# PALMER STATION MONTHLY SCIENCE REPORT

## November 2024

**Heavy ice conditions around station kept boats on land for the first few weeks of November, but luckily the winds finally shifted to allow local sampling and field work on surrounding islands. It's been another season with icebergs dominating the horizon. Photo taken 7 November 2024.** *Image credit: Dr. Natasja van Gestel*

### NEWS FROM THE LAB

Hannah James, Summer Lab Supervisor

Summer is in full swing here at Palmer Station! After the RVIB NATHANIEL B. PALMER departed station on October 31st, it was full steam ahead to ready labs, boats, and personnel for the 2024-25 summer field season. There are currently four groups with scientists and technicians at Palmer Station: B-086-P (van Gestel), C-013-P (Cimino), C-019-P (Schofield), and C-020-P (Steinberg). The first few weeks were spent unpacking cargo, organizing lab spaces, participating in boat trainings, reading through protocols, and conducting field planning meetings. Heavy sea ice conditions and high winds kept folks station-bound for the first half of November, but as soon as conditions allowed, boats got on the water for sampling and field observations during daylight hours. Each of these groups have summarized their work through the month of November below, so I encourage you all to keep reading. It is so wonderful to have boats on the water and samples being processed in BioLab again. We have an excellent group of collaborative, intelligent, kind, and focused minds on station- the season is off to a great start!

It is especially wonderful to welcome back B-086-P (van Gestel) Principal Investigator Dr. Natasja van Gestel who is serving as our Station Science Lead for the summer season. Dr. van Gestel has been a part of all of the field planning meetings to familiarize herself with the field work and sampling structure of the other science groups on site.

With so many grantees on station we've kicked off our weekly Science Tuesday lecture series. Thank you to our November presenters: B-086-P (van Gestel) PI Dr. Natasja van Gestel, Megan Roberts, and Darren Roberts of C-013-P (Cimino) for educating the rest of station on their field work and why it is important! I would also like to thank Ben Rosen-Filardo for hosting an Open House at Terra Lab on Tuesday, November 19th. They did a wonderful job walking people

through each of the experiments our Terra Lab Research Associates watch over, collect samples for, and of course troubleshoot when things go wrong. Thank you, Ben!

**B-086-P: Antarctica as a Model System for Responses of Terrestrial Carbon Balance to Warming**

*Dr. Natasja van Gestel, Principal Investigator, Department of Biological Sciences, Texas Tech University.*

Personnel on station: Dr. Natasja van Gestel and Tiego Ferreira de la Vega

***Science***

Soils contain more than three times more carbon than the atmosphere and still little is known about the fate of that carbon. If warming rates results in faster rates of losses, then planetary warming rates will happen at a faster pace, but this could be partly counteracted by warming-induced enhancements plant growth and photosynthesis. The Antarctic terrestrial ecosystem is far less complex than terrestrial ecosystems elsewhere. If we are to predict how warming affects plant and soil microbial activities and the resulting carbon fluxes, then using a simplified ecosystem, such as the terrestrial ecosystems of Antarctica, as a natural laboratory is ideal.

The goal of B-086-P (van Gestel) is to examine how warming affects the carbon cycle by measuring rates of photosynthesis (incoming carbon) and respiration (outgoing carbon) along a plant productivity gradient (Figure 1). The first site is closest to the glacier (site 1), one mid-backyard (site 2), one near the Station on Arthur Harbor side (site 3), and lastly on Litchfield Island (site 4). In the first field season of 2022-2023, the ages of the sites (i.e., since deglaciation) were: <1 years old (site 1), circa 25 years old (site 2), 65 years old (site 3) and >600 years old (site 4, Litchfield).

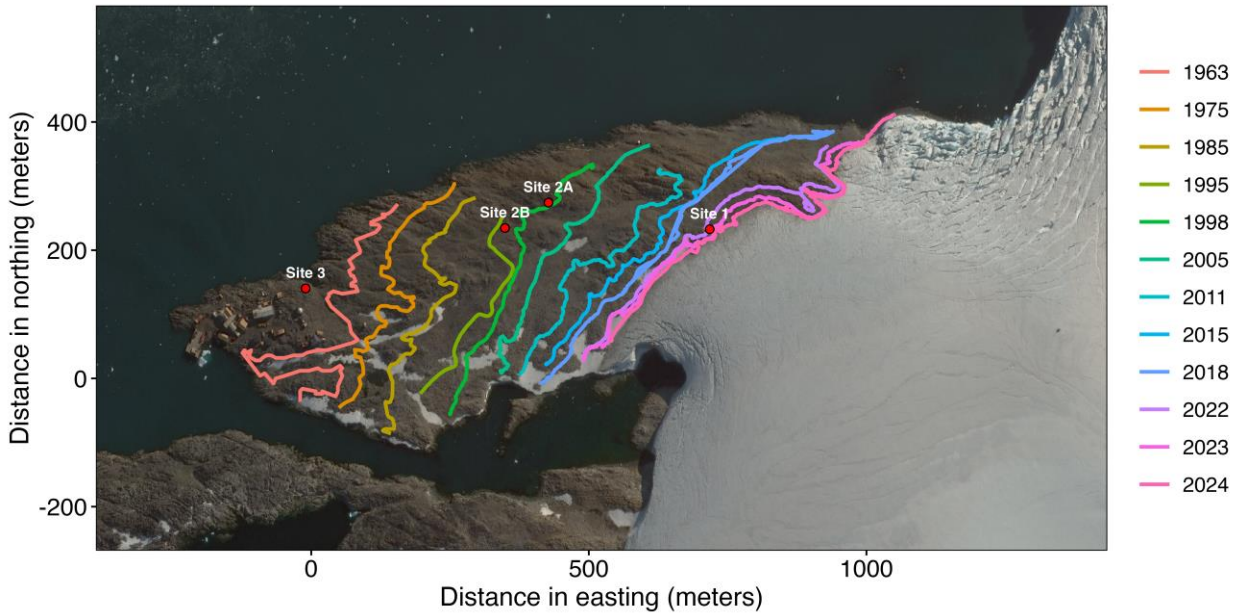


**Figure 1-** Locations of the B-086-P (van Gestel) study sites relative to the glacier retreat over time. Site 1 has no plants, and site 3 has the most plant cover in the Palmer Backyard. Site 4, which represents a late successional stage with moss peatbanks (Litchfield) is not shown.

Upon arrival, the snow-covered landscape impeded the start of our field-warming experiment (Figure 2). Thus, most of November our science was conducted indoors, which included

unpacking the lab, getting ready for the field season, writing code, data processing and uploading data to the Antarctic Master Directory.

