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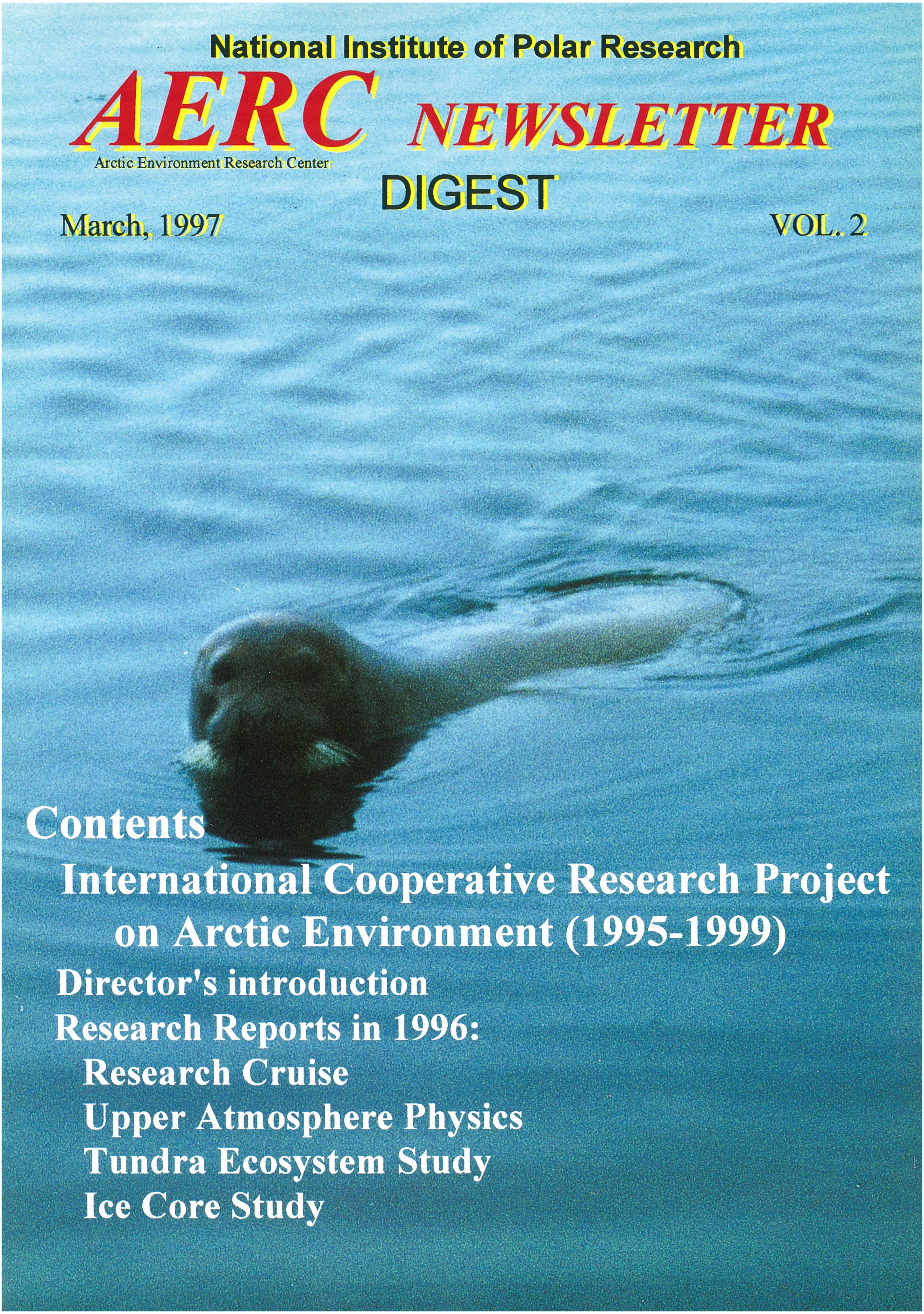

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● Director's Introduction ●
Japan's Role in International Arctic Cooperative Research

by Okitsugu Watanabe,
Director, Arctic Environment Research Center

The International Arctic Science Committee (IASC) has established the goal of promoting greater interaction among scientists, scientific institutions and research project participants of various countries engaged in studying Arctic nature and environmental problems. The Arctic Science Conference serves as a forum for such interaction. The first such conference was held at Dartmouth College in Hanover, New Hampshire in December1995.

