

PALMER STATION MONTHLY SCIENCE REPORT
October 2006



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NEWS FROM THE LAB

Hugh Ducklow, Station Science Leader

Tracey Baldwin, Supervisor Laboratory Operations

The 2006-07 summer research season got underway here at Palmer Station with the arrival of the *R/V Laurence M. Gould* on 11 October, bringing 9 scientists in 4 groups. As the LMG sailed in, we could see the track from her visit the month before... a bad sign. The sea ice hadn't moved at all. But strong northerly winds blew the ice away that very night. Although there have been frequent rain, snow and wind storms we have enjoyed frequent scientific boating and access to the islands and bird colonies since the middle of the month. Science is off to a much earlier start than last season, when Stations B and E weren't accessed until after mid-November. The LMG's return on 03 November brought additional LTER team members, completing the early-season science complement on station. As a result of early rain and wind, much of the previous winter's snowpack has melted and the backyard and glacier are relatively snow-free for this early season.

Wildlife has visibly returned to the Palmer Station vicinity. A rare calm night at the beginning of the month brought the sounds of Elephant Seals on Elephant Seal Rocks. A few days later a Crabeater seal pup was photographed nursing in Hero Inlet. Penguins are returning to their colonies on Torgersen and Humble Islands where they are busily sorting rocks, looking for mates, and watching with wary eyes the newly returned Skuas. Several Minke whales have been spotted within sight of the Two-Mile Boating Limit. Cormorants are frequently seen flying to and from Old Palmer in large flocks as they escort Zodiacs through Arthur Harbor.

Station population peaked at 41 persons for a single day when the winter crew moved onto the Gould and the newly arrive science group members took up residence on station. The first half of October was entirely RPSC support staff preparing the station for summer opening on 12 October. Science represented over a quarter of station personnel by mid month.

Below is a weather summary by Palmer Station Research Associate and principle weather observer, Christina Hammock.

OCTOBER WEATHER

Warmer than usual temperatures and no snowfall in the first half of the month caused all the accumulated snow to melt away. Temperatures cooled down to normal for the last half of the month and a few inches of snow accumulated on the occasional non-windy days. The last week was particularly windy with a maximum gust of 59 knots and maximum sustained winds of 46 knots.

The sea ice surrounding station broke up completely and blew out after the opening of a lead from the *R/V Laurence M. Gould's* mid-month arrival. Alternating days of brash ice pack and completely open water have occurred since, depending on prevailing wind direction.

The high temperature for October was 6.4 C on the 18th with a low of -10.6 C occurring on the 1st, resulting in an average temperature of -0.5 C; a full 5 C higher than the average of September. Palmer received 46.2 mm of melted and 14 cm of snow precipitation with a maximum snow depth at the beginning of the month at 62 cm.

The following projects were active at Palmer Station during the month of October.

B-013-P: LONG-TERM ECOLOGICAL RESEARCH ON THE ANTARCTIC MARINE ECOSYSTEM: AN ICE DOMINATED ENVIRONMENT (SEABIRD COMPONENT)

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

Personnel on station: Jennifer Blum, Kristen Gorman

A smooth crossing of the Drake Passage preceded a delay of one day at King George Island due to pack ice collected around COPA field camp. A successful put-in the next day sent us off to Palmer in a timely fashion, and we arrived on station on the evening of October 11th. Sea ice conditions proved minimal for the first couple of weeks after our arrival, although high winds and short influxes of brash ice kept us on station for a few days. We were able to collect Adelie penguin counts and conduct snow depth transects on all five colony islands: Torgersen, Humble, Litchfield, Cormorant, and Christine. Censuses of Blue-eyed Shags and marine mammals have also been obtained. In between our excursions into the field we unpacked and organized all of our gear and equipment; set up our lab and field notebooks; updated our data sheets and databases; and delved into our lab work by performing skua scat analysis.

The support from RPSC personnel thus far this season has been incredible. Ryan Wallace had 2 boats ready for us upon our arrival, and has been most accommodating with our boating requests. Tracey Baldwin had our lab well-organized for us and has been diligently keeping us updated with all of our cargo. Curt Smith and Jeff Otten have provided us with stellar computer support, assisting with programs and software and troubleshooting with us. Dave Zybowski promptly and enthusiastically assisted us with some small construction requests.

