Appendices

Appendix 1: NSF AON Projects

Atmosphere

Core Atmospheric Measurements at Summit, Greenland Environmental Observatory
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0336450

Cloud Properties Across the Arctic Basin from Surface and Satellite Measurements - An Existing Arctic Observing Network.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632177

Pan-Arctic Studies of the Coupled Tropospheric, Stratospheric and Mesospheric Circulation.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632387

The Collaborative O-Buoy Project: Deployment of a Network of Arctic Ocean Chemical Sensors for the IPY and Beyond.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0612331

Development of Data Products for the University of Wisconsin High Spectral Resolution Lidar.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0612452

Halogen Chemistry and Ocean-Atmosphere-Sea Ice-Snowpack (OASIS) Chemical Exchange During IPY
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0732556

NSF UV Monitoring Network
http://www.biospherical.com/NSF/default.asp

Ocean and Sea Ice

The State of the Arctic Sea Ice Cover: An Integrated Seasonal Ice Zone Observing Network (SIZONET).
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632398

Ice Mass Balance Buoy Network: Coordination with DAMOCLES.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0612391

Collaborative Research: North Pole Station: A Distributed Long-Term Environmental Observatory.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0352754

The Beaufort Gyre System: The Flywheel of the Arctic Climate?
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0424864

Coordination, Data Management and Enhancement of the IABP (International Arctic Buoy Program).
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0520287
A Modular Approach to Building an Arctic Observing System for the IPY and Beyond in the Switchyard

Region of the Arctic Ocean.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0633878

An Innovative Observational Network for Critical Arctic Gateways: Understanding Exchanges through Davis and Fram Straits.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632231

Comparison of Water Properties and Flows in the US and Russian Channels of the Bering Strait - 2005 to 2006
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0528632

The Pacific Gateway to the Arctic- Quantifying and Understanding Bering Strait Oceanic Fluxes.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632154

Observing the Dynamics of the Deepest Waters in the Arctic Ocean.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632201

Design and Initialization of an Ice-Tethered Array Contributing to the Arctic Observing Network.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0519899

Towards an Arctic Observing Network: An Array of Ice-Tethered Profilers to sample the upper ocean water properties during the International Polar Year.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0631951

Ocean-Ice Interaction Measurements Using Autonomous Ocean Flux Buoys in the Arctic Observing System.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0520328

Toward Developing an Arctic Observing Network: An Array of Surface Buoys to Sample Turbulent Ocean Heat and Salt Fluxes During the IPY.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632041

Aerial Hydrographic Surveys for IPY and Beyond: Tracking Change and Understanding Seasonal Variability.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0634226

Hydrology/Cryosphere

Long Term Measurements and Observations for the International Arctic Research Community on the Kuparuk River Basin, Alaska.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0335941

A Prototype Network for Measuring Arctic Winter Precipitation and Snow Cover (Snow-Net).
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632131

Thermal State of Permafrost (TSP): The US Contribution to the International Permafrost Observatory Network.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0520578

Development of a Network of Permafrost Observatories in North America and Russia: The US Contribution to the International Polar Year.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632400

Terrestrial Ecology

Development and Implementation of the Terrestrial Circumarctic Environmental Observatories Network (CEON).
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0622406

Carbon, Water, and Energy Balance of the Arctic Landscape at Flagship Observatories and in a Pan-Arctic Network.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632139

Collaborative Research: Study of Arctic Ecosystem Changes in the IPY Using the International Tundra Experiment.
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632277

Human Dimensions/People and Communities

Is the Arctic Human Environment Moving to a New State?
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0638408

Bering Sea Sub-Network: International Community-Based Observation Alliance for Arctic Observing Network (BSSN).
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0634079

Data and Information

Exchange For Local Observations and Knowledge in the Arctic (ELOKA)
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632345

A Cooperative Arctic Data and Information Service (CADIS).
http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0632313

Appendix 2: State and Local Government Observing Activities in Alaska

The State of Alaska Department of Transportation and Public Facilities (DOTPF) monitors several environmental variables throughout Alaska via its Road Weather Information System (RWIS), a network of 48 meteorological and pavement sensors located along the highway system. RWIS stations are located in strategic locations to provide accurate real-time road weather information and critical observations for forecasts. This and other weather information helps DOTPF improve timeliness of maintenance actions, like when to snowplow or deposit anti-icing/de-icing chemicals on the highways.

