National Institute of Polar Research

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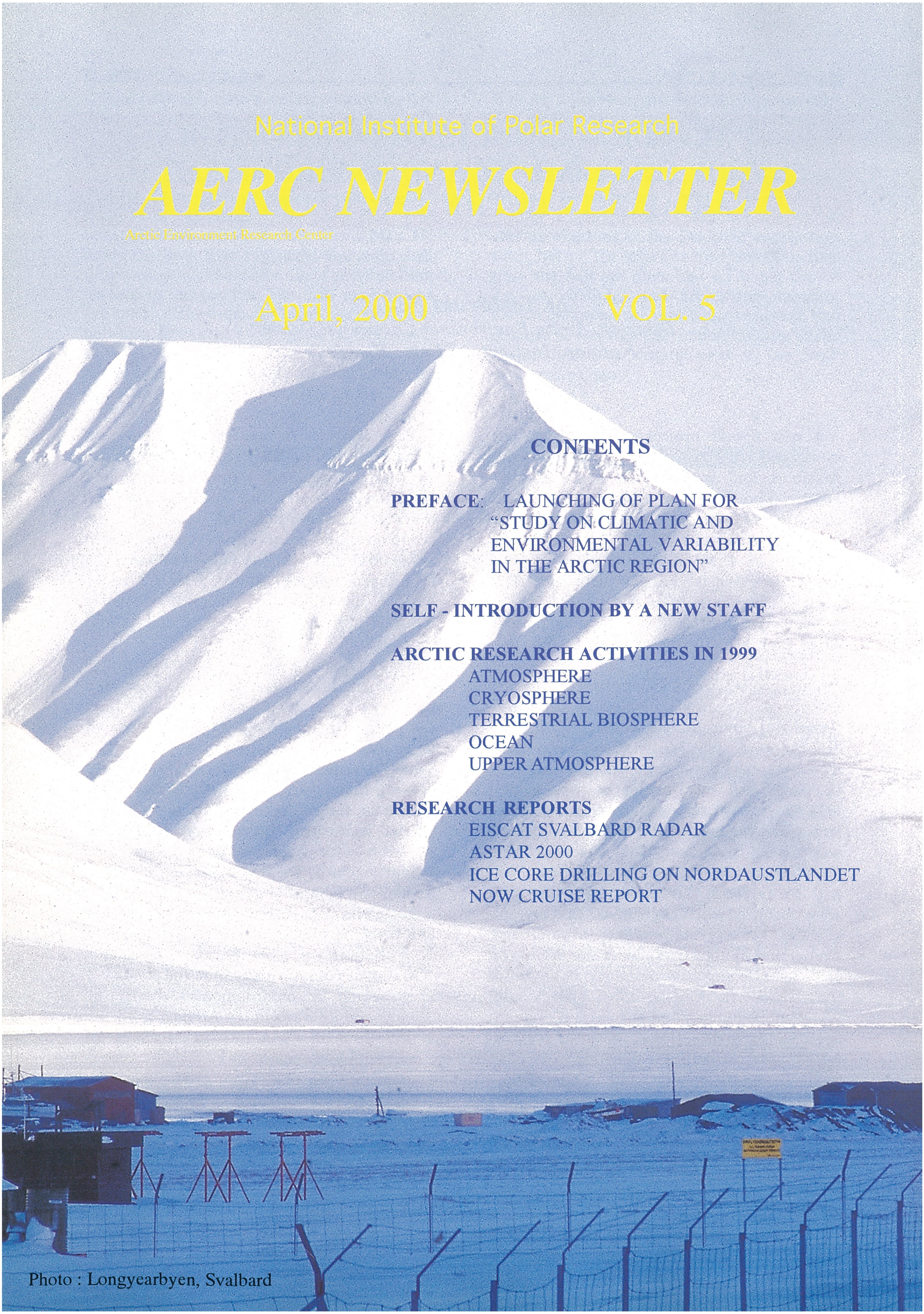

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Photo : Longyearbyen, Svalbard

PREFACE: LAUNCHING OF PLAN FOR "STUDY ON CLIMATIC AND ENVIRONMENTAL VARIABILITY IN THE ARCTIC REGION"

by Yoshiyuki Fujii
Director, Arctic Environment Research Center,
National Institute of Polar Research

A new 6-year project on "Study on climatic and environmental variability in the Arctic region" was started in fiscal year 1999. The Arctic is where global scale climatic and environmental fluctuations appear most strongly. At the same time, changes in the Arctic environment can trigger large scale changes throughout the northern hemisphere or worldwide. There is concern that a feedback mechanism could then amplify the changes in the Arctic.

This project includes studies of the atmosphere, ice and snow, ocean, and the terrestrial environment, centering on field observations, to clarify the nature and mechanisms of environmental variability in the Arctic and the effect on the ecosystem.