B-016-P AND B-032-P

LONG TERM ECOLOGICAL RESEARCH ON THE WESTERN ANTARCTIC PENINSULA - PHYTOPLANKTON ECOLOGY AND BIO-OPTICAL COMPONENTS

Dr. Maria Vernet, Principle Investigator, Scripps Institution of Oceanography (B-016-P)

Dr. Raymond Smith, Principle Investigator, University of California, Santa Barbara (B-032-P)

Personnel on station: Tristan Wohlford (016), Maria Vernet (016), Austen Thomas (032) and Katherine Haman (032) (Scripps Institution of Oceanography)

Personnel arrived on station on October 11th after a smooth and pleasant crossing. Ice left the harbor immediately after our arrival allowing for completion of boating one and boating two. For a week, the group was busy with unpacking, laboratory and zodiac setup and instrument testing.

The phytoplankton component collects samples of phytoplankton for estimation of biomass and carbon uptake rates, as designated by the Palmer Long Term Ecological Research program. The sampling includes filtration for particulate carbon and nitrogen, pigment analysis using high performance liquid chromatography, measurement of dissolved inorganic nutrients, and estimation of primary production by measurement of ^{14}C uptake using an on-deck incubator to simulate in situ conditions. Continuous, daily data is collected on photosynthetically available (PAR) and ultraviolet (UVR) radiation.

The bio-optical component of the LTER collects CTD (Conductivity and Temperature outfitted with a transmissometer and fluorometer) and PRR (Profiling Reflectance Radiometer) data in the water column at all sampling times as well as samples for discrete chlorophyll a levels by fluorometry.

Sampling of Palmer stations E & B occurred four times during the month of October, starting on the 17th. This is the most sampling ever done early in the growth season. High winds limited sampling at the more offshore station E. St B, off Bonaparte Point, was sampled on 17, 20, 23 and 27 October. Ice was also sampled off Gamage Point on the 26th. The phytoplankton in the water column has started to grow, increasing linearly in the two weeks of sampling. Primary production has increased by a factor of 5, from 136 to 569 $\text{mg C m}^{-2} \text{d}^{-1}$. Biomass has doubled from 20.7 to 51.96 mg chl a m^{-2} in the euphotic zone.

B-016 and B-032 would like to thank the FEMC crew, the IT department, The Palmer Lab staff, boating coordinator Ryan Wallace and carpenter David Zybowski for all their help in lab and boat setup, hardware maintenance and construction.

B-045-P

Palmer, Antarctica Long-Term Ecological Research Project: Long-Term Ecological Research on the Antarctic Marine Ecosystem: Climate Migration, Ecosystem Response and Teleconnections in an Ice-Dominated Environment: Microbial/Biogeochemistry Component

Hugh Ducklow, Principal Investigator, School of Marine Science, The College of William and Mary

Personnel on station: Hugh Ducklow, Kristen Myers

Our component of the Palmer LTER is concerned with specifying and understanding the annual cycle of bacteria in the nearshore zone at Palmer Station, as a means to achieve greater understanding of microbial dynamics and carbon cycling in the marine ecosystem of the West Antarctic Peninsula. Over the past five seasons, starting in January, 2002, we characterized the seasonal cycles and interannual variability of bacterial abundance, production rates and dissolved organic carbon (DOC) concentration at Stations B and E, in conjunction with related plankton sampling by B-016, 028 and 032. Now our attention shifts to investigating the mechanisms underlying the seasonal variability in more detail. This research will form the basis of Kristen Myers' PhD thesis. Kristen, a grad student at Wm & Mary-VIMS, is starting her fieldwork here at Palmer Station this season.

Our research now involves two main themes: observing bacterial community composition at Stations B and E; and conducting experiments in the lab to discover the factors that cause the bacterial species composition to change over a seasonal time scale. Community composition will be probed with genomic techniques including terminal restriction fragment length polymorphisms (TRFLP), gene sequencing and fluorescent in situ hybridization (FISH) to detect cells of selected target species. This work will be done in collaboration with Alison Murray (Desert Research Institute, NV), a member of Kristen's advisory committee.

We started the first big experiment November 1-2. 8 50-liter carboys (900 lbs) of surface seawater were collected at Station B using two Zodiacs and a peristaltic pump system. Duplicate carboys have been amended with nutrients (glucose, ammonium or the 2 together, and unamended controls). The carboys are incubating in the -1.5C cold room and various bacterial and genomic properties will be followed daily. The experiment will last 14 days, and will be repeated with new water 3 or 4 times between now and January 1. In this way we can follow the response of the ocean bacterial community to a controlled series of manipulations, as the community itself evolves between early spring and midsummer.

