

Agency Collaboration for Arctic Research By Wanda Ferrell

Given the importance of interactions between the atmosphere-ocean system, the North Slope of Alaska has become a focal point for atmospheric and ecological research activity among many scientific organizations and agencies. One such ongoing, and somewhat unprecedented, collaboration is data sharing between the U.S. Department of Energy and NOAA. Each agency supports a long-term observatory in Barrow.

New Observations from the Arctic

Because of its proximity to the Arctic Ocean and nearby lagoons and lakes, combined with prevailing winds off the Beaufort Sea, Barrow can be characterized as having an Arctic maritime climate affected by variations of weather and sea ice conditions. In 1997, the DOE's Atmospheric Radiation Measurement (ARM) Program began operating a heavily instrumented observation site primarily within the domain of NOAA's existing Barrow Environmental Observatory, established in the mid-1970s. The original collection of ARM radiometric and remote-sensing instrumentation was designed to measure downwelling and upwelling radiant energy flows and to characterize the atmospheric column over the site. Much of the remote-sensing instrumentation was originally developed by NOAA for use by the National Weather Service.



The ARM site in Barrow as of 2011, after enhancements and upgrades from the American Recovery and Reinvestment Act.

Around the same time, ARM funded NOAA to process data from their aerosol measurement suite at the Barrow Observatory. Continuous measurements from the NOAA aerosol suite enable calculation of direct aerosol climate forcing from the following values: light absorption, total scattering and backscattering, and hygroscopic growth. Combined with continuous measurements of clouds, aerosol, radiation and atmospheric state from the ARM site, these long-term, comprehensive data are stored in the ARM Data Archive and freely accessible to anyone (www.arm.gov/data).

Because of the utility of these measurements, ARM used the design of NOAA's aerosol measurement suite to establish similar systems for its research sites at the Southern Great Plains in Oklahoma and one of its mobile facilities. ARM continues to support NOAA researchers who maintain these measurement suites and host these data as an important contribution to the Arctic climate data set.
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New Climate Observations and Infrastructure at Oliktok Point By Lynne Roeder

There is scientific consensus that clouds and aerosols—particles suspended in the atmosphere and often emitted by anthropogenic activities—represent the largest source of uncertainty in climate models. New studies have shown that the Arctic is especially vulnerable to the presence of these constituents in the atmosphere; clouds, often modified by aerosols, induce large volumes of ice melting during the summer. A science-based understanding of the impacts of aerosols and cloud formation in the Arctic is thus critical.



A scenic ocean view from Oliktok Point.

However, the primary factors limiting research in the high Arctic are the lack of access to well-equipped, modern research infrastructure, particularly from the ground. This is because in the Arctic, remote sensing technologies have trouble differentiating between aerosols, low-hanging clouds and “ice fog”—fine ice crystals suspended in the air.

To address these and other similar challenges, the U.S. Department of Energy has operated a heavily instrumented climate observation site in Barrow since 1997 as part of the Atmospheric Radiation Measurement (ARM) Climate Research Facility. Led by a team from Sandia National Laboratories, ARM climate observations on the North Slope of Alaska will soon include continuous measurements from Oliktok Point using a new ARM Mobile Facility.

Beginning in August, the ARM North Slope team will install and begin operating ARM's third mobile facility, or the AMF3, at Oliktok Point, about 30 miles west of Prudhoe Bay. The AMF3 will provide detailed and unprecedented measurements of clouds, aerosols, and other atmospheric parameters essential to understanding the role of Arctic clouds in climate processes and necessary for improving Arctic atmospheric models.

This site will also support operations of unmanned aerial systems (UAS) and tethered balloons, significantly extending the measurements needed to understand and model clouds, aerosols, and radiative transfer processes in the Arctic. Scientific interest in this area is keen, and initial research activities are already underway at Oliktok Point. In mid-July, UAS flights began for the [Marginal Ice Zone Observations and Processes Experiment, or MIZOPEX](#).

Scientists and engineers from the University of Colorado, the University of Alaska Fairbanks, and NASA-Ames flew several different UAS to characterize the ocean surface, sea ice, and atmosphere at the southern edges of the Arctic sea ice, also known as the critical Marginal Ice Zone (MIZ). Along this coastline, the seasonal land-fast ice melts away from the shores of the North Slope of Alaska and the MIZ moves northward.