In the area of atmospheric science, space and time variations of greenhouse gases, aerosols and clouds will be observed, and the effect on climate via the radiative effect will be assessed. In the area of ice and snow studies, ice cores will be taken from glaciers at several locations around the Arctic, and analyzed to clarify the details of past climatic and environmental changes in the Arctic. In oceanography, energy and material exchanges and the carbon cycle in open water in the sea-ice covered regions called polynya will be clarified. In the field of terrestrial environment, the effects of increased ultraviolet radiation accompanying global warming and destruction of the ozone layer, and of the acidification of rainfall, on the terrestrial ecosystem will be studied.

To achieve these research objectives, observations will be taken in such regions as Svalbard, Greenland, Canadian Arctic and the Russian Arctic, and from research aircraft in the Arctic; and there will be oceanographic observations in the North Atlantic Ocean. In the field of mesosphere and thermosphere studies, EISCAT radar will be used to study atmospheric wave motions to clarify the flows of energy and momentum.

Results from various scientific disciplines will be combined and modeled, and compared with results of similar research in the Antarctic to help clarify the nature and mechanisms of variability in the Arctic. This research conforms to the objectives being promoted by the International Arctic Scientific Committee (IASC), and will be carried out as an international cooperative research with Arctic nations. The participation and support of everyone concerned will be appreciated.

To summarize, this research covers the following 5 topics.

1) Variations of atmospheric constituents and their climatic impacts in the Arctic
2) Research on environmental change by snow and ice cores in the Arctic
3) Research on variability in Arctic ocean currents and ecosystems
4) Research on ecosystem changes in the Arctic tundra
5) Dynamical coupling of the middle atmosphere and thermosphere in the Arctic

◆◆ Self - Introduction by a New Staff ◆◆

by ***Kaoru Sato,***
Arctic Environment Research Center
National Institute of Polar Research

I moved from the Department of Geophysics, Kyoto University, to join the staff at the Arctic Environment Research Center, National Institute of Polar Research, last December.

I am an atmospheric scientist. Until now, my research has mainly concerned relatively small-scale atmospheric waves. I have been particularly interested in atmospheric gravity waves at all latitude regions, namely the tropics, mid-latitudes and polar regions. Since I have been most recently interested in the polar regions, it will be a natural move for me to now study a wide variety of atmospheric phenomena in those regions.

What I first want to look at is coupling between upper and lower altitude regions. The thermal structure of the atmosphere is layered; from bottom to top, the principal layers are called the troposphere, stratosphere, mesosphere and thermosphere. In the middle atmosphere, that is, from the stratosphere through the lower thermosphere, the wind and temperature structure shows a much clearer seasonal variation in the polar regions than at other latitudes. It is believed that this strongly affects the vertical transport and mixing of trace gases, and the vertical propagation of atmospheric waves. Another interesting topic is coupling to other latitude regions. A strong westerly jet called the polar vortex appears in the polar stratosphere in winter. From the point of view of tracer transport, this jet has the effect of trapping trace gases inside the vortex. There is a need to investigate just how clear is this boundary between the mid-latitude and polar regions. In addition, it is conceivable that there is direct coupling between the tropical and polar regions through the poleward propagation of atmospheric waves generated by convective activity in the tropics.

In the earth sciences field, first it is necessary to observe phenomena. Observations are most important. For the last several years I have been using upper air meteorological observation data from Syowa Station. I find the quality of these data clearly better than those taken by other nations in Antarctica. Perhaps this is the result of persistent efforts by members of the Japanese Antarctic Research Expedition to obtain good data under harsh environmental conditions. I hope that this high level of research will be maintained.

I have used a variety of data in my research until now, and I try to think of analysis methods that will best take advantages of the characteristics of each data set. There are fewer data available for the polar regions than for other latitudes because of the physical difficulty of taking observations, but with advances in technology in recent years large amounts of data are becoming available even in the polar regions. It is quite possible that there are as yet unknown phenomena waiting to be discovered in these regions, so that a high return on investment can be expected from taking observations there. In order to obtain the most from these data, they must be archived in appropriate formats. As a specialist in data analysis I feel a responsibility to make this part of my work so that many scientists can use the data for their variety of research objectives.

The National Institute of Polar Research has gathered people working in many specialties within polar research. I have participated in a number of seminars here and have found that there is often a good deal of lively discussion that cuts across individual specialties. I am looking forward to being able to pick up a good deal of knowledge by ear, so to speak, from informal interaction with other members of this institute. At the same time, it is a bit of an adventure for me to leave the university, where I was involved in education for many years, and devote myself to a number of observational projects. But I intend to do my best to contribute. The cooperation of all concerned will be very much appreciated.

