National Institute of Polar Research

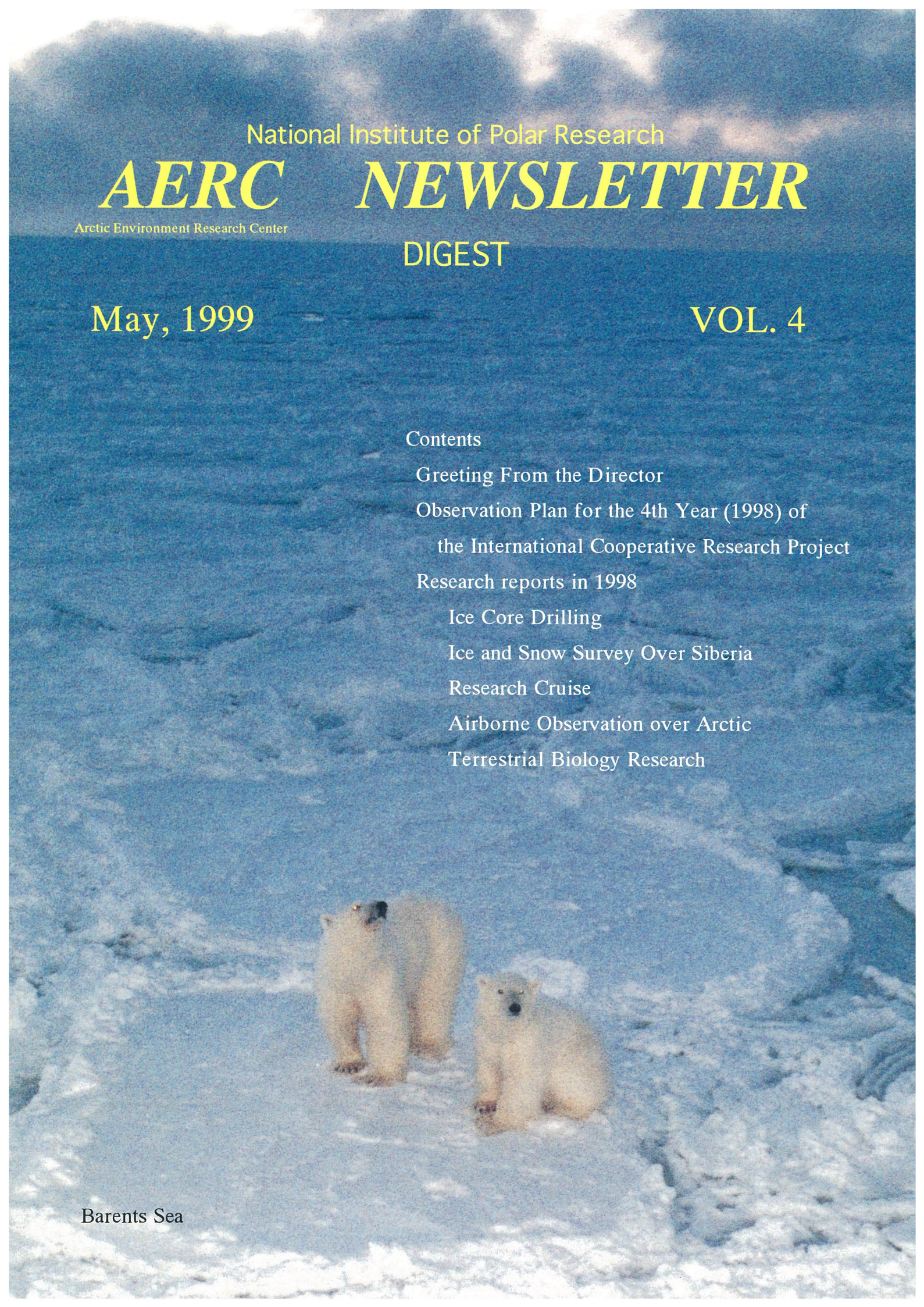
AERC NEWSLETTER

Arctic Environment Research Center

DIGEST

May, 1999 VOL. 4

Contents



Barents Sea

✢✢ Greeting From the Director ✢✢

Yoshiyuki Fujii
Director, Arctic Environment Research Center

The international cooperative research project "Arctic Environment Observations" was conducted in the various scientific fields in 1998 project year. A research aircraft flew to Svalbard for airborne observations from Japan through Arctic Pole in March 1998. Focusing mainly on material transport and exchange processes in the Arctic troposphere and stratosphere, it conducted continuous observations of trace atmospheric constituents and aerosols both inside and outside the polar vortex, and also observed the microphysical structure of clouds in the Arctic region. Ground-based observations were also conducted at the Ny-Ålesund observation station in coordination with the airborne observations. The Arctic is a region of converging atmospheric motion, and, at the same time, is the region where climatic change shows up most strongly. It is hoped that these observations will lead to major improvement in understanding of the ozone hole and Arctic haze. Oceanographic observations were conducted in the Greenland Sea where is a major sink of carbon dioxide, in January 1999 and in the North Water polynya in Baffin Bay in March-July 1998 as a Canada-Japan cooperative research program. In addition, there were cooperative research efforts in ice core drilling observations in Greenland and Svalbard, and observations of the adaptation of plants to global warming in the tundra region in 1998. We hope for your continued support.

