National Institute of Polar Research

AERC NEWSLETTER

Arctic Environment Research Center

March, 2004 VOL. 9

Svalbard poppy

Akkol valley, Altai Mts.

Reorganization of NIPR
Japanese Arctic Research Directory in 2003
Visiting Professor
Research Reports

FROM "ARCTIC ENVIRONMENT RESEARCH CENTER" TO "ARCTIC CENTER"

by Yoshiyuki Fujii

Director, Arctic Environment Research Center

In April 2004, the National Institute of Polar Research (NIPR) will be reborn as an Inter-University Research Institute of "Research Organization of Information and Systems". On the occasion of reorganization of NIPR, the Arctic Environment Research Center is scheduled to become the "Arctic Center", which together with the "Antarctic Center" will form a comprehensive Polar Observation System. Research and observations will be carried out as discrete projects, promoted under a new Research and Education System. This reorganization of NIPR will result in a system to promote interdisciplinary research on the global environment, and to upgrade the level of cooperative research based on evaluation.

Research and observations in the polar regions, where the effects of global warming are most pronounced, are becoming increasingly important, considering the future climate change and the effect on many fields of activity in Japan. Determining the state of global warming, studying mechanisms of variability, and evaluating the effects on the whole terrestrial and biosphere environment require international cooperation, and cooperative research pursued with greater effectiveness than ever before. The new system must fulfill these requirements.

This newsletter is the last in the series issued as the "Arctic Environment Research Center Newsletter". I wish to thank all the people who have supported and cooperated with this Center over the years, and express the hope that under the new system we will be able to meet the great expectations that will be placed upon us for the continued progress of Arctic research and observations.

JAPANESE ARCTIC RESEARCH DIRECTORY IN 2003

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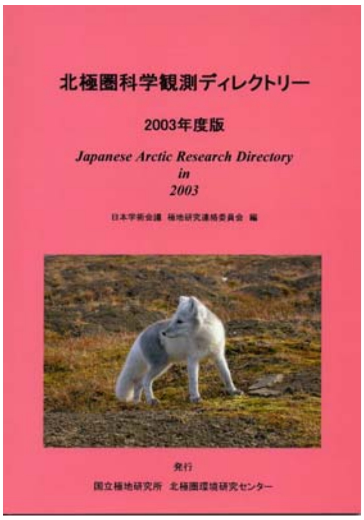
Published by the National Institute of Polar Research (October 2003)



This is the fourth annual directory which lists research activities of Japanese universities and research institutions, based on a questionnaire. The first half is in Japanese, the last half in English. The Directory is distributed to researchers and institutions engaged in polar research both in Japan and overseas.

This year's edition again gathers information on research activities in a wide variety of fields including oceanography･ocean physics, bio-sciences, geochemistry, glaciology, atmospheric science, upper atmosphere physics and cultural anthropology. A total of 34 research projects are listed. A summery of information for the last 3 years can be viewed on the Arctic Environment Research Center home page (www-arctic.nipr.ac.jp). Combined use of the printed directory and the home page is recommended.

We thank the individuals who provided valuable information, and hope that this directory will contribute, even if only in a small way, to the research activities of the people who use it and to the progress of Arctic research in general.

Visiting Professor (September 2003 – January 2004)

Asgeir Brekke

Reflections over a visit

My stay at NIPR is getting close to its end. I would like to take this opportunity to thank Director Okitsugu Watanabe at NIPR for the hospitality I have enjoyed and the generous offer this institute has bestowed upon me when inviting me to become a visiting professor for almost 4 months. I came here with ambitions to do many things but time has been running too fast for me to fullfill all my plans. I was very happy to learn at my arrival, however, that Prof. Takashi Okuzawa has translated my text book "Physics of the Upper Polar Atmosphere" into Japanese and it was with great pride I could receive a copy.

