Abstracts

Volontary contributions

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Internationally Coordinated Environmental Specimen Banking as a Component of the Arctic Observing Network

Formal environmental specimen banking is the systematic long-term preservation of well-documented representative environmental specimens (animal and plant tissues and fluids, soils, sediments, ice cores, etc.) that are used for retrospective analysis and evaluation. Specimen banking has been recognized for decades as an important component of environmental monitoring and research. Specimen banking programs and national facilities to support such programs have existed in several countries for 30 years or more and more are either planned or in development stages. Scientific papers making use of banked specimens as a research resource are appearing more frequently. This is probably due to the relatively long-time series of specimens now available for many banking programs, the realization of newly discovered chemical contaminants in the environment and the need to determine time trends for these materials, an increasing interest in climate change and its potential role in changing historical patterns of contaminant transport and cycling through the ecosystem, and the initiation of new specimen banking programs over the last decade. There is also an effort within the international environmental specimen bank community to extend banking beyond its role in contaminant monitoring by providing materials that can be used for biological response investigations at the molecular level and for investigating changes in ecosystem structure and function. In some cases this requires the banking of new kinds of specimens or preserving the same kinds of specimens in different ways based on newly recognized research applications. Environmental specimen banks exist in many Arctic countries (Sweden, Canada, USA, Finland, Norway, and Greenland) and specimen banks in several non-Arctic countries maintain specimens collected in the Arctic (Germany and Japan). The holdings of these banks and the monitoring programs associated with these banks can provide a valuable resource that should be considered as part of the Arctic Observing Network. The Arctic scientific community should also encourage the further development of such banks and the collaboration among these banks so as to maximize the utility of these resources in international Arctic monitoring and research.

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Landscape-level measurements of carbon, water, and energy exchange at flagship observatories and in a pan-Arctic network

Fluxes of carbon, water, and energy are major regulatory drivers of the Arctic climate system, and form key linkages and feedbacks between land, ocean, and atmosphere. They are also expected to change rapidly as climate warms. The goal of this project is to establish two long-term observatories for year-round measurements of landscape-level carbon, water, and energy balance, and to contribute to a pan-Arctic network where coordinated measurements of these variables are carried out and made available in a unified database. We are in the process of establishing year-round eddy covariance measurements of fluxes of CO2, water, and energy near Toolik Field Station in northern Alaska, and near NE Science Station, Cherskii, Russia. The Russian measurements will also include fluxes of methane. In winter 2007-2008, we will be convening a workshop with our collaborating partners to begin to develop a pan-Arctic network of observatories of carbon, water, and energy flux, and to construct a unified database. In addition to the NE Science Station in Cherskii, Russia, we will be collaborating with existing carbon flux programs based at Daring Lake, Canada, Zackenberg Research Station, Greenland, and Abisko Research Station, Sweden. Finally, we will establish a new arctic field course, offered through the University of Alaska, Fairbanks, to educate advanced undergraduate and beginning graduate students about the present environment and how it is expected to change in the future. This course will offer students the opportunity to participate in on-going arctic research, and in the analysis and synthesis of data.

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Pan-Arctic drainage basin observation networks: current status and potential significance for assessment of climate change effects and feedbacks

Hydrological observation networks are integral for understanding and modeling present and future changes in and climate feedbacks to the Arctic environmental system. Recent studies have reported a widespread decline in these networks, but patterns of decline and location of critical data gaps are less certain. We present an updated and quantitative status of openly accessible observation network data for discharge and water chemistry in the pan-Arctic drainage area. We also compare relevant hydrological and socio-economic characteristics of monitored and unmonitored areas, and analyze the decline in network density in relation to recently observed and future modeled temperature trends. Results indicate that there are significant temporal and spatial variations in accessible data, and that there is a critical lack of accessible water chemistry data for large shares of the pan-Arctic. Furthermore, there are systematic differences in characteristics between monitored and unmonitored areas, within and between pan-Arctic regions. Discharge network density has declined the most in four Eurasian drainage basins, which show the smallest recently observed temperature trends but the greatest modeled future temperature changes. Differences in characteristics between monitored and unmonitored areas may limit the reliability of assessments of Arctic water and solute flux change under a warming climate. Improved understanding of the Arctic hydrological system requires less restricted access to monitoring data, extended network coverage of unmonitored areas, and a commitment to sustaining and improving existing networks.

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Transport climatologies for the Internation Arctic System for Observing the Atmosphere.

Several intensive campaigns have recently focused on the transformation and transport of pollutants to the Arctic. During the International Polar Year large-scale coordinated aircraft campaigns will be conducted throughout the circum-Arctic as a part of the POLARCAT project. Additionally, measurements at surface based sites in the IASOA network will be coordinated to capture unique transport events. Toward improved interpretation of the measurements, 10-year transport climatologies are being developed using the Lagrangian particle dispersion model FLEXPART.This paper presents the climatologies for IASOA network, but also introduces FLEXPART products available for the aircraft campaigns. Climatologies are based on 20-day backward model runs for each station using globally gridded 1x1 input fields from the European Center for Medium Range Weather Forecasting (ECMWF). For analysis of specific measurements, model output for each station is generated at six hour intervals (0, 6, 12, 18 UTC). There are 60 vertical levels, switching to 92 after March, 2006 in the input data. Calculations are based on the release of 40,000 particles representing an idealized inert tracer with an infinite lifetime allowing for interpretation of the results by a wide range of experimentalists. The generated source-receptor relationships are averaged into a seasonal climatology for the various locations.We present retroplumes or three-dimensional Potential Emissions Sensitivity (PES) for the stations. The PES (s kg-1) in each grid cell is proportional to the particle residence time in the cell. For a given source with unit strength (1 kg s-1) the PES provides the simulated mixing ratio at the receptor site. A cluster analysis of particle locations also provides the ability to evaluate the proportion of particles residing in the stratosphere. From this analysis we provide, in addition to the PES, the cluster centroid locations, most analogous to traditional trajectories. Initial results from a concurrent study with HYSPLIT showing seasonal trajectories are also presented.

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SCANNET Scandinavian/North European Network of Terrestrial Field Bases

SCANNET is an expanding network of field site leaders, research station managers and user groups in northern Scandinavia and Europe that are collaborating to improve comparable observations and access to information on environmental change in the North Atlantic Region and beyond. SCANNET consists of 17 partners that represent large geographical gradients in environmental conditions and land use throughout the North Atlantic Region, West Greenland and Siberia. SCANNET partners hold environmental data, provide stability for research and facilitate long term observations in terrestrial ecosystems. Together, they host most of the EU funded projects with a northern dimension, and activities within international organisations such as the ITEX and the PYRN. Also, SCANNET is part of CEON and is working with CEON to provide a geo-referenced database of current and past environmental research and monitoring in the Arctic. Data on climate scenarios, variability in climate, biodiversity, species performance and human dimensions has been compiled for the SCANNET region and made easily available on the SCANNET web site. SCANNET provides a “one stop-shop” for environmental information on the North Atlantic landmasses via its web site, which includes metadata bases of environmental monitoring and searchable bibliography. Access to existing data has been improved and some previously unavailable data have been made available for the research community and others. SCANNET has a proven potential to contribute to coordinated monitoring across many disciplines within the North. It offers experience that ranges from recent, purpose built comprehensive and integrated monitoring programmes to century long focussed observation. It is important that this asset is both sustained and developed to respond to recent challenges of documenting environmental change and the future challenge of tracking the success of mitigation and adaptation strategies to cope with climate change and its impacts.

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Nordic Permafrost Observatory Networks in the IPY

The negative permafrost temperatures respond over time to changes in air temperatures, radiation, precipitation, vegetation and other conditions. During the IPY, the International Permafrost Association (IPA) is coordinating four projects, which establish the current status of permafrost conditions. The Permafrost Observatory Project: A Contribution to the Thermal State of Permafrost (TSP), develops a spatially distributed set of observations on past and present status of permafrost temperatures and active layer thicknesses. This is done mainly by establishing thermal monitoring in boreholes to different depths, and by monitoring the active layer thickness in Circumpolar Active Layer Monitoring, CALM sites, in addition to establishing periglacial landform monitoring networks. Borehole and active layer measurements are part of the GCOS/GTOS Global Terrestrial Network for Permafrost (GTN-P). The IPA-IPY permafrost legacy is to establish a permanent, bipolar network of observatories collecting long-term monitoring data to improve process understanding under changing climatic conditions.

In Scandinavia only sparse quantitative data on the distribution and thermal state of permafrost exist. We aim to establish the North Scandinavia Permafrost Observatory, covering a transect from maritime Norway, into continental NW Sweden and NW Finland. In Norway part of the observatory is with steep rock sides along populated fiords. Here many rockslides occurred most likely during the Holocene, and in historical time generating tsunamis. Monitoring of potential unstable rock slopes have started by local authorities. Potential thawing of permafrost due to climatic warming could decrease the stability of the unstable rock slopes. Nine new boreholes were established as part of the TSP NORWAY project to map the extent and temperature of the permafrost. Permafrost exists all over the Svalbard high-arctic landscape, where we establish the Svalbard Nordenskiöld Land Permafrost Observatory, containing both maritime and continental high-arctic areas and different permafrost landforms. Focus is on the continental Longyeardalen and Adventdalen area (78º15'N), to use the excellent research infrastructure for year-round investigations at the University Centre in Svalbard, UNIS.

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International Arctic Systems for Observing the Atmosphere

International Arctic Systems for Observing the Atmosphere (IASOA) IPY Activity 196 is coordinating the efforts at Arctic atmospheric observatory sites that are year-round, intensive, permanent, and with high-level technical staffing. The science mission is to collect the information necessary to understand the processes and mechanisms of Arctic climate change. The logistical mission is to coordinate measurement programs on atmospheric properties such as precipitation, atmospheric radiation, water vapor, ozone, aerosols, chemistry/radio, green house gases, nuclides, cloud properties, climate-grade temperature/winds, snowfall, and surface fluxes between observatories. At present there are intensive observatories of interest at Barrow (Alaska), Eureka and Alert (Canada), Summit (Greenland), Ny-Alesund (Norway), Pallas and Soldankyla (Finland), and Kiruna (Sweden). A primary objective of the IASOA Activity will be to develop a new intensive atmospheric observatory in Tiksi, Russia. This activity has a direct conceptual link to the IPY Activity 125 years ago that coordinated meteorological measurements between many of the same locations.In light of recent recommendations from the IPCC, IASOA is potentially a front line observation network in a global scenario in which environmentally critical thresholds may be reached within decadal time scales. Observational and predictive tools for anticipating, detecting, and responding to sudden climate change in the Arctic will allow for an informed international consortium to develop policy on new issues regarding seasonal shipping lanes, mineral rights, fisheries, and environmental and societal changes.