Real-time RWIS data are available at AOOS and the US Department of Transportation 'Clarus' system. RWIS data also sent to NCAR, where they are used and archived by MADIS (Meteorological Assimilation Data Ingest System). An archive of raw data with a 30-minute sampling interval DOTPF is maintained in Juneau, Alaska; these data have not been quality-checked and flagged, but they are available on request.

The State of Alaska Department of Natural Resources (DNR) monitors soil temperature, active layer depth and snow depth at stations within the North Slope oil fields for the purpose of determining when conditions are suitable for ice road construction and winter off-road travel by heavy equipment. These monitoring stations were established in 2005. These data are not available on line, but can be obtained by contacting the DNR Northern Regional Office at 907-451-2740.

The Clean Water Act (CWA) mandates that each state develop a program to monitor the quality of its surface and groundwaters and prepare a report describing the status of its water quality. As part of these efforts, the State of Alaska Department of Environmental Conservation (DEC) and EPA perform field monitoring in South-central and Southeast Alaska, and plan to perform field monitoring in the Arctic in the near future. Until an assessment comparable to that underway for South-central and Southeast Alaska coastal waters is completed, DEC has no independent baseline water quality data for the Arctic Ocean.

The State of Alaska Department of Natural Resources (DNR) authorizes specific volumes of water to be withdrawn from lakes for ice road construction on the North Slope, determines the presence or absence of fish in lakes from which water is withdrawn, and ensures that withdrawal techniques do not adversely affect fish. DNR also has a statutory responsibility to protect anadromous waterbodies and ensure free passage of fish. DNR is also responsible for issuing permits for activities such as culvert or bridge installation in streams and rivers. The Office of Habitat Management and Permitting maintains a database of all of these activities in Alaska.

The State of Alaska Department of Fish and Game (DFG) conducts research and monitoring activities on resident fish and wildlife species. Most wildlife activities have focused on the four arctic caribou herds, which have been surveyed and monitored since the 1970s. Considerable work has also been done on muskox, moose, brown bears, and other species. Populations are generally reported on the basis of game management units (GMU). The Arctic game management units are 26A, 26B and 26C.

The North Slope Borough, Department of Wildlife Management, is also engaged in fish and wildlife monitoring for the purpose of facilitating sustainable subsistence harvests. The monitoring activities include: (1) collection of subsistence harvest data; (2) monitoring the movements of Arctic fox and the Teshekpuk Lake caribou herd; (3) estimating the size of the Bowhead whale population, and documenting the movement of Beluga whales; and (4) monitoring Lesser Snow and Black Brant goose colony size and habitat quality. The monitoring is often done in partnership with the State of Alaska Department of Fish and Game and the US Fish and Wildlife Service. The Department of Wildlife Management also has a long history of working with native co-management

groups, e.g., Alaska Eskimo Whaling Commission and Alaska Nanuq Commission, and international bodies such as the International Whaling Commission.

The Barrow Arctic Science Consortium (BASC) organization based in Barrow, Alaska, combines North Slope Borough, Ukpeagvik Iñupiat Corporation, and Ilisagvik College efforts to encourage research and educational activities pertaining to Alaska's North Slope and the adjacent portions of the Arctic Ocean. BASC maintains the Barrow Environmental Observatory (BEO).

The Clean Air Act requires the EPA to set National Ambient Air Quality Standards (NAAQ, 40 CFR Part 50) for pollutants considered harmful to public health and the environment. EPA has set NAAQs for six principal pollutants, which are called "criteria" pollutants: carbon monoxide (CO), lead (Pb), Nitrogen Dioxide (NO_2), ozone (O_3), Particulate Matter (PM), and Sulfur Dioxide (SO_2). In Alaska, the primary air monitoring network evaluates the level of these criteria pollutants and focuses on six separate and distinct monitoring issues, as described in the Alaska draft 2008 Air Monitoring Network Plan: seasonal (October – March) CO monitoring in Anchorage and Fairbanks; coarse PM (PM_{10}) monitoring in Juneau, Anchorage and the central Matanuska-Susitna Valley (Mat-Su); fine PM ($PM_{2.5}$) monitoring in Juneau, Fairbanks, Anchorage and the Mat-Su Valley; statewide $PM_{2.5}$ monitoring during the summer fire season (May – September); $PM_{2.5}$ slash burning monitoring for agricultural and beetle kill (August – May); rural community/tribal village dust monitoring (May – September), residential wood smoke monitoring (September – March), and air toxics monitoring in selected communities statewide.

