

International Arctic Systems for Observing the Atmosphere: Challenges for a NOAA Climate Service

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INTERNATIONAL ARCTIC SYSTEMS FOR OBSERVING THE ATMOSPHERE (IASOA): AN OVERVIEW OF INTERNATIONAL POLAR YEAR ACTIVITIES

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The IASOA Concept

There is an emphasis on **HOW** the climate is changing

- Long term monitoring
- International programs (GAW, AMAP, BSRN etc.)
- Quality Control
- Satellite validation

BUT

Also need an emphasis on **WHY** the climate is changing

- Process Studies
- Research Grade Observations
- Model Support

ALSO

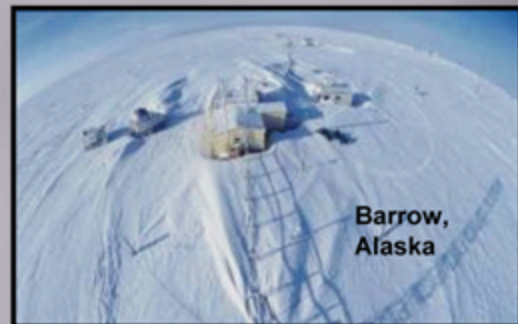
Need to respond to the **NOW** issues

- Sudden events

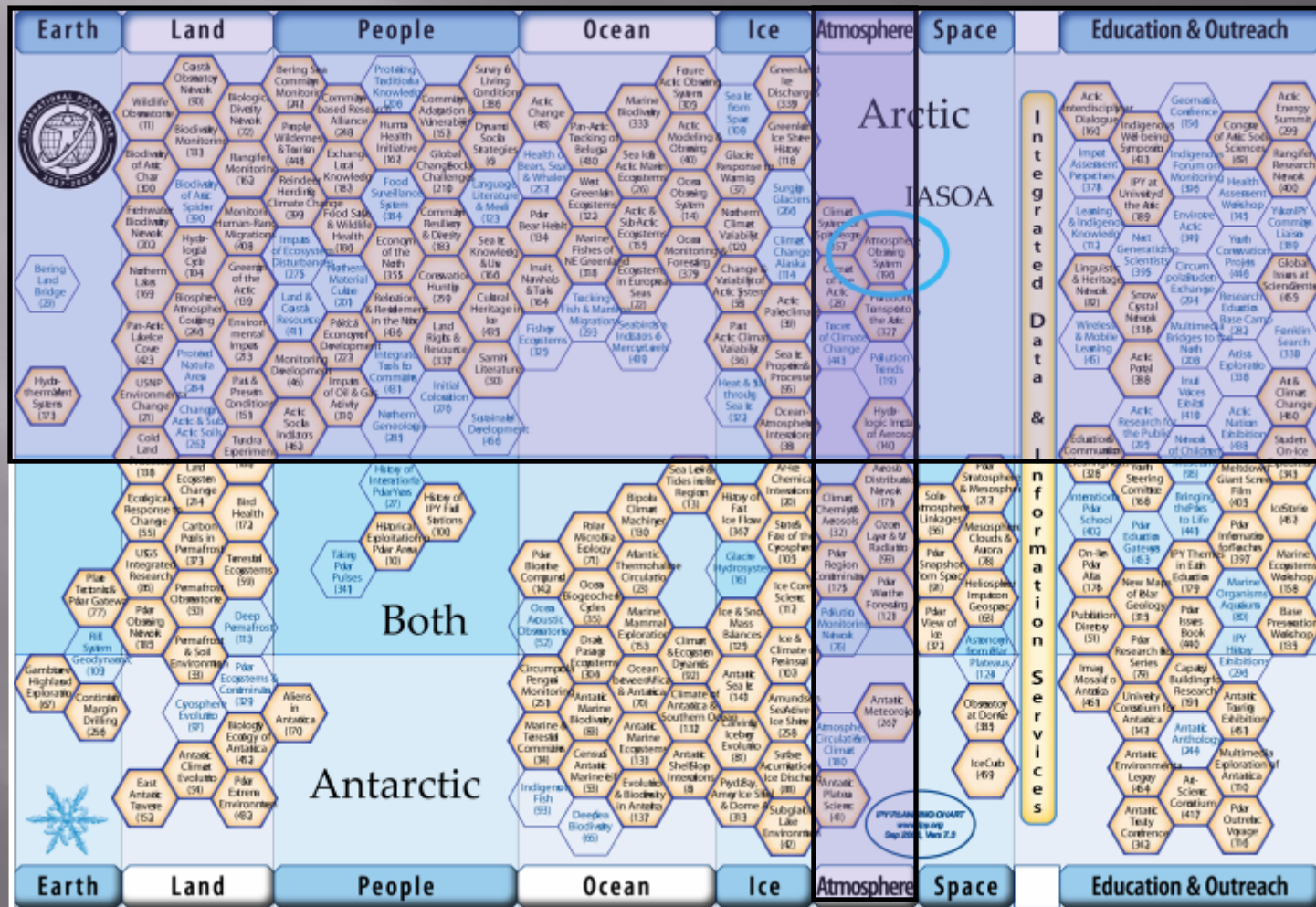
What is the “International Arctic Systems for Observing the Atmosphere” - IASOA? A consortium of long-term, permanent, year round Arctic observatories

- Each observatory is autonomous
 - Separate funding
 - Separate science objectives
 - Separate management
 - Unique circumstances
 - The operation of each observatory is a daily challenge
- IASOA’s goal: Promote and facilitate pan-Arctic atmospheric research

IASOA Observatories



IPY Activities - IASOA is one of the few atmospheric Arctic activities



IASOA web site: www.iasoa.org

INTERNATIONAL ARCTIC SYSTEMS
FOR OBSERVING THE ATMOSPHERE
IASOA

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Historical Tiksi Data
[Meteorological data from Tiksi \(1932 - 2006\) has been digitized and posted online.](#)

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Can we help you?