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Arctic sea-ice change and the need for an integrated observing system

Over the past three decades the Arctic sea-ice cover has experienced substantial thinning and reductions in summer minimum ice extent. Climate models suggest that the perennial ice cover area is likely to continue its downward trend. Coastal communities have been registering the impacts of a changing sea-ice cover; traditional and local environmental knowledge provides a rich and valuable perspective on the nature and impacts of such change at the community level. At the same time, Arctic sea-ice retreat has also played a role in sparking broader stakeholder interests, such as those focusing on the Arctic from the perspective of marine shipping, oil and gas development or geopolitics. Out of these varied, and often competing interests arises the need for an integrated observing system that provides information both scientifically relevant and responsive to stakeholder needs. In this contribution, we outline some key aspects of such an observing system and discuss how to integrate such observations across scales and different knowledge and information systems. We will describe how the concept of sea-ice system services was employed to ensure stakeholder relevance and help with the integration process during design and implementation of the observatory. The International Polar Year 2007-08 provides us with an opportunity to test and refine different concepts on a pan-Arctic scale. We report on progress towards a seasonal ice zone observing network (SIZONet project) and present results from a nascent integrated coastal ice observing system at Barrow, Alaska, that is part of the Alaska Ocean Observing System.

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A Cooperative Arctic Data and Information Service for An Arctic Observing Network

Arctic science in the U.S. lacks a single coordinated force setting a data management direction. This must change in order to address challenges of data management for Arctic-wide observing systems; to meet scientists expectations for sharing data across diverse disciplines; to encourage international data exchange; and to improve efficiency. The Arctic Observing Network (AON) is supported by the National Science Foundation and consists of more than 30 land, atmosphere and ocean observation programs. AON will succeed in supporting the science envisioned by its planners only if it functions as a system and not as a collection of independent observation programs. A system is envisioned through which scientists can find all data relevant to a location or process; browse imagery and documentation; and plot data online. This level of integration requires that data be in a limited number of formats or in self-describing formats, and that data have both Discovery (collection level) and Use (inventory level) metadata. But AON data vary greatly: data are often in ASCII files of various configurations without metadata. The Cooperative Arctic Data and Information Service (CADIS) is a joint effort of the University Corporation for Atmospheric Research (UCAR), the National Snow and Ice Data Center (NSIDC), and the National Center for Atmospheric Research (NCAR). CADIS is addressing these challenges through data format guidelines and a metadata profile that extends the IPY Metadata Profile. In the first year, we are concentrating on establishing data sharing protocols and on demonstrating data submission, search and visualization tools. We are surveying the field in order to understand what tools and resources are ready for deployment now for metadata generation, format conversion and data visualization. Our initial focus is on physical systems, where our technical and standards foundations are relatively strong. In the future we plan to extend this work to encompass other important areas including ecosystems, biodiversity, and human dimensions data and information.

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Zackenberg Basic – an ecosystem approach to understanding and preddicting arctic climate effects.

Zackenberg Basic is a unique monitoring programme in high arctic North-east Greenland. The programme embraces continuous seasonal and inter-annual monitoring of most geophysical, biological and feedback properties of a single high arctic ecosystem in relation to changes in local and regional climate. Over the last decade, Zackenberg Basic has recorded pronounced changes in spring snow melt and summer temperature. In response, high arctic plants, insects and birds displayed a considerable plasticity in the annual timing of reproduction. On average flowering of plants, emerging of insects, and egg-laying of birds advanced 14,6 days since 1995. However, there was considerably spatial variability in phenotypic plasticity within species as well as between species. Diversity in the response to climate increased the complexity in community dynamics, suggesting increased vulnerability of consumer-resource dynamics to climate change. Inter-annual changes in the in local weather conditions are related to changes in the North Atlantic Oscillation (NAO), which varies greatly across the arctic. Hence, future responses may vary significantly depending on the concurrent phase of large-scale natural climate systems and, consequently predictive scenarios.

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ArcticNet's Arctic Observation Networks

ArcticNet is a Network of Centres of Excellence of Canada that brings together scientists and managers in the natural, human health and social sciences with their partners in Inuit organizations, northern communities, government and industry to help Canadians face the impacts and opportunities of climate change and globalization in the Arctic. Over 100 ArcticNet researchers and 275 graduate students and postdoctoral fellows from 28 Canadian universities and five federal departments collaborate with over 100 partner organizations in Canada and nine foreign countries. Long-term funding and access to major core research infrastructure such as the Canadian research icebreaker CCGS *Amundsen* and the Qaujisarvik Network allows ArcticNet to maintain observatories of key climatic, oceanographic, ecological, health and socio-economic indices in the coastal Canadian Arctic. As part of its annual expedition onboard the *Amundsen*, ArcticNet maintains three Long-Term Oceanic Observatories (LTOOs) of 4 oceanographic mooring lines in the Beaufort Sea, Northern Baffin Bay and Hudson Bay. ArcticNet is also maintaining two additional LTOOs in the Laptev Sea and East Siberian Sea in collaboration with the Nansen and Amundsen Basins Observational Systems Network (NABOS). On land, ArcticNet researchers have access to the Centre d'Études Nordiques' Qaujisarvik Network of eight land-based research stations into which feeds 88 automated stations acquiring data on environmental and geological variables. Located along a north-south transect, the Qaujisarvik Network stretches 3500 km from Radisson, Quebec in the South (53 ºN) to Ward Hunt Island, Nunavut in the North (83 ºN). On the human health front, ArcticNet researchers are leading a research initiative with colleagues in Greenland, Alaska and Siberia to develop an international longitudinal study to assess the impacts of dietary and environmental changes on cardiovascular disease, cancer and diabetes in Inuit populations around the world. Over the next few years, ArcticNet will participate massively in the International Polar Year (IPY), both as a successful proponent of new research projects and as a supplier of expertise, services, and logistics in support of the IPY. ArcticNet will strive to consolidate the scientific legacy of this augmented Arctic research effort in partnership with its numerous Canadian and international partners.

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Circumpolar Biodiversity Monitoring Program (CBMP): Towards Integrated Arctic Biodiversity Monitoring

Arctic biodiversity is globally significant and under pressure, but our capacity to monitor and explain trends is limited. These challenges led ACIA to recommend that long-term Arctic biodiversity monitoring be expanded and enhanced. The Arctic Councils CAFF Working Group has responded by implementing the CBMP. The CBMP will harmonize and enhance long-term biodiversity monitoring efforts across the Arctic in order to improve our ability to detect and report on significant trends and pressures. The resulting information will be used to assist decision making from the global to local level. The program has over 60 partners and is strategically linked to other international initiatives.The Arctic's size and complexity represents a significant challenge towards detecting and attributing important biodiversity trends. This demands an integrated ecosystem-based approach that not only identifies trends in biodiversity, but also identifies underlying causes. It is critical that this information be made available to generate effective strategies for adapting to changes now taking place in the Arctic - a process that ultimately depends on rigorous, integrated, and efficient monitoring programs that have the power to detect change within a reasonable time frame.Towards this end, the CBMP will facilitate an integrated, ecosystem-based approach to monitoring through the development of five Expert Monitoring Groups (Marine, Coastal, Freshwater, Terrestrial Vegetation & Terrestrial Fauna). Each group will be comprised of existing monitoring programs, representing a diversity of expertise and capabilities. The CBMP will also conduct an assessment of current Arctic biodiversity monitoring capacity to identify elemental, geographic and statistical design deficiencies to be addressed. This will lead to a strategy for building and maintaining a comprehensive, cost-effective circumpolar biodiversity monitoring program.

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Environmental Monitoring in Sweden of interest for understanding the Arctic

The Arctic Climate Impact Assessment identified the need for continuing long-term acquisition of data as crucial since only a few long-term time series of climate and climate-related variables are available in the Arctic. To meet this requirement environmental monitoring conducted north of approximately 60oN in Sweden was assessed in the present study. The survey includes the Arctic Observing Networks 31 key variables and key indicator variables. National, regional and university environmental monitoring programs were scanned. The main sources of information were the internet and interviews. Programs or variables that could have a bearing on climate change in the Arctic and their biotic or abiotic effects in the Arctic were listed.The major part of the Environmental Monitoring in Sweden is executed on behalf of the Swedish Environmental Protection Agency (SEPA) to fulfill international commitments and the 16 environmental objectives set by the Swedish government. It comprises 64 subprograms, is intended to be long-term and is conducted mainly by IVL Swedish Environmental Institute Ltd (IVL), Swedish Meteorological and Hydrological Institute (SMHI), Swedish Geological Survey (SGU), Swedish University of Agricultural Sciences (SLU) and some of the other universities (Lund, Gothenburg, Stockholm, Uppsala and Ume). Data collected has its final storage in quality secured bases at different Data Base Hosts (IVL, SGU, SMHI, and SLU), but in some cases still in less organized data bases with the different conductors. The monitoring data gathered with governmental money distributed by SEPA are free and can be directly assessed from the data bases via the internet. Some other data, notably climatic and runoff data gathered by SMHI is not freely assessable, but can be bought from SMHI. However, some of these data can be found freely from international agencies to which SMHI are obligated to report.

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Hystory and current status of regional atmospheric pollution network in Russian Arctic

The sensitivity of Arctic ecosystems is observed with the reference to studies on impact of anthropogenic atmospheric pollution on natural forests and tundra area in the vicinity of large industrial cities with considerable pollutant emissions.An outcome of historical observations of regional air pollution level is presented based on national data and campaigns from the end of 1980s as well as scientific evaluation on the role of long range transport and climate aspects in supply of terrestrial and aquatic ecosystems with a number of anthropogenic pollutants. The number of measurement data sets are listed for the Russian Arctic with the main emphasis to its Asian part.The review on current monitoring networks dealing with regional atmospheric pollution and its impact on natural area is presented through the sight on relevant activities of different governmental authorities in Arctic. The brief of relevant reports is done based on publications during the last ten years.A desirable extension of measurements is investigated based on conclusions and problems provided by AMAP Assessments and other evaluation reports. The capacity of current networks is compared with disclosed needs. The prospective improvement of atmospheric pollution monitoring is considered based on necessary development of investigation in Arctic, historical general design of Integrated background monitoring network (IBMoN), strategic plans of relevant international programs, etc.