✢ Observation Plan for the 4th Year (1998) of the International Cooperative Research Project "Arctic Environment Observations" ✢

The Atmospheric Environment Research Group

Observations on the theme "Global Atmospheric Environment Change in the Arctic" are being conducted in Svalbard and elsewhere. During 1998 it was planned to conduct observations of greenhouse gases, aerosols, water vapor, clouds, etc. in the troposphere and stratosphere in 4 locations: Ny-Ålesund in Svalbard, the Greenland Sea, the Norwegian Sea, and the Tiksi and Yakutsk regions of Russia. At Ny-Ålesund, ground - based air sampling for measurement of carbon dioxide and methane, surface ozone measurement, and remote sensing of water vapor, clouds and precipitation, have been conducted year-round since 1992. In winter, observations of stratospheric ozone, balloon and lidar observations of polar stratospheric clouds, and ground-based observations of aerosols have been conducted, and these observations were to be continued during the current year. Observations that were to be newly started during 1998 include sampling of aerosols in wintertime and measurement of their particle size distribution and optical properties to contribute to understanding of the effect of aerosols on clouds.

In the Greenland Sea, shipborne observations of the partial pressure of carbon dioxide in the sea surface layer were planned in regions and seasons where/when such observations have not been done before. In addition, joint observations with the oceanography group of ocean water temperature, salinity and nutrient concentrations were planned.

Simultaneously with the observations at Ny-Ålesund, observations of water vapor, clouds and precipitation were planned on surrounding islands and the Scandinavian peninsula, to determine the transport of water vapor from middle to high latitude in winter.

The observations in Russia include continuation of ongoing sampling of gases and aerosols, and monitoring of the state of environmental pollution in the Arctic, particularly in Siberia. During 1998 it was planned to collect samples of soils and pine

needles. Through these observations it was hoped to learn something about the present state and processes of climatic change in the Arctic region.

The Cryospheric Science Research Group

Observations of the Arctic cryosphere are being conducted to study climate and environment changes in the past, present and future throughout the Arctic region.

1. Circum-Arctic ice core study

Starting in 1997 and continuing through 1998, ice cores were drilled on Nordaustlandet, Svalbard, in cooperation with the Norsk Polarinstitutt. The cores are being analyzed in cooperation with the Norsk Polarinstitutt and others, and used to compare environmental and climatic fluctuations in different regions. Continuation of the drilling is planned in coordination with the Noraustlandet glacier mass balance research being conducted by a European group led by Norway. In addition, an ice core drilled on the Devon Ice Cap on Devon Island, Arctic Canada are being analyzed in cooperation with the Geological Survey of Canada as one link of ICAPP (Ice Core Circum-Arctic Paleoclimate Programme). These research projects tie in with international cooperative research related to IASC, ICAPP and IGBP/PAGES (Past Global Changes).

2. Greenland Ice Core Project

Japan is participating in this project, following its participation in the North GRIP deep drilling project. Some of the core samples are being analyzed in Japan, in cooperation with the North GRIP group. In addition, the possibility of observations in the interior (inland from the coast) of the Greenland Ice Sheet with a view to conducting research on the material transport process in the ice sheet.

3. Observations of characteristics of subpolar glaciers

Information is being gathered from visible, synthetic aperture radar and microwave satellite observations. This information is being gathered from both Japanese and foreign sources regarding the Greenland Ice Sheet and the glaciers and ice caps on islands of the Svalbard archipelago.

4. Study on snow chemistry and snow accumulation in Siberia.

Observations of snow accumulation are being conducted over a wide region in the Lena River basin and the Kolyma Mountains in Siberia. In addition to observations of snow accumulation, snow sampling is conducted to clarify transport mechanism of water vapor and chemical constituents in the Siberian High anticyclone.

The Terrestrial Environment Research Group

The Arctic region is expected to be where global warming will have its most pronounced effects. Rising temperature will accelerate the decomposition of organic matter in soil by microorganisms, thus altering material cycles such as the carbon and nitrogen cycles, and greatly affecting the species composition of the ecosystem. Consequently, in order to predict the effect of global warming on the ecosystem, it is important to clarify the rate of decomposition of soil organic matter and how the soil respiration rate changes with warming. As a result of a short (17 days) warming experiment conducted in 1996, it was found that respiration of soil microorganisms is accelerated with warming, but practically no change was found in the temperature dependence. From this result, it is expected that Arctic soil microorganism colonies will increase their respiration rate with increasing temperature

Ny-Ålesund, Svalbard

while maintaining their present respiration characteristics, that is to say, it is expected that the rate of decomposition of soil organic matter will increase. However, these results concern the response to short-term warming; it is conceivable that when the warming occurs over a longer term, the temperature dependence characteristics will change due to adaptation and the respiration rate will not change much. To study this effect, it was planned to conduct a longer - term warming experiment, for 2 months starting in early July, at Ny-Ålesund on Svalbard, and study not only the respiration characteristics, but also the change in the quantity of microorganisms and the species composition, and thus clarify the response characteristics of soil microorganisms to warming.