There were 260 participants from more than 10countries, including several from Japan, at that conference. Intensive discussions were held concerning Arctic environmental problems. The exceptionally large number of participants shows that international interest in Arctic environmental problems is increasing.

The principal subject of discussion at that conference was the scientific merit, scientific importance and urgency of 10 problem areas proposed as IASC priorities. Following these discussions, it was decided at the April 1996 IASC meeting at the Alfred Wegener Institute in Bremerhaven to give priority to the following 3 problem areas:

1. Feedbacks And Terrestrial Ecology (FATE).
2. Mass balance of Glaciers and Ice Sheets (MAGICS).
3. Effects of Increased UV-Radiation in the Arctic

And regional studies treated on "Impacts of Global Changes in the Arctic" such as BASIS (Barents Sea Impact Study) and BESIS (Bering Sea Impact Study) are, in planning, too.

The international cooperative research project "Arctic Environment Observations" being promoted in Japan, under the leadership of the Arctic Environment Research Center and with the participation of universities and other institutions, has components from 4 major fields: atmospheric science, glaciology, terrestrial tundra ecology and ocean science including sea ice studies. In the past, "international cooperative research project" has consisted of international participation in cooperative observational projects promoted by IASC; the present effort seems to establish a new international framework for Arctic environmental research. In this sense, the agreement between the areas which IASC is choosing to emphasize and the current views of Japanese researchers is encouraging.

At the same time, it cannot be denied that at the March 1996 meeting of the steering committee of the international cooperative "Arctic Environmental Observations" project, there was a complaint that there is still not enough international recognition of this research. It goes without saying that this point must be taken seriously, and positive efforts made to resolve the problem. We hope that this English edition of our Newsletter (issued once per year) and the NIPR Arctic Data Reports will contribute toward this end.

●●Overview of Future Plans of the International Cooperative "Arctic Environmental Observations" Project ●●

(Adapted from minutes of the March 21, 1996 meeting of the Arctic Environmental Observations Steering Committee)

<Atmosphere Research Group>

Studies on Global-scale fluctuation of atmospheric constituents in the Arctic

The purpose of this project is to clarify the mechanism of global-scale fluctuation of atmospheric constituents including greenhouse gases such as carbon dioxide, methane, ozone, aerosols and clouds. At present, Japanese researchers are continuing meteorological observations in the Arctic, centered on Ny-Ålesund in Svalbard, and comparing these with results from Syowa Station in Antarctica. These observations yield information on the present concentrations of these constituents in the Arctic, and their formation or addition to the atmosphere, transport, and removal from the atmosphere.

[1996 Research Plans]

1. Fluctuations of greenhouse gases

Collection of air samples at Ny-Ålesund to measure concentrations of carbon dioxide, methane and carbon isotope ratios; continuous observations of ozone on land; and shipboard observations to measure the difference in the partial pressure of carbon between land and sea.

2. Fluctuations of cloudiness and precipitation, and the radiation budget

Types and structures of clouds, and precipitation, are being observed by vertical radar, microwave radiometer, electric field meter and radiation thermometer.

3. Stratospheric aerosol observations

At Ny-Ålesund, lidar (laser radar) is being used to observe polar stratospheric clouds; an aerosol sonde is being used to observe vertical distributions of aerosols of each particle diameter in the troposphere and stratosphere; and aerosol sampling is being done on the ground.

4.Stratospheric ozone observations

An optical ozone meter is being mounted on a balloon and used to observe the vertical ozone distribution up to 45km altitude.