ARCTIC RESEARCH ACTIVITIES IN 1999

● Variations of atmospheric constituents and their climatic impacts in the Arctic

by Takashi Yamanouchi, National Institute of Polar Research

The Arctic is an energy sink for the global climate, and, in addition, there is a high probability that it also acts as a sink in the circulation of atmospheric constituents. The Arctic is much more directly affected by anthropogenic sources of pollution than its counterpart polar region, the Antarctic. Thus, the Arctic, since it includes some elements that play important roles in governing the global environment and climate, is a region where changes in the atmospheric environment due to anthropogenic causes, such as global warming and ozone depletion, are amplified and show up prominently. This research group is pursuing research on 3 topics dealing with atmospheric constituents in the Arctic troposphere and stratosphere:

(1) Source, sink and transport of greenhouse gases.

(2) Transport and transformation of aerosols and their interaction with clouds.

(3) Distribution characteristics and radiative effects of aerosols and clouds.

The ultimate goal of this research is comparison with the Antarctic and evaluation of the effect on climate.

The principal observational activities of this research in 1999 were as follows:

1. Long-term continuous observations at the Ny-Ålesund station

Air sampling for measuring greenhouse gas concentrations has been continued on a long-term basis at the Ny-Ålesund station in Svalbard. Ground-based meteorological and ozone measurements have also been continued. Through these observations, we tried to clarify the causes of variability in greenhouse gas concentrations and in stable isotope ratio. In addition, we have continued observations of aerosol number concentrations and vertical profiles.

2. Concentrated observations of aerosols and clouds

Concentrated winter observations, including measurements of aerosol concentration, composition and precursor gases; and observations of precipitable water content, liquid water content, ice water content and falling snow particles to determine the relation of aerosols to clouds and precipitation, were carried out at the Ny-Ålesund station. Processes of aerosol transport and transformation were investigated, together with the process of entrainment into clouds and precipitation. Aerosol sampling has been also conducted in Alaska.

3. Simultaneous aircraft and ground-based observations of aerosols and radiation

In cooperation with the Alfred-Wegener Institute for Polar and Marine Research, Germany, coordinated airborne and ground-based observations were conducted in the Svalbard region. The aircraft (a Dornier 228) measured the vertical distributions of extinction and aerosol particles, while on the ground remote sensing techniques such as lidar and photometers were used to measure the aerosol distribution and radiative properties. Together, these observations will permit us to determine the distribution, physical, chemical and optical properties of aerosols, and their radiative effects. Observations were conducted in the spring of 2000 to determine the radiative properties of Arctic haze.

4. Oceanographic observations in the Greenland Sea

Together with the oceanography group, oceanographic observations were conducted in the Greenland Sea to determine the mechanism of variability of CO_2 partial pressure in the ocean surface layer, which determines the amount of carbon dioxide that will be absorbed from the atmosphere. The emphasis was on observations in the fall season in 1999.

● Research on environmental change by snow and ice cores in the Arctic

by Kokichi Kamiyama, National Institute of Polar Research

The variability in the Arctic cryosphere has been studied through analysis of ice and snow cores from many locations in the Arctic. Specifically, the following research was conducted in fiscal year 1999 .

1. Participation in the North GRIP project

From the analysis of deep ice cores taken at the Greenland Summit, it has been proposed that climate was unstable during the last ice age and the last interglacial period. To clarify the nature of the climate during those periods, an international effort is being undertaken, mainly by European countries, to drill a new core several hundred kilometers north of Summit (the North GRIP Project). Japan has sent researchers to participate in this project in the effort to drill a new core all the way down to the bedrock. In addition to the deep core, physical and chemical analyses of shallow cores were being conducted to aid in clarifying the transfer function in the ice core. The experience gained by participation in the North GRIP project would be useful in the future to take deep cores at other Greenland locations in projects in which Japan will play the central role.

2. Contribution to IASC - ICAPP (Ice-Core Circum-Arctic Paleoclimatic Program)

Climatic and environmental variations do not occur uniformly throughout the Arctic, but differ from place to place according to the regional characteristics of the mutual interactions between ocean and land. Therefore, it is necessary to reconstruct the climate and environment not only in Greenland, but also in other areas including Svalbard, Canada and Russia. Japan participates in the IASC - ICAPP project which was initiated for this purpose and in the drilling of cores in Nordaustlandet, Svalbard; in Arctic Canada; and in Arctic Russia. Consideration was also given to drilling ice and snow cores in the interior regions of China, as it would be strongly related to the Arctic.

3. The Arctic Snow and Ice Observation Project

Matter from various sources is transported to the Arctic, deposited on the snow, and is preserved in snow and ice. To claify these mechanisms, observations throughout wide areas of Siberia, Canadian Arctic and Svalbard were conducted on the characteristics of fallen snow, in particular seasonal and interannual variability in the downward fluxes of materials for environmental index, and the processes of post depositional changes. At the same time, satellite observations were used to obtain basic information on the expansion and contraction of the ice and snow area in the Arctic

● Research on ecosystem changes in the Arctic tundra

by Hiroshi Kanda, National Institute of Polar Research

Starting in 1994, a 5-year research was conducted in the area of Ny-Ålesund, Spitsbergen on the topic "Ecosystem changes at the deglaciated area in the Arctic". In the first 3 years, concentrated field studies were carried out in all of the scientific fields involved; the remaining 2 years were used for supplementary studies and monitoring.

