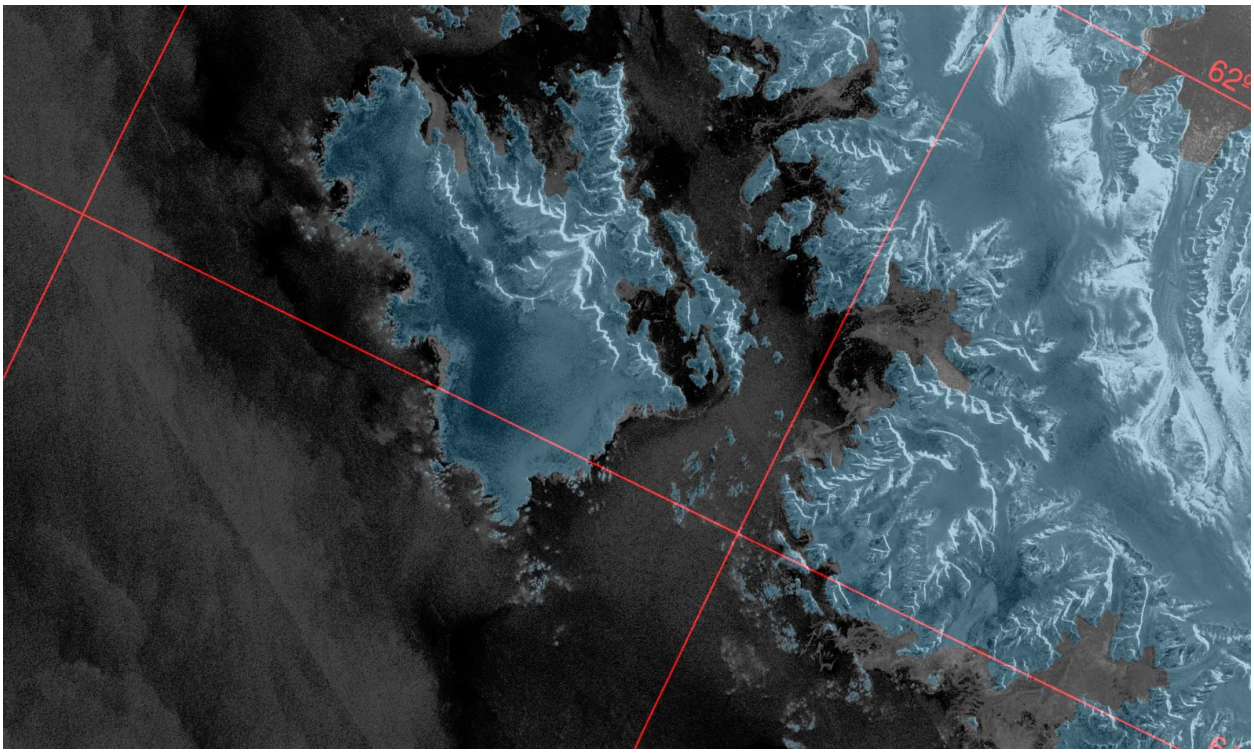
The system operated consistently this month. The RASA GUI was checked daily. The amount of filter material was checked as needed and no anomalies were heard coming from the blower. Daily filters were processed as needed and the monthly log was sent. Additional details about the treaty and monitoring stations can be found on the CTBTO web site, https://www.ctbto.org/.

PHYSICAL OCEANOGRAPHY

Palmer Station has a tide and conductivity gauge located on the pier at 64.774563°S 064.054837°W at a height of (base datum) 12.13 meters. It was installed in 2018 as the previous location was not adequate for tide or temperature measurements.

The Research Associate acts as the station's physical oceanography observer by maintaining and observing the sea state. Observations of sea ice extent and growth stage is recorded along with continuous tidal height, ocean temperature, and ocean conductivity.

Observations of sea ice around station were made daily. The tide data was monitored continuously. Tide data is archived on the AMRC website: ftp://amrc.ssec.wisc.edu/pub/palmer/tidegauge/.