Data and Information Management and Other Useful Links

Barrow Arctic Science Consortium
http://www.arcticscience.org/aboutBASC.php

North Slope Borough, Department of Wildlife Management
http://www.co.north-slope.ak.us/departments/wildlife/

State of Alaska Department of Environmental Conservation
Air monitoring & Quality Assurance:
http://www.dec.state.ak.us/air/am/index.htm

Water Quality Assessment & Monitoring:
http://www.dec.state.ak.us/water/wqsar/index.htm

State of Alaska Department of Natural Resources Division of Oil and Gas:
http://www.dog.dnr.state.ak.us/oil/

Habitat management and planning:
http://www.dnr.state.ak.us/habitat/

Tundra travel:
http://www.dnr.state.ak.us/mlw/tundra/index.htm

State of Alaska Department of Transportation and Public Facilities Road Weather Information System:
http://www.dot.state.ak.us/iways/roadweather/forms/IndexForm.html

RWIS data can also be found at the following sites:

Alaska Ocean Observing System:
http://ak.aoos.org/op/data.php?region=AK&name=met_rwis)

US Department of Transportation Clarus:
http://clarus.mixonhill.com/observations/ClarusMap.html?lat=61.2&lon=-147.3&zoom=5

MADIS:
http://madis.noaa.gov/

Appendix 3: Volcano, Earthquake, and Geomagnetism Observing Activities

The Alaska Volcano Observatory (AVO) is a joint program of the USGS, the Geophysical Institute of the University of Alaska Fairbanks (GI/UAF) and the State of Alaska Division of Geological and Geophysical Surveys (ADGGS). AVO was created in 1988, and uses federal, state, and university resources to monitor and study Alaska's hazardous volcanoes, to predict and record eruptive activity, and to mitigate volcanic hazards to life and property. Alaska has just over 100 historically active volcanoes.

The backbone of the AVO volcano monitoring program consists of networks of continuously recording seismometers installed at more than 20 volcanoes. The seismometers provide a continuous data stream; consequently, the onset of explosive eruptions can be detected quickly in most cases and appropriate warnings issued.

Once a volcanic ash eruption has been detected, the NOAA NWS Alaska Aviation Weather Unit (AAWU) in Anchorage collaboratively serves as the Volcanic Ash Advisory Center (VAAC) and the Meteorological Watch Office (MWO). The role of the VAAC is to monitor all available satellite, radar, and other observational data (e.g. Pilot Reports) to determine the location, extent and movement of volcanic plumes. VAACs use this information to issue real-time text and graphical products about airborne volcanic ash to the aviation community. Volcanic ash dispersion model predictions are used to assist in making a forecast of these ash plumes out to 18 hours. The dispersion model predicts where the volcanic ash will spread over time and this information is then relayed to the user community. Information about the volcano, including a detailed forecast of the ash plume, is included in a Volcanic Ash Advisory (VAA). VAACs provide this information to international Meteorological Watch Offices (MWOs), which in turn issue Significant Meteorological Information (SIGMETs) to the aviation community. The SIGMET is the official warning product for airborne volcanic ash. The Anchorage VAAC is responsible for the Flight Information Region for Alaska which includes a portion of eastern Russia (north of 60°N latitude and east of 150°E longitude).

Satellite imagery provides information which complements seismic monitoring at those volcanoes with seismic networks. AVO analyzes available satellite data twice daily for thermal anomalies and ash plumes at about 80 volcanoes in the north Pacific. By analyzing satellite imagery and working with the NWS to predict where winds will carry the ash, AVO assists the FAA in warning aircraft of areas to avoid.

AVO also operates a network of telemetered GPS receivers at Augustine Volcano, in lower Cook Inlet, that provide a continuous record of ground deformation. AVO also conducts periodic field-based GPS surveys as well as measuring deformation with InSAR techniques. These techniques are providing important information about inflation and deflation of volcanoes, but are not yet evolved enough for routine real-time monitoring of many volcanoes.

As regards earthquakes, USGS works in cooperation with the State of Alaska, the Alaska Earthquake Information Center (AEIC), university partners to support State of Alaska, regional, national, and global seismic-monitoring network. The USGS and university and State geological survey partners have begun to install and operate the Advanced National Seismic System (ANSS), a national network of sophisticated shaking monitors placed both on the ground and in buildings in populated urban areas. The USGS will continue to improve on existing Arctic and global earthquake monitoring, assessment, and research activities, with the ultimate goal of providing new products that facilitate more effective mitigation and response.