INTERNATIONAL ARCTIC SYSTEMS FOR OBSERVING THE ATMOSPHERE

WELCOME!



IASOA web site: www.iasoa.org

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Can we help you?

Summit, Greenland

Summit, Greenland

Greenland Environmental Observatory at Summit (GEOSummit)

Governing Institutions: U.S. [National Science Foundation](#) and the Danish Commission for Scientific Research in Greenland

Location: 72.580 N, 38.48 W, 3238 m asl (10623.4 ft asl)


Primary station contact: John Burkhart (jfb@nilu.no)

Main web site: <http://www.geosummit.org/>

Informational and data web links are below the Table of Measurements

Table of Measurements

Greenland Environmental Observatory (GEOSummit) Summit, Greenland	
Measurement category	PIs/Organization
Meteorology - surface	B. Vazel (NOAA); K. Steffen (Univ. of Colorado)
Meteorology - upper air	B. Vazel (NOAA)
Ozone - surface	E. Oltman (NOAA); B. Johnson (NOAA)
Ozone - upper air	B. Johnson (NOAA)
Greenhouse gases	S. Montzka; J. Butler; E. Diugokancky; T. Conway; J. White, B. Vaughn; J. Elkins (all from NOAA)
Radio Nuclides	J. Dibb (Univ. of New Hampshire)
Aerosol	T. Cahill (UC Davis); R. Bales (UC Merced); J. Burkhart (UC Merced/NILU)
Reactive Gases	D. Helmig (INSTAAR); P. Novelli (NOAA)
Precipitation Chemistry	R. Bales/J. Burkhart (UC Merced)
Bore Hole Strain Rates	Hawley/Waddington (Univ. of Washington)
Accumulation	R. Bales/McConnell/J. Burkhart (UC Merced)




click image to enlarge

IASOA web site: www.iasoa.org

INTERNATIONAL ARCTIC SYSTEMS
FOR OBSERVING THE ATMOSPHERE

IASOA



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Observatories-At-A-Glance

Welcome to the IASOA Observatories-at-a-Glance page. This page has been designed to give you a quick look at what measurements & specialized instruments are available at the IASOA observatories.

For more detailed information regarding instrumentation at the individual observatories, click on the observatory's name.

Y means that the station does have the measurement or instrument listed in the left-hand column, to the best of our knowledge.

We welcome your comments - if you have any additions or corrections that apply to this page, please forward them to lisa.darby@noaa.gov.

Measurement or instrument	Abisko, Sweden	Alert, Canada	Barrow, U.S.A.	Cherskii, Russia	Eureka, Canada	Ny-Alesund, Norway	Pallas/Sodankyla, Finland	Summit, Greenland	Tiksi, Russia
Meteorology - surface (T, Td, P, Ws, Wd)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Meteorology - upper air		Y	Y		Y	Y	Y	Y	Y
Precipitation	Y	Y	Y	Y	Y	Y	Y		Y
Snow depth	Y					Y	Y		Y
Accumulation								Y	
Micrometeorology tower					Y		Y		
Surface energy balance		Y		Y	Y	Y			
Aerosol - surface		Y	Y			Y	Y	Y	
Aerosol - upper air						Y	Y		
Radiation	Y	Y	Y	Y	Y	Y	Y	Y	Y
Radar wind profiler			Y						
Cloud radar			Y		Y				

Outreach & Legacy Activities Sustaining Arctic Observing Networks (SAON) www.arcticobserving.org

- 5 meetings were held to gain input on how to establish long-term Arctic observations for several disciplines
- IASOA is considered a potential “building block” for the atmospheric component of SAON
- The Arctic Council has approved SAON’s recommendations



The screenshot shows the ArcticObserving.org website. The header includes the Arctic Council logo and the text "ArcticObserving.org IPY Workshops on Sustaining Arctic Observing Networks". The main content area is titled "Sustaining Arctic Observing Networks" and features a report cover image. The text below the image reads: "The SAON report 'Sustaining the Arctic' is now ready for distribution. The prepared conclusions have developed during a series of workshops involving 350 Arctic researchers, representatives of inter-governmental, national and sub-national government agencies, representatives of indigenous peoples organizations, and residents of the Arctic. The process, referred to as the SAON process, was initiated as a response to the request from Arctic Council ministers at their meeting in Svalbard, Svalba in November 2008. The report was drafted by the SAON Working Group and is available in various languages. Agencies, governments, networks and programs involved in all aspects of Arctic observing." Below this text are two download links: "Download the SAON Report 'Sustaining the Arctic'" and "Download SAON Terms of Reference for the Arctic Observing Panel (AOP)". At the bottom, it states: "More copies of the above documents can be ordered by contacting Anders Christen for distribution within Europe, or Sissy Shimizu for distribution within North America and the rest of the world."