It has been especially convenient for me to be able to live in one of the flats in the Guest House, and I am very grateful that my family stayed there with me during the Christmas and New Years holidays. It was an extremely interesting experience to see how you celebrate New Year in Japan. Several ten thousands of people were so well behaved in front of the Meiji shrine at Harajyuku, that the contrast to the wild celebration in the streets of Tromsø where fireworks are exploding everywhere cannot be greater.

During the holidays my family and I also were able to go to Kyoto and Nara to see and learn more about your long traditions and interesting culture. Many temples and shrines in Kyoto are well known, but the beauty of all the wonderful handicrafts that are displayed there are as impressive.

I have been able to enjoy many new places that I did not visit through one of my 20 trips to Japan before, like walking in the hills of Kamakura and the Takaosan with Professor Takehiko Aso and his wife. Also when I joined Professor Aso on the trip to Sendai to lecture for the students there, I was given the privilege to visit wonderful Matsushima.

The long tradition this institute has for sending expeditions to Antarctica is outstanding in the World. I enjoyed observing the effectiveness with which the preparation for this year's expedition took place around the institute. There are a number of packages to wrap and details to keep control of in order to secure a successful journey.

It has been interesting for me to learn about the reorganisation that is taking place between universities and research institutes in Japan, the same motion can also be observed at home. I really hope that the new organisation that NIPR enters into from April 1st this year will be beneficial to all of you. I have also followed with interest your campaign for getting a new icebreaker as Shirase now has served its duty for more than 25 years. It was especially stimulating to be allowed to take part in a meeting downtown Tokyo where more than 200 enthusiasts were gathered together backing NIPR's plea for economical support to make a new icebreaker come through.

I am also grateful to Director Watanabe for inviting the Norwegian Ambassador to Japan, Mr. Fosseidbråten and also the representative for the Norwegian Trade Council in Japan, Svein Grandum to NIPR. Norway and Japan have had very close ties in polar affairs and especially in Antarctica for many years. Mr Fosseidbråten stressed the

interest of his embassy in polar matters and especially his personal interest in strengthening the Japanese- Norwegian collaboration in the EISCAT project. He enjoyed being guided through your outstanding collection of meteorites and also the chilly cold room to admire the excellent ice cores. The Norwegian Prime Minister Mr. Bondevik visited Japan last year and during his visit a treaty for scientific cooperation between Japan and Norway was signed. I hope we can find ways to take advantage of this treaty to the benefit of all of us.

EISCAT is an international organisation where Japan and Norway are close partners. EISCAT has no doubt been a successful organisation as a large amount of exciting science has been produced on the basis of data from these facilities. The number of publications based on EISCAT data is large compared to the total cost of the cooperation. It will be hard to find an installation within space science where the cost pr. published paper is lower. In this respect Japan, as the last country to join EISCAT in 1996, has contributed very strongly to this success, and is by now one of the most active partners in EISCAT. For this reason I hope the EISCAT activity in Japan will be strongly supported also in the future.

As the present contract for the international cooperation in EISCAT terminates at the end of 2006, we are all working for a renewal of the contract for 10 more years. EISCAT should not be prolonged just for keeping the system running, but we need very good science projects in which EISCAT can be one of several tools that can be utilized in a larger context. As the EISCAT infrastructure to a large part is based on a technology that is more than 20 years old, there is a need for upgrading the system. For this we need a larger investment in new antenna technology i.e. phased arrays. Norway is prepared to take a larger share of the cost than it has done so far, but for achieving the investments we need, we also need contributions from other partners. It is in this regard I hope that Japan, that is presently such an active user of EISCAT, is willing to increase its contribution in a cost share of these new investments.

I wish my colleagues and friends at NIPR all the best for the future of.

NIPR January 15, 2004
Asgeir Brekke

Research Reports

Installation of New Radar and Optical Observation Equipments at EISCAT Tromsø Radar Site

Takehiko ASO (Arctic Environment Research Center, National Institute of Polar Research)
Hiroshi MIYAOKA (Information Science Center, National Institute of Polar Research)

Fig. 1 The NTMR antenna array and the EISCAT VHF antennae (4 panels).