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The Russian-German Research Station Samoylov, Lena Delta: A Key Site for Long-term Observations of Permafrost Ecosystems in the Siberian Arctic

The Lena Delta is a key region for the understanding of the basic processes of the dynamics and development of permafrost in the Siberian Arctic. It is also the largest river delta in northern Asia and one of the richest areas in the Arctic for both species diversity and breeding densities of migratory birds. The delta channels one of the largest fluvial contributions of water to the Laptev Sea. The research station is located on Samoylov Island (7222N, 12630E), in one of the main river channels approximately 120 km south of the Arctic Ocean. The dry continental climate is characterized by very low temperatures (-13.6 C) and low precipitation (summer rainfall usually < 200 m). The summer water balance of the polygonal tundra is mainly controlled by precipitation.Within the framework of the Russian-German scientific co-operation between the German Federal Ministry of Education and Research (BMBF) and the Russian Ministry of Science a variety of projects have been conducted since the mid-nineties. They include long-term measurements of carbon, energy and water fluxes as well as microbiological, limnological, pedological, geobotanical, hydrological and coastal process studies. The research station Samoylov is an observatory on carbon dynamics in Arctic permafrost ecosystems that connects trace gas flux measurements with studies on microbial processes and communities and with analyses of the energy and water budgets. The findings demonstrate the close relationship between apparent carbon fluxes and the modes and intensities of microbiological processes of organic matter decomposition in permafrost soils. The evaluation of microbiological and hydrological data and their correlation with climatic and geochemical results represents the basis for the understanding of the role of permafrost in the global system, in particular feedback mechanisms related to material fluxes and greenhouse gas emissions in the context of a warming Earth.

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Monitoring the exchanges between the Atlantic and the Arctic across the Greenland-Scotland Ridge

The Arctic Mediterranean (the Arctic Ocean and the Nordic Seas) receives a continual input of warm water from the Atlantic Ocean. This Atlantic inflow supplies about 90% of the total inflow to the region and keeps large areas much warmer than they would otherwise have been and free of ice. In the Arctic Mediterranean, the imported Atlantic water is cooled and freshened. It returns to the Atlantic, partly in near-surface layers on both sides of Greenland, and partly as a deep overflow of cold, dense water that crosses the Greenland-Scotland Ridge. After crossing the ridge, the overflow water entrains ambient water and sinks into the depths of the Atlantic where it becomes the main contributor to the North Atlantic thermohaline circulation. Some climate models indicate that anthropogenic climate warming may induce a substantial weakening of these flows in the 21st century (IPCC, 2007). If this were to happen, large ecological and societal impacts may be expected (ACIA, 2005) and monitoring the characteristics and intensity of the exchanges is therefore a high priority task. To fulfill this task, a group of European marine research institutes have implemented a monitoring system, including regular research vessel cruises and quasi-permanent moorings with self-recording current meters and other instruments. This system has been developed over the last decade and has provided time-series of the characteristics and intensity of the exchanges. The field-work has mainly been carried out by national fisheries research institutes, but a number of other European institutes have been involved. Funding has been supplied by grants from national, Nordic, and European research funds, most recently within the ASOF (Arctic / Subarctic Ocean Fluxes) project, which has been funded by the European Framework Programme, but future funding of the monitoring system is unclear.

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The Alaska North Slope Science Initiative Data System and the Geographic Information Network of Alaska

The North Slope Science Initiative (NSSI) is an inter-agency effort to increase collaboration at the local, state, and federal levels to address the research, inventory, and monitoring needs as they relate to development activities on the North Slope. Alaska\\\'s North Slope is bordered by the foothills of the Brooks Range to the south and the Arctic Ocean to the north. The region encompasses 230,000 square kilometers, comprised of diverse and unique ecosystems. The North Slope provides important terrestrial, marine, and estuarine habitat for thousands of migratory birds, caribou, and other terrestrial mammals, marine mammals, and fish, and is culturally important to many Alaska Natives and their communities. This area is also well known for its oil and gas fields, which are among the largest in the United States and are thought to have significant further potential. http://www.northslope.org/The Geographic Information Network of Alaska (GINA) is the University of Alaskas mechanism for organizing and sharing its diverse data and technological capabilities among the Alaskan, Arctic, and world communities. GINA maintains an enterprise-level geographic information system (GIS) with online archiving, internet mapping, and metadata services. GINA offers training and provides satellite image processing, geographic data management, and visualization services. GINA works with agency, NGO, international, and private sector organizations to serve geospatial data needs for Alaska. http://www.gina.alaska.edu/In partnership, the NSSI and GINA serve vital data--both real-time and historical--in support of information- and science-based decision making for Alaska and the Arctic. These data currently include real-time satellite imagery and geospatial base layers. As the NSSI Data System is built out in the coming year, a broad suite of information products will be cataloged, ingested, and served in support of sound Arctic science and decision making.

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Svalbard as a candidate for European Research Infrastructure

The European Roadmap for Research Infrastructures (ESFRI) counts 35 projects. No Norwegian projects are on the list, though Norway participates in several projects led from other countries. An effort was made to nominate Svalbard as a Norwegian candidate in the previous process but it did not make it through the final rounds of selection. There will be a revision of the roadmap in 2007-2008. The ESFRI organization expects that there will be room for 5-6 new projects. We believe that Svalbard can be a well qualified candidate for the European roadmap for research infrastructures. Svalbard has many unique qualifications and has already wide international attention through the many delegations of politicians and scientists visiting Svalbard and through the many foreign research institutions based here.Svalbard is probably the best location anywhere to study and to understand the biological and geophysical processes occurring in the high Arctic. It is also a leading station in monitoring changes in the Arctic climate. Svalbard has the easiest access of any high Arctic location and has a well developed community and research infrastructure provided by Norway and international partners. In addition, Svalbard has a broad international scientific presence with approximately 20 countries represented on a regular basis.The main goal of Svalbard as an ESFRI candidate is to study and to understand the biological and geophysical processes occurring in the high Arctic as well as the changes in the Arctic climate. The present proposal is a Norwegian initiative to build a European cornerstone in the international effort to build a whole Arctic observing system. This will provide a European legacy of IPY for the Arctic.

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NorthSTAR (Northern Specnet Tundra ARray): Using optical sampling to monitor tundra response to climate change

To monitor both alpine and arctic tundra ecosystem response to climate change we propose an approach based on optical sampling using near-surface sensors. This approach avoids many problems of aircraft and satellite platforms: observations even when there are clouds, no atmospheric corrections, exact location is always known, viewing geometry is constant, and frequent observations. Multi-band reflectance data can be collected automatically from relatively low-cost sensors. Frequent observations allow the measurement of several important ecosystem characteristics: timing of snowmelt; albedo changes (due to both snow and vegetation changes); ecosystem phenology (timing of greenup, mid summer, senescence); seasonal and year to year changes in green LAI; fractional coverage of vegetation types (e.g. herbaceous plants, shrubs, lichens, and mosses); and carbon uptake; all from passive sensors with no contact with the plants. Near surface reflectance directly links with aircraft and satellite data providing a method to scale up to the region. For observations of timing, such as phenology, surface data provides temporal resolution far better than satellites that are limited by orbital constraints and cloudiness to multiday time resolution. NorthSTAR would establish an array of stations from the high arctic to the boreal forest and in alpine regions. Each station would support a set of meteorological instruments along with upward and downward viewing multispectral sensors, allowing direct connection between climatological variables and quantifiable ecosystem characteristics from spectral reflectance. The array can be grown over time and stations are readily added to existing measurment sites. While automated, there would be a visit at least once during growing season for maintenance, calibration, and site measurements.

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U.S. Department of Energy's Atmospheric Radiation Measurement Climate Research Facilities on the North Slope of Alaska

To provide greater research capability for the global scientific community, the Department of Energy designated the Atmospheric Radiation Measurement Program's scientific infrastructure and data archive as a national user facility: the ARM Climate Research Facility (ACRF). ACRFs role is to provide infrastructure support for climate research to the scientific community. DOEs climate research programs, with focus on clouds and aerosols and their impact on the radiative budget, define the research scope supported by the Facility. ACRF operates field research sites to study the effects of clouds on global climate. Three primary fixed locations -Southern Great Plains, Tropical Western Pacific, and North Slope of Alaska - represented a range of climate conditions that should be studied. Sites were instrumented to gather climate data that are freely available to the international community through a data archive. The ARM Mobile Facility gathers atmospheric measurements similar to those at the three fixed sites for periods up to a year anywhere in the world. The Aerial Vehicles Program supports aircraft measurements for priority scientific questions, including in-situ cloud properties, aerosol size and chemical composition, and remote sensing of various parameters.Since 1998, the North Slope of Alaska (NSA) site, with facilities in the towns of Barrow and Atqasuk, has provided data about cloud and radiative processes at high latitudes. These data are used to refine models and parameterizations related to the Arctic.The ACRF is available for collaborative international research for both long- and short-term projects: weeks, months, or longer. Campaigns have common research themes and extend baseline ACRF measurements. Past campaigns studied boundary layer clouds, mixed-phase Arctic clouds, and radiative heating in dry winter atmospheres. A 2008 campaign will include instrumented aircraft. Unmanned aerial vehicles and tethered balloons are proposed for the future.