In addition, the processes of plant growth in a natural environment and in an artificial environment will be compared, and ongoing observations of changes of vegetation with warming were to be continued. This forms one link in long - term observations of changes in plant growth and phenology in warming experiments in OTCs (Open Top Chambers), which is a main theme of ITEX (International Tundra EXperiment).

In addition to the warming experiment, plans called for study of the sizes of *Dryas octopetala* colonies and the number of the flowers, the density of the flowers, differences in the gender expression, and research on the reproduction ecology of *Polygonum viviparum.*

The Marine Science Research Group

This group is participating in the International North Water Polynya Study, which is one of the pillars of the International Arctic Polynya Project (IAPP) proposed by the Arctic Ocean Sciences Board (AOSB). This project is to continue for 3 years starting in 1997, using a Canadian coast guard icebreaker as a platform for oceanographic observations. Oceanographers from 9 nations are participating in this research, with the Canadian group playing the lead role. Polynyas, which are believed to play a major role in formation of the polar ocean environment, are the object of this research. The principal specific objectives of this research are to clarify the state of the polynya environment and its formation mechanism, biological primary production, and the circulations and transports of energy and of materials such as carbon. To achieve these goals, in addition to the standard collection of samples for on-board analysis and experiments, and oceanographic observations, moorings were to be placed for 2 year-long periods, 1997-1998 and 1998-1999, for physical oceanography observations of the polynya region, and for placement of sediment traps to study biological production activity and material transports. In addition, satellite observations are being carried out, together with matching "sea truth" observations on the ship.

The 1998 cruise was planned to consist of 4 legs, from March 24 to July 28 of these, Legs 1 to 3 were to be devoted to oceanographic observations, "sea truth" observations to verify the satellite observations, and biological sampling; while Leg 4 was to be devoted to recovery of the first set of moorings (current meters and sediment traps) and placement of new moorings.

Barents Sea

Report on Ice Core Drilling on Austfonna, Nordaustlandet

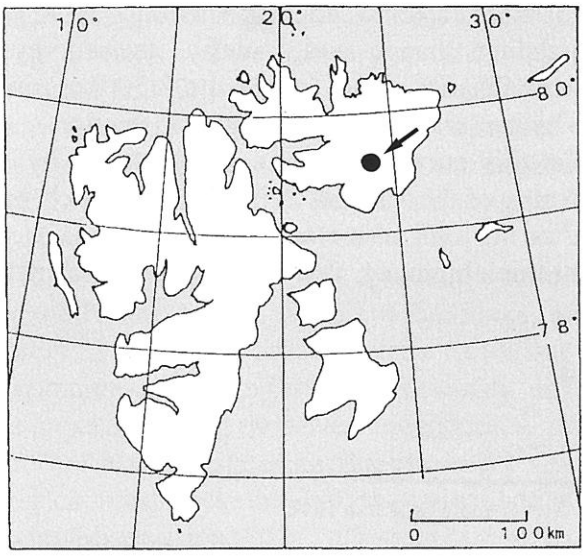
by Makoto Igarashi
Division of Meteorology and Glaciology
National Institute of Polar Research

Ice core drilling was carried out in March and April, 1998, in the central part of the Austfonna (79°48'03"N, 24°00'21"E, 750m above sea level) on Nordaustlandet, the northeastern island of the Svalbard archipelago. This ice core drilling was one link in the drilling that has been carried out since 1987 by the JAGE (Japanese Arctic Glaciological Expedition) in the Svalbard archipelago, mainland Norway and Greenland to clarify fluctuations in the climate and atmospheric environment in the Arctic region over the last several hundred years. The details of the research objectives are discussed in Kamiyama (1998). Here the emphasis is on describing the field activities.

Ice core drilling has been conducted several times in the Svalbard archipelago. All of the previous drillings were during the relatively warm season, from May through July, and the strong sunlight often raised the daytime temperature in camp above 0°C. In addition, since this is the season of the midnight sun and it is always light, life in camp was relatively easy. On the other hand, it was very hard to store the cores that were obtained in such a way that they would not melt. In addition, the sea ice disappears from the ocean around Svalbard in summer, so that a great deal of water vapor is supplied to the atmosphere and the glacier is often enshrouded in clouds. As a result, either retrieval of the cores by helicopter or travel over the glacier was often delayed by a week or more. To deal with these problems, it was decided to conduct the present drilling during March and April, when the ocean around Svalbard is covered with ice and the weather can be expected to be relatively good, yet the period of daylight is still half a day or more.

Activity on the ice cap started on schedule, on March 7. On that day an advance party consisting of 3 members (2 Japanese and 1 Norwegian) traveled to the ice cap. The weather was good, as expected, but the temperature was -33°C, the lowest ever experienced at a drilling camp in Svalbard. Living activities in camp, including thawing food and preparing drinking water, were extremely difficult. On the 9th the 4 remaining Japanese arrived, and full-scale camp activity started. For the next several days the good weather and low temperature continued. During this time the living and dining tents, and the tent to be used for analysis of the retrieved cores, were set up. The drill was assembled by the 12th, permitting the final activity, the winding up of the cable, to start on the 13th. But after noon on that day, we were hit by a blizzard, with wind sometimes reaching 20m/sec, and were forced to suspend work.