Based out of the Long Range Radar Station at Oliktok Point, flight operations for MIZOPEX lasted about three weeks. Flights began in Restricted Area R-2204, a restricted flight area 4 miles in diameter and centered at Oliktok Point. The flight paths extended northward through an Altitude Reservation corridor to international airspace. During this campaign, members of the ARM North Slope of Alaska team from Sandia National Laboratories operated Restricted Area R-2204 on behalf of the DOE Office of Science, which is granted FAA access for atmospheric research purposes.

IASOA Observations

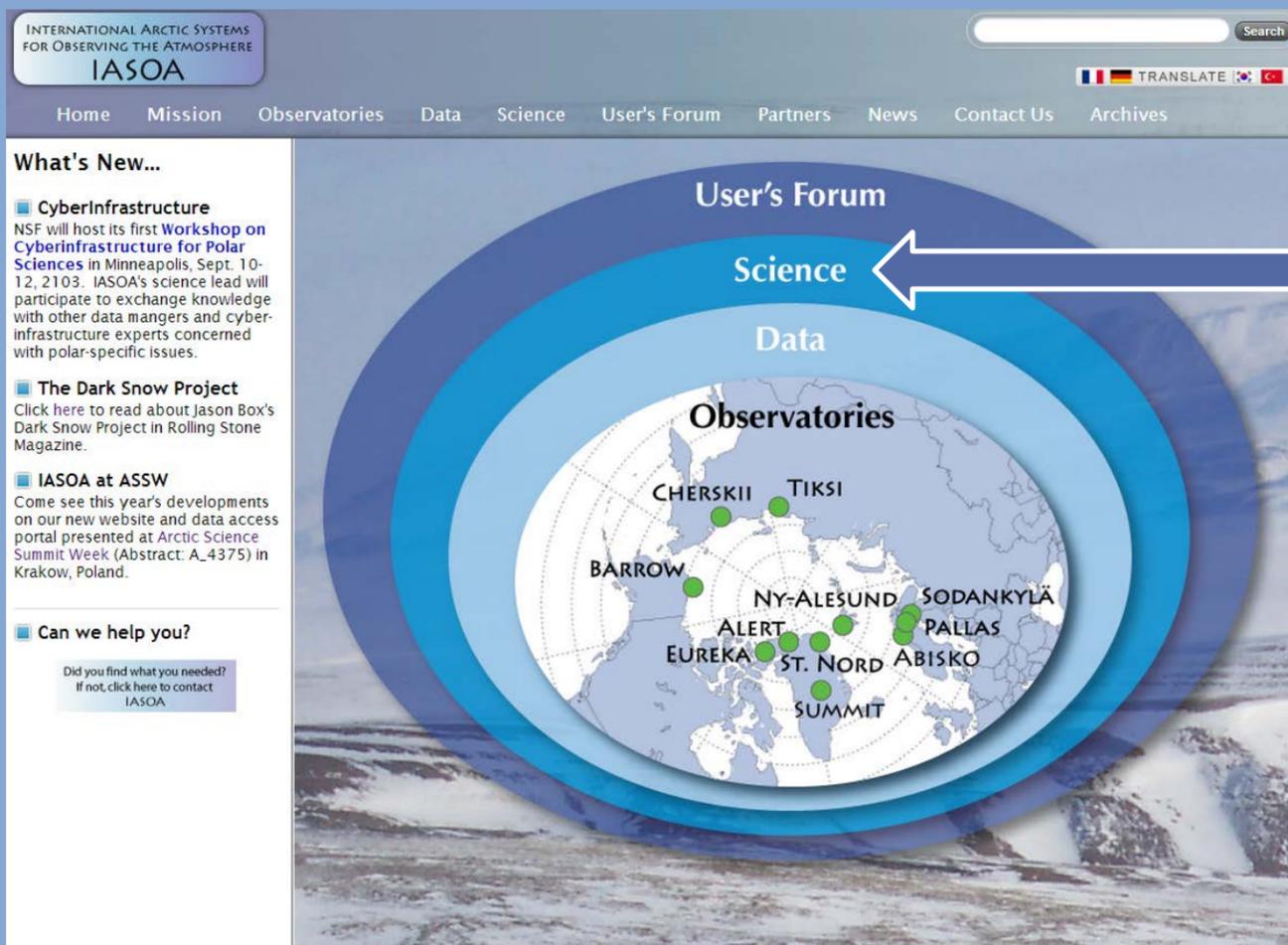
Summer-Fall 2013 issue

IASOA's New Data Access Portal – Demonstration Link Now Available

By Sandy Starkweather

Visit: <http://www.esrl.noaa.gov/psd/iasoa/>

Have you ever discovered a new data set through a data portal only to struggle to find links to the actual data? Have you ever downloaded an undocumented data file only to scratch your head at lists of numbers without labels or units? We listened closely to frustrations like these from our scientists as we re-designed our IASOA data access portal and we hope you are pleased with the results. The latest version of our website (Figure 1) features a focus on science topics as well as a [further-expanded data portal](#) that continues to enhance expedited access to data across the IASOA network. The most active science working groups are tackling radiation and black carbon issues under the leadership of Von Walden at the University of Idaho and Sangeeta Sharma with Environment Canada respectively. Other science working groups will be developed within the year to address pan-Arctic concentrations of gases, atmosphere-surface exchanges and Arctic regional prediction.



We have initiated two science working groups: Black Carbon and Net Radiation. Explore our developing Science pages to learn more about their activities and our vision for future working groups.

Figure 1. The IASOA website was designed to reflect and support our mission: (1) strategically developing comprehensive observational capacity, (2) facilitating data access and usability through a single gateway, and (3) mobilizing contributions to synergistic science and socially-relevant user services derived from IASOA assets and expertise.