A new five year project was started in 1999. The following topics are to be covered:

1) How do environmental changes affect the diversity of species?
2) What effect do environmental changes have on the ecosystem, in particular on the energy budget and the water balance?
3) What feedback is there from the changed ecosystem to the climatic system?

From mid-July to mid-August in 1999, fixed observation points in the Ny-Ålesund area were used to study the ground surface environment, to investigate in particular the relationships between soil properties and soil organisms. Equipments to measure soil respiration and photosynthesis were used in this study.

Several scientists were sent to Spitsbergen for studies related to the soil environment, respiration and decomposition. In addition, data were recovered from open

top chamber studies related to the ecology of soil surface organisms, in particular mosses, lichens and cyanobacteria. Internationally, until now emphasis has been on the ITEX project, with monitoring research using the chambers; from 1999 a link with FATE (Feedbacks and Arctic Terrestrial Ecosystems) started. This program has been designated an area of emphasis by the International Arctic Scientific Committee (IASC).

● Research on variability in Arctic ocean currents and ecosystems

by Mitsuo Fukuchi, National Institute of Polar Research

The Arctic Ocean and the Antarctic Ocean are the two great cold regions of the world ocean, and have considerable influence on the global scale ocean circulation. In both, ice formation in winter is accompanied by the production of cold, highly saline dense water which becomes the bottom water of the ocean. It is claimed that the deep circulation of the world ocean originates from this bottom water as its source and has a time scale on the order of thousands of years. In addition, the ocean is a far larger reservoir of carbon dioxide than the atmosphere; the dissolution of carbon dioxide from the atmosphere into the ocean is very large in the cold regions, which therefore serve as sinks of atmospheric carbon dioxide. That is to say, information about the atmosphere is entrained into the deep ocean through bottom water formation and the general circulation. The bottom water formation process has accumulated information about the last 1,000 years or more.

Bottom water is not formed everywhere in the polar oceans. It is strongly related to ice formation in winter, and is strongest in regions called polynya where the surface remains ice free. These polynyas are known as regions of high biological productivity. Marine mammals and marine birds congregate there in winter: a polynya plays the role of an oceanic "oasis". The basis for these oases is primary production by photosynthesis, which in turn intensifies the role of the ocean as a source/sink of atmospheric carbon dioxide.

The Antarctic Ocean has a relatively simple oceanic structure, dominated by the Antarctic Circumpolar Current; in contrast, the Arctic Ocean is very complicated, with intermingling inflow and outflow paths. Three major polynyas are known in the Arctic region.

Starting in fiscal 1997, we conducted joint research with Canada and U.S. on the North Water polynya region; the current project continues this research. We have also been studying the Greenland Sea and the Barents Sea in cooperation with Norway. These are regions of very complicated oceanic structure. We are planning to continue research in these regions.

In this research, we first conducted exploratory cruises to these ocean regions and the surrounding sea ice regions (using chartered vessels). At the same time, we gathered satellite data, and conducted observations with moored instruments to clarify the space and time variations of sea ice formation and the process of bottom water formation through the thermohaline circulation driven by cooling by the atmosphere. In particular, we obtained time series data that permit us to determine the seasonal variability.

Sea ice forms a barrier to material exchanges between the ocean and the atmosphere, and the penetration of sunlight into the ocean, but there is also significant primary production within the sea ice itself. Through this primary production carbon dioxide is fixed. In addition, the production of dimethyl sulphide that accompanies primary production is related to the amount of clouds formed in the atmosphere, which feeds back into climatic changes.

Matter produced by primary production in the ocean surface layer and sea ice, sinks, first into the intermediate layer and then into the bottom layer where it accumulates, forming a record of biological production in the surface layer. In this research, the processes related to primary production were clarified, and the response of the biological production process to sea ice and oceanic environment variations were analyzed.

It is believed that Arctic environmental phenomena respond early to global scale environmental variations. In this research we focused particularly on 2 relevant objectives:

(1) To clarify the mechanism of bottom wa-

ter formation that accompanies sea ice formation and its relation to environmental variability.
(2) To clarify the mechanism of ecosystem variations, focusing on the primary production process.

During the International Arctic Polynya Project in fiscal 1999, a North Water Polynya observation cruise was conducted from the end of August to early October. Instruments that had been moored in the previous year were recovered, and at the same time a variety of shipboard observations were carried out. Japan paid part of the cost of the cruise, and 6 researchers and graduate students from Japan participated. In addition, one Japanese scientist participated in a cruise to the Greenland Sea and Barents Sea in cooperation with Norway. Also, within the coming year it is planned to hold a research conference to discuss research using data from the 1997, 1998 and 1999 North Water Polynya cruises.

