

Report on CANDAC Activities at Eureka, Nunavut during 2011
submitted to
The Nunavut Research Institute

Prepared by:
Pierre F. Fogal, Ph.D.
PEARL Site Manager
and
Lisa M. LeBlanc, M.Sc.
CANDAC Network Manager

University of Toronto
Department of Physics
60 St. George Street
Toronto, ON
M5S 1A7

on behalf of:
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Executive Summary

In 2011, the Canadian Network for Detection of Atmospheric Change (CANDAC) continued operations at the Polar Environment Atmospheric Research Laboratory (PEARL) located near the Environment Canada (EC) weather station at Eureka, on Ellesmere Island, Nunavut. With the ending of much of our research funding, this year was rather quiet, with more emphasis put on routine data acquisition than on initiating new programs. Effort has also been put on ensuring that as much of our data as possible is put into national and international data catalogues. Metadata from our instruments have been submitted to the Canadian Polar Data Catalogue. As has become an annual occurrence, the Polar Sunrise campaign was run in combination with the ACE satellite validation campaign in late winter-early spring. This year we noted an extremely low amount of ozone with the return of the sun – the lowest amount recorded in the Arctic – and have responded to numerous media inquiries regarding this.

In addition to our three regular operators, we had 20 visitors to the laboratory, 10 of them students (See Appendix A.). While our financial situation inhibits our ability to initiate new instrumentation and research programs, we continue to publish research papers in peer-reviewed journals and to make numerous presentations at national and international conferences. We also participate in various national and international workshops. (See Appendix B.)

We continue to refine the resources for teachers on our website (<http://www.candac.ca>) and, in late Spring, launched a new outreach project called Student-Researchers Atmospheric Collaboration at Qarmartalik School in Resolute Bay, Nunavut and Pickering College in Newmarket, Ontario. Similar to CANDAC scientists, students monitored the atmosphere using a variety of scientific instruments for several months, and then shared and compared their data to make meaningful analyses. We plan to repeat this project with new schools, but how many schools and their locations will depend on available funding. We continue to publish our newsletter when time allows to showcase our research to an extended community.

Introduction

At the end of 2008, the Canadian Network for Detection of Atmospheric Change (CANDAC) was pleased to report that all of the CANDAC installed instruments were operational. This year was one of status-quo and maintenance as lack of financial resources has prevented us from expansion or significant upgrades to our instrument suite. This year also saw continued problems with two of our lidar instruments and on-going attempts to fix them. The first is the legacy Ozone DIAL located at the PEARL Ridge Lab that dates back to the opening of the original Arctic Stratospheric Ozone Observatory and the second is the Arctic High Spectral Resolution Lidar (AHSRL) operated by CANDAC on behalf of the American National Oceanic and Atmospheric Administration (NOAA). As of the writing of this report, we do still expect that the AHSRL will return to Eureka, pending the completion of its re-fit and stabilization of funding for PEARL.

We continue to provide metadata of results from PEARL as well as data to the Polar Data Catalogue. We also provide a link to our publications database on our webpage. We have continued to publish a non-technical newsletter showcasing various research and results from the Network.

Within the purview of our Outreach Program, we initiated a new outreach project called Student-Researchers Atmospheric Collaboration. This project took place jointly at Qarmartalik School in Resolute Bay, Nunavut and Pickering College in Newmarket, Ontario. The two sets of students acquired and shared their data. We also took advantage of several opportunities to educate southern students about the work being done at Eureka.

New Instrument Installations

Ridge Laboratory

There were no new instrument installations at the Ridge Laboratory during this time period.

ØPAL Laboratory

There were no new instrument installations at the ØPAL Laboratory during this time period.

SAFIRE Laboratory

There were no new instrument installations at SAFIRE during 2011.

On-going Research

The Canadian Arctic ACE Validation Campaign 2011 took place from February 20 to April 6 at PEARL. A team of researchers from the University of Toronto, Environment Canada and CANDAC collected atmospheric composition measurements using a suite of 11 instruments, some of which are permanently installed on-site and some which were brought in for the campaign. These observations will be used to verify results obtained by a Canadian scientific satellite mission, the Atmospheric Chemistry Experiment (ACE). The measurements are made at polar sunrise: when sunlight returns to Eureka and which is the period when ozone depletion processes are occurring. This is the eighth consecutive year that the ACE team has conducted their campaign at PEARL.

As mentioned above, due to reduced financial resources, our research has been more in the nature of basic monitoring than in initiating anything new. We have continued to make routine observations. However, we have been able to make some modest expansions through collaborations with other research groups, such as the astronomy group interested in establishing a telescope at Eureka.

For the most part, all our instruments have been working as expected and the results are being reported in the scientific literature as well as being presented at various national and international conferences and workshops.

Outreach Activities

As they do every year, our researchers participated in a number of outreach activities in Nunavut and southern Canada. In April/May, four CANDAC members (two graduate students, one undergraduate student and the outreach coordinator) visited Qarmartalik School in Resolute Bay to establish the instruments required for the Student-Researchers Atmospheric Collaboration. Students were trained in the use of the instruments and the acquisition of data.