Following the fall 2003 EISCAT Council meeting held in Copenhagen, I (Aso) visited Tromsø, Norway, where we installed the National Institute of Polar Research's new meteor radar equipment at the EISCAT Tromsø Radar Site and started continuous observations of atmospheric dynamics in the upper mesosphere to lower thermosphere which can complement the EISCAT radar observations at higher altitiudes. Dr. Miyaoka joined me in Tromsø and we installed optical equipments for aurora observation in 2 domes which we are renting from the University of Tromsø.

The meteor radar is similar to NSMR (NIPR/Norway Svalbard Meteor Radar) that has been operating near the EISCAT Svalbard Radar Site since March 2001; the S is replaced by T for Tromsø to make "NTMR". The meteor radar is used to investigate the motion and diffusion of trails created by meteors impinging upon the upper mesosphere and lower thermosphere. These observations are very important, as they reveal wind and temperature fields which bear signals on the warming and cooling in the lower and upper atmosphere, respectively. The system is a pulse Doppler radar with frequency of 30.250MHz and output power of 7.5KW. The interferometer system employs a 3-element Yagi transmission antenna and 5 receiving antennae to detect echoes and determine the angle of arrival. Many active instruments including a dynasonde, digisonde and MF radar are in operation at the EISCAT site, so transmission synchronization and a notch filter are used to avoid serious interference.

Fig. 2 A new NTMR hardware system.

Fig. 1 shows the antenna field. The building at left is called the Tromsø University PRE (PRE stands for Partial REflecttion radar; now called as MF radar). The instrument shown in Fig. 2 is installed there; the radar operation can be monitored from Japan through a network. In addition, a synchroscope image of transmission and reception signals can be observed continuously by a WEB camera.

Now the daily echo rate is sometimes more than 10,000. A provisional result of the initial observations for 20 days in November 2003 is shown in Fig. 3. The figure shows a contour plot of meridional wind with respect to height and day number. From the figure it is clear that the wind system around 90km altitute has a distinct semidiurral component.

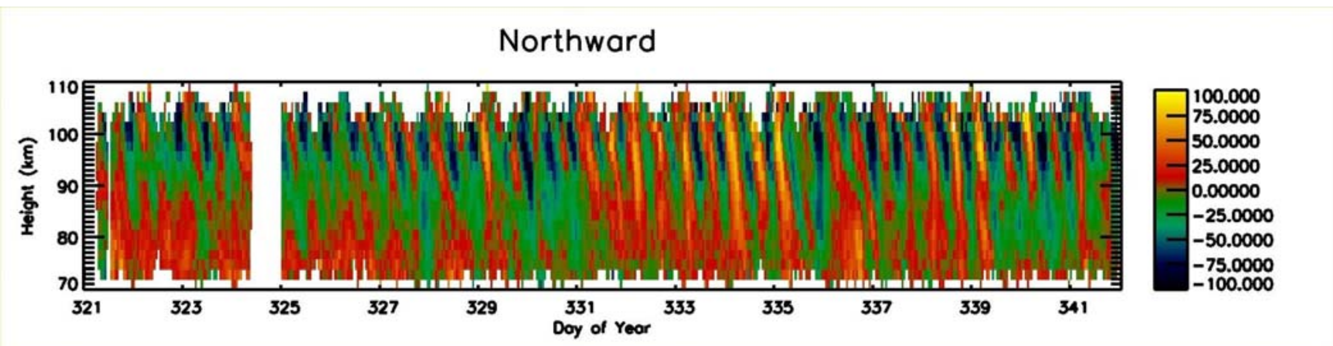


Fig. 3 Initial NTMR observation results.

Fig. 4 The all sky camera installed in Tromsø.