Sentinel-1 satellite image of the sea ice around Anvers Island 25 February 2021. *Image Credit: EC Copernicus data/ESA/CMEMS/Polar View*

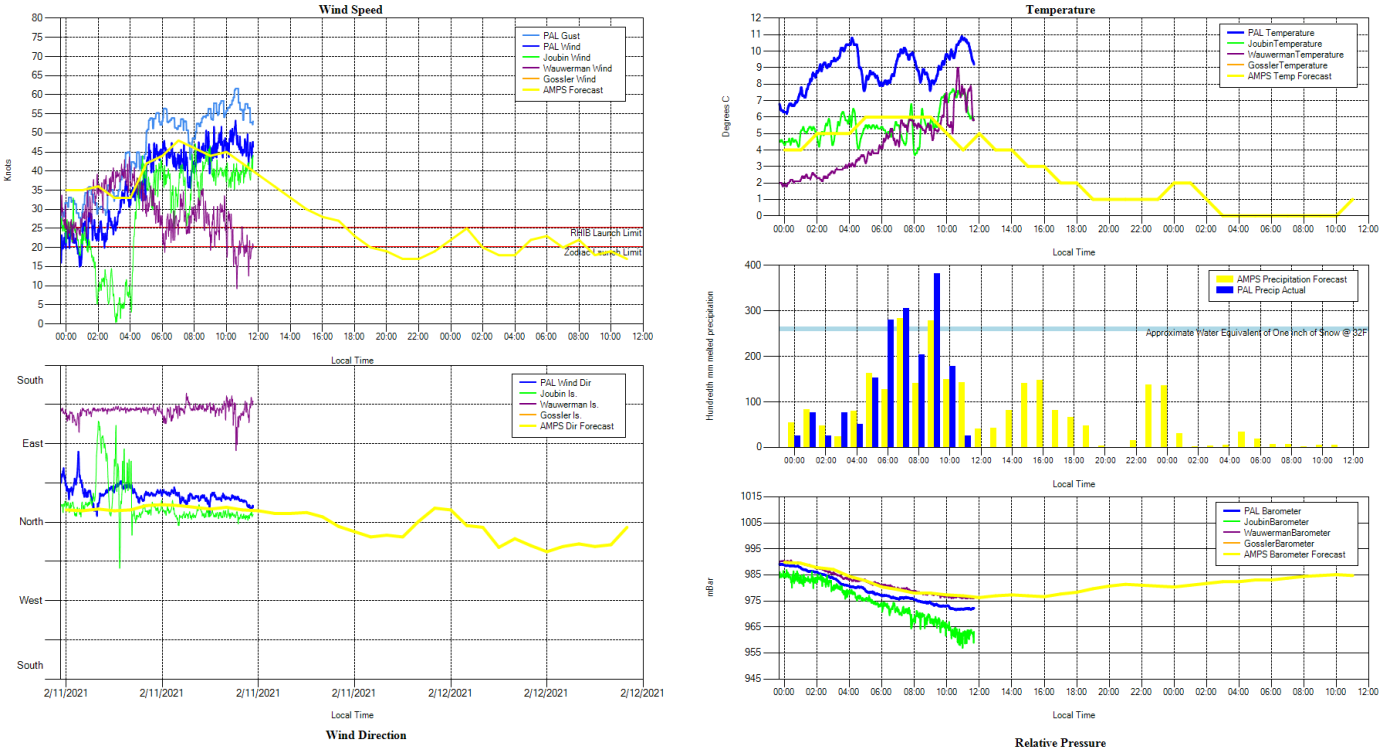
METEOROLOGY

Mike Carmody, Principal Investigator, United States Antarctic Program

Palmer Station is Station 89061 in the World Meteorological Organization (WMO) Worldwide Network. Automated surface synoptic observations are made 8 times each day and emailed to the National Atmospheric and Oceanographic Administration (NOAA) for entry into the Global Telecommunication System (GTS).

The Palmer Automatic Weather Station (PAWS) is a collection of sensors, computers, and software that records the meteorological data and generates synoptic reports. PAWS began recording data in September 2015. It was a replacement for the Palmer Meteorological Observing System (PalMOS) that was taken down in November 2017. The PAWS sensors and data acquisition hardware are located on a ridge in the backyard at 64.774130°S 064.047440°W at an elevation of 38.3 meters above sea level using the World Geodetic System-84. In addition to the synoptic and METAR reporting, PAWS also archives the current conditions at one-minute intervals and displays both raw data and graphs of the sensor data on our local intranet.