In addition to organizing school visits, the CANDAC outreach coordinator has developed practical lesson plans and activities that Canadian teachers can easily incorporate into their regular science curriculum (grade 1-12). These lesson plans consider current science expectations by province and territory, and then incorporate Arctic atmospheric research in interesting and meaningful ways. They include topics such as ozone depletion, climate change, air pollution, and weather. Lesson plans and classroom activities have been made available on our website as part of the IPY legacy project.

In May, we hosted a CANDAC booth at the Toronto-wide science outreach initiative, Science Rendezvous held at the University of Toronto. The booth featured CANDAC and PEARL posters, brochures, and stickers. CANDAC researchers demonstrated clouds in a jar, conducted spectroscopy and Cartesian diver building workshops, and displayed Arctic outdoor gear.

We have continued with our newsletter, bringing what we do to a wider audience.

Our regularly maintained web-site is at <http://www.candac.ca>.

Summary of Plans for 2012

At this point, we are making two sets of plans; one set for continued operations and a set of contingency plans to close the facility. At the time of writing this report, continued funding for the PEARL facility remains unclear. With the end of International Polar Year in early 2009, IPY funding ceased and several other sources, such as the Canadian Foundation for Climate and Atmospheric Science (CFCAS), will no longer have funds after March 2012. At present Canada has no regular funding source for maintenance of a facility of this nature outside of a government department.

CANDAC continues to work hard to put together a funding package for the time period beyond 2012. As part of an ongoing effort to continue Arctic Research, the researchers of CANDAC and PEARL are participating in a proposal for a Network of Centres of Excellence (NCE) under the title of the Canadian Advanced Polar Science Network (CAPSNet).

CAPSNet will provide an umbrella for much of the research at PEARL. The CAPSNet vision is: *“The Canadian Advanced Polar Science Network (CAPSNet) will focus attention on the state of the Canadian High Arctic and particularly on the entire Polar year including the Polar night. Canada’s new challenges require a more comprehensive all-year view of the High Arctic, not a seasonal one. Key objectives and facilities have been identified that produce the solutions needed to problems that we are facing today as well as having implications for future needs.”* CAPSNet research is divided into five themes: Arctic Processes concentrates on the state of the Arctic now and on developing our predictive capabilities. Arctic Interfaces looks at smaller scales at how the disparate regions of ice, snow, water, land and air interact with each other. Arctic Connections is concerned with the influence that the Arctic has on the rest of the globe and vice versa. The Arctic Night theme focuses attention on the time when the sun has set. Wrapping around these four themes is the fifth theme of Communication, Collaboration and Communities that is set up to manage the many facets of the interaction between these research efforts and the world. In addition to these five themes, four core assets are defined: PEARL, MARS (the McGill Arctic Research Station on Axel Heiberg Island), aircraft and a lidar terrain mapper.

The proposal has been submitted and it is expected that a decision on funding will be made before the end of calendar 2011. In the time period between now and the possible commencement of subsequent funding, PEARL operations will be somewhat decreased and focused on the operation and support of the more automated instruments and for the first time since our inception may include a time period during which no CANDAC personnel are on site at Eureka. We expect to ramp up to full operation for the 2012 sunrise campaign.

Should we fail to garner additional funding, then we will need to remove the instrumentation and begin the close up of PEARL facilities for which we retain responsibility. The earliest that this might occur is the late spring of 2012. The process will begin with the removal of instruments where economical and would include substantial discussion with our partners at Environment Canada to determine the fate of various CANDAC site assets at Eureka. Removal of these instruments will incur significant cost and seriously diminish our ability to perform long-term atmospheric measurements in the High Arctic for many years to come.

The ACE team plans to return to PEARL for the ninth Canadian Arctic ACE Validation Campaign in early 2012. The time period will be very similar as in previous years and we will be continuing to validate the ACE results during polar sunrise.

This represents the sum total of CANDAC planning at this time. Assuming the CAPSNet funding goes forward, we will be inviting proposals for research based out of Eureka and PEARL but do not expect much new activity until late 2012 or early 2013. In general, assuming we are able to operate in 2012, operations will be routine in nature, with an emphasis on servicing the backlog of upgrades or repairs to instruments deferred during a year of reduced effort.

Again, assuming funding exists, CANDAC will continue our outreach effort in the form of contact with Nunavut communities principally through school visits. We also hope to be visiting several schools in the south to provide some education to those students about the Arctic and the importance of

the work we do there.

Concluding Remarks

As was to be expected, 2011 has been a rather quiet and routine year for both CANDAC and PEARL, during which we continued to improve and stabilize our operations at Eureka. At this point, we are well equipped to support both our own research and other research that might benefit from our facilities. Research results are making their way into the scientific world and are contributing to a greatly improved understanding of the Arctic atmosphere. Our Outreach efforts continue to educate future generations of Canadians. We are determined to continue our small part in asserting that the Arctic is an important part of Canada through our presence, our research, and through education. The CANDAC team is working hard to ensure a continuation of these efforts in the future.