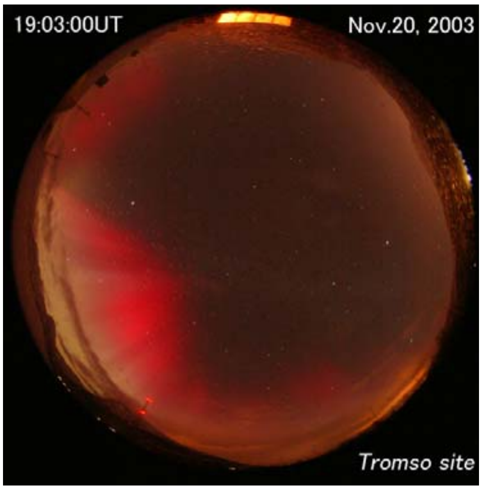


Fig. 5
An all-sky image of red aurora over Tromsø

To complement the ionosphrere observations by the EISCAT radar in Tromsø, an all sky digital camera and narrow field-of-view imager for aurora and airglow were installed in a optical dome in the same building, as shown in Fig. 4. This equipment is particularly intended to observe the fine structure of aurora by radar and optics. Continuous monitoring of aurora activity is also in our view.

During the stay in Tromsø, our group run the EISCAT heating campaign using a Swedish ALIS camera to perform artificial aurora excitation experiments. On October 28, a big solar flare event took place. In the Arctic auroral zone high energy particles produced strong auroral activity, and strong geomagnetic disturbances, exceeding 2000 Gamma, were observed. On November 20 recursive strong disturbances occurred. A magnetic disturbance which started at 08:01UT reached a maximum about 19:00UT. Around that time a very strong red aurora (Type D), characteristic of a magnetic storm was observed over the upper southeastern sky (Fig. 5). From 19:00UT to 23:00UT observations of fine structure of aurora were carried out by Japan and Norway through a special program using the EISCAT radar. Very valuable simultaneous ionosphere data were obtained.

The NIPR Tromsø Server, running on Linux, collects these Tromsø data. It is planned to put the images obtained from the optical instrument onto the WEB in order to monitor aurora activity in the Arctic.

Research of Permafrost in the Altai Mountains of Russia

Kotaro FUKUI (National Institute of Polar Research)

Photo 1 Participants in our research.
From left: Mr. Boroja, our driver; Prof. Mikhailov; Galena; myself; Dmitrii; Oleg.

The Altai Mountain Range is long, extending over 1,000km from western Mongolia into southern Siberia. In the last 40 years the climate has warmed up considerably around the Altai Mountains. The Arctic Environment Research Center and the Geography Department of Altai State University have planned a cooperative international research project lasting 3 years from 2003 to study changes in topography and water circulation on mountain slopes triggered by the melting of permafrost accompanying climatic warming in the South Chyskiy Range in the southern part of the Altai Mountains. From August 2 to 26, 2003, data loggers were installed to observe air temperature and ground temperature, and surveying points for observing the flow of rock glaciers were set, in the Akkol Valley in the South Chyskiy Range. Participants included Prof. Yoshiyuki Fujii of Arctic Environment Research Center, this author, Prof. N. Mikhailov, Dr. Dmitrii, and Mr. Oleg and Ms. Galena, postgraduate students of the Altai State University.

Barnaul, the central city of the Altai Republic of the Russian Federation where Altai University is located, is one of the principal cities of southern Siberia, together with

Novossibirsk; it lies on the Ob River and has a population of 660,000 (Fig. 1). We spent 2 days there to discuss the observations with participants from the Altai State University and to purchase food and fuel. In Barnaul, the stores were overflowing with goods, much like in a provincial city in any Western country. The Altai State University participants seemed to be well accustomed to doing outdoor research, and our purchases of food and fuel went smoothly.