5. Circum-Arctic atmospheric pollution observations

With the aim of clarifying the spread of atmospheric pollutants and their effect on the Arctic atmosphere and climate, gas aerosol sampling is being done at Yakutsk, Noril'sk and Tiksi in Siberia, and the concentrations of sulphurous acid gas and nitrates are being measured.

6. Water vapor and aerosol transport processes, and the growth of snow crystals

The growth of multicrystalline snow crystals is being investigated in Canada in relation to snowfall systems and water vapor and aerosol transports, and a relation between environmental fluctuations and the formation and development of clouds that bring snowfall established.

<Glaciology Research Group>
Circum-Arctic Ice-Core Drilling Project

With the principal objective of clarifying the role of the Arctic cryosphere on global-scale past and present environmental fluctuations cooperative research among groups both in Japan and abroad is being promoted. At present, Ice-core Circum-Arctic Paleoclimate Programme (ICAPP), which started in fiscal 1995, is in progress.

[1996 Research Plans]

1. The Drilling Project of Canadian Penny Icecap

It is planned to conduct drilling to intermediate depth, and estimate the absolute ages of the snow and ice cores obtained. Consideration is also being given to doing the next drilling on the Agassiz Icecap.

2. Ice and snow drilling on Nordaustlandet, Svalbard archipelago, and analysis

The cores obtained will be analyzed in cooperation with Russian and Norwegian researchers. In this analysis, attention will be focused on the fast rate of deposition of ice and snow on Nordaustlandet, analysis conducted to extract various environmental indices, and the formation processes of the environmental indices clarified.

3. Promotion of cooperative research with Russia

Preparation for observations on Severnaya Zemlyais proceeding, along with a preparatory survey in eastern Siberia, in consideration of Russia's research system.

4. Cooperation with the North GRIP plan

Ice and snow drilling is being conducted in northern Greenland, in cooperation with scientists from Denmark, France, Switzerland, Sweden and U.S.A.. Attention is being focused on a major achievement of GRIP, the alternation of ice ages and interglacial periods, and past fluctuations of icecaps and the earth's environment investigated.

[Long-range prospects]

Cooperative research is being promoted as a link in ICAPP. This is being coordinated with Antarctic snow and ice core analysis to clarify the roles of both polar regions in climate change, as well as the roles of such global phenomena as tropical forest destruction, ozone-hole expansion and large-scale volcanic activity on the glaciological environment in both polar regions.

<Oceanography and Sea Ice Research Group>
Arctic Polynya Research Cruise Project

Research is being conducted with the principal objective of clarifying the role of the Arctic Ocean and surrounding ocean regions in energy and mass exchange processes.

[1996 Research Plans]

Observations will be conducted with the aim of clarifying the state and fluctuations of energy and material exchange between fjords and the outer ocean. In addition, numerical modeling will be started to analyze fluctuation processes in Arctic oceanography.

1. Barents Sea observations

Summer observations will be conducted in cooperation with Norway, to determine year-to-year fluctuations in the ocean environment and confirm the results of 1995 observations and also to study the carboncycle.

2. Oceanographic observations around Svalbard

Long-term research will be continued with emphasison moored observations in fjords, marine meteorological monitoring and shipboard environmental observations

[Long-Term Prospects]

A major part of the time fluctuations in the Arctic seas is seasonal. Observations will be used in conjunction with theoretical work including numerical modeling to clarify the role of the seasonal ice zone in climate fluctuations. We aim to develop a unique Japanese viewpoint within the framework of international cooperative research. The seasonal ice zones in the Northern Hemisphere cover a wide latitude range. Observations and modeling will emphasize the Barents Sea, in the northern part of that range, and the Sea of Okhotsk in the southern part.

<Terrestrial Environment Group>
Tundra Ecosystem Change in the Arctic

The "Ecosystem change at the glacier-edge area in the Arctic" research plan, emphasizing terrestrial ecology, is in progress.