Outreach & Legacy Activities IASOA sessions at AGU

The screenshot shows the IASOA website interface. At the top, the logo reads "INTERNATIONAL ARCTIC SYSTEMS FOR OBSERVING THE ATMOSPHERE IASOA". Below the logo is a navigation menu with links: Home, Mission, Observatories, Science, News, About, Gridded Data, Partners, and IPY Media Day. The main content area is divided into two columns. The left column contains a "Historical Tiksi Data" section with a link to "Meteorological data from Tiksi (1932 - 2006) has been digitized and posted online." and a search bar. Below this is a "Menu" section with links to Home, Mission, Observatories, Science, News, About, Gridded Data, Partners, and IPY Media Day. The right column features an "AGU Abstracts - Poster Session A31G" section. It includes a search bar and a list of abstracts. The first abstract is titled "Comparison of Barrow, Alaska and Tiksi, Russia Climate variability Using Historical Meteorological Records" and lists authors: Matrosova, L., Ullal, T., Makshas, A., and Ivanov, N. Y. The second abstract is titled "Evaluation of Polar WRF Across the Arctic Using IASOA Observations" and lists authors: Seefeldt, M. W. and Cassano, J. J.

- 27 papers presented (oral and poster)
- All abstracts are posted at www.iasoa.org

Outreach & Legacy Activities

International Polar Year Media Day

- IPY organized a media blitz – IASOA was featured on 10 Feb 2009
- Created a Media Day web page, lined up scientists for interviews



Outreach & Legacy Activities

Cooperative Arctic Data and Information Service (CADIS) www.aoncadis.org/

- Designed for AON and SEARCH PIs
- It's been requested that IASOA have a presence on CADIS web site
 - Using Eureka as a test site
 - We are only offering links to data bases



Datasets

- 📁 High Spectral Resolution Lidar Deployed at Eureka Nunavut Canada - Customized Access to Data and Images (Empty)
- 📁 High Spectral Resolution Lidar Deployed at Eureka Nunavut Canada - Processed Data Files (Empty)
- 📁 Microwave Radiometer Deployed at Eureka Nunavut Canada - Raw Data Files (Empty)
- 📁 Millimeter Cloud Radar Deployed at Eureka Nunavut Canada - Image Files (Empty)
- 📁 Millimeter Cloud Radar Deployed at Eureka Nunavut Canada - Raw Data Files (Empty)

Observatory Activities- Eureka

<http://candac.ca/candac>

- Many new instruments were installed, including a new flux tower and E-AERI has been installed
- A “posse” of diplomats visited Eureka as part of the “Northern Diplomatic Tour”
- Grade 11-12 students and their teachers visited as part of the “Northern Experience Program”
- CANDAC discussing hosting an Arctic Facilities Manager Meeting later this year