The IASOA data portal is making innovative use of the ISO-19115-2 metadata standard as the basis for a dynamic database that updates automatically. Our goal is to harvest existing metadata in a non-duplicating manner, allowing us to effectively crowd-source the metadata collection activity. But crowd sourcing takes considerable coordination! IASOA has coordinated the implementation of this standard with GAW SIS, DOE-ARM, CANDAC, FMI, ACADIS and more to ingest interoperable metadata for more than 1200 parameters in 600 data sets from 18 archives. Our data set offerings will continue to expand as we bring more archives into the process. For details, visit <http://www.esrl.noaa.gov/psd/iasoa/contribute>

This month the DOE-ARM Data Archive delivered 147 new metadata records for inclusion in the portal. DOE-ARM data sets from the North Slope of Alaska sites include cloud physics, radiation, atmospheric state and aerosol measurements. The DOE-ARM Data Archive contributions provide an important addition to the IASOA data access portal and serve as a valuable proof-of-concept for the crowd source approach. ARM archivist, Giri Palanisamy, followed our ISO-19115-2 template for structured metadata and made many wonderful suggestions for its improvement. This winter, we aim to host our first IASOA Data Managers meeting to further develop our collaborative metadata authoring endeavor.

Station Updates

Eureka, Nunavut

Eureka's Polar Environment Atmospheric Research Laboratory in Nunavut has been awarded a grant through CANDAC to sustain core operations. Click [here](#) to learn about sustained operations moving forward. The station needs \$1.5 million to operate continuously. Lead Investigator Drummond says the new grant is not enough to keep an operator at the site year-round, but that his team is working to automate some of the instruments.

Summit, Greenland

IASOA's newly inaugurated [Net Radiation working group](#) realized rapid results at Summit, Greenland this August within 3 months of forming. In assessing the inventory of high quality radiometric data sets at IASOA stations, it was recognized that the BSRN-candidate suite of instruments installed in 2000 and since maintained by National Science Foundation's AON-PI Konrad Steffen would benefit greatly from a side-by-side calibration with fresh radiometers from NOAA-ESRL. This approach allows the long-term data set to proceed un-interrupted while benefiting from in-situ fitness testing.

NOAA-ESRL's Rob Albee deployed to Summit in record time with freshly calibrated radiometers and an innovative custom mounting rack designed by Bob Stone (Photo credit: Rob Albee). At Summit, he met AON-PI Von Walden who was checking in on the ICECAPS project - ICECAPS funding has been renewed for another 5 years of extremely valuable cloud, atmosphere and radiation measurements.