**Figure 2-** Our site closest to the glacier is indicated by flags. Date of photo: 15 November 2024. *Image Credit: Natasja van Gestel*

Warmer weather towards the end of the month finally reduced the amount of snow cover sufficiently for us to finally be able to access the data loggers without fear of stepping into our plots. We downloaded logger data from three of the four sites. We were not able to download site 1 (nearest the glacier) because there was still too much snow (Figure 2), with the loggers still buried somewhere beneath the snow. For three of the four sites, we show average near-surface soil temperature data measured over a two-year period (Figure 3).

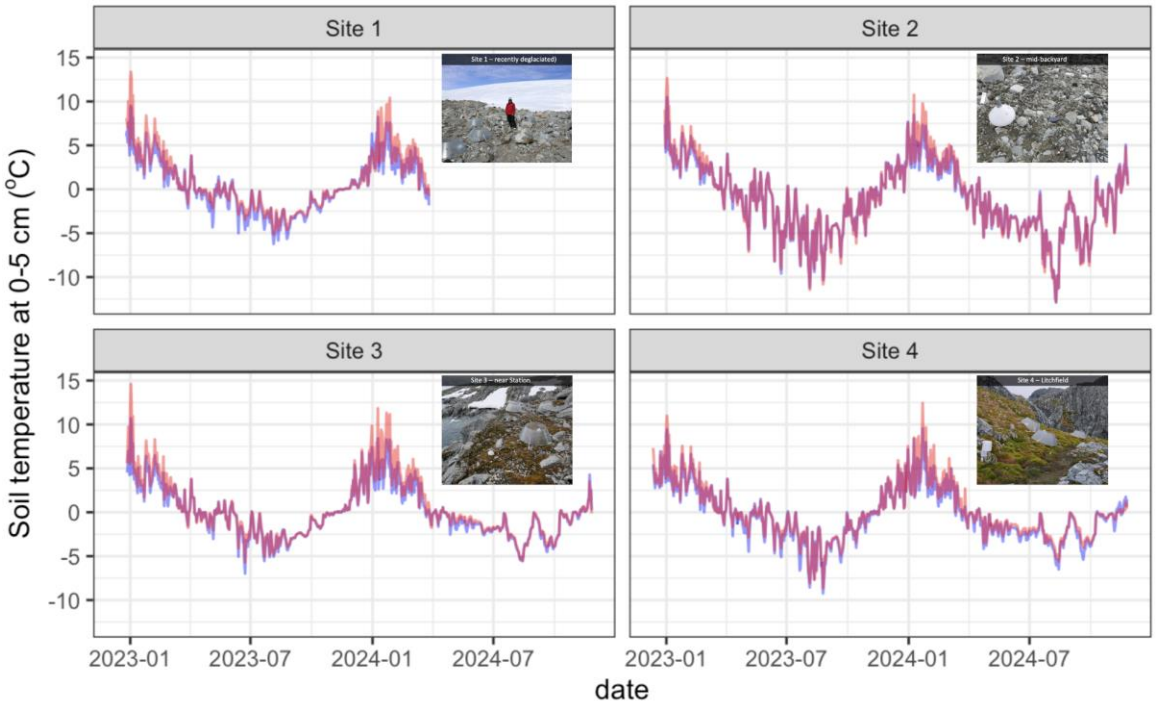


**Figure 3-** Soil temperatures over the span of two years for sites 1 (closest to glacier) to Site 4 (farthest from glacier, on Litchfield Island). Site 1 data has not yet been downloaded this year.

***Outreach/Broader Impacts***
I gave a Science Tuesday presentation on station on November 12 to share how vegetation in the Palmer region is responding to warming.

I continue to update my blog, which I re-started this year, but have links to the blog from previous years. My Antarctic blog (https://www.nvangestel.com/antarctica) has 2,839 users worldwide, mostly from the US (2,200), the Netherlands (125 users), and the UK (76 users), with the remaining users from 59 other countries.

My Instagram page (https://www.instagram.com/antarcticresearchadventures/), which also links to the blog, has 317 followers and continues to grow.

Lastly, I helped welcome visitors from the cruise ship MV USHUAIA to station on November 27. All science groups were present in the Galley by their research posters. The visit was a big success, with all of station participating in providing tours, refreshments, working in the store, and answering questions. A big thank you to Katie Harrison for her leadership in training station to provide a great experience for the tourists. This was the first cruise ship visiting station allowed to come inside since before the pandemic.

***Station Science Lead***
During my tenure at Palmer Station I am the Station Science Leader. In that capacity I serve to ensure that the research programs at Palmer Station are successful, with the help of the Station Manager Ken Keenan and Lab Supervisor Hannah James. My role as Station Science Lead was advertised by TTU:
https://www.ttu.edu/now/posts/2024/12/texas-tech-researcher-plants-flag-in-antarctica.php

To help facilitate communication and coordination, I have been compiling a document containing all the notes during the weekly Science Boating meetings. Hannah adds her own notes to that document, and together we ensure the Station has the latest information on the Science Boating needs for the week.

To be apprised of the current demands for science, I have also been present at the Field Planning meetings of all the science groups on station. As such, I have also put together a document that reflects what was discussed.

Every week during the All Station Science meeting I, or via a round-robin of the lead grantees, have been providing Science Highlights for the week.

We have a GREAT group of people on station and thus far the research has operated smoothly.

**C-013-P: PALMER, ANTARCTICA LONG TERM ECOLOGICAL RESEARCH (PAL-LTER): ECOLOGICAL RESPONSE TO "PRESS-PULSE" DISTURBANCES ALONG A RAPIDLY CHANGING WEST ANTARCTIC PENINSULA**
*Dr. Megan Cimino, Principal Investigator, University of California at Santa Cruz.*
Personnel on Station: Megan Roberts, Victoria Hermanson, Ricky Robbins, Darren Roberts

**Figure 4-** An Adélie Penguin colony at Humble Island. *Photo credit: Darren Roberts*

C-013-P (Cimino) personnel arrived at Palmer Station on October 29th.

Field work this month began with breeding chronology studies on a subset of Adélie nests on Torgersen, and Humble Islands. Population assessment of Adélie and gentoo populations began at Torgersen, Humble, Cormorant, Christine, Patterdo, Parmelee, Biscoe, and Point 8. A portion of Adélie Penguin nests were sampled as the second egg of the clutch was laid to obtain adult body condition and egg morphometric data. Timing of a peak egg census was also determined and completed for Adélies in the local island group, Biscoe Point, and at Dream Island. Peak egg is a measurement of the colony size at its largest for the season.