Photo: R. Albee



Photos: J. Drummond and CANDAC web site



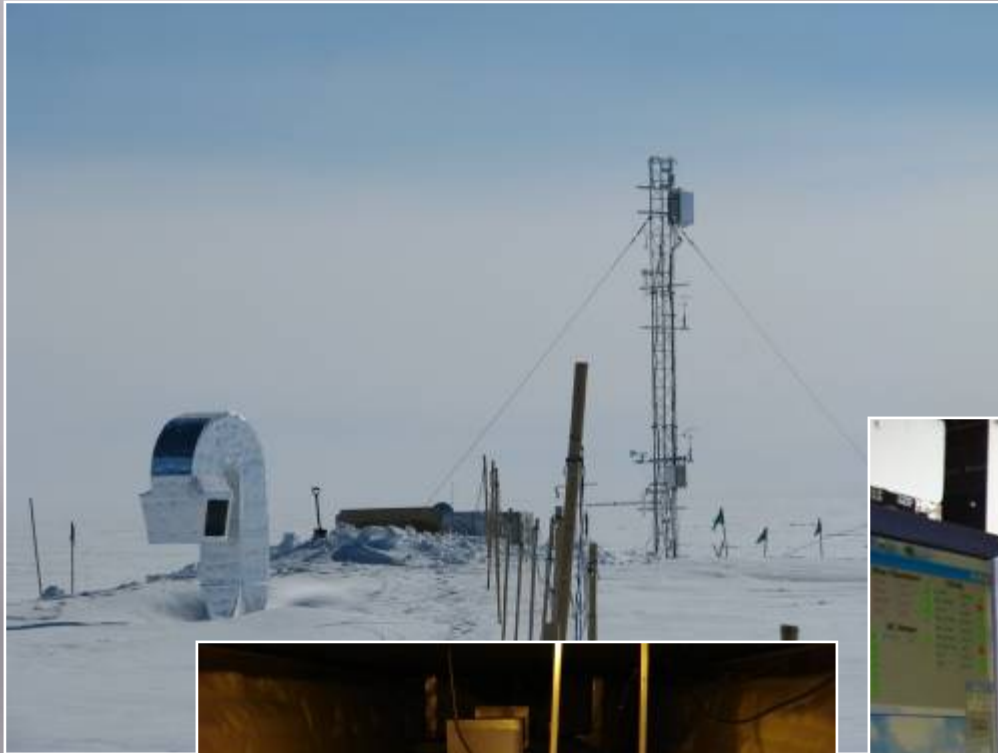
Observatory Activities - Summit

<http://www.geosummit.org/>

Online Summer 2008

Measuring surface flux of O_3 and NO_x

Helmig & Honrath project



Observatory Activities - Cherskii

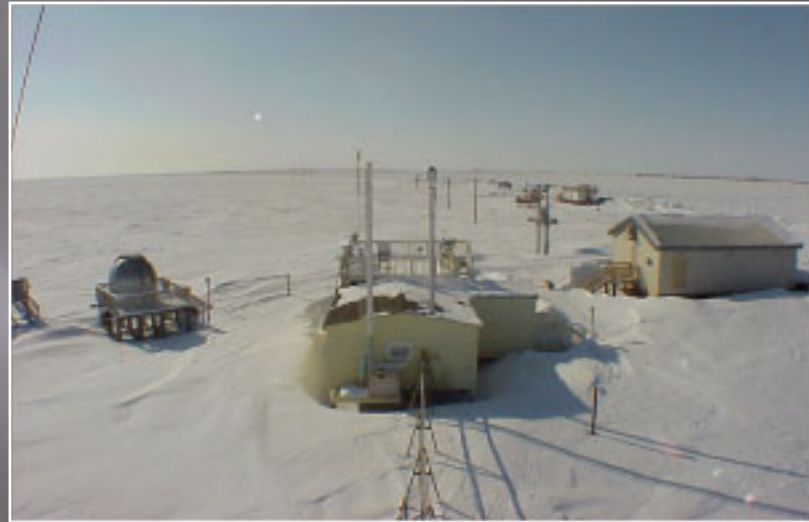


- A collaboration between the University of Alaska Fairbanks (UAF) and NOAA has resulted in tower measurements of CO_2 and CH_4 .
- The researchers at Cherskii also partnered with The Polaris Project (<http://www.thepolarisproject.org/>), providing undergraduate students with the chance to do field work in the Siberian Arctic

Photos: S. Zimov

Observatory Activities - Barrow

- ❑ Two new systems for aerosol size and chemistry composition & persistent organic pollutant (POPs) measurements
- ❑ The meteorology measurement and data system has been completely upgraded
- ❑ Barrow provided ground support and lodging for POLARCAT



POLARCAT overflights



NASA DC8 on July 9, 2008 – Summit and Ellesmere Island Overflights also occurred over Barrow and Zeppelin (Ny-Ålesund)

Observatory Activities-Tiksi

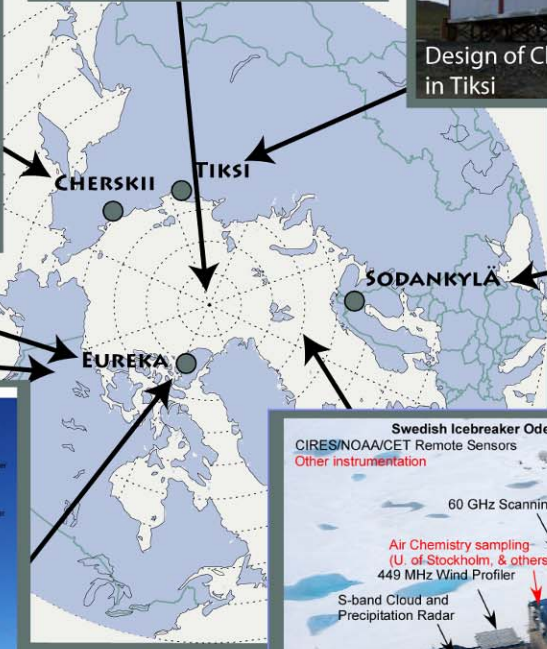
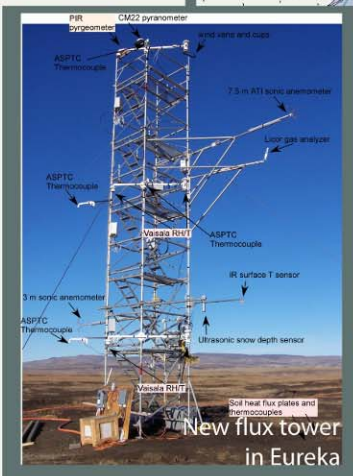
- Logistics Team Meeting St. Petersburg in March '09 - construction plan for finishing the site and Clean Air Facility improvements in August 2009
- Science Team Meeting in Boulder May '09 - resulting in the finalization of a current science plan with 14 identified joint science projects
- NOAA contributions include:
 - BSRN facility, flux tower, CRN site, flask sampling, black carbon sampling
- Instrument installations in August '09
- Operations Team will meet in Sep '09 to work out the details of continuing operations



IASOA's Future

- ▣ Scientific steering committee (2 members from each observatory)
- ▣ Science meetings
- ▣ Conference sessions (hoping for a session at the IPY conference in Oslo, June 2010)
- ▣ Make the web site stronger and more comprehensive
 - Summer student will work on observatories-at-a-glance chart

Contributions of the NOAA Arctic Atmospheric Observatory Program to IASOA Infrastructure