● Dynamical coupling of the middle atmosphere and thermosphere in the Arctic

by Takehiko Aso, National Institute of Polar Research

The Arctic middle and upper atmospheres span a wide range of atmospheric layers from the troposphere and stratosphere below through the mesosphere, thermosphere and magnetosphere, and form an open and very complicated system. The solar wind and terrestrial magnetic lines of force interact with each other to inject solar wind energy through the magnetosphere from above. There is also a flow of solar radiation energy from below through dynamical coupling with wave motions in the lower part of the polar atmosphere, along with complicated flows of energy between high and low latitudes: in short, the region is dominated by the mixture of ionospheric electro-dynamical and geophysical fluid-dynamical phenomena. Varieties of dynamical phenomena produced in the transition region between the dense, neutral lower atmosphere and the rarefied ionized upper atmosphere are signals of wide-ranging changes in the mutually interacting layers of the terrestrial atmosphere. The need for quantitative clarification of this scenario does not require comment.

There are many interesting problems in polar atmospheric dynamics. In this research, we stated to study disturbances in the atmospheric parameters and fields, and clarify quantitatively the behavior of planetary wave motions, the atmospheric tide which is the principal type of wave motion in the middle and upper atmosphere, and gravity waves and turbulence on a variety of scales, using the EISCAT radar and other radars, as well as optical instruments. This will give us new information about many issues including transport and dynamical processes related to the polar vortex, PSCs (Polar Stratospheric Clouds) and mountain lee waves which are said to be related to ozone fluctuations, the roles of turbulent diffusive transport, the effect of transport of momentum and energy by gravity waves on the atmospheric general circulation; the PSME (Polar Summer Mesospheric Echo), phenomenon; interactions and variabilities of atmospheric tidal waves. In addition, we study fluctuations due to solar activity and changes in atmospheric properties due to composition changes originating from wave motions and precipitating particles.

This research project involves mainly radio and ground-based optical observations connected with EISCAT radar in several locations including Svalbard, Scandinavia and Iceland; and data analysis and numerical modeling.

1. Arctic radar observations

Wave motions and plasma dynamics have been studied from the stratosphere through the thermosphere using the EISCAT, Tromso MF, and Longyearbyen MST radars.

2. Optical observations of atmospheric airglow and aurora

Optical observations include monochromatic and spectral observations, and conjunctive observations with EISCAT were conducted in cooperation with the Swedish Institute of Space Physics, Tromsø University and the University Courses on Svalbard (UNIS).

3. Comprehensive data analysis and numerical modeling

Comprehensive analysis of the data obtained, and numerical modeling of tidal waves in the polar atmosphere are on-going now.

Research Report

Comprehensive Observations of the High Latitude Upper Atmosphere and Magnetosphere in March 1999 Centering on the EISCAT Svalbard Radar

Takehiko Aso
National Institute of Polar Research

In March, 1999, the observation of nighttime aurora and atmospheric dynamics at Longyearbyen mainly using the EISCAT radar was conducted, as a cooperative research project with UNIS, Tromsø University, Oslo University etc. T. Aso of the Arctic Environment Research Center and A. Kadokura of the Aurora Data Division of NIPR planned and participated in this campaign. For about 2 weeks starting in early March, observations were carried out, based at the EISCAT Svalbard Radar site and the Tromsø University Aurora Station. In this research, the principal objective is to observe the dynamics of the high latitude nighttime aurora through simultaneous observations over a wide area. The observations were on the ionosphere - magnetosphere system by the EISCAT radar, centering on the time of conjunction of the FAST satellite and the GEOTAIL satellite, that is, the time band when the footprints of the magnetic lines of force at satellite locations were passing through Longyearbyen.

The plan called for comprehensive observations including observations by the Super DARN HF radar network and north -south conjugate observations with Zongshan Station in Antarctica, the geomagnetic conjugate point of Longyearbyen. Instruments used in optical observations at Aurora Station include the National Institute of Polar Research's imager; all-sky cameras of the Finnish Meteorological Institute, University of Oslo and University of Tokyo; the University of Alaska's MSP (Meridian Scanning Photometer); and the University of Utah's DIS (Doppler

Fig. 1.