**Figure 5-** Gentoo Penguins at Point 8. *Image credit: Megan Roberts*

Brown Skuas have arrived and we began their mark-recapture and breeding chronology studies, including leg band re-sights and monitoring nests in the local area, and at Dream and Biscoe. We began population assessment and breeding phenology monitoring at the Blue-Eyed Shag colonies on Cormorant Island this month.

South Polar Skua surveys were completed at Shortcut Island to record arrival dates of banded birds. Additionally we completed our annual Thanksgiving Giant Petrel survey at Shortcut.

Giant Petrels have begun laying in the area, and we initiated our mark-recapture and breeding chronology studies on this species. We have focused our efforts at Humble and Shortcut so far. Additionally, we began our effort to recover over-winter tags from Giant Petrels at Shortcut in November. Deployment of GPS tags began on Giant Petrels in November and will continue for the majority of the summer.

**Figure 6**- A GLS (location) tag recovered from a Giant Petrel at Shortcut Island. *Photo credit: Darren Roberts*

Marine mammal censuses of seals and whales began this month. Pinniped sightings this month included Weddell seals, leopard seals, and Southern Elephant seals. We observed evidence of Elephant seal pupping in the local group of islands.

We would like to thank all of the personnel on station for helping us get the season moving. We would especially like to thank the Palmer Lab Manager, Hannah James, for her exceptional logistic support.

### C-019-P: Palmer, Antarctica Long Term Ecological Research (PAL-LTER): Ecological Response to "Press-Pulse" Disturbances Along a Rapidly Changing West Antarctic Peninsula

*Dr. Oscar Schofield, Principal Investigator, Rutgers University, Institute for Earth, Ocean, and Atmospheric Sciences, Department of Marine and Coastal Sciences*
Personnel on Station: Abby Tomita and Charlotte Bramich

Rolling into the summer season, the sun is shining and the phytoplankton are blooming! Joining the C-019-P (Schofield) lab in Antarctica are Abby Tomita, Charlotte Bramich, and Mya Sharpe. With Abby staying the entire season, Charlotte will be accompanying her until January when Mya arrives to finish out the summer season. This is Abby's second season at Palmer, with her first being the Austral Winter of 2023 working with the B-459-P (Bernard) lab. She was last here as an NSF Research Education for Undergraduates (REU) student intern, studying the overwintering strategies of Antarctic krill. This is Charlotte's first season at Palmer, having recently completed her Master of Science in Operational Oceanography at Rutgers University.

Her thesis characterized bottom water of Atlantic Surfclam habitats off the coast of New Jersey and she is looking forward to immersing herself in the world of phytoplankton. Mya is a PhD student at Rutgers and will be investigating the influence of glacial meltwater on the community composition of phytoplankton in the area once she arrives.


**Figure 7-** Abby (left) and Charlotte (right) in their lab space with Rutgers's Slocum glider. *Image credit: Danny Tropper*

The C-019-P (Schofield) group hopes to deploy a Slocum Glider this season. The last deployment of a glider from this group was in January of 2019. Charlotte, the resident glider expert, worked closely with these autonomous underwater vehicles (AUVs) as part of her master's curriculum. The glider will be deployed in December, and is equipped with a CTD and optics sensor to measure the characteristics of the water column and chlorophyll levels. The glider will travel on a preplanned track set by the glider team back at Rutgers in New Jersey and will continue to be monitored from there when in the water. While underway, data will be transmitted via iridium satellite each time the glider surfaces. The team hopes for a deployment that goes swimmingly.

Their first full month on station involved setting up the lab space, attending trainings and orientations, and beginning daily pumphouse sampling. By sampling the water from the pumphouse, the group can get an idea of what's going on in the water immediately surrounding station. Things were off to a slow start after many weather delays, packed brash ice in Hero Inlet, and standard commissioning procedures needs on R/V HADAR, the rigid hull inflatable boat (RHIB) on which the Schofield group conducts their twice weekly water collections. As the weather and sea state improved, Abby and Charlotte got out for a couple of sea trails of the instruments they will be using for the remainder of the season, such as the CTD rosette and Go-Flo bottle, which are used to measure physical parameters of the seawater and collect water from different depths. They look forward to honing their skills with the EK80 Wide Band Echosounder and the Compact-Propulsion Option for Profiling Systems (C-PrOPS).

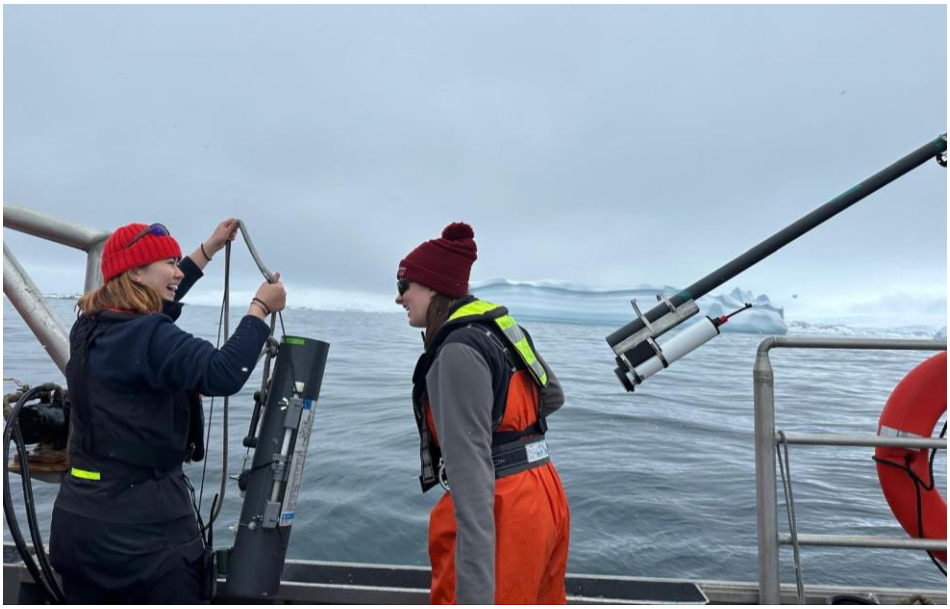

**Figure 8-** Abby and Charlotte on board RHIB Hadar getting ready to deploy a Go-Flo bottle to collect surface water. *Image Credit: Meredith Nolan*

## C-020-P: Palmer, Antarctica Long Term Ecological Research (PAL-LTER): Ecological Response to "Press-Pulse" Disturbances Along a Rapidly Changing West Antarctic Peninsula

*Dr. Deborah Steinberg, Principle Investigator, Virginia Institute of Marine Science, William & Mary's Batten School, Section for Coastal & Ocean Processes*
Personnel currently on station: Meredith Nolan, Isabelle Castro

The C-020-P (Steinberg) Lab is excited to return to Palmer Station for our 7$^{th}$ season studying the coastal zooplankton community here. Master's student Meredith Nolan is on station for the first half of the season, returning for her fourth season in the Antarctic and first at Palmer Station. VIMS graduate student Isabelle Castro is joining the Steinberg group for her first time in the Antarctic! This year, we will continue to conduct pelagic net tows aboard R/V HADAR at Station E. We are deploying 1-m$^2$ frame metro nets and 1-m ring nets to a depth of approximately 50m to collect and study zooplankton, the organisms living in the near-surface layer of the water column that cannot swim against a current.