Thanks to many people for getting us off and running with a great early start: Capt. Marty Galster and his officers and crew got us here safe and on time. The Palmer winterover crew and early summer season arrivals equipped our lab and assembled field gear: especially Lab Manager Tracey Baldwin, Boating Coordinator Ryan Wallace and

Instrument Technician Ken Keenan. All our stuff was ready and waiting thanks to Logistics Team L members Cathy Borowsky and Bob Devalentino. Carpenter Dave Zybowski constructed several last-minute items for our lab and boat. Waste Supervisor/Skytrack Driver Tim Kramer helped Ryan land all our carboys. Thanks everybody! We look forward to a great season.

B-114-P: PALMER STATION, ANTARCTICA: DISTRIBUTION, PHYLOGENETIC AFFINITIES, AND ECOLOGY OF AMMONIUM-OXIDIZING BACTERIA IN THE PALMER LTER STUDY AREA.

Dr. James T. Hollibaugh, Principal Investigator, School of Marine Science, University of Georgia

Personnel on station: Nicole Middaugh

The goals of this project are to obtain more conclusive information concerning the species composition of Antarctic ammonium oxidizers, begin characterizing their physiology and ecology, and obtain cultures of the organisms for more detailed studies.

Personnel arrived on station October 12. A new project to Palmer Station this season, the beginning of the month was largely spent setting up water baths for temperature incubation experiments, readying the zodiac and equipment for sampling, and preparing reagents for analysis. An ice-free Arthur Harbor allowed for sampling at Station E in the Palmer boating vicinity earlier in the season than anticipated. The first water sample was collected October 23. Favorable weather and ice conditions have allowed consistent boating and sample collection after that date.

Ammonium oxidizing bacteria are most readily found in deeper part of the nearshore water column. This requires collecting water at 150m using 4, 5L Niskin Go Flo bottles. Consequently, large volumes of water, 20L, have been collected three times and brought back to the lab for processing and analysis. The water was processed to determine ammonium oxidation rates by incubation and enrichment of the water with various substrates. The samples are then measured for nitrite and ammonium concentration using a spectrophotometer and spectrofluorometer, respectively. DNA was collected from this water and from melted sea ice using Sterivex Millipore filter units. The samples were frozen and will be sent back to UGA for genomic analysis.

I would like to thank all RPSC personnel on station for their support this month, especially Tracey Baldwin, Ken Keenan, and Ryan Wallace for their tremendous efforts to help the project get up and running smoothly.

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G-052-P GPS CONTINUOUSLY OPERATING REFERENCE STATION.

Jerry Mullins, Principal Investigator, U.S. Geological Survey

The Research Associate operates and maintains on-site equipment for the project. Throughout the month, 15-second epoch interval GPS data files were collected continually at station PALM, compressed, and transmitted to the NASA/CDDIS in Reston, VA.

The system operated well throughout the month. Science group B-013-P was trained on new Trimble rover GPS system for use in the precise location of previously measured GPS latitude and longitude points. Group B-013-P tested the new system in a long range application using the repeater antenna and the system worked excellently with the base-station's RTK corrector transmissions. Reston GPS data was sent manually after PC restart was required for a Windows Update installation. A Real Time Kinetic GPS survey was conducted on the location of the BSI UV monitor and results were forwarded to UNAVCO for review.

Project inventory was organized and labeled.

G-090-P GLOBAL SEISMOGRAPH NETWORK (GSN) SITE AT PALMER STATION.

Rhett Butler, Principal Investigator, Incorporated Research Institutions for Seismology (IRIS)

The Research Associate operates and maintains on-site equipment for the project. Station PMSA is one of more than 130 sites in the GSN monitoring seismic waves produced by events worldwide. Data files are recorded to tape and also sent real-time to the U.S. Geological Survey (USGS).

The system operated well throughout the month. Mass positions were re-centered and bell jars were pumped down to train incoming Research Associate. Digital Processor was reset after finding it in unresponsive state. Situation was reported to projects. No data was reported lost.

O-202-P ANTARCTIC METEOROLOGICAL RESEARCH CENTER (AMRC) SATELLITE DATA INGESTOR.

Charles Stearns, Principal Investigator, University of Wisconsin

The Research Associate operates and maintains on-site equipment for the project. The AMRC SDI 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 system is running normally. Plans were made with project engineer to begin decoding Automatic Weather Station (AWS) data locally and in real-time using the Satellite Data Ingestor computer. PI was informed when AWS station on Bonaparte Point stopped transmitting data.