[1996 Research Plans]

These plans are centered on the island of Spitsbergen, in the Svalbard archipelago.

1. Continuous observations using the open-top chamber will be continued to investigate the response of the flora and polar ecosystem to climate changes.
2. The plant distribution survey that was started in fiscal 1994 will be carried out in more detail, and a vegetation distribution chart of the study area completed.
3. Attention will be focused on microorganism activity, and the relation between soil respiration and the decomposition process studied with the aim of clarifying their roles in the polar ecosystem.

[Long-Term Plans]

It is necessary to rapidly firm up our plan for participation in ITEX (International Tundra Experiment), and get in step with it to promote research on the Arctic terrestrial ecosystem. Plans are being drawn up for future international cooperative research on either Disko Island off the western Greenland or the Taymyr Peninsula of Siberia.

●●● Research Reports in 1996 ●●●

Report on Arctic Ocean Observations Participating in ICE-BAR96

by Gen Hashida,
Antarctic Environment Monitoring Research Center, National Institute of Polar Research

From July 20 to August 15, 196, I participated in a cruise to the northern part of the Barents Sea on board the Norsk Polarinstitutt ice-strength ship, LANCE. The National Institute of Polar Research has been sending someone to participate in LANCE cruises every year since the Arctic Environment Research Center was formed in 1991, with the exception of 1994. During this time, physical oceanographic observations and measurements of dissolved carbon dioxide have been continuing. In summer of this year, there were 3 LANCE cruises, to the ocean around

Bjornoya (Bear Island) (Tanimura and Kudoh participated), to the northern Barents Sea (Hashida participated) and to the Greenland Sea. The cruise in which the present author participated was the second of two year plan, one in 1995 and one in 1996, which constituted the ICE-BAR project. Shirasawa and Ikeda of Hokkaido University participated in ICE-BAR95. I am thankful to the people connected with the project who made it possible for me to participate.

ICE-BAR is a multidisciplinary study aimed at studying the ecosystem in the Marginal Ice Zone in the northern Barents Sea. Physical oceanographers and ecologists shared the same platform and conducted related observations. The cruise was well-organized and flexible as to details. There were 24 scientists on board, including 13 marine biologists (2 ornithologists, 3 ecologists, 1 microbiologist, 1 sea ice ecologist, 1 benthos expert, 1 zooplankton expert, 1 phytoplankton expert, 1 taxonomist and 2 ROVs), 7 geophysicists (2 radiation meteorologists, 2 sea ice experts, 2 physical oceanographers and 1 chemical oceanographer), 2 engineers (1 computer engineer and 1 electrical engineer) and 2 helicopter crew (1 pilot and 1 mechanic). The scientific party was international, with 16 Norwegians, 3 Germans, 2 Swedes, 2 Russians and 1 Japanese. The research plan was to anchor the LANCE in an area several kilometers on a side and study the ecosystem under the ice. The marine biology group took samples by diving and studied the ecosystem directly under the ice by ROV. Meanwhile, the geophysics group took physical oceanography observations, spectral observations of the top and bottom of the ice, and sonar observations of sea ice topography. Concentrated observations lasting 2 to 3 days each were taken at 4 locations having different types of sea ice, and the helicopter was used to study ice to the north which the LANCE could not reach. The present author monitored dissolved carbon dioxide, nutrients and fluorescence in the surface layer, and, at the same time, as a member of the geophysics group took sea ice cores and shared the CTD watch. Many of these observations were continuations of those on the cruise in which Tanimura and Kudoh had participated.

The LANCE crew is highly skilled at winch work for various types of oceanographic observations, and responded well to the scientists' frequent changes of plans and sometimes unreasonable demands. I came to admire them. At the Operation Meeting after dinner every evening, the results of that day's work and the next day's plans were discussed in detail. During the first half of the cruise, each scientist spoke on his observation plans; during the second half, each scientist gave a progress report on results. During the final stage of the cruise there were heated discussions about what kind of papers could be written. It was a fairly hard schedule, relieved by a party every Saturday at which everyone could unwind.