**Figure 9-** Experimental tanks set up in the aquarium room. One is set to ambient temperature and the other to 4ºC**.** *Image credit- Meredith Nolan.*

In previous seasons, the zooplankton we commonly capture include krill (*Euphausia superba* and *Thysanoessa macrura*), salps (*Salpa thompsoni*), pteropods (*Limacina helicina*), and several species of copepods. We are interested in how this assemblage grows and changes in structure throughout the austral summer season (November to April). Additionally, we are freezing organisms individually to analyze their diet composition. These zooplankton form the central component of the pelagic food web, serving as an important link between lower trophic levels (e.g., diatoms, cryptophytes, and other groups of phytoplankton) and higher trophic levels (e.g., humpback whales, penguins, skuas, and other seabirds).We plan to deploy

net tows twice weekly at Station E; although we were delayed for much of November due to ice and storms.

Despite the weather challenges, science has still been happening in the Steinberg Lab! We have conducted two warming experiments on juvenile krill, which will be a part of Meredith's thesis. Many thanks to ASC personnel on the turnover cruise in October who collected krill in the Gerlache Straits for these experiments! For these experiments, krill are kept at ambient temperature and 4ºC for 48 hours in the aquarium room. Individuals are removed at 2, 4, 12, 24, and 48 hours, weighed, measured, flash frozen in liquid nitrogen, and then stored at -70ºC until they can be shipped back to VIMS. These samples will be used to track the molecular response of heat shock proteins and enzymes over time. Antarctic krill are a central part of the Southern Ocean ecosystem, and this work will allow us to make predictions about the tolerance of Antarctic krill to warming.

In addition to these experiments, we were able to deploy three 1-m ring nets, collecting mostly larval fish, copepods, and chaetognaths (arrow worms). As December approaches, the C-020-P (Steinberg) team is excited to see how the zooplankton community around Palmer Station changes as we enter the austral summer!

**PALMER STATION**
**RESEARCH ASSOCIATE MONTHLY REPORT**
**November 2024**
Ben Rosen-Filardo

**Sunset off the pier on a calm evening, November 1st, 2024.** *Image credit: Ben Rosen-Filardo*

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

*Dr. Hyomin Kim, Principal Investigator, New Jersey Institute of Technology; Newark, NJ*

Extremely Low Frequency/Very Low Frequency (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. 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.

The ELF/VLF radio wave observations at Palmer Station contributes to the wider network of experiments studying high-latitude geospace variables. Together with South Pole and McMurdo, these staffed U.S. Antarctic geophysical stations measures the interactions between Earth's upper atmosphere, the magnetosphere, and solar wind. In 2026, this imperative network will be managed by the NJIT-Polar Engineering Development Center (PEDC).

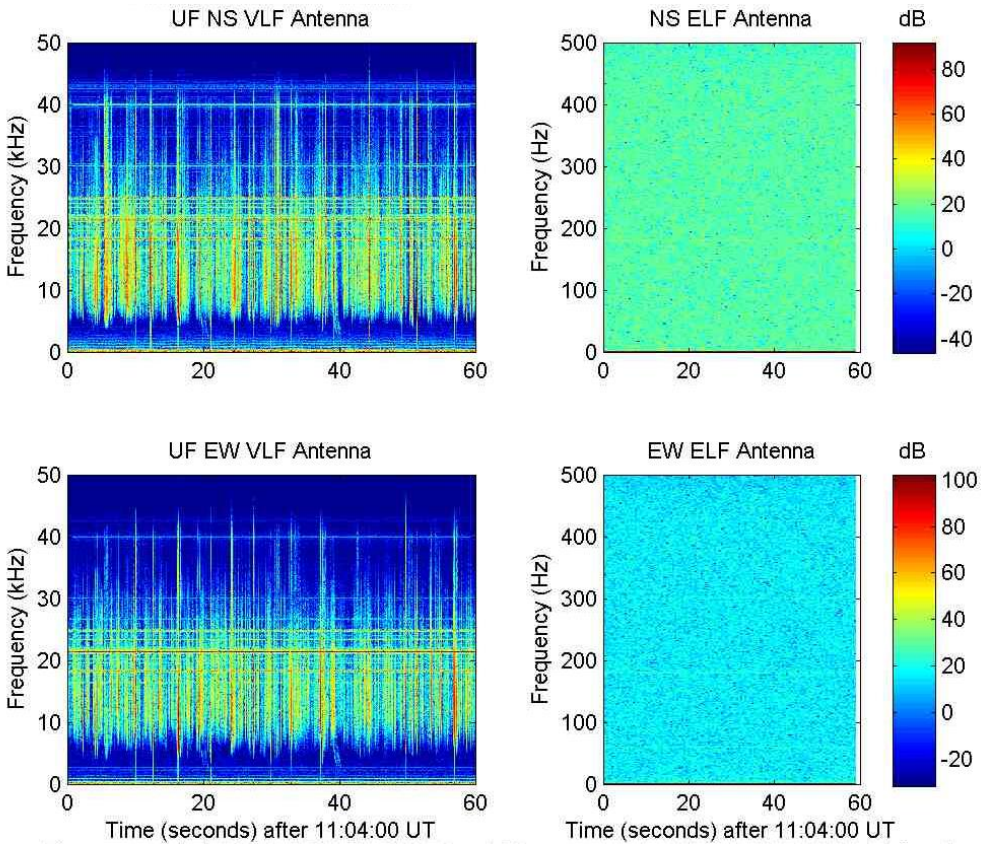


**Figure 10.** Real-Time broadband VLF and ELF Spectrogram from Palmer Station, Antarctica.

The VLF/ELF radios have been turned on, though are not logging data. The bi-weekly antenna inspections continued as weather allowed. The VLF PC was downgraded to Windows 10 but the DAQ is not yet up and running. A new computer will be arriving in January, 2025.

When online, current VLF/ELF data from Palmer Station can be observed at: http://halo.ece.ufl.edu/realtime_palmer_bb.php.