O-204-P A STUDY OF ATMOSPHERIC OXYGEN VARIABILITY IN RELATION TO ANNUAL TO DECADEAL VARIATIONS IN TERRESTRIAL AND MARINE ECOSYSTEMS.

Ralph Keeling, Principal Investigator, Scripps Institution of Oceanography

Air samples are collected on a semiweekly basis by the Station Physician.

The goal of this project is to resolve seasonal and interannual variations in atmospheric O₂ (detected through changes in O₂/N₂ ratio), which can aid in determining rates of marine biological productivity and ocean mixing. The results are also used to help determine the 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. Palmer Station is especially well situated for resolving signals of carbon cycling in the Southern Ocean. Samples taken from the station are sent to Scripps where the analysis of O₂ and CO₂ content takes place.

O-264-P COLLECTION OF ATMOSPHERIC AIR FOR THE NOAA\CMDL WORLDWIDE FLASK SAMPLING NETWORK.

David Hofmann, Principal Investigator, Climate Monitoring and Diagnostics Laboratory, National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA) Climate Monitoring and Diagnostics Laboratory continues its long-term measurements of carbon dioxide and other climate relevant atmospheric gases. The Palmer Station air samples are returned to the NOAA laboratory for analysis as part of NOAA's effort to determine and assess the long-term buildup of global pollutants in the atmosphere. Data from this experiment will be used in modeling studies to determine how the rate of change of these parameters affects climate. Air samples are collected on a weekly basis by the Station Physician.

A-306-P GLOBAL THUNDERSTORM ACTIVITY AND ITS EFFECTS ON THE RADIATION BELTS AND THE LOWER IONOSPHERE.

Umran Inan, Principal Investigator, Stanford University

Stanford University has been operating a Very Low Frequency (VLF) receiver antenna at Palmer Station since the 1970's. By receiving naturally and manmade signals between 1 and 40 kHz, the Stanford VLF group is able to study a wide variety of electromagnetic phenomenon in the ionosphere (uppermost layer of the atmosphere ionized by solar radiation) and magnetosphere (the area surrounding the earth dominated by the Earth's magnetic field and particles trapped by it. Many of these studies relate to the energetic releases associated with lightning. For example, Palmer Station's unique location enables it to pick up small bits of radiation from lightning strikes as far away as Africa, the USA, or the Pacific Ocean.

Extra recordings of Terrestrial Gamma-ray Flash (TGF) events were made during the month. A DVD burner failed on one VLF computer and was replaced. A VLF computer mouse and keyboard were added to an existing KVM switch to improve the experiment

user interface. Subsequent computer crashes were linked with a new device driver on the computer and the KVM switch was removed from the computer.

The VLF antenna cable was serviced due to early melting out of the guide poles on the lower portion of the glacier. Several prussic knots were also found to be frayed and broken and were replaced or rotated. Research into alternatives to normal cable ties for attaching the cable to the guide wire was conducted.

T-312-P TERASCAN SATELLITE IMAGING SYSTEM.

Dan Lubin, Principal Investigator, Scripps Institution of Oceanography

The Research Associate operates and maintains on-site equipment for the project. Throughout the month, the TeraScan system collected, archived, and processed DMSP, NOAA, and ORBVIEW-2 satellite telemetry, capturing approximately 25-30 passes per day. A weekly 85GHz SSM/I ice concentration image was produced and transferred to UCSB for B-032-P (Smith).

The system operated well throughout the month. A few passes failed to be captured during the month and the problem was fixed after rebooting the data acquisition computer twice. Multiple ice images were produced for operations and planning for the R/V Laurence M. Gould. Transfer of NOAA satellite images to SPAWAR for forecasting failed due to a password expiration on the remote FTP site. The problem was diagnosed and fixed. Email notification was implemented for failed FTPs in the future.

NASA Goddard Space Flight Center contact confirmed that they do wish to continue to receive archived SeaWiFS satellite passes.

A-357-P EXTENDING THE SOUTH AMERICAN MERIDIONAL B-FIELD ARRAY (SAMBA) TO AURORAL LATITUDES IN ANTARCTICA

Eftyhia Zesta, Principal Investigator, University of California Los Angeles

The three-axis fluxgate magnetometer is one in a chain of longitudinal, ground-based magnetometers extending down through South America and into Antarctica. The primary scientific goals are the study of ULF (Ultra Low Frequency) waves and the remote sensing of mass density in the inner magnetosphere during geomagnetically active periods. 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. The station Research Associate maintains the on-site system.