That blizzard continued for 4 full days. Work was finally resumed on the 18th. Drilling finally started on the 19th. On the 27th there was an exchange of members; only one of the original party of 7 remained, while the remaining 6 left and were replaced by 3 new people. These 4 people continued the work through its conclusion on April 20.



The glacial drilling point.

Of the full period of 45 days, work was impossible on close to half because of blizzards. For this reason, the drilling reached only 118.62m, far short of the original goal of 200m. In addition to the direct effect of the wind on outdoor work, the temperature in the tents sometimes dipped as low as -20°C, creating a very difficult living environment for the party members.

The cores that were obtained are now being analyzed, and it is hoped that we will be able to learn

something about the climate and environment changes in the northeastern part of Svalbard.
[Reference: Kamiyama, Kokichi (1998) Glacial drilling on Nordaustlandet (in Japanese). Arctic Environment Research Center Newsletter (Japanese edition), No. 7, 12-13.]

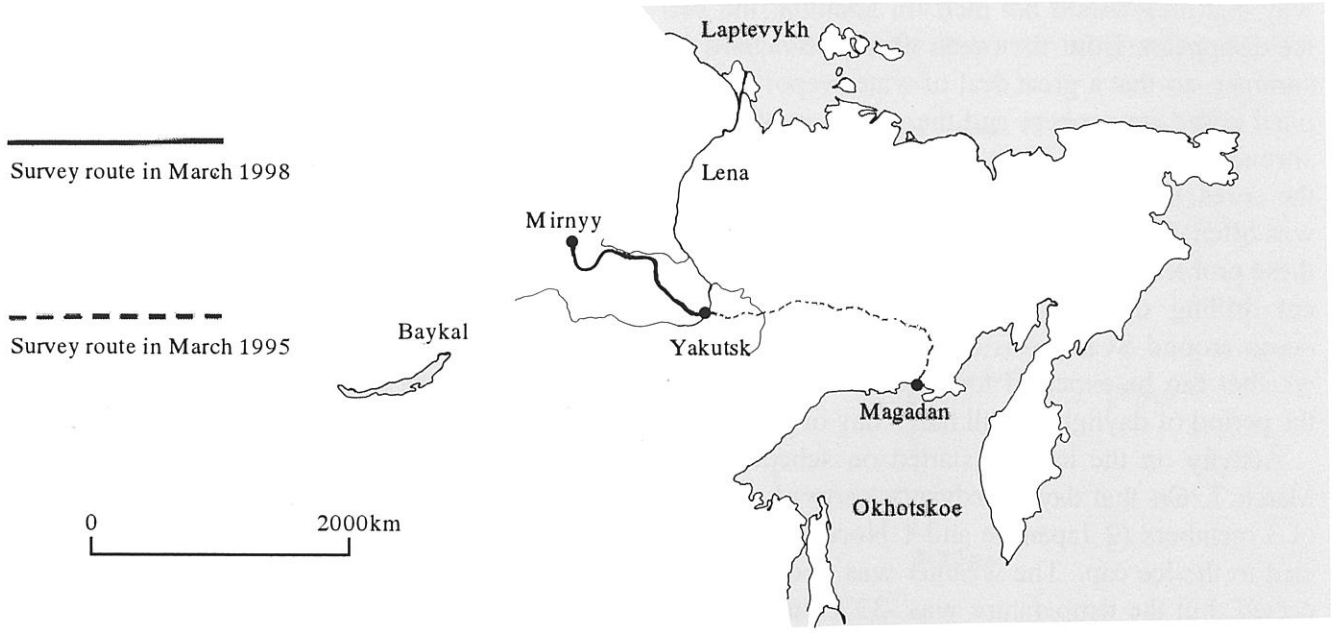
Report on Ice and Snow Survey Over Wide Area of Eastern Siberia

by Akira Takahashi
Communication Research Laboratory

As one of the activities of the international cooperative research plan "Comprehensive Research on Arctic Environmental Fluctuations" in the 1997 project year, an ice and snow survey was conducted over a wide area of eastern Siberia for 13 days, from March 16 to 28, 1998. The 3 members of the party were Shun'ichi Kobayashi of Niigata University, Fumihiko Nishio of Hokkaido University of Education, and Noboru Takahashi of Communication Research Laboratory. Although the flight from Japan to Yakutsk was interrupted by a scheduling change and a delay, the survey of eastern Siberia, which involved a 2,500km round-trip by car, was completed to get satisfaction.