From Barnaul it was 700 km to the site of our research, which we traveled in a Russian made 4-wheel drive vehicle belonging to the University. Carrying 5 adults and fully loaded with food, the vehicle was heavy, and we had to struggle to cross over passes. Most of the main highway which we traveled from Barnaul to the Mongol border was paved, and we did not have any flat tires. After 2 days of travel we arrived at our campsite in the middle of the Akkol Valley, elevation 2,300 m. From the campsite we could hike to the Sofiyskiy Glacier and back in a day. In addition to our group, there were a number of other groups at the campsite including Russian and German trekkers, and scientific parties. We held big dinner parties and had a very lively time.

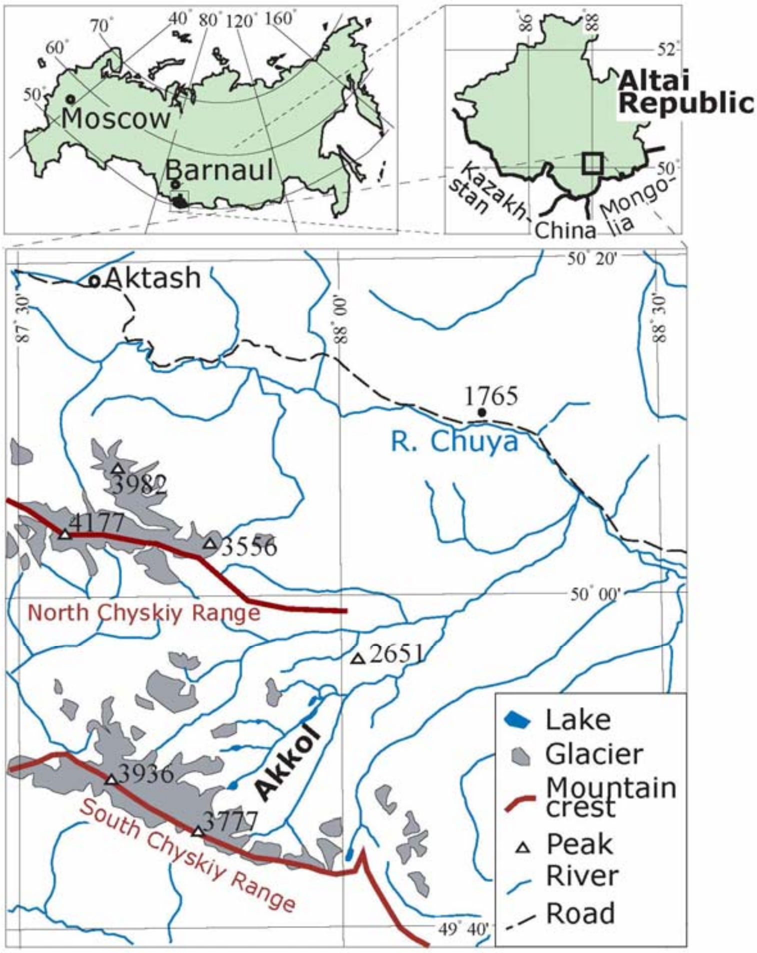


Fig.1 Locations of the Akkol Valley and the Altai Republic.

On the northwest slope on the right side (looking downstream) of the Akkol Valley more than 30 rock glaciers are lined up one after another (Photo 2). On the valley bottom there are many landforms which are characteristic of high latitudes and indicative of permafrost, including pingo and frost splitting (a photograph of pingo appears on the front cover of this newsletter). We installed data loggers to measure air temperature and ground surface temperature at 20 locations on rock glaciers. There are herdsmen living in the Akkol Valley with their flocks, and, just as in Nepal, any data loggers that they discover are virtually certain to be stolen. Every time we installed a data logger Prof. Mikhailov observed the movements of the herdsmen through binoculars. As a precaution we installed the data loggers several meters apart from the markers which we put in to mark their locations. If we are able to recover the data this year we will obtain valuable information, including average annual temperature, for the study of permafrost.

Photo 2 A group of rock glaciers on the right slope (looking downstream) of the Akkol Valley.