Ny-Alesund, Svalbard & the Mirai (Central Arctic Ocean)

This September, researchers from Japan, Germany, the U.S. and Russia will collaborate on the ARCROSE experiment to advance Arctic regional prediction. Read more about this project at: <http://www.esrl.noaa.gov/psd/iasoa/node/123>

Pallas-Sodankyla, Finland



Sammaltunturi monitoring station at Pallas within a cloud during PaCE-IV in October 2012 (Photo: David Brus, FMI).

Pallas investigators are now in the preparation phase for the fifth Pallas Cloud Experiment (PaCE) campaign. Last year's PaCE IV, conducted at Finnish Meteorological Institute's Pallas-Sodankylä Global Atmosphere Watch (GAW) station, was very successful [1]. The wide range of available instrumentation will again allow the team to investigate in depth the physico-chemical properties of aerosol, cloud droplet activation and hygroscopicity of aerosol particles and also directly the cloud particle phase.

[1] D. Brus, K. Neitola, E. Asmi, M. Aurela, U. Makkonen, J. Svensson, A.-P. Hyvärinen, A. Hirsikko, H. Hakola, R. Hillamo, and H. Lihavainen: Pallas cloud experiment, PaCE 2012, 19th International Conference: NUCLEATION AND ATMOSPHERIC AEROSOLS, 23-28 June 2013, Fort Collins, Colorado, USA, AIP Conf. Proc. 1527, pp. 964-967; doi:

<http://dx.doi.org/10.1063/1.4803433>

Tiksi, Russia

In July, scientists from the Finnish Meteorological Institute visited Tiksi to install an exceptional array of instrumentation at the Clean Air Facility. What follows are excerpts from their trip report. By Tuomas Laurilla, FMI

"The new equipment may be grouped to aerosol, weather, greenhouse gas and soil-radiation sensors. Aerosol and greenhouse gas analyzers were installed in the racks." (Photo: FMI's aerosol rack at Tiksi)

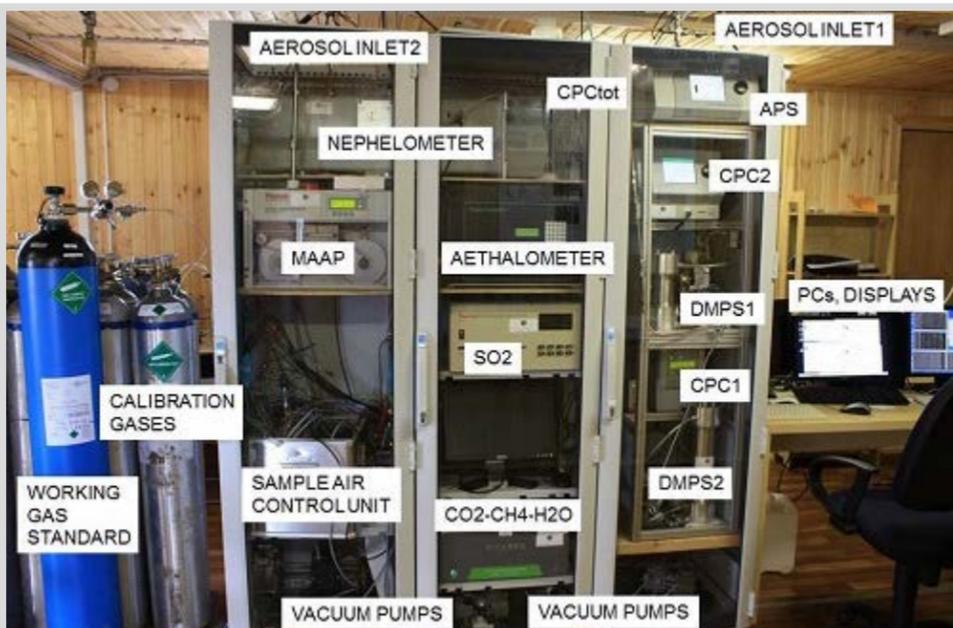
Some instrumentation highlights:

Aerosols: Installation of new instruments: MAAP, Nephelometer, Ultrafine CPC 3776, SO₂ monitor

Meteorology: Visibility and present weather sensor Vaisala FD12P was installed on the roof of the CAF.