**A-111-P: SAMBA MAGNETOMETER**
*Dr. Hyomin Kim, Principal Investigator, New Jersey Institute of Technology; Newark, NJ*

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. In 2024 the project was taken over by Dr. Hyomin Kim.

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. A new Raspberry Pi system was installed in 2023. The system operated normally this month. More information can be found at: http://magnetometers.bc.edu/index.php/palmer.

**G-090-P: GLOBAL SEISMOGRAPH NETWORK (GSN) SITE AT PALMER STATION.**
*Dr. David Wilson, Supervisor Research Geophysicist, USGS Earthquake Hazards Program, Albuquerque, NM*

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 CTBT/IMS installation; CTBT-specific protocols for the seismic system are covered in the CTBT (T-998-P) 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.

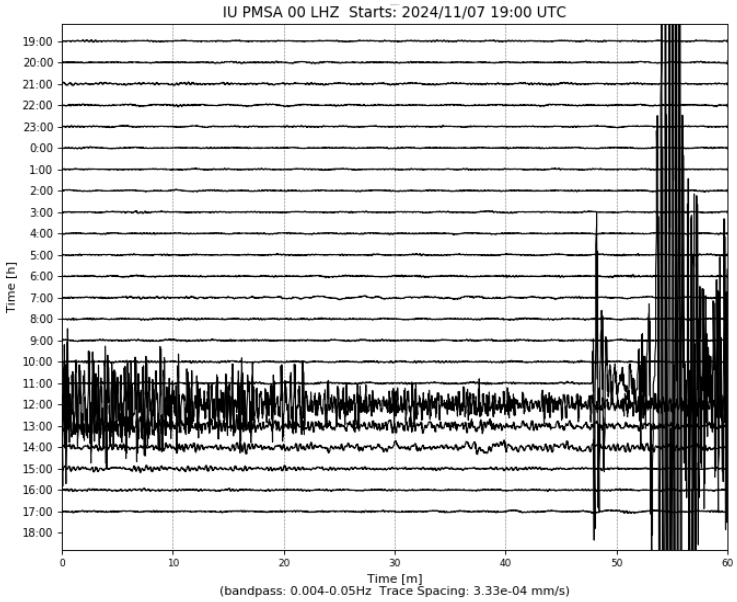


**Figure 11-** A November 8th 6.3 earthquake off the coast of Chile, as recorded from the Palmer seismic station.

The system performed normally during the month. The time stamp and seismic activity found on the Heliplot was checked daily. 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.

*Drs. Vanda Grubisic and Ralph Keeling, Principal Investigators, National Oceanic and Atmospheric Administration /Global Monitoring Laboratory; Boulder, CO and Scripps Institution of Oceanography; La Jolla, CA*

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 processes, 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.

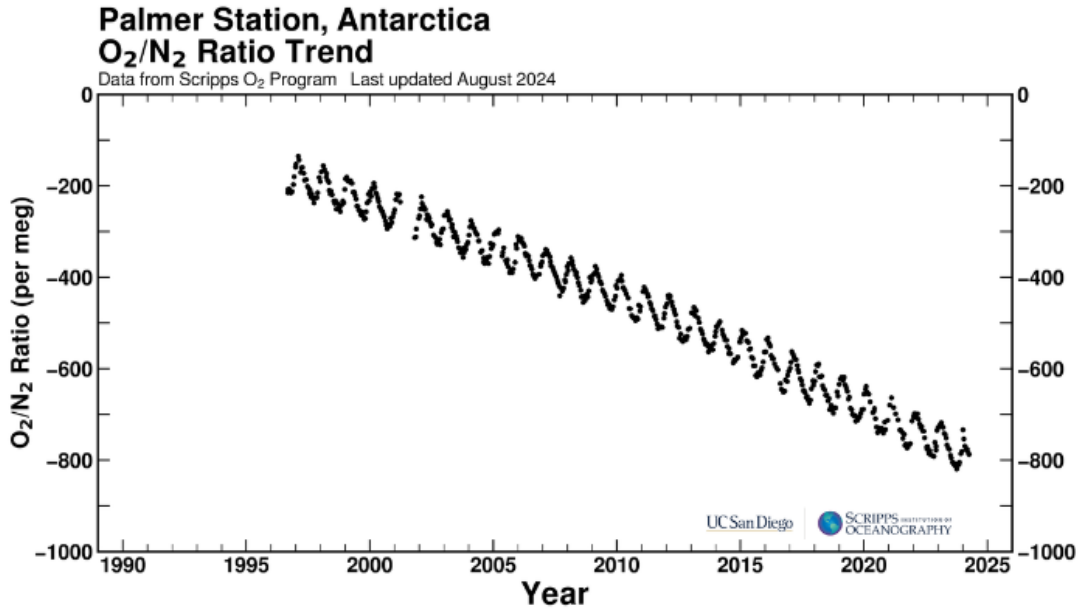


**Figure 12-** Historical plot of $\mathbf{O_2/N_2}$ ratio per meg and $\mathbf{CO_2}$ ppm, updated August 2024.

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.

Air samples were collected on November 1st and 19th. 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. These air samples are shipped to the Scripps Institution of Oceanography in California for analysis. More information and data can be found at: https://scrippso2.ucsd.edu/graphics-gallery/o2n2-graphics/psa.html.

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

*Dr. Vanda Grubisic, Principal Investigator, National Oceanic and Atmospheric Administration /Global Monitoring Laboratory; 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 ($N_2O$) and halogen containing compounds. The Research Associate collects weekly air samples for the CCGG group and fortnightly samples for the HATS group. 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 November 3rd, 7th, 12th, and 23rd during favorable wind conditions. More information and data for the Carbon Cycle group can be found at: https://gml.noaa.gov/ccgg/.