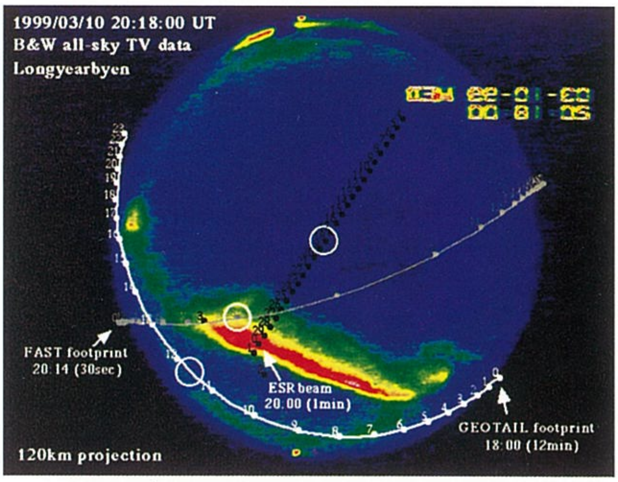
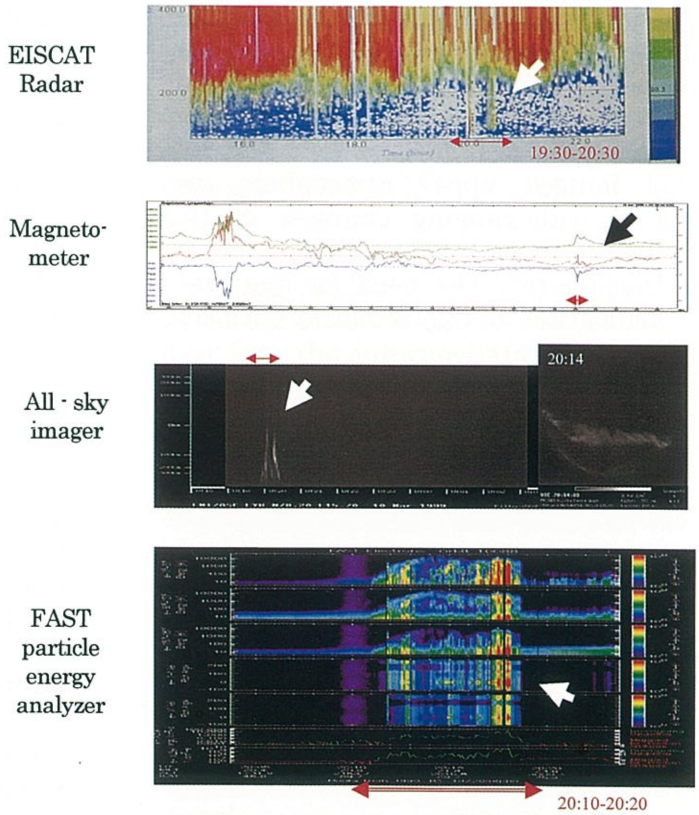


Fig. 2



Imaging System) and MIS (Meridian Imaging Spectrometer).

Active auroras were observed on March 9 and 10. Especially, after 20:00 on March 10 a substorm occurred, and a strong aurora arc appeared. The phenomenon was captured magnificently by the EISCAT Svalbard Radar, which was conducting beam scanning observations at 30 points every minute in the magnetic meridian plane; by the FAST satellite and the GEOTAIL satellite; and by the various imagers. Figure 1 shows the all-sky camera image at 20:18:00, the FAST and GEOTAIL satellite footprints, and the ESR beam directions. Circled points show positions at that time. EISCAT observed a high latitude discrete aurora; the footprint of FAST near the plasma sheet boundary cut across it in a timely manner; and GEOTAIL was in the tail region about 30Re from Earth, entering the plasma sheet. Thus, conjunctive data on magnetosphere particles which form the aurora, electric current along magnetic lines of force, electric field, ionospheric plasma, etc, were successfully obtained. The various data at that time are shown in Fig. 2. Starting at the top these are the enhanced electron density due to precipitating particles observed by the EISCAT radar, the geomagnetic disturbance shown by a magnetogram, an all-sky image and the result of energy spectrum measurement by the FAST satellite. Synchronized observations of the strong disturbance that occurred from 20:10 to 20:20 are shown by the red arrows.

Also, on March 17 and 18, a 24-hour observation of zonal and meridional components of atmospheric tidal waves at the mesopause and in the lower thermosphere were carried out, which was rendered possible since August, 1999 by the removal of radar clutter. The antenna beam was switched between the south and west, providing useful information on the phase quadrature relationship. These tidal observations aim at clarifying its dynamical coupling of the Arctic middle and upper atmospheres.

Arctic Field Campaign
ASTAR 2000 (Arctic Study of Tropospheric Aerosol and Radiation)

Takashi Yamanouchi
National Institute of Polar Research, JAPAN
and
Andreas Herber
Alfred-Wegener Institute for Polar and Marine Research, GERMANY

A new German-Japanese cooperative project on aerosols in the Arctic, ASTAR (Arctic Study of Tropospheric Aerosol and Radiation) 2000 was carried out in March and April in the vicinity of Svalbard. The goal of the project is to investigate the behavior and radiative effects of tropospheric aerosols in the Arctic (high concentrated layered aerosols are called "Arctic Haze") .

