Research Organization of Information and Systems
National Institute of Polar Research (NIPR)

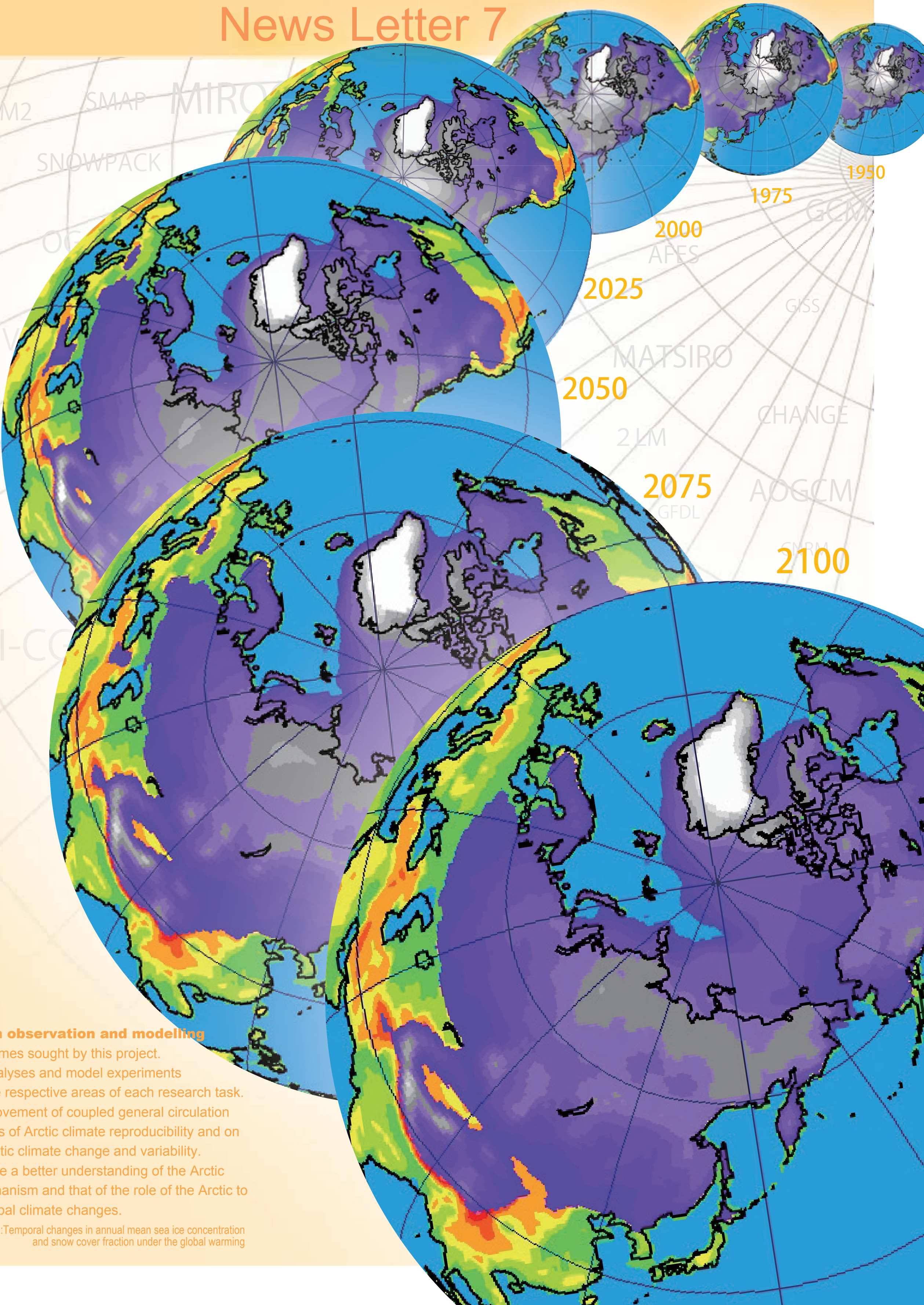
December 18, 2015

Final Issue

GRENE Arctic Climate Change Research Project
www.nipr.ac.jp/grene/e/

Arctic

News Letter 7



Collaboration between observation and modelling

This is one of the major themes sought by this project. Thus far, observed data analyses and model experiments have been conducted in the respective areas of each research task. Our aim has been the improvement of coupled general circulation models based on validations of Arctic climate reproducibility and on mechanism analyses of Arctic climate change and variability. We are advancing to acquire a better understanding of the Arctic warming amplification mechanism and that of the role of the Arctic to the historical and future global climate changes.