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Tarfala Research Station - Monitoring the Cryosphere for the Future

Tarfala Research Station, Stockholm University, has maintained monitoring of the sub-arctic high alpine environment in northern Sweden since 1946. The program consists of measurements of glacier mass balance, glacier fluctuation, catchment runoff, meteorology and deep permafrost borehole temperatures. The mass balance measurements of Storglaciren that started 1946 now constitute the longest continuous series of its kind in the world. Meteorological measurements allow studies of glacier-climate relationships. A more extensive program of glacier fluctuation measurements was initiated in the 1960s to yield a larger statistical data set. Gauging of the Tarfala valley catchment began at a permanent hydrological station during the hydrological decade (1965-75). New glacier mass balance programs were initiated to improve understanding of regional glacier status in the 1980s. A 100 m deep bedrock bore hole was drilled and instrumented in 2000 to monitor the permafrost. The extensive monitoring program has been built through initiatives from individual researchers and by the opportunities that emerge from international scientific ventures but without an underlying strategic plan. As a result the Tarfala program now consists of unique and extremely valuable data series but it lacks an organizational structure that efficiently convey the data to the scientific community. Hence there is dire need to establish efficient ways to secure data sets, find ways to ensure that data series can continue to build and also to simplify access to the data. Such structures need several components: (i) a governing body that can critically discuss the data and perform evaluations of program efficiency and needs; (ii) a secure funding strategy (national and international) and (iii) an internationally funded database structure for depositing monitoring data sets.

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Arctic Aquatic Monitoring Program of Fisheries and Oceans Canada

High inherent variability, and cumulative effects of major stressors particularly climate change, have significant implications for northern aquatic ecosystems, resources and communities. An Arctic aquatic monitoring program is necessary to understand and properly manage changes in marine and freshwater ecosystems. DFO has wide ranging programs in the North encompassing fishery, habitat, biological, physical and chemical sciences, ands well as hydrographic charting. Through the Canadian IPY program, DFO is strengthening and extending these to deliver key data and information related to fish species, marine mammals, marine circulation, freshwater through-flow, ocean properties and severe arctic storms. The surge of IPY observing activities provides a platform from which a sustained aquatic monitoring program can be launched for the Canadian Arctic. This will integrate physical, chemical and biological oceanographic measurements, increase understanding of physical and chemical processes that drive primary and higher trophic level production using an integrated ecosystem based approach and focus on known productive regions. To ensure a legacy for IPY and to enhance linkages to a pan-Arctic aquatic monitoring program, DFO is committed to the archival of all aquatic data in open access databases in a timely manner. Within Canada, DFO has key partnerships with northern co-management boards to also link such work to community-based monitoring programs which address community priorities, builds capacity and utilizes traditional knowledge. Development of a national and international pan-Arctic integrated aquatic monitoring program contributes to the objectives of the Canadas Oceans Strategy, management and policy decisions regarding marine species as well as a Canadian Agenda for the Arctic. This program will also deliver key contributions to programs associated with the Arctic Ocean Sciences Boards (iAOOS)and the UN IOC (GOOS) and to initatives being developed by the AC.

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Information Management for the Northern LTSER platform in Finland

The setting of Long-Term Socio-Ecological Research (LTSER) is complex for information management (IM). The key feature of LTSER is its long-term approach with collection of long-term data series at local sites. Ecological data are extremely heterogeneous, and the social component of LTSER adds further complexity. Data sets are dispersed in various geographical and institutional locations. Long-term data sets can have multiple kinds of uses and reuses during their life-cycle. Furthermore, LTSER promotes sharing and reuse of data, as well as large-scale, interdisciplinary collaborative research. From IM point of view these suggest need for 1) preservation and stewardship of dynamic data to ensure longevity and integrity of data collections, 2) provisioning continuous access to both primary data and metadata for various types of users, and 3) building and maintaining sustainable information infrastructure.Within the Northern LTSER platform of the nascent Finnish LTSER network, our aim is to promote a collaborative socio-technical approach to the development of information management and infrastructure in an incremental, process-like manner. Awareness raising is needed among the participants in data sharing, data stewardship and data-intensive large-scale collaboration. In addition, the need to educate a range of skillful information management personnel is recognized as pressing. We recognize LTSER IM must provide support for the needs of both data, science, and information infrastructure. 1) Local sites are to establish IM systems as they best understand their data collection and quality assurance processes. 2) Science conduct is to be supported continuously by offering various means of facilitation. 3) Common procedures, standards and policy as well as technological solutions forming information infrastructure are created and implemented in collaboration with FinLTSER, LTER-Europe and ILTER networks.

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Northern Long-term Socio-ecological Research Platform (Northern LTSER Platform) - a new tool for collaborative research in Northern Finland

Northern LTSER Platform, founded as a part of Finnish LTER Network in 2007, constitutes environmental transect from northern boreal forest landscapes to arctic tundra. The main aim of the Northern LTSER Platform is to pool long-term research activities and monitoring data of the northernmost university research stations in Finland under five research themes related to socio-ecological changes in northern nature and communities. The platform covers almost entirely northern parts of Finland and the study design of the platform operates as a sensitive instrument to assess drivers, pressures and the state of environment on multiple spatial scales both on nature and human systems and their interaction. The sites maintain high-quality infrastructures that enable research with a focus on complex interactions between environmental pressures (climate change, land use change, atmospheric pollution) and ecosystem functions and services. The sites cover a wide range of ecosystems and human induced pressures and serve as bases for socio-economic research. Well-developed network of university research stations (Oulanka, Kilpisjärvi, Kevo, Värriö) and northern units of research institutes offers the basic infrastructures for conducting collaborative research, basic laboratory facilities, competent personnel and office as well as accommodation facilities for visiting scientist. About 30 senior researchers or professors with their research groups are involved in the work of the platform. LTER in Finland has objectives similar to that of the international LTER network. Research themes of Northern LTSER Platform are the following: Population dynamics and productivity of plant and animal populations living in the periphery of their distribution, Effects of global change on northern ecosystems, Changing society and livelihoods in rural and peripheral areas, Human health and wellbeing in northern communities, and Information management and research infrastructure for scientific collaboration.

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Long-term ice-drifting buoy observations in the Arctic Ocean interior by: JAMSTEC

To monitor and better understanding hydrographic conditions in the Arctic Ocean interior, we have been conducting ice drifting buoy observation since 1992. Especially, during 2000, we began to conduct sustainable time-series observations using JAMSTEC Compact Arctic Drifter (J-CAD). Ten J-CADs providing temperature-, salinity-, upper ocean current-, and meteorological- data were operated in the Arctic Ocean interior. Certain observational results from these buoys showed signals of important changes in the Arctic Ocean and several articles have been published from some scientific journals. After thorough data processing- and quality-checks, these data were released on a CD (J-CAD data report) and on our web site (JAMSTEC Arctic Ocean Climate Research web site). Based on J-CAD successful performance, we developed a new buoy system tethering an Argo-type subsurface CTD profiler in collaboration with METOCEAN Data Systems. This Polar Ocean Profiling System (POPS) consists mainly of an ice platform and an Argo-type subsurface CTD profiler. The profiler is mounted on an oceanographic cable interfaced to the platform; the profiler samples salinity, temperature, and depth from below sea-ice down to 1000m. Following the field test near the North Pole in April 2005, we initiated the observation of the Arctic Ocean interior using the POPS in April 2006 and we also started sending the data to the Global Telecommunication System (GTS) in real time. These data are the first Argo data sent from the Arctic Ocean. Not only Arctic oceanographers but also everyone who is interested in Arctic oceanographic conditions can easily access these data from the Argo data server. Combined the POPS observation results with the previous observations, we are now investigating not only environmental changes of the Arctic Ocean interior but also important processes related to the recent Arctic sea ice reduction.

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Sustained Observations of the Arctic Ocean in all Seasons Using Bottom-Tethered Moorings and Ice-Tethered Profilers

Since 2003, the Beaufort Gyre Observing System (BGOS; www.whoi.edu/beaufortgyre) has been acquiring year-round observations of bottom pressure, ice draft and seawater temperature, salinity, and velocity (between 50 and 2000 m), from an array of bottom-tethered moorings deployed in the Canada Basin. In 2007, sediment traps and additional deep temperature, salinity and velocity instruments were added. The moorings are serviced and data retrieved each summer on an icebreaker cruise, which also occupies a synoptic survey of the physical and geochemical ice/ocean properties. To observe upper-ocean properties on wider scale, the expendable Ice-Tethered Profiler (ITP; www.whoi.edu/itp) was developed in 2004. ITPs acquire 2-to-4 temperature, salinity (and optionally dissolved oxygen) profiles per day for up to 3 years while drifting with the ice pack and transmit the data back to our laboratory in near real time where they are made available on the ITP website. The ITP is also able to support other sensors on the profiling vehicle (such as bio-optical sensors, and a current meter) and additional fixed-depth modules such as surface meteorological sensors and subsurface acoustic systems. The latter could constitute a telecommunications link through the surface ice pack and serve as a future backbone for two-way transmissions to buoys, AUVs, and subsurface moorings. With international collaboration, there are presently 15 ITPs deployed throughout the ice-covered Arctic.The combined BGOS-ITP dataset is providing a near-comprehensive record of the Beaufort Gyre system on time scales ranging from a day up to interannual period. Significant changes in ocean heat content, freshwater, and the ice cover have been detected, along with novel observations of Pacific and Atlantic Layer intrusions, fronts, eddys at various depths, and biogeochemical information. We have proposed to continue the BGOS and ITP programs into the future as contributions to the Arctic Observing Network.

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Marine biological observing networks at IO PAS

The need for sustaining long term observations is one of the research priorities of many research teams at the Institute of Oceanology, Polish Academy of Sciences (IO PAS) in Sopot, Poland. In addition to marine hydrodynamics and marine physics measurements, reported elsewhere during this meeting, there are also biological/ecological monitoring programs, carried on during the regular research cruises of RV Oceania to open seas, as well as during land based expeditions to sheltered marine waters, within the area of European Arctic (the Nordic Seas an Spitsbergen, in particular). At present we have data on plankton composition and distribution within the West Spitsbergen Current for 1987-1999 and since 2001 onward, as well as data on plankton and soft bottom benthos distribution on long term monitoring stations in Spitsbergen fjords (Kongsfjorden: plankton since 1996, benthos since 1997; Hornsund: plankton and benthos since 2001, with gaps). Several of this data have already been published, giving evidence of ongoing changes in marine ecosystems. This could not be proved without the effort put to carry on continuous monitoring programs also in the marine environment.In the presentation we would like to introduce the framework of our biological/ecological monitoring system, discuss some limitations as well as logistics and methodological problems in addition to presenting some of the foremost results.