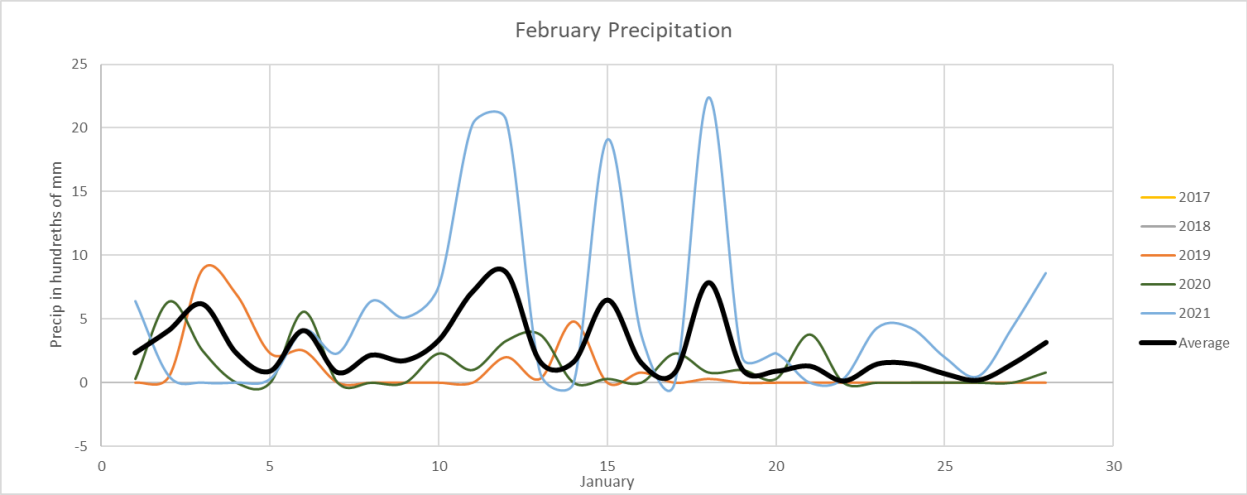
The Research Associate acts as Chief Weather Observer on station measuring, compiling, and distributing all meteorological data. Snow accumulations are physically observed by taking an average of five accumulation stakes found near the PAWS system. All weather data is archived locally and forwarded once per month to the University of Wisconsin on the first day of each month for archiving and further distribution.



A storm on 11 February 2021 reached the highest ever recorded temperature for the month of February and the second highest temperature ever recorded at Palmer. *Image Credit: Marissa Goerke*

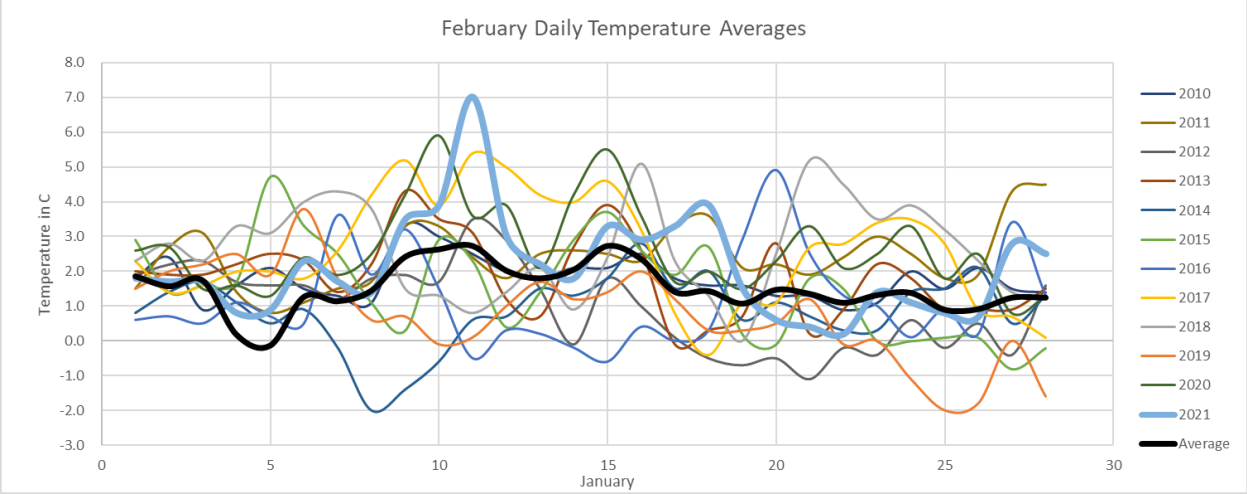
The local weather station (PAWS) operated well throughout the month. AWS1 in the Wauwermans Islands operated intermittently throughout February possibly due to a loose

antenna cable. There is an issue with AWS3 at the Gossler Islands that will need to be addressed during a site visit. One minute weather data is archived on the AMRC website: ftp://amrc.ssec.wisc.edu/pub/palmer/observations/.