The research work was very easy. The Russians worked skillfully; for example, they installed prisms in the direction where it would be easy for the radar to strike them. We asked them about this, and it seems that students majoring in geography undergo thorough training in the use of the theodolite. We were able to complete the installation of surveying markers at 45 points on 5 rock glaciers in only 4 days.

This was my first visit to Russia, but I was able to carry out my research work easily, without difficulty. Summer of this year I am planning to go back to recover the data from the loggers and to sample spring water from the rock glaciers, and I am really looking forward to it. Finally, I wish to thank Prof. Mikhailov and the other people from Altai State University for their assistance.

Glaciological Observations on the McCall Glacier, Alaska

Makoto IGARASHI (National Institute of Polar Research)

Photo 1 A view of the entire accumulation region of the McCall Glacier.
From left Upper Cirque, Middle Cirque, Lower Cirque.

1. Introduction

As one link of both IGBP/PAGES (Paleo-environment Reconstruction Project) and of ICAPP (Ice-Core Circum-Arctic Paleoclimate Program), an international project being promoted by IASC (International Arctic Scientific Committee), ice core drilling is being planned and carried out in and around Alaska, where there have previously been practically no records of past climatic and environmental variability. Under ICAPP, a 220m ice core was drilled in April to June 2002 on Mt. Logan, on the North Pacific side of Alaska. For north - south comparison with information on climatic and environmental variability obtained from analysis of this Mt. Logan core, in the 2003 fiscal year a glaciological survey was planned in the Brooks Range, on the Arctic Ocean side of Alaska. However, most of the Brooks Range is designated as the Arctic National Wildlife Refuge, and even for scientific research entry is restricted. As a result the only glacier on which research is possible is the McCall Glacier (Photo 1). A glaciological survey was carried out on this glacier, as an example of a subpolar glacier, during the International Geophysical Year in 1956-57, and follow-up surveys have been subsequently carried out. The present survey was intended to prepare for ice core drilling on the McCall Glacier in subsequent years.

Specifically, a study of the snow accumulation environment and the snow melting condition was carried out from August 8 to 20 last year together with Assistant Professor Matt Nolan of the University of Alaska Fairbanks. Japanese participants included Prof. Shuhei Takahashi of Kitami Institute of Technology as Leader, the present author, and Takahiro Segawa, a second year doctoral candidate in physical science at Tokyo Institute of Technology. Dr. Frank Pattyn of the Vrije Universiteit Brussel in Belgium also participated, in order to conduct ice thickness observations.

2. The on-site survey

The McCall Glacier is in the Arctic, at 69 degrees 20 minutes north latitude, 143 degrees 20 minutes west longitude. It is a long narrow glacier, 8km long and 500m wide, with its source at 2,400m elevation and its terminus

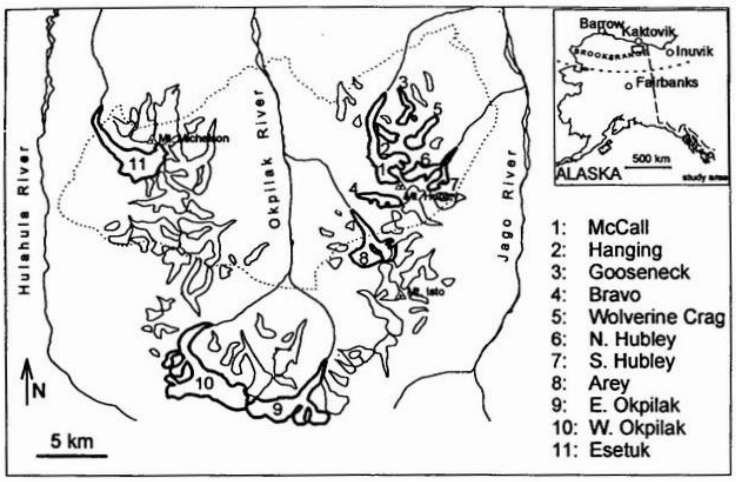


Fig. 1
Location of the McCall Glacier (from B.T. Rabus and K.A. Echelmeyer, Journal of Glaciology, 1998).