The cruise went as far east as possible without infringing on Russian territorial waters, and as far north as the ship would go, reaching 82 degrees north. While the risk of being arrested for infringing on territorial waters was avoided, there was still danger, since this region has the highest concentration of polar bears. During the cruise we spotted more than 30 polar bears from the bridge. When the ship anchored at sea ice, one member of the crew and one from the scientific party kept watch from the bridge, while the ecological observation team, the radiation observation team and the sea ice topography team operating on the ice each included one member whose job was to keep watch, armed with a rifle. The present author, responsible for taking sea ice cores, was fortunate to be paired with the best marksman, and did not meet up with any bears while on the ice. However, in the 4 periods during which the LANCE anchored for operations on the ice, operations were suspended several times because a polar bear approached the LANCE. There was one time when 7 or 8 people were on the ice and a polar bear managed to evade the watchmen and approach at close range. Since a polar bear can easily climb up onto the ice from a lead or the gap between the ice and the ship, it goes without saying that after that saying the watch system was intensified, similar to that in the movie "Alien". Even when one is observing from on deck, when a bear is only a few meters away one's breathing and sensing of information with senses other than sight, such as smell, take on the character of the wild Arctic. After taking a number of photographs we chased the bear away with a flare gun, but afterward felt a sense of regret. While polar bears are always around one in the Barents Sea, they do not attack unprovoked but usually merely approach out of curiosity, and if one is careful it is quite possible to observe them from a distance. If they do get to close then it is usually possible to chase them away with a flare gun. But many precautions must be taken. It goes without saying that one does not feed the bears. Handling a gun properly is` also important. One must be sure that there is nobody in the direction in which a warning shot is fired or in which the bear might flee, or in the direction in which a gun is pointed while carrying it; and ammunition must be handled properly. Everyone is trained thoroughly in these matters immediately after boarding the ship.

The sea ice that covered the Barents Sea in summer stopped the surge of water from the far-off Gulf Stream and received the LANCE gently, whether in clear weather or covered by fog, under a sun that never set. Reinert Korsnes, who participated in ICE-BAR96 and spent time in the Arctic Environment Research Center last spring, said, F. Nansen was ice-bound in the Arctic Ocean, but from time to time he must have enjoyed a truly wonderful days. I agree completely.

Arctic Upper Atmosphere Physics Observation Project Japanese Participation in the EISCAT Science Association

by Natsuo Sato,
Information Science Center, National Institute of Polar Research

As a result of the National Institute of Polar Research approving funding for the construction of an IS radar antenna at Longyearbyen, Svalbard, Japan became the 7th country to participate in the EISCAT Science Association. The EISCAT Science Association was formed in 1975, jointly funded by 6 European countries (Germany, France, Britain, Norway, Sweden and Finland) for research on the magnetosphere, ionosphere and atmospheric environment in the aurora zone of northern Scandinavia. EISCAT, an abbreviation of European Incoherent SCATter, means large output radar used to study incoherent scattering by electrons in the ionosphere. This radar makes it possible to observe physical quantities such as distributions of ion concentration, temperature and velocity with high accuracy at altitudes from several kilometers to several tens of kilometers. At present two types of radar are being used, in the VHF band and the UHF band. UHF band radar, with a 32-meter diameter parabolic antenna, has been installed at 3 locations, at the Tromsø Station in Norway, the Kiruna Station in Sweden and the Sodankyla Station in Finland. Electromagnetic waves are emitted from the Tromsø Station and waves scattered from the ionosphere are received at all 3 stations. A VHF band radar antenna of total length 120 meters is installed at the Tromsø Station. In addition to radar, the Tromsø Station also has a short wave ionosphere heating device. Since Svalbard lies in the cusp region in which the solar wind flows directly into the earth's magnetosphere (in the vicinity of magnetic latitude 75 degrees), it is a very important location to clarify the mutual interaction between the solar wind and the earthUs magnetosphere typified by the daytime aurora phenomenon. The Svalbard radar was installed to achieve this research objective.