The USGS Geomagnetism Program has, for over a century, monitored the geomagnetic field through a network of magnetic observatories located in the United States and its Territories. The Alaska observatories are located at Barrow, College (Fairbanks), Shumagin and Sitka. They support modern digital acquisition systems, designed to produce long time series of stable magnetometer data having high accuracy and resolution.

Data and Information Management and Other Useful Links

Alaska Volcano Observatory
http://www.avo.alaska.edu/

NOAA National Weather Service Alaska Aviation Weather Unit
http://aawu.arh.noaa.gov/

USGS Earthquake Hazards Program
http://earthquake.usgs.gov/

USGS National Geomagnetism Program
http://geomag.usgs.gov/

Appendix 4: List of Abbreviations and Acronyms

AAWU	Alaska Aviation Weather Unit
ACEX	Arctic Coring Expedition
ACIA	Arctic Climate Impact Assessment
ACRF	ARM Climate Research Facility
ADA	Arctic Domain Awareness
ADGGS	Alaska Division of Geological and Geophysical Surveys
AEIC	Alaska Earthquake Information Center
AFSC	Alaska Fisheries Science Center
AICC	Alaska Inter-agency Coordination Center
AMAP	Arctic Monitoring and Assessment Program
AMSA	Arctic Marine Shipping Assessment
AMSR-E	Advanced Microwave Scanning Radiometer-E
ANSS	Advanced National Seismic System
AON	Arctic Observing Network
AOOS	Alaska Ocean Observing System
AOSB	Arctic Ocean Science Board
APRFC	Alaska-Pacific River Forecast Center
ARCSS	Arctic System Science (NSF-OPP)
ARCUS	Arctic Research Consortium of the United States
ARM	Atmospheric Radiation Measurement
ASF	Alaska Satellite Facility
ASOS	Automated Surface Observing System
ASTER	Advanced Space-borne Thermal Emission and Reflection Radiometer
AVHRR	Advanced Very High Resolution Radiometer
AVO	Alaska Volcano Observatory
BASC	Barrow Arctic Science Consortium
BASIS	Bering-Aleutian Salmon International Survey
BEO	Barrow Environmental Observatory
BEST	Bering Sea Ecosystem Study
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CADIS	Cooperative Arctic Data and Information Service
CAFF	Council Conservation of Arctic Flora and Fauna
CALM	Circumpolar Active Layer Monitoring
CARMA	Circumarctic Rangifer Monitoring & Assessment Network
CASTNet	Clean Air Status and Trends Networks
CBMP	Circumpolar Biodiversity Monitoring Program
CDC	Centers for Disease Control and Prevention
CEON	Circumarctic Environmental Observatories Network
CliC	Climate and Cryosphere
CLIVAR	Climate Variability and Predictability
C-MAN	Coastal Marine Automated Network
CO-OPS	Center for Operational Oceanographic Products and Services
CORE	Collaborative Observation and REsearch
CReSIS	Center for Remote Sensing of Ice Sheets
CRN	Climate Reference Network
CRREL	Cold Regions Research and Engineering Laboratory
DAAC	Distributed Active Archive Center
DAMOCLES	Developing Arctic Modelling and Observing Capabilities for Long-term Environmental Studies
DEC	Department of Environmental Conservation, State of Alaska
DESDynI	Deformation Ecosystem Structure and Dynamics of Ice
DFG	Department of Fish and Game, State of Alaska
DGGS	Division of Geological and Geophysical Surveys, State of Alaska
DMSP	Defense Meteorological Satellite Program