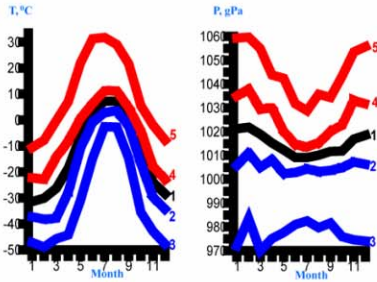


Contributions of the NOAA Arctic Atmospheric Observatory Program to IASOA - Science

NOAA SEARCH Arctic Atmospheric Science

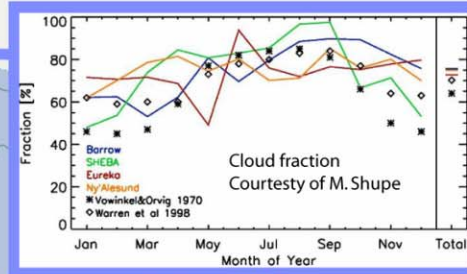


Tiksi surface meteorology

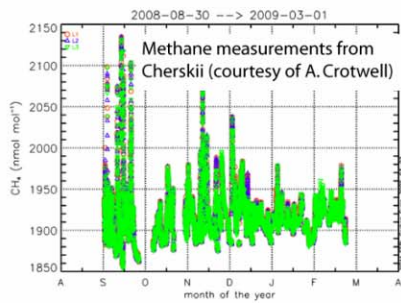


Historical meteorological data at Tiksi has been digitized, making it easier to perform climatological analysis of surface data

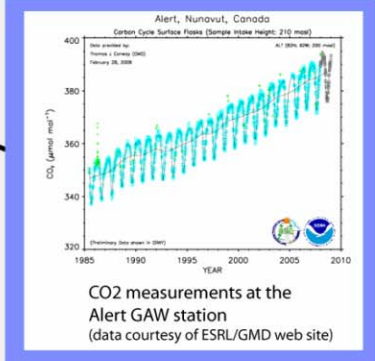
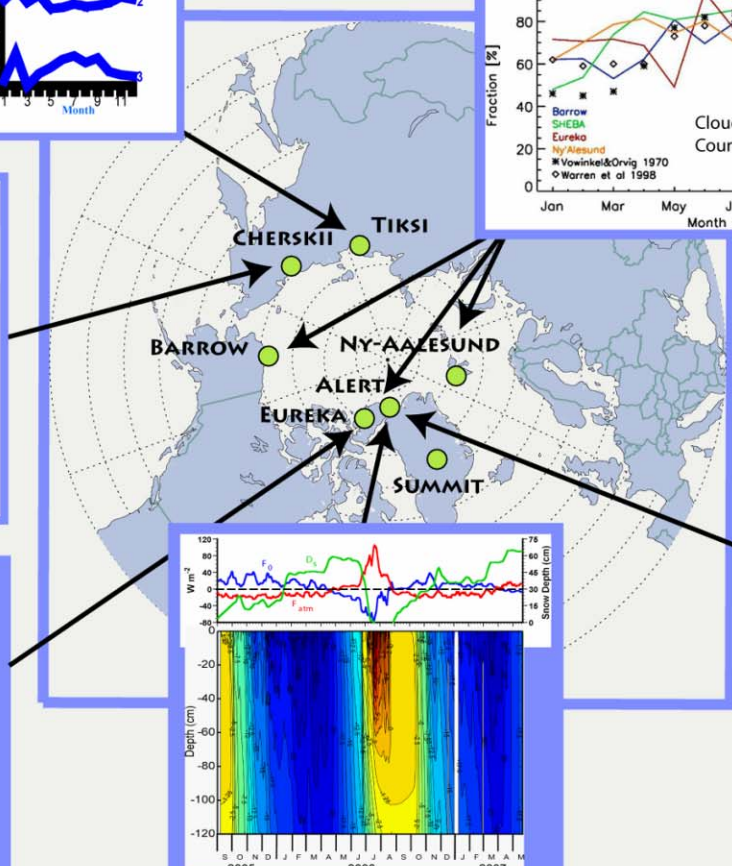
Courtesy of A. Makshtas



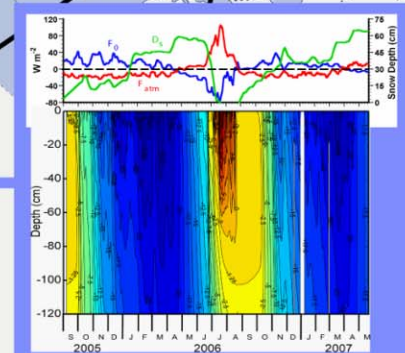
Cloud fraction
Courtesy of M. Shupe



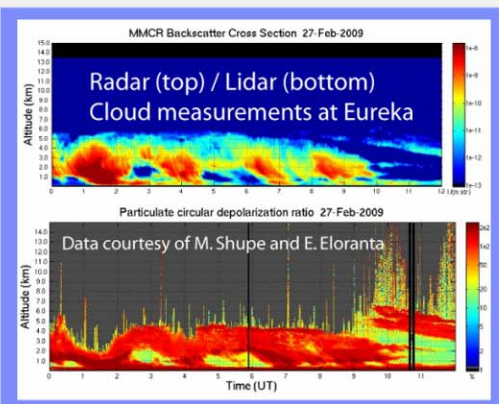
Methane measurements from Cherskii (courtesy of A. Crowell)