Japan's becoming a member country of the EISCAT Science Association makes it possible for Japanese scientists to use the new Svalbard radar and the existing radar stations on an equal footing with scientists from the 6 European nations.

Cooperative Ozone Balloon Observations with AWI in Ny-Ålesund

by Shoichi Okano,
Upper Atmosphere Division, National Institute of Polar Research

Since 1994 we have been using small high altitude balloons BT-5 at Ny-Ålesund on Spitsbergen to observe the summer Arctic ozone distribution up to the upper stratosphere. These observations have the following objectives. The destruction of the ozone layer by anthropogenic CFCs is pronounced in the Antarctic ozone hole, but what about the Arctic? Since the polar vortex is not as stable in the upper Arctic stratosphere as in the Antarctic, the winter temperature does not become low enough to cause the non-uniform chemical reactions that are the mechanism of formation of the Antarctic ozone hole, so a clear-cut ozone hole is not observed. However, it is possible that ozone destruction by vapor phase reactions could occur; we believe that in such a case changes would first appear in the upper stratosphere. Therefore, we developed an optical ozone sonde for the purpose of observing the ozone height distribution at altitudes of 30km and higher, which is difficult with an ordinary electrochemical (ECC) type ozone sonde. This instrument measures absorption of solar ultraviolet radiation in the vicinity of wavelengths 300nm (the Hartley absorption band) and 600nm (the Hartley absorption band), from which the ozone height distribution is determined up to the maximum height reached by the balloon, generally 40km or higher. These observations in the Arctic are conducted in July and August every year at Ny-Ålesund in cooperation with the Alfred Wegener Institute. The following 4 balloon launchings were carried out in 1996; data analysis is presently in progress.(1) Date of launching (2) Altitude reached (3) Wavelength

August 18,1996	40.1 km	ECC ozone sonde also used
August 24, 1996	38.1 km	ECC ozone sonde also used
August 24, 1996	40.1 km	ECC ozone sonde also used
August 27, 1996	42.6 km	

In order to investigate long-term fluctuations of ozone in the Arctic, we believe that it is necessary to continue these annual observations in cooperation with AWI.

Glacial Terminus Ecology Research
The Ecosystem Change at the glacier-edge area in the Arctic

by Yukiko Bekku,
Plant Ecology, Faculty of Science, Tokyo Metropolitan University

When people hear of the Arctic, they immediately conjure up an image of cold desolation at the end of the earth. I was the same way when I first set foot in Ny-Ålesund 2 years ago. To be sure, the image might very well be accurate except for the short summer. However, the plants and animals who live there make maximum use of the short 2-month summer, using various strategies to survive and produce descendants. A moraine from which the glacier receded several thousand years ago is covered with mosses, lichens and vascular plants with beautiful yellow and pink flowers. Many of them are highly prized as scarce high mountain wildflowers in Japan. Those plants form the core of an ecosystem which also includes insects, migratory birds such as Arctic terns and geese, mammals such as foxes and reindeer, soil animals and microorganisms. Wildflowers against a glacier in the background form a beautiful, phantom-like scene. However, this hardy, beautiful, unique ecosystem is vulnerable to change due to environmental fluctuations, principally global warming.