DNR	Department of Natural Resources, State of Alaska
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of Interior
DOTPF	Department of Transportation and Public Facilities, State of Alaska
ELOKA	Exchange for Local Observations and Knowledge of the Arctic
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FMP	Fishery Management Plan
FOCI	Fisheries Oceanography Coordinated Investigations
GCM	Global Circulation Model
GC-Net	Greenland Climate Network
GCOS	Global Climate Observing System
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GINA	Geographic Information Network of Alaska
GIS	Geographic Information System
GISP-2	Greenland Ice Sheet Project-2
GLAS	Geoscience Laser Altimeter Satellite
GLOBE	Global Learning and Observations to Benefit the Environment
GOOS	Global Ocean Observing System
GOSIC	Global Observing Systems Information Center
GPM	Global Precipitation Measurement
GPS	Global Positioning System
GRACE	Gravity Recovery and Climate Experiment
GTN-P	Global Terrestrial Network-Permafrost
GTOS	Global Terrestrial Observing System
HHS	Health and Human Services
IABP	International Arctic Buoy Program
iAOOS	Integrated Arctic Ocean Observing System
IARC	International Arctic Research Center
IARPC	Interagency Arctic Research Policy Committee
IASC	International Arctic Science Committee
IASOA	International Arctic Systems for Observing the Atmosphere
ICARP II	Second International Conference on Arctic Research Planning
ICESat	Ice, Cloud and Land Elevation Satellite-II
ICOS-RMI	Interagency Committee on Ocean Science and Resource Management Integration
ICS	International Circumpolar Surveillance
IIP	International Ice Patrol
IMPROVE	Interagency Monitoring of Protected Visual Environments
InSAR	Interferometric Synthetic Aperture Radar
IODP	Integrated Ocean Drilling Program
IOOS	Integrated Ocean Observation System
IPCC	Intergovernmental Panel on Climate Change
IPY	International Polar Year
IPYDIS	International Polar Year Data and Information Service
ISAC	International Study of Arctic Change
ITEX	International Tundra Experiment
LTER	Long Term Ecological Research
MADIS	Meteorological Assimilation Data Ingest System
MDA	Maritime Domain Awareness
MMS	Minerals Management Service
MODIS	Moderate Resolution Imaging Spectroradiometer
NABOS	Nansen and Amundsen Basin Observational System
NADP/NTN	National Atmospheric Deposition Program/National Trends Network
NARS	National Aquatic Resource Survey
NASA	National Aeronautics and Space Administration
NASA DAAC	NASA Distributive Active Archive Centers

NASQAN	National Stream Quality Accounting Network
NCAR	National Center for Atmospheric Research
NCDC	National Climatic Data Center
NCEP	National Center for Environmental Prediction
NDBC	National Data Buoy Center
NDVI	Normalized Difference Vegetation Index
NEEM	North Eemian Ice Core Project
NEON	National Ecological Observatory Network
NGO	Non-Governmental Organization
NIC	National Ice Center
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOPP	National Ocean Planning Partnership
NOS	National Ocean Service
NPMC	North Pacific Fishery Management Council
NPRB	North Pacific Research Board
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPP	NPOESS Preparatory Project
NPS	National Park Service
NRC	National Research Council
NSF	National Science Foundation
NSIDC	National Snow and Ice Data Center
NSSI	North Slope Science Initiative
NWLON	National Water Level Observation Network
NWS	National Weather Service
OASIS	Ocean-Atmosphere-Sea Ice-Snowpack
OCO	Orbiting Carbon Observatory
OMB	Office of Management and Budget
OMI	Ozone Monitoring Instrument
ONR	Office of Naval Research
OPP	Office of Polar Programs
OSE	Observing System Experiment
OSSE	Observing System Simulation Experiment
OSTP	Office of Science and Technology Policy-White House
OSTM	Ocean Surface Topography Mission
PALE	Paleoclimates from Arctic Lakes and Estuaries
PAOOS	Passive Acoustics Ocean Observing System
PARCS	Paleoenvironmental Arctic Sciences
PMEL	Pacific Marine Environmental Laboratory
RAWS	Remote Automated Weather Station
RGPS	RADARSAT Geophysical Processing System
RUSALCA	Russian-American Long-term Census of the Arctic
RWIS	Road Weather Information System
S4D	SEARCH for DAMOCLES
SAON IG	Sustained Arctic Observing Networks Initiating Group
SAR	Synthetic Aperture Radar
SCICEX	Submarine Arctic Science Program
SEARCH	Study of Environmental Arctic Change
SEER	Surveillance, Epidemiology and End Results
SIGMET	Significant Meteorological Information
SIZONET	Seasonal Ice Zone Network
SMAP	Soil Moisture Active Passive
SNOTEL	SNOpack TELemetry
SSM/I	Special Sensor Microwave Imager
TES	Tropospheric Emission Spectrometer
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGEO	United States Group on Earth Observations
USGS	United States Geological Survey
USIABP	United States Interagency Arctic Buoy Program
USIEOS	US Integrated Earth Observation System
USNCDC	United States National Climate Data Center
UV-B	Ultraviolet-B radiation

VAAC	Volcanic Ash Advisory Center
VIIRS	Visible Infrared Imaging Radiometer Suite
WACAP	Western Airborne Contaminants Assessment Project
WFO	Weather Forecast Office
WMO	World Meteorological Organization