The system performed flawlessly throughout the month. Plans for removal of the magnetometer for inspection and reinstallation with a Styrofoam base were reviewed with the project PI.

B-390-P: THERMO-SALINOGRAPH

Vernon Asper, Principal Investigator, University of Southern Mississippi

Sea water is pumped continuously through a thermosalinograph (TSG) sampling system, recording the temperature, conductivity, salinity, and fluorescence. The real-time data, including graphs and web camera images of the ocean in the vicinity of Palmer Station, are compiled by a local server into web page format and relayed to a mirror site at Woods Hole Oceanographic Institute, which is a collaborator in the project. The URL for the WHOI mirror site is <http://4dgeo.who.edu/tsg/>.

The system has operated well throughout the month. A cleaning of the entire system tubes and fluorometer was conducted and flow was adjusted afterwards to return measured values to their normal range. Issues with data availability on the remote TSG website were reported to PI. Plans to test an increase in the update rate of the project webcam were completed. Data disturbances due to sea water intake maintenance were reported to PI.

T-513-P ULTRAVIOLET SPECTRORADIOMETER NETWORK

Charles Booth, Principal Investigator, Biospherical Instruments, Inc

The Research Associate operates and maintains on-site equipment for the project. A 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, while the sun is above the horizon. A BSI GUV-511 filter radiometer, which has four channels in the UV and one channel in the visible for measuring Photosynthetically Active Radiation (PAR), is located next to the SUV-100. Data from the GUV-511 instrument is made available on a daily basis on the project's website at <http://www.biospherical.com/nsf>.

The UV monitor performed normally throughout the month. A persistent GPS error was reported to PI and resolved. Thorough inspection and photography of the instrument circuitry revealed that the instrument was indeed on a separate circuit from instrument peripherals at the request of PI. Project SOP was forwarded to project engineer for review.

T-998-P: IMS RADIONUCLIDE MONITORING

Michael Pickering, Principal Investigator, General Dynamics

The International Monitoring System (IMS) radionuclide sampler is part of the Comprehensive Test Ban Treaty (CTBT) verification regime. The automated Radionuclide Aerosol Sampler and Analyzer (RASA) unit pumps air continuously through a filter for 24 hour periods, collecting particulates in the .2-10 micron range. The filter is then tested for particulates with radioisotope signatures indicative of a nuclear weapons test. The station Research Associate operates and maintains the instrument.

The system operated through the month without incident. Filter samples were prepared and shipped to the CTBT for archival. Shipping details for commercial shipment of samples from Punta Arenas, Chile to Vienna, Austria were forwarded to project data analyst. Procedure for frequency of filter sample shipment was clarified with project data analyst.

Digital Processor on USGS Seismic Station, which provides seismic data to the CTBT, was reset after finding it in unresponsive state. Situation was reported to projects. No data was reported lost.

TIDE GAGE

The Research Associate operates and maintains on-site equipment for the project. Tide height, seawater temperature, and salinity are monitored on a continual basis by a gage mounted at the Palmer Station pier.

The tide gauge operated fine throughout the month.

METEOROLOGY

The Research Associate acts as chief weather observer, and compiles and distributes meteorological data. At the end of the month a summary report is prepared and sent to interested parties. 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 six hours by the Palmer Meteorological Observing System (PalMOS) and emailed to the NOAA for entry into the Global Telecommunications System (GTS).

Isobaric charts were sent to R/V Laurence M. Gould in support of the current cruise.

The barometer in the PalMOS system was replaced with a recently calibrated barometer. The desiccant and battery in the PalMOS system were replaced. A backup anemometer for the PalMOS system was received. Anomalous visibility sensor values were investigated to insure that values were not affecting synoptic message data.

The current weather display macro was restarted after automatic daylight savings time update caused it to stop updating. A new email address for weather synoptic distribution was tested and implemented at the request of NOAA. The Antarctic Meteorological Research Center was contacted to diagnose problem with IT isobar animation update.

Project B-016 (Vernet) was assisted with request for cumulative and current weather data. For the use of all grantees on station, the folders "Weather Information" and "Tide Information" were updated on the common drive to include all data up to the present.

The sending of weekly weather data summary for Antarctic Sun was coordinated and resumed. Winter weather statistics were also compiled for the Antarctic Sun.

The Automatic Weather System on Bonaparte Point failed near the end of the month. Plans to attempt to fix the station have been made and all interested parties have been notified.