On this survey we were accompanied by Dr. Makarov of the Yakutsk Permafrost Research Institute as the joint observations along the main east-west trunk highway, that stretches from Yakutsk in the Saha Autonomous Region of the Russian Federation to Mirnyy. Specific observations, included accumulated snow depth, and snow temperature, and cross-section observations was carried out to determine the layer structure of the accumulated snow and the crystalline structure of the snow, and snow sampling for the analyses of its chemical compositions, which includes sulphur isotopes. This was done once each at 14 locations spaced 50km to 100km apart, including grassland, forest, naked land, shrub-covered land and river ice surface.

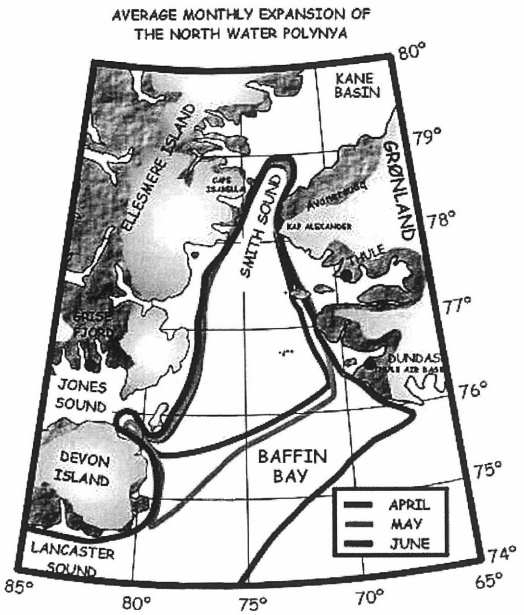
The objectives of the research, including the survey of accumulated snow depth and snow layer structure are the ground truth for satellite observations in the interior of Siberia, and to make clear the transport processes of water vapor and chemical constituents. The survey region, in the middle of the Siberian High anticyclone, receives on the order of 200 to 250mm of precipitation per year, 40% of which falls as snow. After we returned to Yakutsk we were hit by a full - scale snowstorm, but during the survey, typically the days started out cloudy and then cleared up before noon. Average accumulated snow depth was on the order of 50cm; from the cross-section observations we found that the particle diameter increases downward continuously. In particular, from about 10 to 20cm below the snow surface there was a well developed depth hoar layer with particle diameters of 4mm and more. Since the accumulated snow depth and accumulated



snow structure tended to be uniform independent of the ambient conditions, we believe that the survey area was representative of the entire region under the Siberian High.

From analysis of the chemical composition, we believe that we obtained a good information on the water vapor and material transports.

Simultaneously with our ground survey, RADARSAT/SAR (500x500km) wide area satellite observations were taken. At present, we are looking into the possibility that there might also be other satellite data that can be used.



http://kestrel.fsg.ulaval.ca/giroq/now/spread.jpg

Report on Leg 1 of International NOW Cruise

by Kazutaka Takahashi
Department of Bioengineering, School of Engineering
Soka University

This international cooperative research project was planned to study the environment and biological activity in the North Water Polynya (NOW) that forms between Canada and Greenland, with Laval University of Canada as the lead institution., At present a 3-year cruise plan covering the 3 years 1997 to 1999 is in process of being carried out. During the year covered by this report 4 legs were planned for the 4 month period from March 26 to July 28, 1998. the present author participated in Leg 1, from April 8 to May 6, together with Dr. Suzuki of Kanagawa University and Mr. Nagao of Soka University.

At the start of the observations, Denmark refused to permit the ship to enter Danish (Greenland) territorial waters (perhaps to prevent interference with hunting by the local native people?), which made it impossible for the observations to cover the entire North water region as originally planned, so that observations were only possible within Canadian territorial waters, in the western half of the region. In addition, trouble with observation equipment and bad weather caused delays in the observations, making it impossible to conduct all of the planned observations. With a view to conducting the observations as efficiently as possible under the circumstances, meetings were held every day and plans were modified as necessary. Some observations were carried out while the ship was under way, but the plan was centered on stations taken while the ship was stopped. There were 3 types of stations: Basic Stations during which mainly the physical environment was observed; Full Stations during which biological sampling was also conducted; and Long Stations where primary productivity was measured and full diurnal cycles were observed. Many scientists in different fields cooperated with one another in these efforts, which are expected to yield significant results. The Japanese team's observations are summarized below.

The ship's schedule was frequently modified, and the Japanese team, like all of the others, had to modify its own plans accordingly. we tried our best to communicate in English, but inevitably difficulties arose in making ourselves understood to people who are used to speaking English every day. In these circumstances, the 3 of us carried out the following observations.

A. Zooplankton observations

1. Research on the diurnal cycle of food uptake rate: At one station, zooplankton were samples from 3 layers (less than 100m depth, 100 to 200m and deeper than 200m) at 4 hour intervals, and their food uptake rates were determined experimentally.
2. Evacuation rate measurement

These measurements were carried out at the same stations as the food uptake rate measurements.