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Acoustic Navigation and Communications for Autonomous Platforms in the Arctic Ocean

Recent community reports on autonomous and Lagrangian platforms and Arctic observing (Instrumentation for Arctic Ocean Exploration, 2002; Ice-Based Observatories, 2004; Autonomous and Lagrangian Platforms and Sensors- ALPS, 2003) identify the development of under-ice navigation and telemetry technologies as one of the critical factors limiting the scope of autonomous (e.g. floats, AUVs and gliders) high-latitude measurement efforts. These platforms could provide persistent, high-resolution, basin-wide sampling in ice-covered regions and collect measurements near the critical ice-water interface.Motivated by the dramatic advances in temporal and spatial reach promised by autonomous sampling and by the need to coordinate nascent efforts to develop navigation and communication system components for near-term observational efforts, an international group of acousticians, autonomous platform developers, high-latitude oceanographers and marine mammal researchers gathered in Seattle, U.S.A. from 27 February - 1 March for an NSF Office of Polar Programs sponsored Acoustic Navigation and Communication for High-latitude Ocean Research (ANCHOR) workshop. ANCHOR workshop participants focused on summarizing the current state of knowledge concerning Arctic acoustics, navigation and communications, developing an overarching system specification to guide community-wide engineering efforts and establishing an active community and steering group to guide long-term engineering efforts and ensure interoperability between elements developed by disparate teams. This presentation will summarize ANCHOR workshop findings.

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Seasonal and annual variations of phytoplankton production in the Bering Strait region and Chukchi Sea.

Because of the political issues and logistic problems, none of field studies has been done seasonally and annually in the whole Bering Strait and Chukchi Sea regions, although these regions are the only conduit of water masses and organic matter between the North Pacific and Arctic Oceans. Based on the in situ measurements for chlorophyll-a and primary production in 2003-2004, the seasonal and annual variations of primary production in the regions were examined from the satellite ocean color images (MODIS) during the recent period (2002-2006). The Seasonal and annual variations of chlorophyll-a concentration and production of phytoplankton were generally higher in the western side than in the eastern side of the Bering Strait region. This is corresponding to the variation of nitrate concentration measured in the Bering Strait region from 2000 to 2004, although the pattern of ammonium concentration was not same as that of nitrate. The primary production in the eastern side of the region was much higher in this study than those of in situ measurements. This is believed to the effects of inorganic particles in the water column discharged from rivers and coastal areas in Alaska. Another alternative one is the effects from suspended particles from sediments on seafloor because of a shallow water depth. The production in the central Chukchi Sea as a hot spot also was rather variable in different seasons based on the average production from 2002 to 2006.

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The Swedish Meteorological and Hydrological Institute - Data: Measurements, archives and policy

Sweden has a long tradition in the area of systematic observation. The observation of ice break up in the Torne River is documented from the end of the 17th century and ice formation and ice break-up have been observed on 300 lakes since 1870. Continuous, long-term, engagement in these areas is in line with the Swedish Government's prioritisation of research and development.

SMHI has a responsibility to supply society with meteorological, hydrological and oceanographic data. The institute is responsible for national forecasts and warnings as well as preparedness for catastrophes where actual and prognostic information on weather and water conditions is required. The responsibility also includes production of basic information for the general needs of society, for research and observations as well as for rational decision-making. SMHI is also responsible for the development and maintenance of national data sets within meteorology, hydrology and oceanography. The content and conditions are described at the web page http://www.smhi.se. The institute provides expertise in the area of climate variability and climate change issues and the Government has assigned to the institute a more permanent role as regards Climate Change Projections.

SMHI conducts measurements and observations at numerous locations in Sweden and the surrounding seas, and collects data from its national and international partners. Observations and measurements are made from various platforms; weather stations, hydrologic stations, aircraft and ships, balloon-borne instruments, buoys, etc. Satellites, weather radar and lightning sensors also supply information which is processed in our systems.

SMHI represents Sweden in the World Meteorological Organisation (WMO) and provides a national contribution to World Weather Watch (WWW). The institute is also part of EUMETSAT with the operational meteorological satellites and EUMETNET responsible for the EUCOS (EUMETNET Composite Observing System for the North Atlantic and Europe). SMHI is involved in Nordic radar and lightning localisation networks. Also in the oceanographic field there is international cooperation in IOC, EuroGOOS and other organisations. Comprehensive information about measurements and archived data is found in http://www.smhi.se/sgmain/lopsedel/GCOS-2005%20slutlig.pdf.

Science plays a key role in supporting policy decisions aimed at minimising climate change and its impacts. A precondition for sound science and understanding of global climate variation and change is the work undertaken in the areas of Global Climate Observing Systems (GCOS) and systematic observation. The new intergovernmental Group on Earth Observations (GEO) has been established with Swedish participation. The GEO Secretariat was established as an independent intergovernmental body to oversee the fulfilment of a 10-year implementation plan to create a Global Earth Observation System of Systems (GEOSS). The global initiatives GEOSS and GCOS, both with important implementation plans, are expected to experience mutual benefit through the coordinated effort to address capacity-building needs related to Earth observations. For GCOS and GEOSS the **International Polar Year** is an important injection in order to establish enhanced long-term measurements in the Polar Regions. In line with enhanced needs as regards advanced multidisciplinary research and monitoring in the Polar Region SMHI has a strategy to improve access to data; measurements as well as basic analyses of past conditions and projections into the future. This is in line with the EU directive INSPIRE but also in line with the new possibilities where

different data bases can be combined through grid technology. These possibilities are exploited in the WMO Information System (WIS) and within EUMETNET UNIDART.

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Results of the Russian Federal Agency for Mineral Resources Program the offshore geoenvironmetal monitoring

For sustainable development of the Arctic resources the arctic offshore environmental monitoring (OEM) is the main component of the provision of the ecology safety. The OEM includes the monitoring of the offshore geological environment. The top part of quaternary depositions and bowels of shelf are a main object of the geoenvironmental monitoring (OGM). The exogenic component of OGM includes the analysis of pollution of bottom sediments, near-bottom and pore waters. In Russian Federation the State program for OGM exists from 1999 under umbrella Ministry of the Natural resources and Federal Agency for mineral resources, which carry out the State Company Sevmorgeo. On basis of the previous geoecological investigations for arctic seas the locations of stations of a federal monitoring network was determined. In the period from 1999 to 2007 the average geoenvironmental characteristics for OGM polygons was measured and corresponded database was created. The location of monitoring stations was connected with zones of the most intensive accumulation of the clay sediments (natural sediment traps). Every year SC Sevmorgeo carry out the measurements on the 50-60 monitoring stations in the Barents sea. Into account for the experience of previous OGM and requirements of the Arctic Council Guide Lines for it the standard complex of observations was created and confirmed by Rosnedra. The results of the OGM which was carried out during 1999 -2007 on the foregoing oil and gas fields have shown, that geologic environment in their margins is practically not disturbed. In the Pechora Sea (fields "Varandey-sea" and "Prirazlomnoe") the bottom sediments has predominantly sandy structure. The contents of a fraction < 0,01mm does not exceed 20 %. These sediments are characterized by the decreasing sorption, periodically disturbed and do not contain high concentrations hydrocarbons. The temporal tendency of the mean meanings of THC (total hydrocarbons) for bottom deposits of the Varandey for the last years demonstrates that they have the decreasing trend (except for 2000). The increasing of the THC concentrations for 2000 is connected, most likely, with influence of the oil mining on the coast. On the Shtokman field the contents of the hydrocarbons in the bottom deposits are also low, though their concentrations in sediments are higher, than in the Pechora Sea. It is connected with the predomination of the clay sediments in bottom deposits. However, the data of monitoring for the separate dots showed that on it the local anomalies of hydrocarbons repeatedly appear. On the next years they, as a rule, disappeared, but at other stations the local anomalies again were fixed. The high concentrations of cupper and zinc in separate dots, the part from which coincided and with the heightened concentrations of the hydrocarbons in near-bottom waters, can not be connected with a pollution of these areas. Their occurrence more really can be explained by the expiration of fluids from earth entrails. The measuring which was carried out in this period for the radioactive nuclides (specially, 137Cs) have shown, that bottom deposits and near-bottom water within federal polygons are characterized by the background meanings of activity practically for all radionuclides. Even the special investigations around the was sanked nuclear submarine Kursk (1999) and K-159 (2002) have shown, that these emergencies were not tracked by appreciable increasing of radioactivity even in immediate proximity from their bodies.

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Atmospheric and Space Physics Monitoring in the Scandinavian Arctic

To monitor the atmosphere in the Scandinavian Arctic, the Swedish Institute of Space Physics (IRF), with head office in Kiruna (67.84° N, 20.41° E), employs mm-wave measurements, lidars, the ESRAD MST radar and a number of spectrometers (FTIR and DOAS). These instruments monitor ozone and other trace gases, aerosols, polar stratospheric and noctilucent clouds as well as winds and other structures in the atmosphere. IRF in Kiruna is one of the measurement sites of the Network for the Detection of Atmospheric Composition Change (NDACC), a set of more than 70 remote-sensing research stations which observe the physical and chemical state of the stratosphere and upper troposphere and assess the impact of stratosphere changes on the global climate. Most of the instruments are also involved in IPY projects.

To monitor the Earth's ionosphere and magnetosphere, IRF and other space physics research organisations use satellite-borne instruments and such ground-based instruments as cameras and other optical instruments (to detect and record aurora), magnetometers (to observe the Earth's magnetic field), riometers (to detect particle precipitation), ionosondes (to measure the electron density of the ionosphere) and HF radars (to detect ionospheric convection). Magnetic observatories such as IRF contribute data to such magnetic indices as local K-indices and global AE indices. Data are archived at data centres such as World Data Center WDC-C1 in Copenhagen, WDC-C2 in Kyoto and NGDC in Boulder.

The optical auroral instruments include all-sky cameras (operating in Kiruna since the IGY in 1957) which take one picture per minute with a 180-degree field-of-view. IRF also coordinates the International Network for Auroral Optical Studies of the Polar Ionosphere, a forum for planning measurement campaigns, distributing information and intercalibrating different sets of instruments located in different parts of the world. The network is part of the IPY-endorsed project Heliosphere Impact on Geospace, IPY Cluster # 63, with ICESTAR (Interhemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research) and IHY (International Heliophysical Year) as lead projects.