Photo 2
Drilling an ice core using a hand auger.

at 1,350m (Fig. 1). People and equipments were transported to the glacier by a light glacier plane and helicopter chartered in Kaktovik, on the Arctic coast of Alaska. Since the purpose of this survey was to select a location for a shallow core to be drilled in subsequent years, it was decided to survey the snow accumulation environment over the whole of the McCall Glacier. For this purpose, samples for chemical and biological analysis were taken from 24 locations from the upstream end to the terminus of the glacier. At 2,300m elevation, believed to be within the accumulation area of the glacier from past surveys, snow stakes were emplaced to measure the annual accumulation. Temperature sensors were installed at 10cm intervals on the snow stakes and interval cameras were installed 5m away from the snow stakes to observe the time variation of accumulation depth.

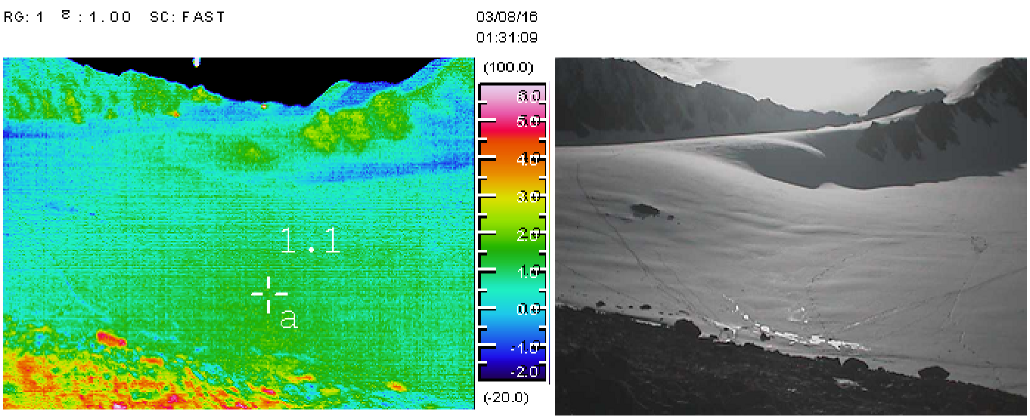


Photo 3 Infrared (left) and visible (right) images of the Upper Cirque.

In addition, to determine the snow accumulation mass balance over the past several years at this location, accumulated snow cross section pit observations to a depth of 1.5m and a 4.5m ice core drilled with a hand auger were taken (Photo 2).

To determine the time variation of the snow surface condition in the mid-stream region of the glacier, an interval camera was set up on a col on the right bank (looking downstream) of the glacier, located where it had a good view over a wide area of the glacier. The University of Alaska group set up an automatic meteorological observing system at this location, so that information about the climatic environment around the glacier can be obtained throughout the year.

Ice thickness, bedrock topography and internal glacier structure were observed by ice radar in the upstream and midstream regions of the glacier. In addition, in the midstream region GPS units were set up at 2 locations to observe the glacier flow.

While we were on the glacier, we used an infrared camera to observe the glacier surface temperature from the midstream to the upstream region (Photo 3).

In the future, we plan to analyze the results of our observations and collect information that will permit us to select the optimum location to drill a shallow ice core.

Our survey was short, lasting only 13 days. Much of our success in conducting a variety of observations in such a short time was due to the tremendous support received from Prof. Nolan's wife Kris, who accompanied us as our camp assistant. We wish to thank her for her help.

EDITOR'S NOTE

The Arctic Environment Research Center of the National Institute of Polar Research, Japan, has been distributing a newsletter (2 domestic editions in Japanese per year) to provide Japanese scientists with news of Japanese projects under way, news of important research abroad and news of domestic and international conferences. This volume, AERC NEWSLETTER, Vol. 9, incorporates numbers 18 and 19 of the domestic bulletin, which includes news of potential interest and/or novelty to international readers.

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