3. Supplementary sampling at net sampling stations

B. Phytoplankton observations

1. Continuous observations of surface water

(chlorophyll fluorescence, salinity, water temperature)
2. Vertical profiles of natural fluorescence intensity
3. Sampling for measurement of light absorption coefficient
4. Experimental measurement of the light-photosynthesis rate curve
5. Measurement of the chlorophyll fluorescent light quantum absorption rate

<On life aboard the ship>

When we first arrived in the North Water Polynya, the outside air temperature frequently dipped to -20 degrees C, so that adequate protection from the cold was necessary to conduct observations. In addition to down garments brought from Japan, a large number of "Mustang Coats" which protected against both cold and water were provided by the ship, and we borrowed these to wear while working. We were plagued by such troubles as the observation winch pulley falling off and the wire breaking due to overload during stormy weather; fortunately nobody was injured.

Regulations required us to wear helmets and safety boots while working on the deck, and there were indeed a number of occasions on which we felt the need for such equipment. I felt that goggles would have also improved working efficiency during stormy weather.

The conversation among researchers was in English, but the official language on board was French since mother part of the ship is Quebec Province, when French is daily language. Since there were some crew members who only spoke French, I felt that it would have been helpful to at least be able to speak a little bit of everyday French.

Meals were greatly different than on a Japanese research vessel. Researchers were permitted to use either the officers' or the noncommissioned officers' dining room. You could choose anything you wanted from that day's menu cafeteria - style, and you could also go into the kitchen any time you wanted to help yourself to bread or drinks, or to make sandwiches. You could use the shower and the washing machine at any time. Bath and face towels, and soap, were issued to everyone upon boarding, so you did not need to take your own. During specified hours there was bar service in the lounge, so that scientists and researchers could shoot the bull over drinks.

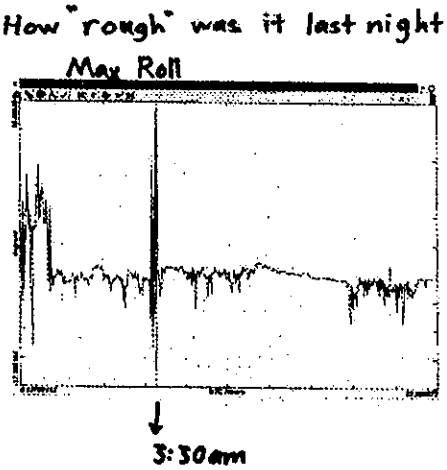
Report on Leg 2 of International (NOW) Cruise

by Yoshihiro Suzuki
School of Physical Sciences, Kanagawa University

The present author boarded the icebreaker Pierre Radisson in Quebec City on March 23 for Legs 1 and 2. During the interval prior to arrival in the study area on April 6, he prepared for the Japanese group's observations together with Mr. Nagao of Soka University. Mr. Takahashi, also of Soka University, joined the cruise for Leg 1 from April 8 to May 6, and was replaced by Mr. Sasaki of Hokkaido University on Leg 2 from May 7 to June 1. The present report focuses on Leg 2.

1. Meteorological conditions

During Leg 2, the region in which the polynya occurs had 24 hours of daylight; the sun remained fairly high even during normal nighttime hours. For this reason, it was possible to carry out observations without regard to whether it was day or night. The temperature was also fairly high; it did not drop below -10 degrees C during that leg. There were many clear days, but we were always plagued by strong wind. Even on days when it was possible to conduct observations, the equipment frequently broke; problems included plankton nets drifting away, breakage of communication cables, and sampling bottles falling off of the wire and sinking. There were also times when the strong wind forced the boat to seek refuge in quieter waters. In particular, early in the morning of May 21, the boat rolled badly in waves whipped up by the



strong wind (see the figure); several of the on-board laboratories could not be used for 2 days. This caused us to fall behind schedule, so that on days when the wind was relatively quiet, observations had to be conducted on a very concentrated schedule.

2. The researchers

Nearly every day we held meetings to discuss how to make the best use of the limited time during which the wind permitted observations. On Leg 2, as on Leg 1, we were not permitted to conduct observations near the Greenland coast because they might interfere with hunting by the local native people. At first, the researchers could not conceal their irritation at this completely unexpected limitation on our observation area. However, gradually even the most irritated of the researchers calmed down, and the observations were conducted in a somewhat calmer on-board atmosphere during Leg 2 than had prevailed during Leg 1. There was also a change in the makeup of the on-board party; many of the researchers who boarded for Leg 2 were young, including a number of students.

3. The observations

Most of the observations were conducted from stations during which the ship was stopped. There were 4 types of stations: CTD Stations during which only the physical environment was observed; Basic Stations during which water samples were taken, and chemical samples and biological samples were analyzed in addition to the physical observations; Full Stations, at which nearly all observations were carried out, including observations of primary productivity; and Long Stations, which lasted more than a day so that observations of a full daily cycle could be conducted. A variety of observations were carried out at stations located throughout the region of interest.

4. Activities of the Japanese group

On Leg 2, Mr. Sasaki and I conducted phytoplankton observations. Specifically, we continued the same observations that had been started on Leg 1, including the following:

1. Continuous observations of the surface water
2. Measurement of the vertical profile of intensity of natural fluorescent
3. Taking of samples for measurement of the light absorption coefficient
4. Experimental measurement of the light - photosynthesis rate curve
5. Measurement of the chlorophyll fluorescent light quantum absorption rate

Mr. Nagao joined the Canadian zooplankton group, and was very busy making zooplankton observations.