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Influx of Freshwater Runoff to the North Atlantic Ocean from Greenland

Arctic hydrological processes are changing and evolving in response to changes in climate. In the Arctic the remote terrain, logistic challenges, and harsh climatic conditions yield a lack of both cryospheric and hydrological knowledge. This is a serious impediment to hydrological research at Greenland; for example the amount and changes in cryospheric storage and freshwater runoff to the North Atlantic Ocean are relatively unknown. In Greenland, the terrestrial cryospheric storage does have a very important influence in the high-latitude freshwater runoff contribution to the ocean. Estimates of freshwater runoff from the only two long-term measured East Greenland catchments (Mittivakkat catchment, Ammassalik Island (65N), SE Greenland, and the Zackenberg catchment (74N), NE Greenland) have been conducted based on snow, glacier, and runoff observations and modeling. These estimates include glacier recession and average loss of glacier volume on ~600 mm w.eq. y-1 (Mittivakkat) and ~1,300 mm w.eq. y-1 (Zackenberg) (19992004). The runoff contribution from glacier recession dominates the mean annual catchment runoff by 30 to 90%. Total freshwater runoff from Mittivakkat was ~3.710-2 km3 y-1 and Zackenberg ~21.910-2 km3 y-1. For the future period of 20712100, IPCC A2 and B2 climate scenarios, based on the HIRHAM regional climate model and HadCM3 atmosphereocean general circulation model simulations, was used as input in runoff models. Results demonstrate a mean annual Mittivakkat and Zackenberg runoff about one and a half times higher than todays runoff, which subsequently indicates an approximately two to three times higher negative glacier net mass balance than today.

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The North Pole Environmental Observatory: Tracking Change in the Marine Arctic

In the late 1980s and through the 1990s we saw major shifts in the Arctic marine environment. The influence of Atlantic Water in the Arctic Ocean became more widespread and intense and the pattern of water circulation and ice drift shifted, resulting in a more cyclonic circulation. These changes became manifest in the central Arctic near the North Pole as increases in upper ocean salinity and Atlantic Water temperature. They occurred in concert with a decrease in surface atmospheric pressure. With the aim of helping to track such changes, the North Pole Environmental Observatory (NPEO) has been maintained since 2000. Along with installing an automated drifting station every year and maintaining a deep ocean mooring near the Pole, NPEO conducts airborne hydrographic surveys that track ocean changes along key sections radiating from the Pole. In addition to these core elements, NPEO supports collaborating projects logistically and with observations. Examples of collaborating projects include ocean flux measurements, snow sampling, and in situ and remote sensing observations of ocean bottom pressure.NPEO hydrographic measurements show that between 2000 and 2005, oceanographic conditions relaxed toward the pre-1990 state. These changes can be related to a decline in the Arctic Oscillation (AO) index. Bottom pressure trends indicate that shift back to pre-1990s circulation extended over the whole Arctic Ocean. Ice draft measurements at the Pole suggest a recovery in ice thickness toward 1970s values, at odds with observed continued declines in sea ice extent. However, the Spring 2007 NPEO hydrographic surveys and the 2006-2007 bottom pressure data suggest the trend towards pre-1990s conditions has now, once again, reversed.

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International Study of Arctic Change: A System Science Approach to Documenting, Understanding and Responding to Arctic Change

The past two decades has seen a set of interrelated changes, detected and documented across the Arctic system. These changes have occurred across all domains (biological, chemical, ecological, human and physical) and have already had an impact on life in the Arctic. The International Study of Arctic Change (ISAC) (http://www.iasc.se/isac.htm) is a long-term, international, cross-disciplinary pan-arctic program concerned with Arctic change induced by enhanced greenhouse warming and other anthropogenic 'interferences' and with the effects of natural variability on the Arctic system. ISAC is being designed to document and track Arctic changes, understand their causes, nature and connectivity, and to study socioeconomic, political, and cultural responses and feedbacks in order to minimize future negative effects through adaptation and mitigation. This requires study of the Arctic as a system - past, present and future – and understanding the role of the Arctic as a component of the global system, including society as an integral part.

Critical to a successful international and integrated system-science effort targeted at Environmental Arctic Change is the development of an integrated, multi-disciplinary observing system that is suited for addressing scientific hypotheses and that will accumulate observational data that are relevant to addressing system level questions about Arctic change. Long-range science planning should develop within a framework structured to provide expanded knowledge about all components of the Arctic system with the goal of leading to a better understanding of the nature of Arctic environmental change and improved assessments of its impacts. Of crucial importance is the integration of human dimensions data. This requires careful thinking about the means by which such data can facilitate system studies, and system-level understanding. ISAC provides a venue for international collaborative science planning and for guiding and developing system-level observing activities on a pan-arctic scale, relevant to understanding the present changes, as well as assessment of relevance to societal and policy needs.

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The Circumpolar Active Layer Monitoring (CALM) Program and Network

The Circumpolar Active Layer Monitoring (CALM) program tracks changes and trends in the seasonally frozen (active) layer of permafrost regions. CALM is a hypothesis-driven program that monitors active-layer thickness and shallow ground temperature, coordinates field experiments, and provides data for use in a wide-range of cold-environment research activities. The CALM network is currently comprised of more than 150 sites distributed throughout the Arctic, parts of Antarctica, and several midlatitude mountain ranges. Data-acquisition methods include monitoring the soil thermal and moisture regimes with automatic data loggers, mechanical probing of the active layer, frost/thaw tubes, and measurements of frost heave and thaw subsidence. Groups of sites are used for mapping active-layer thickness and obtaining regional estimates of the volume of thawed soil. The CALM network has provided a large amount of data pertaining to cryostratigraphy, cryoturbation, and soil carbon. Data obtained from the network are used widely to validate hydrological, ecological, and climatic models. Data are archived at the Frozen Ground Data Center (http://nsidc.org/fgdc/) in Boulder, Colorado. CALM is sponsored by the U.S. National Science Foundations Office of Polar Programs, and linked with many other global-change programs through the Global Terrestrial Network for Permafrost (GTN-P), a network under the WMO Global Climate Observing Network (GCOS). With its sister programs Thermal State of Permafrost (TSP), Antarctic Permafrost, Periglacial, and Soil Environments (ANTPAS), Carbon Pools in Permafrost Regions (CAPP), and Arctic Coastal Dynamics (ACD), CALM forms a comprehensive effort on the part of the International Permafrost Association to monitor, understand, and predict environmental change in permafrost regions. CALM is a major component of the IPAs coordinated program for the International Polar Year. Information about CALM can be found at http://www.udel.edu/Geography/calm/.

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Observing the Arctic Circumpolar Coast ACCO-Net in SAON

Variations in sea ice extent, wave and storm intensity, air and water temperatures, and ground ice content affect the rate and magnitude of coastal change in the Arctic. The Arctic coastline is poorly observed, although Arctic human systems are located in and depend on processes in the coastal zone. Monitoring is necessary as a barometer for global change and for its human relevance. The international effort to align coastal observations in the Arctic is led by the Arctic Circumpolar Coastal Observatory Network (ACCO-Net). ACCO-Net provides: 1) a network of regional experts responsible for running observations; 2) historical and current data in an Arctic circumpolar GIS database; and 3) a catalogue of site characteristics based on remotely sensed products. The regional experts have been assembled through IASCs Arctic Coastal Dynamics project, and through the IPY project cluster on Arctic coastal observatories, which ACCO-Net leads. The coastal database is currently available in beta form, and includes a segmentation and classification of the circumpolar Arctic coastline. The World Vector Shoreline has been divided into over 8000 segments on the basis of geomorphology, coastline position change rate, and ground composition, among other parameters. The GIS format allows searching and querying, and the database is currently mounted as an internet map server. The site catalogue includes: i) a monitoring template of primary and secondary monitoring parameters for each site, with links to standard operating procedures, and ii) consistent coastline position and digital elevation models for each observatory site, based on optical and infrared satellite data collected during IPY as part of the European Space Agencys IPY program. ACCO-Net partner projects are currently selecting imagery for the catalogue and will co-ordinate their activities via a series of workshops supported by the International Space Science Institute.

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Pallas-Sodankyl LTER Observatory

The Pallas-Sodankyl Long-Term Ecological Research (LTER) Observatory, a part of the Northern LTSER-platform, consists of the Pallas-Yllstunturi natural park and the Finnish Meteorological Institute\'s Arctic Research Centre at Sodankyl in northern Finland (www.environment.fi/syke/lter). In contrast to the general case in remote regions in northern Eurasia and North America, the Pallas-Sodankyl site is covered with dense weather, hydrological and environmental monitoring networks and specialized research stations. The Pallas-Sodankyl site is a good representative of boreal and sub-arctic Eurasian environment in a transition zone from marine to continental climate in the west to east direction. The site provides in situ monitoring and high spatial resolution land cover data sets that are hardly available for other regions north of the Arctic Circle. A special feature of the site is that it is the westernmost part of the Eurasian taiga belt that reaches close to the Pacific Ocean in its easternmost extent. As the Russian in situ environmental and climate monitoring network has declined since the early 90s, the Pallas-Sodankyl LTER area provides data and a research infrastructure (available e.g. for measurement campaigns) that are not available elsewhere in that particular ecological and climate region. The site is particularly suitable for long-term ecological and atmospheric monitoring because the Pallas area has been a national park over six decades and thus represents a relatively pristine nature. The site incorporates a variety of biotopes, e.g. forests, bogs, barren mountain tops, lakes and rivers. The data sets available from the Pallas-Sodankyl LTER area include e.g. the weather and atmospheric parameter monitoring data, land cover characteristics, hydrological and surface water quality monitoring and modelling data, forest ecosystem monitoring data, and environmental radioactivity data.

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IOPAS station Grid in the Norwegian and Greenland Seas for long-term observation of large scale ocean dynamics

Starting in 1987 IOPAS established in Norwegian and Greenland Seas network of hydrographic Stations aimed mainly at research of variability of the Atlantic Water properties and transport by Norwegian Atlantic Current (NAtC) and the Westspitsbergen Current (WSC). To investigate the exchange between main fjords of the West Spitsbergen and open sea and hydrography inside fjords observation network was developed there as well. Later on this station grid was modified according to gained knowledge and current needs e.g. demands by project like ASOF or DAMOCLES. Scheme of the latest version (since 2000) of hydrographic stations, occupied each summer (June-July) is shown at Fig 1. Some, selected results based on these observations are discussed as well as are methodological question of importance of spatially distributed observation network on one hand and time serious at certain location on the other.