CO₂ measurements at the Alert GAW station (data courtesy of ESRL/GMD web site)



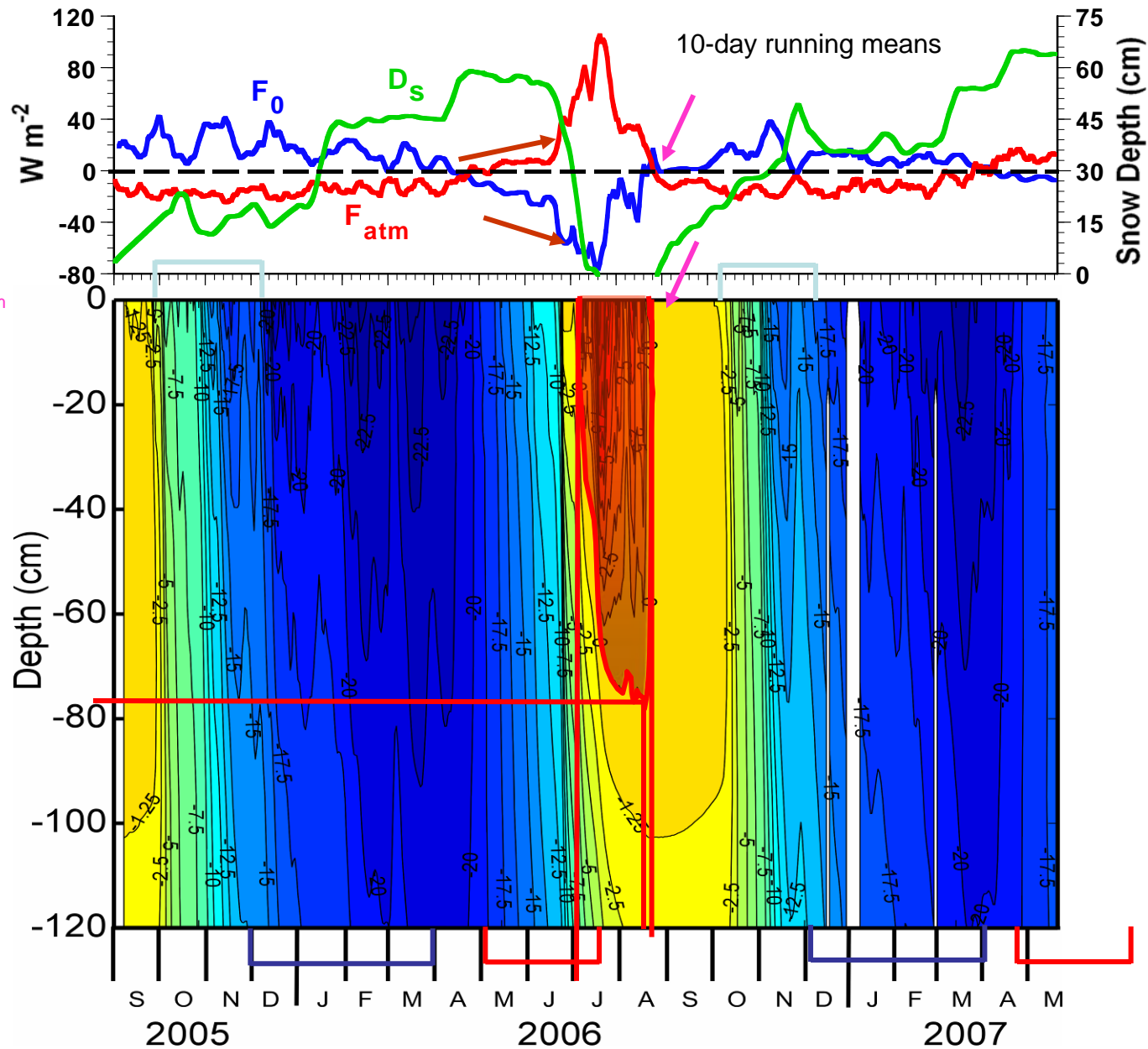
Annual cycle of GAW soil temperatures at Alert (courtesy of O. Persson)



Radar (top) / Lidar (bottom) Cloud measurements at Eureka

Particulate circular depolarization ratio 27-Feb-2009
Data courtesy of M. Shupe and E. Eloranta

Annual Cycle of Alert GAW Soil Temperatures



1) Active layer ($T > 0^{\circ} C$) begins at surface near Jul 2, reaches maximum depth of 77 cm in mid-Aug, and is gone by Aug 22.