5. Miscellaneous

Dr. Takahashi gave a detailed description of life aboard the ship in his report, to which the reader is referred. I would like to conclude this report with a brief summary of the environment on board the ship for observations and experiments., The Pierre Radisson is an icebreaker which was originally used for coastal patrolling; the deck is somewhat higher above the water than is the case on an ordinary research vessel. Sampling of zooplankton with a plankton net, optical measurements, mud sampling and so on were done from the deck; CTD observations and water sampling were done from a platform protruding out from the side of the ship. The principal experiments were done in container - type laboratories assembled on the deck. it was divided into a chemical laboratory, a primary production laboratory, a low temperature laboratory (which at 0 degrees C was actually warmer than the outside temperature), an RI laboratory and a zooplankton laboratory. The Japanese group borrowed part of that laboratory for experiments. Space was not unreasonably tight, but I must still say that it would have been easier to work had a bit more space been provided. It was a difficult environment to work in; the large amount of breakage of laboratory equipment is something that I will not easily forget. Considering that the ship went 4 months without stopping in a port, I think that it would have been prudent to take more spare pieces of laboratory equipment and more spare parts for repairs. Unfortunately, the PAM(pulse-amplitude-modulated fluorescence technique) measurement device was broken at the start of Leg 2, and those measurements could not be resumed until a replacement unit was brought on board at the start of Leg 4, 2 months later. I hope that the researchers who join the cruise in 1999 will take the trouble to make adequate preparations in this regard.

Over Svalbard (AAMP98)

AAMP98 REPORT

by Masataka Shiobara
National Institute of Polar Research

The Arctic Airborne Measurement Program (AAMP) 1998 campaign, which had been introduced in the Japanese edition of AERC Newsletter No. 7 (page 12), were carried out successfully. The program is directed by Prof. Yoshiyuki Fujii, Director of the Arctic Environment Research Center, National Institute of Polar Research (AERC/NIPR). This report briefly describes those observations.

The research objectives of these airborne observations are to clarify the 3-dimensional distributions of trace constituents in the Arctic atmosphere, their transports and circulations, and related physical and chemical processes. Participating institutions include the Graduate School of Science, Hokkaido University; the Graduate School of Engineering, Hokkaido University; the Graduate School of Science, Tohoku University; Miyagi University of Education, the Solar Terrestrial Environment Laboratory (STEL), Nagoya University; the National Institute for Environmental Studies; and NIPR. The aircraft carried sensors and sampling equipment for gases, aerosols and cloud particles prepared by the participating groups. The aircraft used was a Gulf Stream II twin-jet aircraft belonging to Diamond Air Service K.K. It is a specialized research aircraft, which has been modified so that it can conduct the variety of atmospheric observations required for BIBLE (Biomass Burning and Lightning Experiment), etc. It carried 2 pilots (K. Kitahara and D. Kageyama), a flight engineer (T. Kamine) and 5 scientists: Y. Asuma (School of Science, Hokkaido University), S. Yamagata (School of Engineering, Hokkaido University), S. Sugawara (Miyagi University of Education), S. Morimoto (NIPR) and the present author.

On March 6, 1998 the aircraft departed from Nagoya and flew via Petropavlovsk-Kamchatskii to Anchorage, where we stayed over one night. The next day we flew via Barrow, over the North Pole, and arrived at Longyearbyen on March 7. AAMP Director, Prof. Y. Fujii had previously arrived in Longyearbyen, together with Y. Inomata and M. Watanabe of STEL, and they came to meet us. Starting the next day we carried out 3 flights, based in Longyearbyen. There was some rotation of members on those flights. Fujii flew on March 8. Prof. O. Watanabe of NIPR, who had come primarily for the Nordaustlandet ice drilling project, flew on March 9. Inomata and Watanabe of Nagoya University flew on March 10.

A German group was in Longyearbyen working on ARTIST (Arctic Radiation and Turbulence Interaction Study). There had been prior discussion

about simultaneous coordinated AAMP - ARTIST flights, but that plan was abandoned because of unfavorable weather. On March 12 we left Longyearbyen and retraced our previous route back to Nagoya, arriving on March 14.

During those flights, we conducted measurements and sampling of trace gases, aerosols and cloud particles. The nearly 20 instruments and samplers aboard the aircraft worked well, and good data were obtained. The long flights across the Arctic found a clear inverse correlation between fluctuations of ozone concentration and carbon dioxide concentration in the lower stratosphere. It is believed that this reflects the circulation processes in the polar atmosphere, between the troposphere and stratosphere and between the inside and outside of the polar vortex. Another interesting result was a clear positive correlation between concentrations of methane and N_2O. Tropospheric aerosols in the Arctic, the so-called Arctic haze, were found to be present over a wide area, and showed greater optical thickness than had been expected. Vertical profiles above Svalbard and Alaska showed that the Arctic haze has a multi-layered structure and reaches to near the tropopause. These results hint that these haze layers could be closely related to the formation of stratus clouds in the lower layer and ice clouds in the upper layer.