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The Climate and Cryosphere Project (CliC) and Sustained Observing Networks

The Climate and Cryosphere Project (CliC) is one of the four core projects of the World Climate Research Program (WCRP). CliC principal goal is to assess and quantify the impacts that climate variability and change have on components of the cryosphere and its overall stability, and the consequences of these impacts for the climate system. CliC co-ordinates climate activities related to all parts of the earth's cryosphere. This includes sea ice, snow, ice shelves, icebergs, lake/river ice, and permafrost. CliC is helping to co-ordinate the WCRP role in the International Polar Year (IPY), in particular to insure that a legacy of data management, observational and research capabilities remain after IPY. Outcomes from CliC research will contribute to seasonal forecasting, estimates of sea-level prediction, water management, energy production and many other application areas. CliC has also been instrumental in completing the IGOS-cryo theme report: < http://igos-cryosphere.org >. This theme creates a framework for improved coordination of cryospheric observations conducted by research, long-term scientific monitoring, and operational programs, and to generate the data and information needed for both operational services and research. CliC supports sustained observing networks in the Arctic and the Antarctic for all cryospheric components. Ongoing sustained networks include already implemented and well-developed research programmes in the field of Arctic sea ice (upwards-looking sonars in the Fram Strait: the Integrated Arctic Ocean Observing System iAOOS, see: < www.iaoos.no >) and of Arctic permafrost (Permafrost Observatory Project: A Contribution to the Thermal State of Permafrost TSP, see: < www.ipa-permafrost.org>). CliC invites and encourages scientists to register in its specialist database at <http://clic.npolar.no/specialists>.

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Sustained Observations of the Arctic Ocean in all Seasons Using Bottom-Tethered Moorings and Ice-Tethered Profilers

Since 2003, the Beaufort Gyre Observing System (BGOS; www.whoi.edu/beaufortgyre) has been acquiring year-round observations of bottom pressure, ice draft and seawater temperature, salinity, and velocity (between 50 and 2000 m), from an array of bottom-tethered moorings deployed in the Canada Basin. In 2007, sediment traps and additional deep temperature, salinity and velocity instruments were added. The moorings are serviced and data retrieved each summer on an icebreaker cruise, which also occupies a synoptic survey of the physical and geochemical ice/ocean properties. To observe upper-ocean properties on wider scale, the expendable Ice-Tethered Profiler (ITP; www.whoi.edu/itp) was developed in 2004. ITPs acquire 2-to-4 temperature, salinity (and optionally dissolved oxygen) profiles per day for up to 3 years while drifting with the ice pack and transmit the data back to our laboratory in near real time where they are made available on the ITP website. The ITP is also able to support other sensors on the profiling vehicle (such as bio-optical sensors, and a current meter) and additional fixed-depth modules such as surface meteorological sensors and subsurface acoustic systems. The latter could constitute a telecommunications link through the surface ice pack and serve as a future backbone for two-way transmissions to buoys, AUVs, and subsurface moorings. With international collaboration, there are presently 15 ITPs deployed throughout the ice-covered Arctic.The combined BGOS-ITP dataset is providing a near-comprehensive record of the Beaufort Gyre system on time scales ranging from a day up to interannual period. Significant changes in ocean heat content, freshwater, and the ice cover have been detected, along with novel observations of Pacific and Atlantic Layer intrusions, fronts, eddys at various depths, and biogeochemical information. We have proposed to continue the BGOS and ITP programs into the future as contributions to the Arctic Observing Network.

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Education and research programs in Circumpolar Health and Well-being

The framework for the Circumpolar Health and Well-being consists of an international masters program, PhD graduate school and research programs coordinated by the Centre for Arctic Medicine which is one of the operative units in the Thule Institute of University of Oulu. All these activities are included in the network of Arctic Medicine in the University of Arctic and IPY. The multidisciplinary focus is based on the close collaboration with two programs (Global Change in the North and Northern Land Use and Land Cover) also coordinated by the Thule Institute. The research program studies human health, well-being and adaptation in the North. It emphasizes the northern point of view: man is considered as a physical, cultural and social actor in the northern environment and society. The projects include prevention of marginalization (North Finland Birth Cohorts), environmental health, adaptation to cold, revitalization processes for Northern minority languages and cultures, effect of place and environment in the stories of Northern people and seamless services by e-Health. There are altogether over 30 PhD students in these six research projects. The research program is very closely connected to the PhD Graduate School which provides doctoral education for over 60 students. Every year 6-10 PhD students complete their theses. Sami language and the health issues of Sami people will be included in the research program in the next few years. Masters program in Circumpolar Health and Well-being is a multidisciplinary two-year programme (120 ETCS) approaching health and well-being as a holistic phenomenon. The members of the network are the University of Oulu (as coordinator), Center for Health Education (Greenland)/University of Southern Denmark, Lule University of Technology, Northern State Medical University, Pomor State University, University of Lappland, University of Manitoba and University of Troms (NORUT). The pilot will start in autumn 2008.

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Pan-Arctic Monitoring of Arctic chars Key Observers of Aquatic Change

Long-term monitoring of northern aquatic ecosystems and their key biotic components are both essential for addressing ecosystem health and integrity, and the sustainability of ecosystem services including harvest of high quality food. Two approaches to ecological monitoring are possible ecosystem-level and focal species-level. As an example of the latter, an integrated monitoring programme under development for Arctic chars which encompasses both research-based and community-based activities is described. This group of salmonid fishes occupy pivotal roles in nearshore marine, estuarine and freshwater ecosystems throughout the Arctic, thus integrate a wide variety of anthropogenic and non-anthropogenic effects. Chars are the basis for extensive northern fisheries, thus have great economic and social importance in the North. A pan-arctic integrated monitoring programme for chars presently under development will contribute to the following: Arctic Monitoring Programme of Fisheries and Oceans Canada (see accompanying poster), a Canadian IPY project on char biodiversity and an international IPY node, a network underpinning the Circumpolar Biodiversity Monitoring Programme (CBMP) of the Conservation of Arctic Flora and Fauna (CAFF) working group of the Arctic Council, and as an example of the Joint Monitoring Programme for both biodiversity and contaminants of CAFF and the Arctic Monitoring and Assessment Programme (AMAP) of the Arctic Council. High biodiversity within (e.g., life history and ecological types) and among (e.g., spatial differences) char populations results in differential responses to anthropogenic stressors. Thus, placing stressors in the context of char biodiversity will aid understanding cause-response pathways at both the fish and ecosystem levels thereby allowing for better understanding of future ecosystem status.

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The International Arctic Buoy Programme (IABP) A Cornerstone of the Arctic Observing Network

The IABP has maintained a network of drifting buoys since 1979, providing the longest continuing record of observations from the Arctic Ocean. These buoys provide critical atmospheric, ice, and upper-ocean hydrographic measurements that cannot be obtained by other means, thus these observations have been one of the cornerstones for environmental forecasting and studies of climate and climate change.These buoy observations have been essential for: 1) Monitoring Arctic and global climate change; 2) Forecasting weather and sea ice conditions; 3) Forcing, assimilation and validation of global weather and climate models; 4) Validation of satellite data; etc. Many of the changes in Arctic climate were first observed or explained using data from the IABP, and over 500 papers have been written using these data. The observations from the IABP are posted on the Global Telecommunications System in near real-time for operational use, and can also be obtained from the IABP web server for research (http://iabp.apl.washington.edu).The IABP is evolving to better support operations and research across the Arctic Ocean. For example, some Participants of the IABP have been deploying buoys which not only measure sea level pressure and surface air temperature, but also ocean currents, temperatures and salinity. Other buoys have been enhanced to measure ice mass balance (IMB) using thermistor strings and ultrasonic pingers aimed at the top and bottom of the sea ice. Most of these ocean and IMB buoys are deployed in close proximity to each other providing a myriad of concurrent observations. From such data time variations in other geophysical variables such as oceanic heat storage and heat flux can be estimated.The harsh Arctic environment and changes in wind (ice circulation) make maintaining the buoy network a challenge, especially in the Eurasian sector of the Arctic Ocean. As such, the IABP welcomes new partners to help sustain the buoy network, and to develop new technology.

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A user oriented model for ecologically based land-use planning in northern Sweden

Reindeer are part of the native herbivorous fauna in arctic and subarctic regions around the globe and play important roles both ecologically and economically. In northern Scandinavia reindeer play a key role in the indigenous Sámi people's cultural identity and traditions. In Sweden the reindeer husbandry area covers 1/3 of the country with reindeer using the Scandian mountains during summer and migrating far too forested areas used during winter season. A lack of knowledge and understanding between the reindeer industry, and other land users (forest, power, tourism and mining industry) about each other's needs has often led to heated debates. In this paper, we illustrate how remote sensing and GIS techniques can be used to gather and compile information about land-use activities and patterns among reindeer herders and other land users. The project represents a novel user-oriented effort largely based on the work carried out by the principal end user - the reindeer herders. The basis for development of land-use plans for reindeer husbandry consists of 3 parts: 1. Collection and digital systemization of traditional ecological and landscape knowledge of reindeer habitat use; 2. Integration of this information with results from field inventories and satellite-based vegetation classifications; 3. Mapping and compilation of other land user's activities. The resulting land-use plans provide information that can facilitate consultation between the reindeer herders and other stakeholders and can facilitate operational work in reindeer husbandry. The work is now completed for 6 Swedish reindeer herding districts (in Swedish; sameby) covering 6 million ha and is ongoing in an additional 6 districts. The work has involved 85 reindeer herders and key personnel in the Swedish Forest Agency. This project can serve as a model for participatory involvement and planning, bringing indigenous knowledge and advanced remote-sensing techniques together in an interactive process.

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SEARCH (Study of Environmental Arctic Change) Observing System

The Arctic has been characterized in recent decades by a complex of significant, interrelated, pan-Arctic changes including, but not limited to, increased air temperature over most of the Arctic, reduced sea ice cover, warming of permafrost, changing Arctic Ocean circulation, and northward movement of tree lines and vegetation zones. Understanding and responding to these changes and the related socioeconomic impacts poses a considerable challenge to the Arctic research community that has to be grounded in data from a comprehensive, long-term observing system. In response to this challenge the Study of Environmental Arctic Change (SEARCH) has been designed to understand the nature, extent, and future development of the changes presently seen in the Arctic. Major elements of the SEARCH science and implementation plans include: a system-scale, cross-disciplinary, long-term observing system (determination of extent and nature of change), a data assimilation and modeling component (understanding and projection of change), and translation of the combined results from observations and modeling into impact assessments and tools that help stakeholders in planning adaptive responses. Here we present the efforts of SEARCH in designing and implementing major components of a science-driven, multi-disciplinary, long-term observing system of pan-Arctic scale. Many of these components have been established as part of the U.S. IPY program through the AON (Arctic Observing Network) effort, preparing the ground for regional and thematic integration of an observing system.