Figure:Temporal changes in annual mean sea ice concentration and snow cover fraction under the global warming

Identification and uncertainty evaluation of the feedback processes that cause amplification of Arctic warming

Masakazu Yoshimori/Associate Professor, Hokkaido University
Ayako Abe-Ouchi / Associate Professor, The University of Tokyo
Alexandre Lainé/ Project Researcher, NIPR(The University of Tokyo)

In our climate system, a long-term stable state can be maintained by preserving the balance between the solar radiation energy absorbed by the Earth and the radiation energy released from the Earth. However, the emission of greenhouse gases due to human activity since the Industrial Revolution broke this balance. More greenhouse gases will likely be emitted by the end of the 21st century. The global warming this brings about does not occur everywhere in the same way. Rapid and extensive global warming has been observed thus far in the Arctic region. It is also predicted using climate models that it will occur in the future. On the other hand, it is also a fact that there is significant uncertainty in climate model predictions. Our current research aims to identify the factors explaining why the Arctic region is more significantly warmed compared with other regions, and why there is significant uncertainty in the predictions. Future prediction simulations by 32 climate models used around the world are analyzed here, and examples of the research on the process of factors that contribute to the warming in the Arctic region are introduced.

As a method to understand the responses of the climate system, there is an analysis method that focuses on feedback. One well-known kind of feedback is the ice-snow albedo feedback. When the temperature increases, snow melting progresses, the absorption of sunlight increases according to the decrease in the white snow-ice surface, and then snow melting further progresses due to the increase in temperature. Since the response goes back to and amplifies the initial change, this is called positive feedback. On the other hand, when an increase in temperature causes an increase in the amount of cloud, and the effect of sunshine interruption restrains the increase in temperature, it becomes negative feedback. The response of a climate system is decided by the complicated interlocking of such positive and negative feedback. Quantification of the contribution of such feedback will assist our understanding of the responses of the climate system. Therefore, we will conduct research with a focus on energy interactions, as shown in Figure 1.

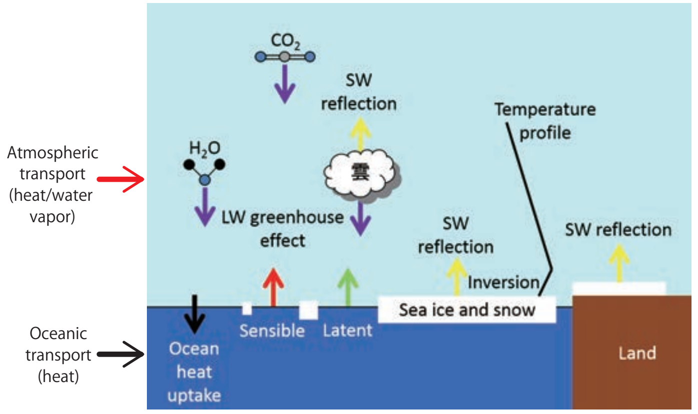


Figure 1: Schematic illustration of (a part of) the energy interaction between the atmosphere in the Arctic region and the surface system.

Based on a comparison between the 20 years at the end of the 20th century and the 20 years at the end of the 21st century, the results of evaluating the effect of factors that contribute to the increase in (skin)surface temperature in the Arctic region are shown for the ocean and the land, respectively, for each month (Figure 2). In the first place, the average value (black line) of the 32 computer-simulated climate models indicates that the temperature most significantly increases in November both on the ocean and on the land. This is understood as being the result of the combined effect (i.e., the feedback) of various factors as expressed in the color bar graph. The results greatly differ between the ocean and the land, as well as between seasons.

Although the albedo feedback on the ocean due to sea ice melting (cyan:surface albedo) has the most significant influence in July, when the solar radiation is strong, the actual increase in temperature is considerably suppressed, because most of its energy is absorbed by the ocean or expended on melting snow and ice (blue: ocean heat uptake, etc.). However, the energy absorbed by the ocean is released in the period from autumn to winter (blue), and the increase in temperature is confined near the surface because of the strong influence of atmosphere stratification, as represented by an inversion layer (red: variation in vertical temperature structure), and the greenhouse effects due to cloud cover (light gray: clouds) causes an increase in temperature in the period from October to January. These factors contribute to the significant increase in temperature.

On the land, the effect of melting (albedo feedback) appears with the highest strength in May, and becomes small in July, which is midsummer. This is partly because the latitude of this site is lower compared with that of the Arctic Ocean. The amplitude of the temperature increase remains relatively flat throughout the year because, unlike the ocean, there is almost no delay effect in the heat absorption and release on the land. Just like the case of the ocean, however, the temperature increase is affected by the influence of atmosphere stratification and the greenhouse effect of cloud to a large extent in autumn, after October, to winter. Regarding the contribution of atmospheric temperature increase (orange: vertically-homogeneous temperature variation + red), it is possible to apply a different analysis method in order to obtain the more detailed process (Yoshimori et al., 2014a; Yoshimori et al., 2014b).

Through such analysis, we are identifying the factors that cause the differences in behavior among climate models, as well as our understanding of the mechanism. By comparison with the measurement data for individual factors, it will be important to make linkages to refining the climate model.