There was some redundancy of the observations, with some quantities being measured and/or sampled by more than one instrument, providing interesting opportunities for comparison.

Ground-based observations, timed to coincide with the airborne observations, were conducted at Ny-Ålesund. Clouds, precipitation and trace gases were observed by M. Wada (NIPR), H. Konishi (Osaka Kyoiku University) and A. Sasaki (Tohoku University); and lidar and aerosol sonde observations were carried out by T. Shibata, H. Adachi and K. Hara of STEL, and by K. Shiraishi and S. Makiyama of Fukuoka University.

At present, the data and samples are being analyzed by the participating institutions, and it is expected that new knowledge concerning material cycles in the Arctic region and the mutual interactions of trace gases, aerosols and clouds will be obtained. Preliminary results were presented at an AAMP meeting on April 22; a copy of the proceedings (in Japanese) can be obtained from AERC.

Considerable cooperation in these observations was obtained from Diamond Air Service K.K., which not only cooperated in preparing and installing the hardware for the observations but also in looking into the necessary arrangements with the local airport and coordinating in advance with the aviation authorities of the countries on route. Considerable advice was also received from the planning stage from Prof. Y. Ohta of the Norsk Polarinstitutt, and the Norsk Polarinstitutt itself cooperated in obtaining and storing materials locally. Our thanks go to all those who cooperated in this research.

CASSIOPE--TERRESTRIAL BIOLOGY RESEARCH AT NY-ÅLESUND

by Naomi Misato
Department of Biology and Global Environment
Faculty of Science and Engineering
Graduate School of Shizuoka University

There are many unusual phenomena on our Earth. To be sure, the word "unusual" is often overused just to stimulate peoples' interest in something. But there are also "unusual" things that are only visible to people who want to see them. Perhaps most research starts when someone lucky enough to observe something "unusual" starts to try to explain it.

It is 3 years since I started to study plant ecology. During this 3 years, I have seen unusual things where I did not expect them. Until now, I did not know that there is an island in the Arctic that is covered with a sea of flowers in summer, nor did I try to think of how life would survive there. What is the secret of flowers that live in the severe Arctic environment, and come alive in bloom in the short summer ?

We arrived at Ny-Ålesund at the beginning of July. After completing the necessary procedures, we, the terrestrial plant ecology group, immediately set off on foot to study the plant communities around Rabben Base. Since we had only one week in Ny-Ålesund, we had to start work immediately upon arrival. *Dryas octopetala* and bulbiferous knotgrass (*Polygonum viviparum*) appeared to have not yet started to bloom. At the end of that day my supervisor, Prof. Masuzawa, led us to "*Cassiope* Hill". It is a hill that is completely covered with *Cassiope*. But our timing was not good;

at first we did not see the flowers. Only after we searched for some time we found the plant with 5 mm long white flowers. That was my first encounter with *Cassiope* in Ny-Ålesund. Specifically, it was *Cassiope tetragona.* I had previously seen similar white flowers with pursed lips in Japan. That was on a 5-day hiking trip on Mt. Daisetsu (a large mountain massif) in Hokkaido. The white flower that I saw on that occasion only grows on high mountain crags; it is called "iwahige" (literally "rock beard"; *Cassiope lycopodioides*) in Japanese. They resembled the little flowers that we saw on "*Cassiope* Hill".

My first impression upon seeing the Arctic *Cassiope* was that the leaves have a special structure. First of all, the leaves are not flat. The leaves all appear to be clinging tightly to the stems. The *Cassiope* ("iwahige") that I saw on Mt. Daisetsu had similar leaf structure. I took one leaf in my hand to get a closer look. What?? I noticed an even more unusual structure. There was a space on the outside, the part that does not contact with the stem. It looked like the space between the torso and wings of a ladybird beetle that is ready to take off in flight. Perhaps this will be easier to understand if I say that the ladybird beetle holds on tightly to many branches before it takes off. (Or does this make it harder to understand?) The *Cassiope* that I saw on Mt. Daisetsu did not have this kind of structure with an open space. Perhaps this difference means something. Both environments can be called "extreme" in their own respective ways, but after visiting the Arctic I understood clearly that there is a difference. Both environments are cold, but in contrast to the alpine crags, the Arctic in summer has a greater abundance of water than I had realized. Melt water from glaciers keeps the surrounding land irrigated. Perhaps that is the key to the difference. Believing that the spaces between the *Cassiope* leaves must have significance in terms of the growing environment, I brought a number of samples back to Japan for analysis.

Before I realized it, it was past 7:00 p.m. The sun was still as bright as during the daytime. Whether or not they knew it was supposed to be nighttime is not clear, but reindeer approached us. There were many flattened spots on the cushion - like *Cassiope* ground cover where reindeer had slept. It seems that *Cassiope* also holds appeal for the reindeer.

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 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 digest, Vol. 4, incorporates numbers 8 and 9 of the domestic bulletin, which include 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: +81-3-3962-5720 Fax: +81-3-3962-5701 E-mail: arctic@pmg.nipr.ac.jp

Published in May, 1999