2) active layer disappears when F_{atm} becomes negative and F_0 positive

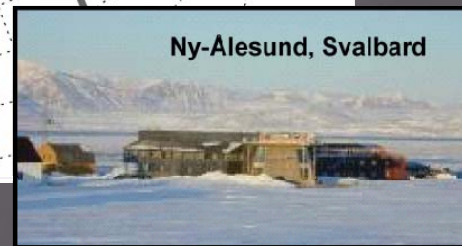
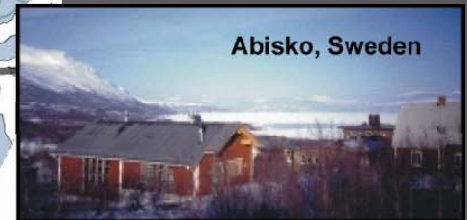
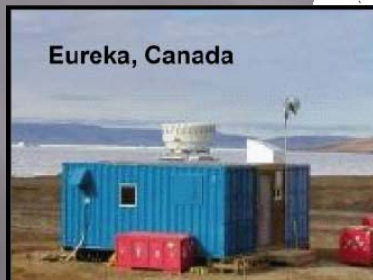
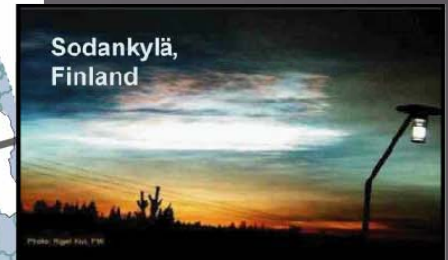
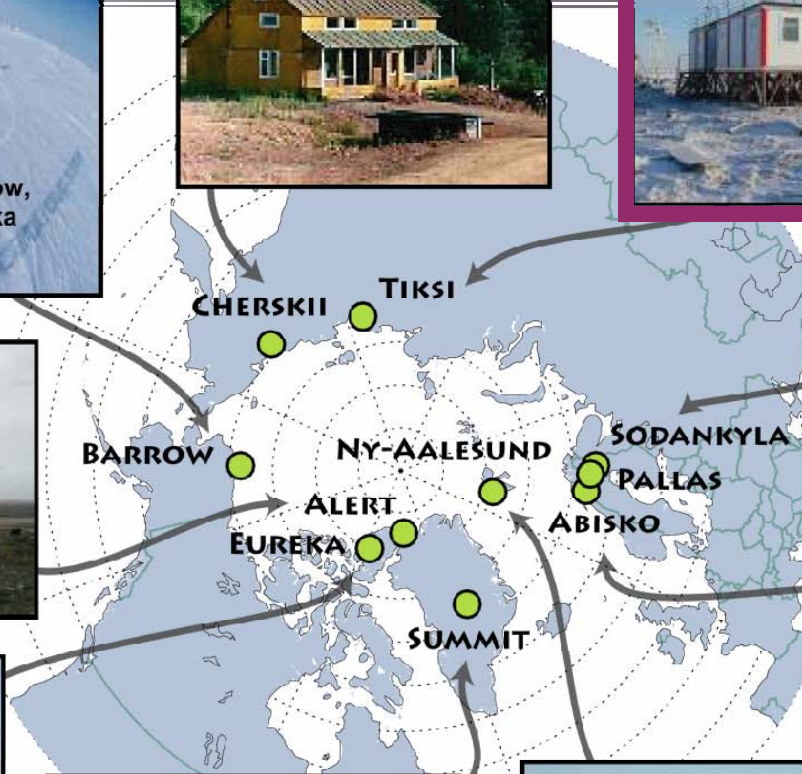
3) rapid cooling at all levels from early Oct until mid-Nov to early Dec

4) gradual cooling (in pulses) until mid-Mar-early Apr when coldest temperatures occur

5) rapid warming throughout from late Apr to mid-Jul

6) rapid increase in F_{atm} leads to rapid decrease in F_0 producing active layer

Tiksi, Russia



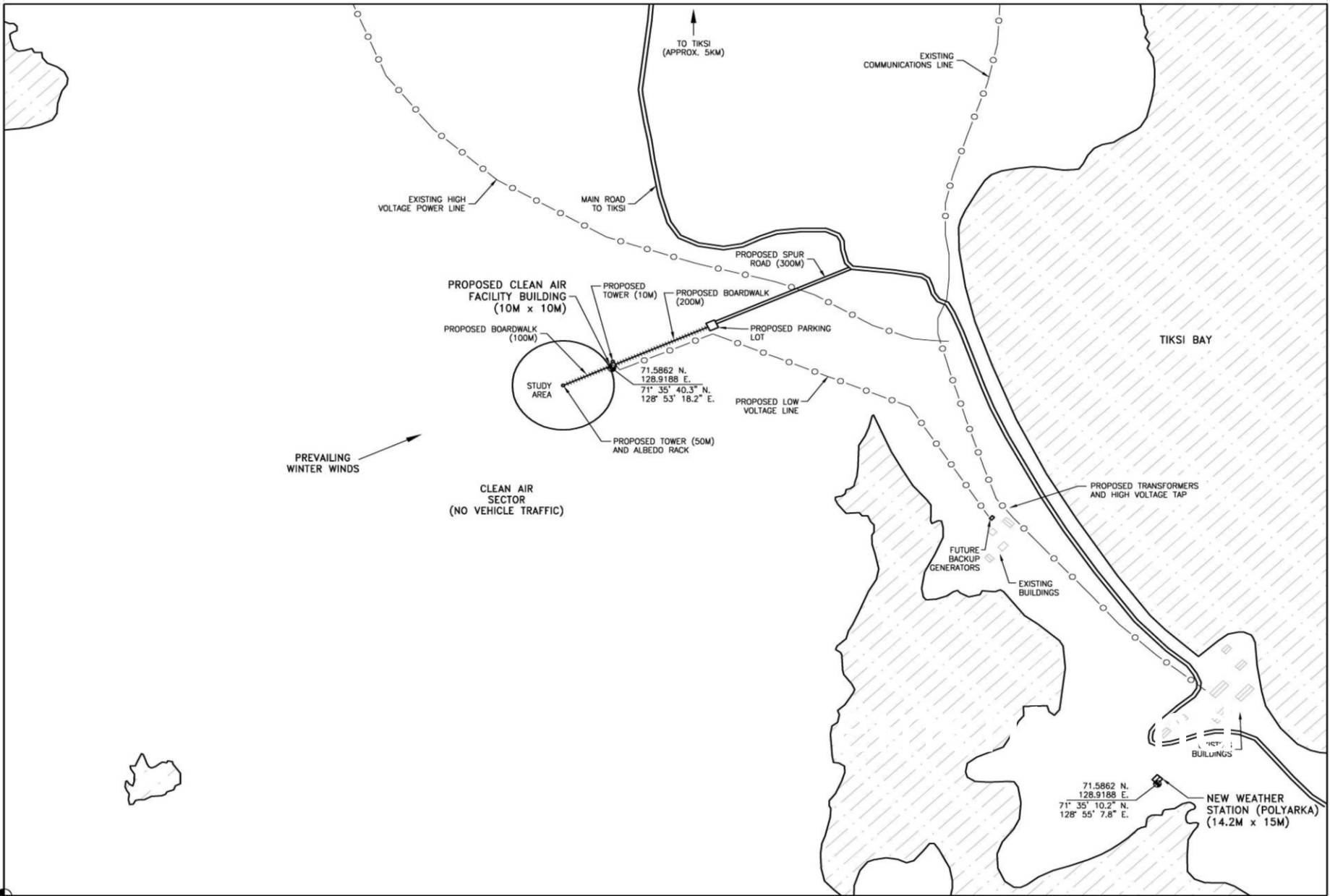
The Existing Weather Station in Tiksi – Measurements since 1937