Airborne observations of vertical distribution of physical, chemical and optical properties of aerosols was be made around Svalbard using a German aircraft Polar 4 (Dornier 228) of Alfred-Wegener Institute for Polar and Marine Research. Particle size distribution, absorption and scattering coefficient were measured by optical particle counters (OPC), a particle soot absorption photometer and an integrating nephelometer, respectively. Extinction coefficients were measured by sunphotometer. Sampling of aerosols were also made with filter sampler and impactor to conduct chemical analyses and electron microscope analyses. 23 flights with about 83 flight hours were conducted based at Longyearbyen airport (78° N, 15° S) during March 15 and April 20, 2000.

Remote sensing of aerosols by Raman lidar, micro-pulse (backscattering) lidar, sky radio meter and sun/star photometers, *in-situ* measurements and sampling of aerosols were made coordinately at the surface of Ny-Ålesund Scientific Station (78° 55' N, 11° 56' E), Svalbard. Also, aerosol sondes were launched and a tethered balloon with OPC were applied. 3-D wind data have been supplied from SOUSY Svalbard radar. Data are compared with the SAGE (Stratospheric Aerosol and Gas Experiment) -II measurements in order to validate satellite aerosol extinction measurement and to derive 3-D distribution of aerosols. These data will be used as the input parameters for the Arctic regional climate model to calculate the radiative

at Ny-Ålesund Airport

forcing and then to discuss climatic impact.

The project was co-organized by National Institute of Polar Research (NIPR) and Alfred-Wegener Institute for Polar and Marine Research (AWI), together with participation from Hokkaido University, Nagoya University, NASA Langley Research Center, Norwegian Institute for Air Research (NILU), Meteorological Institute of Stockholm University (MISU), Norwegian Polar Institute (NP) and Max Planck Institute.

Ice Core Drilling on Nordaustlandet

by Makoto Igarashi
National Institute of Polar Research

The Japanese Arctic Glacier Expedition (JAGE) conducted ice core drilling to a depth of 289 m at the summit of the Austfonna Icecap (79° 50' N, 24° 00.3' E; 750 m a.s.l.) in April and May, 1999, as a joint Japan-Norway project. The objective of this ice core drilling was to clarify variability in the Arctic climate and atmospheric environment over the past 100 years. I participated in this project for the 2nd straight year; in the previous year I had participated in a related drilling at a point 3 km south of the 1999 location. There were total of 6 members, including 5 Japanese led by Dr. Hideaki Motoyama of the National Institute of Polar Research, and 1 from the Norsk Polarinstitutt.

In the past we had relied entirely on helicopters to transport men and materiel onto the ice cap, but this time, for the first time, we used a Twin Otter. It could carry twice as much as a helicopter on the flight from Longyearbyen to the ice cap, and in less time and at lower cost. This time we used a helicopter only when we ourselves went up onto the ice cap, and to retrieve some supplies that had been kept on the west coast of Nordaustlandet the previous year. We had planned to go up onto the ice cap the first time on April 20, but because of bad weather at the drilling site and a scheduling conflict for use of the transport helicopter, the start of drilling was postponed until April 25. The weather information that we used in making this judgment was provided by a 4-man snow surface mass budget observation group led by Chief Scientist Dr. J.O. Hagen of the University of Oslo that went up onto the ice cap before us. Thanks to them, we were able to transport men and materiel to the drilling site without wasting flight time.

After we traveled to the drilling site, the temperature was quite cold, about -20 degrees C, but otherwise the weather was good. Our living tent and drilling tent were set up, and the snow cave to be used for core analysis was dug, without incident, and we were able to start drilling 4 days later, on April 29. Compared to the previous year, when we had been attacked by several blizzards and it took us 11 days before we could start drilling, it was a very smooth start.

The good weather continued, so that drilling continued for 17 straight days, until May 15, without a break. As a result, we were able to drill the second deepest shallow core, without using borehole liquid, ever by a Japanese expedition, 289 m, second only to the 700 m core at Mizuho Station, Antarctica. However, from a depth of about 135 m the ice became brittle, and it became extremely difficult to recover a core with its shape undamaged after withdrawing the drill. It took a great deal of effort to keep the core log, in which was recorded the order of the core pieces.

On May 6, the temperature suddenly rose, and from May 8 it remained at -5 to 0 degrees

C, and with the clear weather continuing day after day the temperature in the drilling tent became higher than the outside air temperature, which adversely affected the drilling operation. Chips collected around the core, inside the drill barrel, preventing core samples from being extracted from the drill. The worst problem occurred after about May 10, when the base that supported the main drill unit became unstable because of snow melting, leading to danger that the drill mast might fall over. However, the snow surface temperature remained at or below -5 degrees C throughout the period that we occupied the camp, which was favorable for preserving the core samples in the snow. It was also favorable for preserving our food during our stay. The outside air temperature of about freezing and temperature of 10 degrees C or higher inside the tents made our stay comfortable. In contrast, in the previous year just being there had been a struggle.