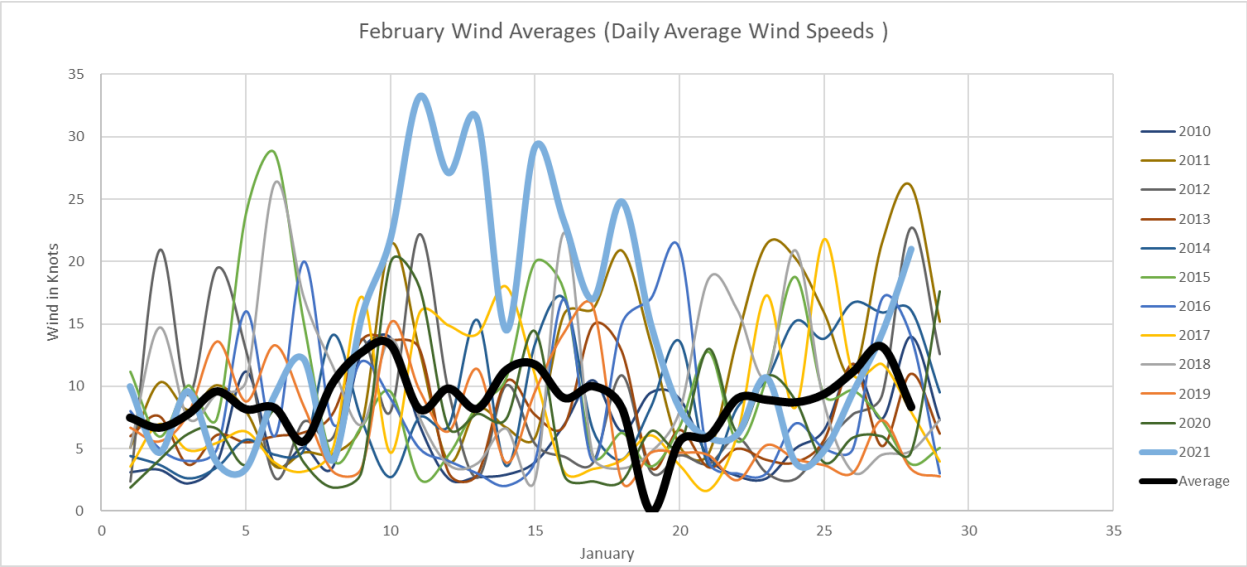
Daily precipitation totals for February 2021 and how they compare with the last five years.
Image Credit: Marissa Goerke

Precipitation at Palmer has been exceptionally high in February. Total precipitation for February was three times the ten year February average.



Daily average tempertures for February 2021 and how they compare with the last ten years.
Image Credit: Marissa Goerke

The highest temperature ever recorded in February occurred on 11 February reaching 10.9°C. This is the second highest ever recorded temperature for Palmer Station.



Daily average wind speeds for February 2021 and how they compare with the last ten years.
Image Credit: Marissa Goerke

It was a windier than the ten year average this February.

Palmer Monthly Met summary for February, 2021

Temperature
Average: 2.1 °C / 35.8 °F
Maximum: 10.9 °C / 51.6 °F on 11 Feb 13:55
Minimum: -1.1 °C / 30.0 °F on 22 Feb 09:21
Air Pressure
Average: 981.5 mb
Maximum: 999.7 mb on 9 Feb 16:28
Minimum: 952.3 mb on 1 Feb 06:51
Wind
Average: 14.1 knots / 16.2 mph
Peak (5 Sec Gust): 62 knots / 71 mph on 11 Feb 13:43 from NNE (25 deg)
Prevailing Direction for Month: NNE
Surface
Total Rainfall: 148.1 mm / 5.83 in
Total Snowfall: 10 cm / 3.9 in
Greatest Depth at Snow Stake: 7.2 cm / 2.8 in
WMO Sea Ice Observation: 1-6 icebergs with growlers and bergy bits
Average Sea Surface Temperature: 1.26 °C / 34.3 °F