Existing Components

- ▣ NSF infrastructure contributions
 - ▣ NOAA project coordination and long-term design
 - ▣ NSF funding of science projects
 - ▣ Government of Sakha road and power improvements
 - ▣ Roshydromet weather station upgrades – communications and weather station measurement systems
-
- ▣ NOAA observation programs
 - ▣ Roshydromet observation programs
 - ▣ NASA observation programs
 - ▣ FMI observation programs





TIKSI CLIMATE OBSERVATORY



The main building of future Hydrometeorological Observatory (November 2006)



Official opening of the New Tiksi Weather Station on November 28, 2006

President of the Republic of Sakha (Yakutia) Vyacheslav Shtyrov and Special Representative of the RF President on IPY issues Arthur Chilingarov



Clean Air Facility – Completion in 2009



NOAA Contributions to Tiksi 2009

Baseline Surface Radiation Network Facility

Flux Tower

Climate Reference Network Site

Flask Sampling

Black Carbon

Roshydromet Contributions to Tiksi 2009

Satellite Communications System for Data Transmission

Flask Sampling Program

Standard Russian Radiation Measurements

Upgraded Meteorological Measurements

Finnish Meteorological Institute to Tiksi 2009

Aerosol Sampling

Green House Gas Sampling

Operational Issues in the Arctic

TRANSPORTION MAKES EVERYTHING EXPENSIVE

- ❑ Cost of a Charter Flight from Resolute Canada to Eureka Canada - \$14,000 USD
- ❑ Likelihood of getting on your scheduled Canadian Military Hercules Flight to Alert – 30% and falling
- ❑ Mechanisms for buying tickets on Yakutia Airlines to Siberia– CASH only
- ❑ Likelihood of staying on schedule on an Arctic Trip – LOW
- ❑ Cost on site in Eureka - \$480/ day
- ❑ Restaurants in Tiksi, Russia regularly open (0)
- ❑ The sauna in Tiksi, Russia – not yet located

Internationalization of NOAA Challenges for a Climate Service

- ▣ The State Department and NOAA/IA develops Treaties, MOUs, MOAs, and projects agreements that are statements of intent without mechanisms for implementation
- ▣ NOAA contracts for transferring funds are limited with Foreign governments (especially Russia) – Authorities?
- ▣ Travel - How to arrange travel on foreign charter aircraft and provincial non-U.S. carriers (First Air in Nunavut and Yakutia Airlines in Siberia) in remote regions. Invited travel is problematic for travelers without U.S. bank accounts and credit cards

Internationalization of NOAA Challenges for a Climate Service

- ▣ NOAA property does not allow transfer of equipment to foreign governments
- ▣ How to account for NOAA property permanently deployed at foreign stations?
- ▣ NOAA security treats all activities as if they are high security. How to have NOAA computers networked to computers and computer systems in foreign countries?
- ▣ NOAA contracts with International shipping brokers that cannot ship to Siberia.

Question:

Will a NOAA Climate Service be based on primarily on models, satellite observations and observations in U.S. territories **or** will there be additional programs for significant ground-based, climate-grade measurements in non-U.S. territories?

Acknowledgements and Transparency

Acknowledgements:

Support for IASOA and the Arctic Observatories program comes from

- NOAA/CPO/Arctic Research Office (\$1M)
- NOAA/ESRL (\$500K)