This expedition has conducted studies at various locations in the Svalbard archipelago since 1987. The weather conditions this time were the best we have had for living out on the ice, drilling, and preserving samples. The core samples are now being analyzed, and promise to advance our understanding of the glacial deposition environment in the Svalbard archipelago.

International North Water Polynya Study (NOW) Cruise Report

By Makoto Sampei
Graduate School of Ishinomaki Senshu University

From August 23rd to October 2nd 1999, field work of the International North Water Polynya Study (NOW Project, P.I. Prof. L. Fortier, Laval Univ.) was conducted in northern Baffin Bay. This cruise was the final field work of the project. There were 6 Japanese participants, led by Dr. T. Odate of the National Institute of Polar Research. Five others were Dr. Suzuki of Kanagawa University, Mr. Kobayashi of Hokkaido Tokai University, Mr. Takahashi of Soka University, Mr. Hayashi of Himeji Institute of Technology and myself. Dr. Odate conducted continuous monitoring of the ocean surface layer (chlorophyll fluorescence, water temperature and salinity), and represented Japan in liaison with Canada. Suzuki did research on the dependence of the rate of photosynthesis on light in phytoplankton communities. Kobayashi measured the amounts of pigments in the digestive tracts of zooplankton and the rate of excretion of pigment; Takahashi measured the rate of metabolism in zooplankton; Hayashi analyzed xanthophyll cycle function in phytoplankton communities; I was responsible for the initial shipboard processing of sediment trap samples.

This cruise consisted of 2 legs. Leg 1 was from August 23 to September 12 and Leg 2 was from September 13 to October 2. The main objective on Leg 1 was to recover moored instruments. CTD observations, water sampling and collecting zooplankton by plankton nets were also carried out. On Leg 2 there were 3 kinds of stations: "CTD stations" at which only CTD observations were carried out; "basic stations" at which CTD observations and, in addition, water samples were taken and zooplankton were collected by plankton nets; and "full stations" at which, in addition to all of the above observations, box corings were conducted and marine birds were sampled. All moorings that included sediment traps were successfully recovered. In addition, one mooring which was not recovered during the previous year, was successfully recovered this time. This was a very lucky happening, and that evening the scientists whose work was connected with mornings held a small party to celebrate.

Other observations were hampered by frequent trouble with instruments and winches, but nevertheless the weather was good. And the observations were carried out successfully. There were no major illnesses or injuries, and the cruise as a whole can be considered to have been a success.

This success was brought about by considerable efforts on the part of Canadian participants centered on Laval University staff, participants from the Japanese National Institute of Polar Research, and the members of the Canadian Coast Guard. I was honored to be able to participate.

Staffs

Arctic Environment Research Center
National Institute of Polar Research

Director	Professor	Yoshiyuki Fujii	(Glacial climatology)
	Professor	Hiroshi Kanda	(Terrestrial botany)
	Professor	Takehiko Aso	(Upper atmospheric physics)
	Associate professor	Hajime Ito	(Marine glaciology)
	Associate professor	Kaoru Sato	(Atmospheric physics)
	Research associate	Sakae Kudoh	(Aquatic ecology)
	Research associate	Shuki Ushio	(Polar oceanography)
	Research associate	Shinji Morimoto	(Atmospheric physics)
	Concurrent professor	Natsuo Sato	(Magnetospheric physics)
	Concurrent professor	Mitsuo Fukuchi	(Marine ecology)
	Concurrent professor	Takashi Yamanouchi	(Atmospheric physics)
	Concurrent professor	Kiichi Moriwaki	(Physical geography)
	Concurrent associate professor	Kumiko Azuma	(Glaciology)
	Visiting Professor (April – August 2000)	Kaz Higuchi	(Atmospheric physics)
	Research Assistant	Miki Yoshioka	
	Secretary	Masako Sakai	

EDITOR'S NOTE

In 1995 the Arctic Environment Research Center of the National Institute of Polar Research, Japan, started distributing a newsletter (2 domestic editions in Japanese per year) to give Japanese Scientists news of Japanese projects under way, news of important research abroad and news of domestic and international conferences. This volume, AERC NEWSLETTER, Vol. 5, incorporates numbers 10 and 11 of the domestic bulletin, which includes news of Japanese arctic research projects and other news of potential interest and/or novelty to international readers. Contributions are welcome and should be addressed to:

AERC Newsletter Editor
Arctic Environment Research Center, National Institute of Polar Research
Address: 1-9-10 Kaga, Itabashi, Tokyo, 173-8515, Japan
Phone: +81-3-3962-4971 Fax: +81-3-3962-5701 E-mail: arctic@pmg.nipr.ac.jp

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