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Long-term monitoring under the Canadian Northern Contaminants Program

In the Canadian Arctic contaminant levels in air, biota and people are monitored under the federally funded Northern Contaminants Program (NCP). Data generated by the NCP feeds into the Arctic Monitoring and Assessment Program (AMAP), a working group under the Arctic Council that coordinates monitoring activities at a circumpolar level.Since its inception in 1991, the NCP has been managed by a multi-jurisdictional group of stakeholders, including representatives from various levels of government and northern aboriginal organizations. Early research identified the sources, pathways and processes that lead to the now widely publicized levels of contamination in Arctic biota and people. These findings were instrumental in building the case for international agreements to reduce global pollution resulting from the long range transportation of contaminants, e.g. the Stockholm convention on persistent organic pollutants. One of the long term priorities of the NCP, along with the ongoing assessment of contaminant associated risks to human health, is an extensive program to monitor the spatial distribution and temporal trends of contaminants in Arctic air, biota and humans. Results of the monitoring program are used to support human health risk assessment and to assess the effectiveness and sufficiency of international agreements at reducing global levels of pollution. Monitoring is carried out by a network of researchers, institutions, community organizations and individuals. The monitoring network involves over 25 communities from every corner of the Canadian Arctic, as well as two remote air monitoring installations. Community based hunters are involved in the collection of biotic specimens including various species of freshwater and marine fish, marine and terrestrial mammals, and seabird eggs. Annual sampling will continue into the future and builds on data that has been collected periodically at well established sites since the late 1970s, in the case of seabird eggs, and the early 1980s for other species. The primary air monitoring station at Alert has been collecting data continuously since 1992. Results are published annually in a Synopsis of Research report.

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ENFIN - a network of terrestrial forest observation systems

Monitoring the environment and natural resources is becoming increasingly important for sustainable development. So is networking in order to cover large regions in a harmonised manner so that patterns of change can be interpreted consistently. While remote sensing has many advantages regarding the provision of monitoring data, there is in most cases an urgent need for ground information both in order to fully utlise the potential of remote sensing and in order to monitor features that cannot be detected with remote sensing systems. Field based monitoring of forest resources and forest ecosystems has a long tradition. Nowadays most countries in Europe have installed a national system for sample based forest assessment, as a means to deliver data for national forest policy and planning, international agreements, and for research. In some cases the time series of forest data are long; in the Nordic countries this type of assessments started already in the 1920s. Further, in many countries wall-to-wall mapping of forest resources and habitat are a by-product of the inventories, obtained by linking remote sensing data with field based data from the sample based monitoring systems. These types of data are available also for northern boreal regions and, e.g., monitoring tree line change is an issue that currently receives increasing interest. Starting in 2003, a bottom-up harmonisation process among the national forest inventories in Europe is ongoing. Within the framework of ENFIN (the European National Forest Inventory Network) harmonisation is conducted within several fields of forest information. For example, one area concerns the reporting requirements according to the Framework Convention of Climate Change, and its Kyoto Protocol. A major portion of data for the land-use sector in Europe is delivered by the national forest inventories. Another field concerns forest biodiversity information.

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Towards the development of basic principles and methods of socio-oriented observations within the IPY (2007-2009) collaborative activities.

Within IPY a special Sub-committee on Observations (SCOBS) has been formed and social observations have been considered as one of the directions of its work. Preliminary screening of IPY endorsed proposals in the sphere of Socio-oriented Observations (SO) has been fulfilled. It has shown that during IPY many new social science activities will be undertaken. Although this work reveals the vast diversity of IPY SO activities in different regions of the Arctic, it is very difficult to identify methods used which are most appropriate from both technical and scientific frameworks and from northern cultural and social perspectives. The critical evaluation of methods and measurement protocols which are used in IPY projects could be very helpful in the work towards the development the SAON set of recommendations on how to achieve multidisciplinary long-term Arctic-wide observations and involving local peoples. One example of such a measurement SO Protocol is the draft of Canadian-Russian collaborative Protocol which has been prepared by Carleton University, Canada and Institute of Geography, Russia within PPS Arctic IPY N 151. This Protocol has been tested by Canadian-Russian research team during First IPY Field activity in Nunavut, 2007. The Protocol will enable researchers to better understand challenges and opportunities experienced by peoples and communities of the Arctic and Sub-arctic in their struggles for a better quality of life while under the impact of climate and environmental change in the taiga-tundra interface (TTI). This Protocol is based on two fundamental categories of SO-collection of quantitative and qualitative data and ethical research participation methodologies which enables to identify the Key Indicators most important for assessing health and well-being, and for setting objectives for a better quality of life. This contribution will assist in achieving SAON goals for planned, lasting SO within TTI ecotone of Circumpolar North.

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Pan-Arctic Lake-Ice Methane Monitoring Network (PALIMMN): An IPY effort to estimate methane bubbling from arctic lakes

A recent first-order estimate suggests that arctic lakes are significant emitters of methane (CH4) contributing as much as ~6% of global atmospheric CH4 sources annually. Emissions are particularly high from lakes influenced by permafrost degradation, a process that discharges labile organic matter to anaerobic lake bottoms, fueling biological methane production and emissions. Emissions from arctic lakes are projected to increase as permafrost thaws in the Arctic, releasing tens of thousands of teragrams to the atmosphere in the form of bubbles. Complete thaw of permafrost beneath lakes may destabilize deeper methane sources such as hydrate methane and provide pathways for the release of sub-permafrost methane from biogenic or thermogenic sources. High methane bubbling has also been observed in non-permafrost influenced lakes in the boreal and sub-boreal zone. Little is known about the occurrence, extent, and vulnerability of methane bubbling sources in different regions. Quantifying, mapping, and projecting biological and geological methane emissions from arctic lakes in conjunction with climate change are our goals during the IPY by pioneering new methods of measuring methane bubbling (dominant mode of emissions) from lakes using geophysical measurements, isotope geochemistry, remote sensing and the establishment of a Pan-Arctic Lake-Ice Methane Monitoring Network (PALIMMN). Participants in PALIMMN commit to surveying the number and area of methane bubbles trapped in lake ice on local lakes once per year in early winter when lakes first freeze. Data are deposited in a common database for comparison of bubbling dynamics around the North. This collaborative effort involves a highly interdisciplinary and international team of researchers, educators and citizens from the United States, Canada, United Kingdom, Russia, Germany, and Sweden as well as integration with IPY certified projects including SEARCH, AON: Collaborative Research on Carbon, Water, and Energy Balance of the Arctic Landscape at Flagship Observatories and in a Pan-Arctic Network, Permafrost Observatories: Thermal State of Permafrost, Arctic Circum-Polar Coastal Observatory Network, and Carbon Pools in Permafrost Regions. New PALIMMN participants are welcome.

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Sustainable monitoring system for dense water production on polar shelves

Monitoring of the flow of dense water from its formation area towards the abyss of the world oceans is a key issue for climate research. In the Weddell Sea, Antarctica, formation of high salinity shelf water (HSSW) takes place on the Ronne shelf. Underneath the floating Filchner-Ronne ice shelf the HSSW is transformed to Ice Shelf Water (ISW, t<-1.9). The ISW cascade towards the deep Weddell Sea, and its fate in connexion with the formation of the WSBW, and finally AABW, are key issues. The North Atlantic is separated into two basins by the Greenland Scotland Ridge (GSR). Most of the ventilation in the northern basin, the Arctic Mediterranean, occurs by formation of HSSW on the Arctic Ocean shelves and by open ocean convection. Cold dense waters pass southwards as a deep overflow across the GSR at a number of sites and together with entrained water feed most of the NADW.In our IPY project the Bipolar Atlantic Thermohaline Circulation (BIAC) we will define and operate an optimal ocean observing system for the lower polar limb of the Atlantic component of the THC. This observation system, consisting of in-situ stations with self contained instruments supported by ship- and space-borne measurements, will provide accurate time series of mass, heat and salt fluxes at key locations, allowing us to assess the strength of the bipolar Atlantic THC. The stations (moorings) will be constructed so that they only need to be serviced at ~5 year intervals, and the data are planned to be extracted by ships of opportunity, acoustic communication and via satellites. The running costs will therefore be low, and these climate stations should be operative for several decades.

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Ocean Weather Ship Station M, in the Norwegian Sea

Having performed daily oceanographic measurements in the deep Norwegian Sea since 1 October 1948, Ocean Weather Ship Station (OWS) M, at 66N,02E, can present the longest existing homogeneous time series from the deep ocean. Station M is operating above the eastern margin of the Norwegian Sea deep basin where a branch of the Atlantic current is entering the area, Figure 1. The location proved to be strategic both for studying the Atlantic inflow and the Norwegian Sea Deep Water. The OWS M is operated by The hydrographic programme is carried out by Geophysical Institute, the University of Bergen. With the expansion of civil aviation and growing understanding of the impact of aerological observations on weather forecasts after World War II, ICAO (The International Civil Aviation Organization) demanded a greater network of aerological stations, primarily in the North Atlantic.In 1946 a plan for a network of 13 ocean weather stations in the North Atlantic was set forth under the auspices of ICAO. The Stations were to supply meteorological services, search and rescue services, and navigational aids to aircraft. The USA, Canada and eighth European countries should be responsible for operating the stations, which were referred to by letters from A to M. Norway was to operate station M (phonetic name Mike) at 66N,02E, with financial backing from Sweden and Great Britain.ICAO attempted to organize an international oceanographical research programme for the weather ships, but failed due to lack of interest, shortage of money and difficulties in procuring the necessary scientific equipment. In Norway, a country which held great traditions in oceanographical research, a small group of three scientists, led by the oceanographer Hkon Mosby , took upon themselves to implement an extensive research programme on station M.