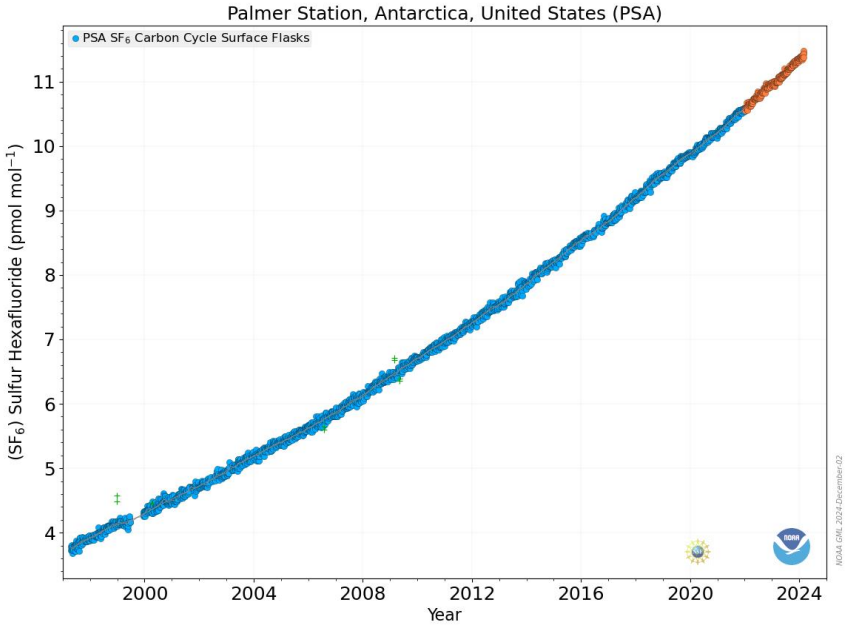


**Figure 13-** Sulfur Hexafluoride (SF6) levels at Palmer Station dating back to 1997. Orange dots are preliminary data and green pluses are poorly mixed air masses, which should not indicate background conditions.

HATS samples were collected on November 11th and 25th during favorable wind conditions. More information and data for the Halocarbons and other Atmospheric Trace Species group can be found at: https://gml.noaa.gov/hats/

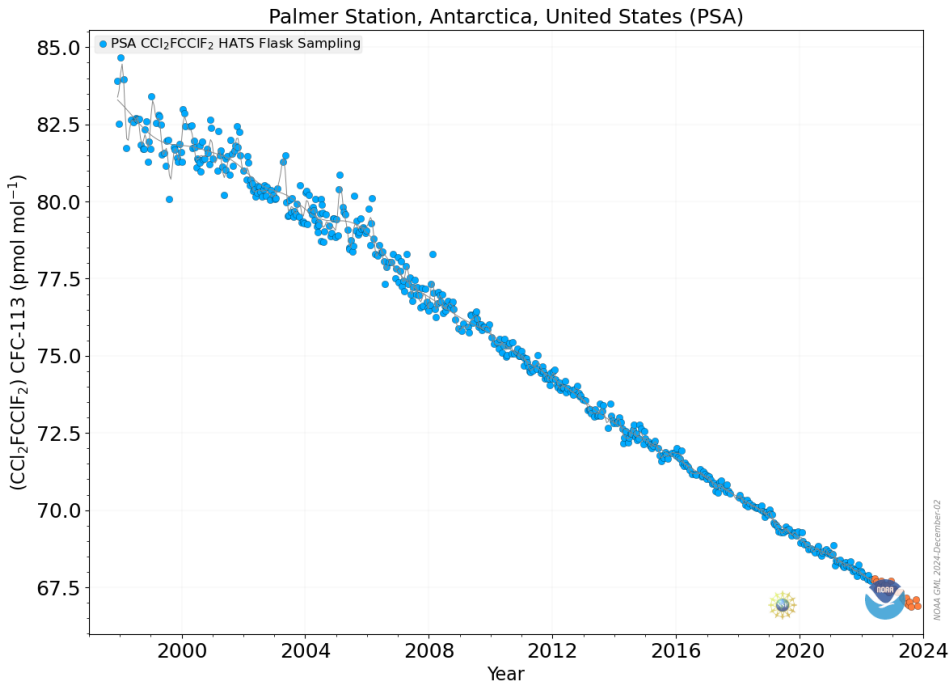


**Figure 14-** CFC-113 ($CCl_2FCClF_2$) levels dating back to 1997, one of the Halocarbon and Trace Gases measured at Palmer Station. Orange dots are preliminary data

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. Scott Stierle, Principal Investigator, National Oceanic and Atmospheric Administration /Global Monitoring Laboratory; 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 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.

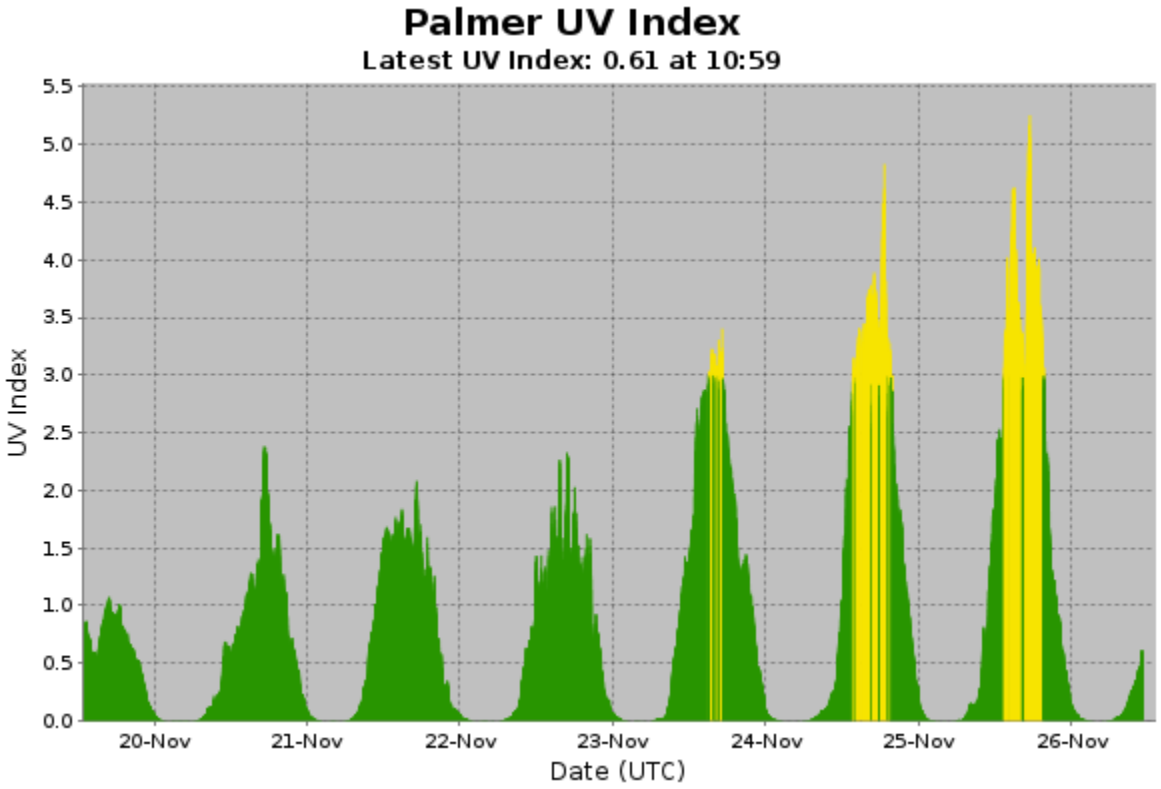


**Figure 15-** UV index generated from the GUV-511 radiometer in real time.

The log was filled out and collectors were cleaned on a daily basis. Level checks were performed once a week to confirm that the instrumentation was within +/- 0.2 degrees. The weekly log was sent out each Monday, and SUV-100 Absolute Scans were performed on November 5$^{th}$ and 23$^{rd}$ without issues. The connector on the TUVR is broken, and the instrument has been intermittently reporting since November 5$^{th}$.
For more information, visit: https://esrl.noaa.gov/gmd/grad/antuv/.