Surface Flux: A new albedo rack on the dry, rather bare soil was installed.

There are global and reflected radiation components by Kipp&Zonen, CMP11 and Photosynthetically active radiation. Soil temperature and moisture profile is measured down to 50cm.



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Also in 1997, an intensive observational effort called the Surface Heat Budget of the Arctic, or SHEBA, placed the Canadian icebreaker DesGroseilliers in the Arctic ice pack 570 kilometers northeast of Prudhoe Bay, Alaska. For a year, a comprehensive suite of atmospheric, ocean, and ice sensors operated on the ship and surrounding ice floe. As a part of SHEBA, ARM deployed about two dozen instruments and also operated a lidar and millimeter cloud radar built by NOAA's Earth Systems Research Lab. Subsequently, ARM collaborated with NOAA to build similar cloud radars for its climate research sites in Barrow, the U.S. Southern Great Plains and the Tropical Western Pacific.

Scientists used the combined DOE/NOAA data sets from SHEBA in developing year-long retrievals of cloud properties, including crystal/droplet sizes, optical depths, water contents, and cloud boundaries through the depth of the troposphere. With the coming twentieth anniversary of SHEBA, scientists are exploring collaborations to return to the Arctic ice pack. Shortly after SHEBA, NOAA deployed a climate monitoring site in Eureka, Canada, as part of the Study of Environmental Arctic Change (SEARCH) Program. The intent was to duplicate the ARM Barrow site, as nearly as possible, in instruments, data streams, and data formats, thus providing similar robust measurements from another Arctic location. Due to the expected similarity of the ARM and SEARCH data sets, NOAA colleagues proposed to deliver ARM-like data streams from the Eureka site to the ARM Data Archive. Initial development efforts between NOAA and ARM focused on "raw-file" compatibility with existing ARM data to ensure a clean data ingest format and quality assurance. With that hurdle crossed, SEARCH data from the Eureka site began flowing to ARM's comprehensive Data Archive in 2005.

IASOA's Data Portal

With better and higher resolution tools for monitoring climate change in the Arctic, researchers need additional routes for accessing large, Arctic data sets. As described in the last newsletter, a new IASOA Data Access Portal will provide a succinct and informative snapshot of cross-site Arctic data inventories, as well as expedited access and advanced documentation for more than one thousand data sets.

In anticipation of this new portal, NOAA and ARM are once again working to identify interoperable and relevant data among ARM data set for access through this portal. To publish ARM data on the IASOA, ARM is providing science metadata records for NSA and SHEBA datastreams using the ISO 19115 metadata standard. The IASOA metadata harvesting tool will then access and add the records to the IASOA index. Users of IASOA will be able to search and discover the ARM metadata records, including the forthcoming data from Oliktok, using various keywords. The DOE-ARM goal for users is a seamless transition from IASOA to the ARM data ordering tool to download the ARM data.

IASOA's New Data Access Portal – Demonstration Link Now Available

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ARM Cimel Sunphotometer (CSPHOT): principal planes data at North Slope Alaska , Barrow Facility		
Measurements in this dataset: Shortwave narrowband radiance	Take me to the data Date Range: 1997-07-30 to Current Data Contact: Laurie Gregory laurie.gregory@bnl.gov Abstract Format Info Full Metadata Record	
ARM G-band (183 GHz) Vapor Radiometer at North Slope Alaska , Barrow Facility		
Measurements in this dataset: Microwave narrowband brightness temperature	Take me to the data Date Range: 2006-09-28 to Current Data Contact: See Full Record Abstract Format Info Full Metadata Record	

Figure 2. Example search results from IASOA's Data-at-a-Glance lead users to a list of standardized data documentation, including expedited access to the original data sets, information on file formats and data processing. This example shows two of the new additions to our metadata collection from the DOE-ARM Data Archive.

We encourage users to test [IASOA's data portal](#) and provide feedback for ongoing improvements for rapid data access. For live demonstrations, look for an announcement on the APECS webinar list this fall and for our presentations at the AGU fall meeting. User feedback is extremely important to us.

Special thanks to our summer students for their contributions: Alex Curtiss and Christopher Chen. Good luck with your studies.