Model predictions show that the effect of global warming is largest in the polar regions, with a possibility of average summer temperatures rising as much as 4.5 to 6 degrees C. If this happens, it can be expected that the effect of the temperature rise on the ecosystem in this region will be extremely large. An air temperature rise will directly affect the physiological processes of plants and animals on the ground, and at the same time there will be an indirect effect via underground processes. Specifically, it is possible that an increase in soil microorganism activity (the rate of organic decomposition) will change the amounts of nutrient salts that can be used by plants. For the past 2 years we have been conducting research focusing on the latter process. In 1995 our main objective was to estimate the amount of soil respiration (the amount of organic decomposition) under the present environment. In 1996 we conducted detailed measurements of the relation between the respiration rate of soil microorganisms and temperature in the laboratory, and in addition conducted an experiment to determine the effect of increases of 4 degrees C and 8 degrees C in the soil incubation temperature. So what happened in the laboratory when soil microorganisms in a Petri dish were subjected to environmental warming? Well, it happens that this work is still being written up, and I enjoy keeping people in suspense. But joking aside, the Arctic ecosystem gives we who are used to looking at temperate organisms a new view of the world. The particular project in which we participated is ending this year, but I hope for continued progress in Arctic biology and ecology.

Circum-Arctic Ice and Snow Core Drilling Project

by Hideaki Motoyama,

Hydrosphere Division, National Institute of Polar Research

In 1992, ice and snow core drilling was conducted down to the bedrock at the northernmost point of Greenland (72 degrees 30 minutes north, 37 degrees 37 minutes east, altitude 3,227m) under auspices of the GRIP project. In 1993, core drilling was again done down to the bedrock, at a location 30km from the GRIP drilling, under the name GRIP 2. From analysis of these two ice and snow cores, a variety of information relevant to ages from the present back to 200,000 years ago was obtained. There was surprising agreement between the two cores, but there were differences in the bottom 300 meters above the bedrock, perhaps because of the effect of icecap flow. This disturbed region started from the layer corresponding to the Eemian period, which was an interglacial period.

The first objective of the present North GRIP project is to clarify the climate more than 100,000 years ago. This drilling is being conducted mainly by Denmark and Germany, with the participation of France, Switzerland, Sweden, the United States and Japan. The first year of the project, 1996, was also the year in which the EPICA deep drilling test at Dome C in Antarctica was planned. North GRIP consists not only of the deep drilling, but also shallow drilling, ice radar observations, icecap flow observations, gravity measurements and altitude measurements in the surrounding area. The North GRIP location is at 75 degrees 6 minutes north, 42 degrees 20 minutes west, altitude 2,920m, ice thickness 3,000m. An advance party entered from the end of April 1996, decided on a camp site and constructed a base. The main dome, utility dome, garage, living tents and the 4m deep drilling trench in the snow, and core analysis trench were completed by the end of June, and solidly roofed with square timber and plywood. Basically the camp is to be occupied only during summer, from May to August. The living tents are to be removed at the end of that period. Other structures such as the main dome are built on snow piled up 2 meters.

During the last month the main activities were drilling and core analysis. While members came and went frequently, the basic composition of the group was 1 leader, 1 cook, 1 camp helper, 1 doctor, 1 electrician, 1 heavy machinery mechanic, 1 engine mechanic, 8 drilling crew members and 6 core analysis scientists, for a total of 21 people. After making a number of improvements to the EPICA drill, the season's drilling finally reached 350 meters. The 3 French drillers who participated will also take part in the deep drilling at Dome C in Antarctica. From Japan Hideaki Motoyama (National Institute of Polar Research) and Morihiro Miyahara (Geo. Tecs. Co. Ltd.) participated as drillers; it is planned for several Japanese to participate in the drilling and core analysis in subsequent years as well.

EDITOR'S NOTE

In 1995 the Arctic Environment Research Center of the National Institute of Polar Research, JAPAN, started distributing a newsletter (2 domestic edition in Japanese per a year) to give Japanese Scientists news of Japanese projects under way, news of important research abroad and news of domestic and international conferences. Last year 1 international digest edition in English per a year also had been distributed. This volume, AERC NEWSLETTER digest, Vol.2, incorporate numbers 4 and 5 of the domestic bulletin, which includes news of Japanese Arctic research project and other news of potential interest and/or novelty to international redears. Contributions are welcome and should be addressed to:

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Contributions will only be considered for printing in the international edition if it is considered that the information is not readily available to international readers elsewhere, or if inclusion in the international editions is specifically requested.

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