**R-938-P: TERASCAN SATELLITE IMAGING SYSTEM**
*Justin Maughmer, Principal Investigator, System Administrator, 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.

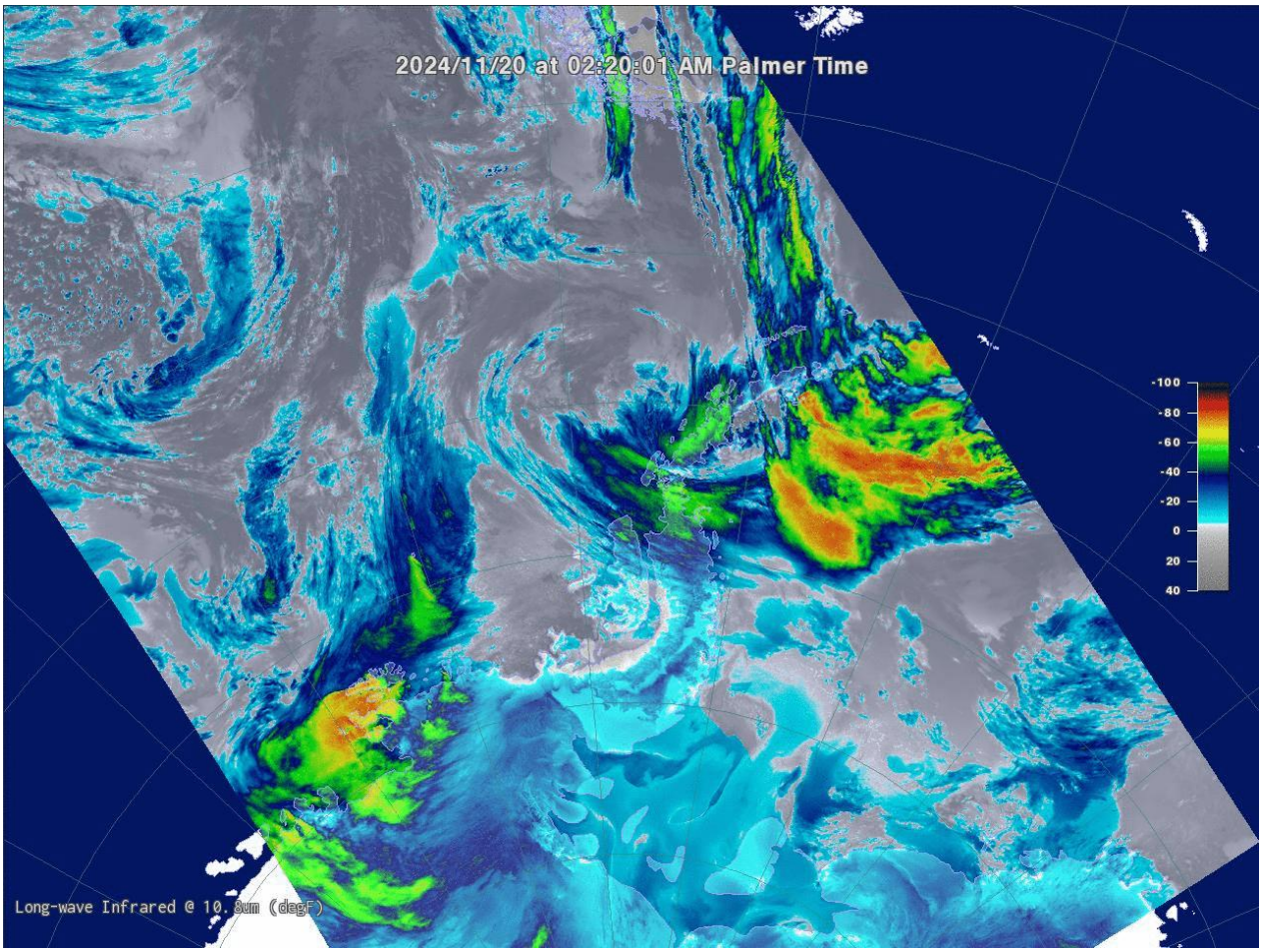


**Figure 16-** NOAA-18 November 20th satellite pass.

The imagery was checked daily. Both the MetOp and NOAA satellite passes were captured normally this month.

**T-295-P: GPS CONTINUOUSLY OPERATING REFERENCE STATION.**
*Joe Pettit, Principal Investigator, EarthScope Consortium; Washington, DC and Socorro, NM*

The National Science Foundation (NSF) tasked and funded the USGS Antarctic Program to establish a GPS (Global Positioning System) 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.

JPL/NASA is contracted to maintain the system, and they have sub-contracted to EarthScope. 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 support to visiting grantees at their discretion.

The system operated consistently throughout the month. The lights on the Trimble and Septentrio receivers were all illuminated in the correct pattern and showed no signs of interruption. For more information, visit: https://www.unavco.org/polar-services/forward-fielded-instruments/palmer-station/

**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 of 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 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 amount of filter material was checked as needed. Daily filters were processed on November 8th, and 11th. The monthly log was sent on time. Additional details about the treaty and monitoring stations can be found on the CTBTO website, http://ctbto.org/.

**PHYSICAL OCEANOGRAPHY**

Palmer Station has a tide and conductivity gauge located on the west side of the pier at

-64.774558° -64.055580° at a depth of 11.46 meters (WGS-84). It was reinstalled at this deeper depth after the completion of the Palmer Pier in June 2022.

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.

Aside from what remains in Hero Inlet, the sea ice has receded. However, many large bergs remain in the boating area. The 2024 snow level continues to be well above average in the 8-year record, surpassed only by 2022.

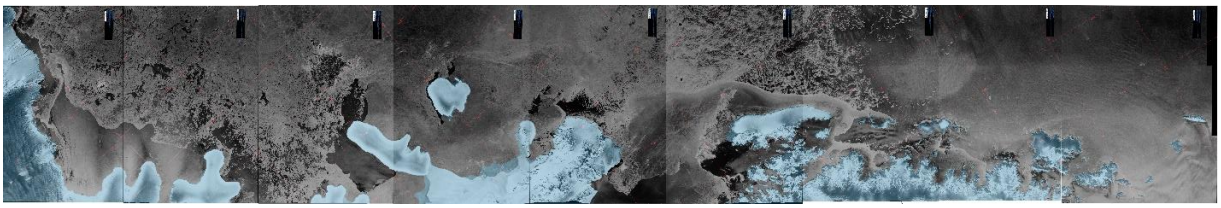

**Figure 17-** Sentinel-1 radar imagery from November 23rd, showing sea ice along the West Antarctic Peninsula.

Tide level, sea water conductivity, and sea water temperature data is archived on the AMRDC website: https://amrdcdata.ssec.wisc.edu/dataset?q=Palmer+Station.

## 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 of 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° -64.047440° 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 accumulation is physically observed at five accumulation stakes found near the PAWS system. All weather data is archived locally and forwarded to the University of Wisconsin on the first day of each month for archiving and further distribution.

An ongoing effort to clean up the AMRDC database continued this month.

One minute weather data is archived on the AMRDC website: https://amrdcdata.ssec.wisc.edu/dataset?q=Palmer+Station.

## Palmer Monthly Met summary for November, 2024

| |
|---|
| **Temperature** |
| **Average:** -1.2 °C / 29.8 °F |
| **Maximum:** 4.5 °C / 40.1 °F on 20 Nov 04:19 |
| **Minimum:** -7.9 °C / 17.78 °F on 6 Nov 03:43 |
| **Air Pressure** |
| **Average:** 981.1 mb |
| **Maximum:** 996.6 mb on 9 Nov 21:54 |
| **Minimum:** 963.9 mb on 2 Nov 15:36 |
| **Wind** |
| **Average:** 11.9 knots / 13.7 mph |
| **Peak (5 Sec Gust):** 56 knots / 65 mph on 19 Nov 08:48 from NNE (12 deg) |
| **Prevailing Direction for Month:** SW |
| **Surface** |
| **Total Melted Precipitation:** 97.3 mm / 3.83 in |
| **Total Snowfall:** 27 cm / 10.5 in |
| **Greatest Depth at Snow Stake:** 151 cm / 58.9 in |
| **WMO Sea Ice Observation:** 11-20 bergs, bergy bits, growlers, brash ice. The ice in Hero Inlet has receded about 100 feet past Terra Lab. |
| **Average Sea Surface Temperature:** -0.82 °C / 30.5 °F |

The week of November 17$^{tb}$ ushered in a new phase of the summer season, when warm northerly winds and rain caused the snow level to drop 40.4 cm from 11/16 to 11/23. This was the greatest 7-day snow melt on record since the installation of the backyard snow stakes in 2016. 84 mm of melted precipitation fell during this time period, as measured by the backyard heated rain gauge.

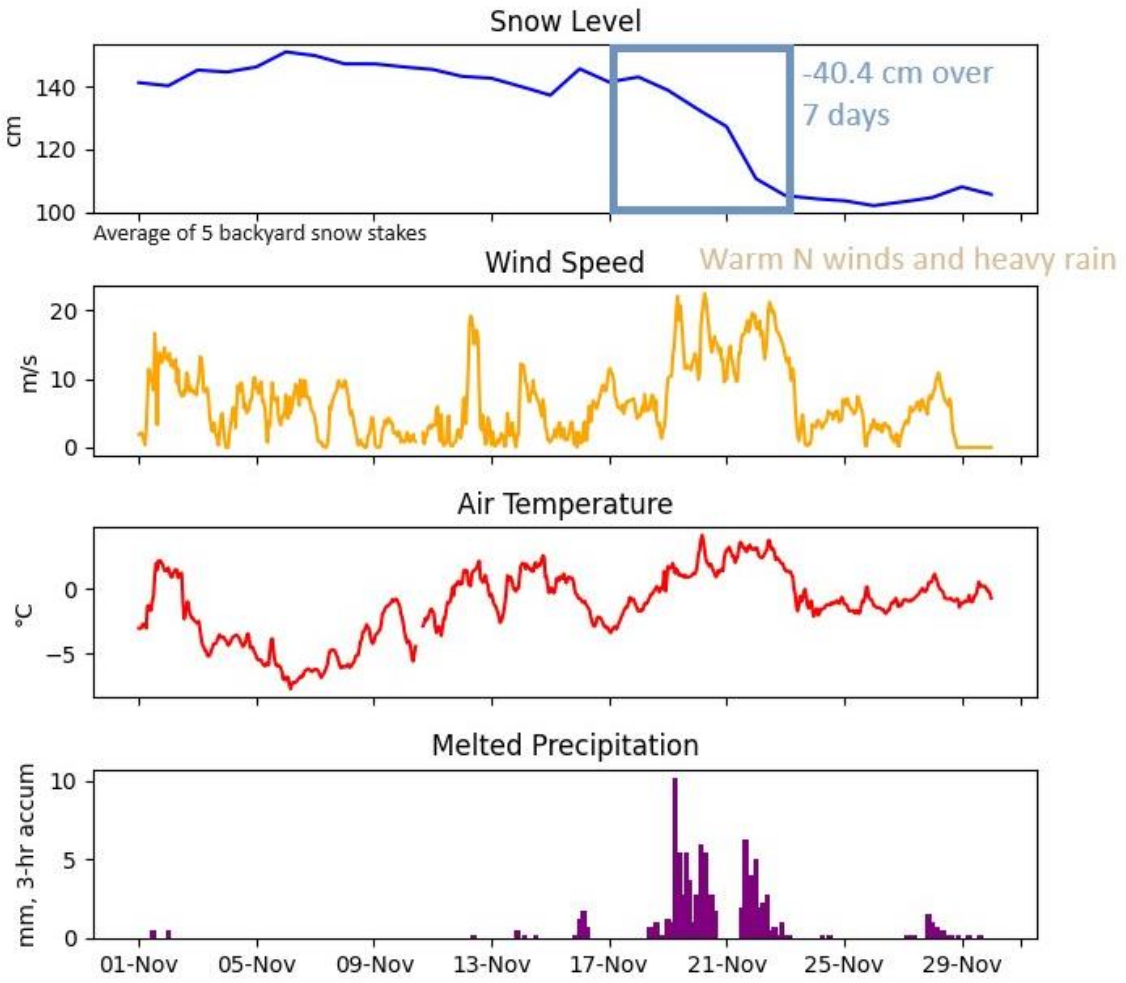


**Figure 18-** Snow level, wind speed, air temperature, and melted precipitation for the month of November 2024. Warm, wet weather the week of November 17th led to a record-breaking snow melt.