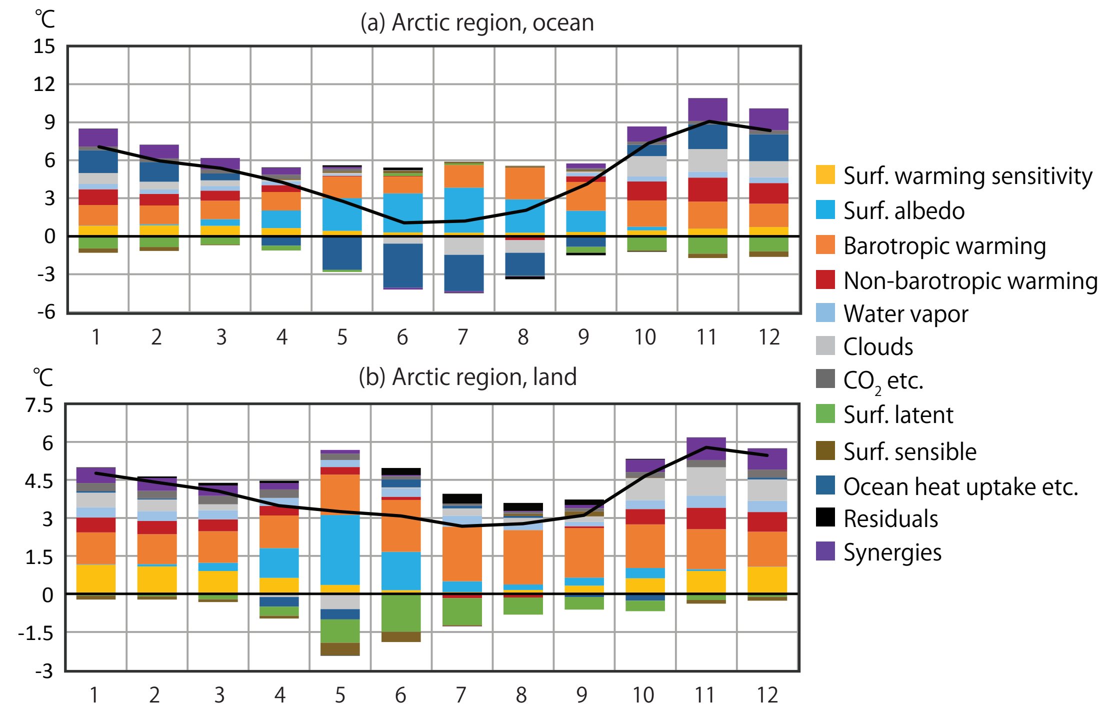


Figure 2: Monthly chart of the effect of factors that contribute to the increase in the (skin) surface temperature in the Arctic region (the latitudes north of 60°N) , expressed in temperature (°C). The black solid line indicates the average of the increase in (skin) surface temperatures over the 20 years at the end of the 20th century and the 20 years at the end of the 21st century, as simulated by 32 climate models (RCP4.5 scenario).
Surface warming sensitivity: The effect based on the Stefan–Boltzmann radiation law.
Residuals: The effect and error that are not explained by the decomposed terms.
Synergistic effect: The synergistic effect between the surface warming sensitivity and other processes (Lainé et al., 2015, in revision). Refer to Figure 1 for other terms.

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Influence of the decrease in Arctic sea ice on cloud cover

Manabu Abe/ Engineer, JAMSTEC

In recent years the Arctic sea ice has been undergoing a remarkable decrease, mainly in September, due to the influence of global warming. It has been reported by studies (such as Liu et al., 2012) using artificial satellite data that low-level cloud cover is increasing because of the changes in the vertical structure of the temperature and water vapor, and in the horizontal transport field caused by the decrease in sea ice. Since the change in cloud cover changes the amount of longwave radiation, it is considered to be one of the factors contributing to the increase in temperature and the decrease in sea ice in the Arctic region during autumn through spring, when the amount of incident sunlight is small or almost non-existent, and so it has become an issue to clarify its influence on the amount of cloud cover and the radiation balance. However, due to the lack of measurement data in the Arctic Ocean region, it is still difficult to grasp the real variation in cloud cover, including the vertical structure, and to inspect the mechanism. Therefore, in order to clarify the actual variation in cloud cover and to clarify the mechanism, we carried out a survey of the vertical structure of temperature and water vapor and the variation in the amount of cloud cover influenced by the decrease in sea ice, and the effect of the change in cloud cover on the amount of radiation by making use of a global climate model, and we investigated the feedback in climate change between sea ice in the Arctic Ocean and cloud cover.

From an experiment to reconstruct the climate of the 20th century using a global climate model (using MIROC5.0; this is an experiment that input realistic boundary conditions and climate external forcings into the climate model and obtains the time variation of the climate variables), it becomes clear that global warming occurred in the 1980–2005 period, and that the area of sea ice in the Arctic region decreased mainly in September (Figure 1ab). On the other hand, the amount of cloud cover in the Arctic Ocean seems to have decreased in October (Figure 1cd), and the amount of cloud cover decreased mainly in the area where the sea ice significantly increased (Figure 2). The increase in the amount of cloud cover in the region where the sea ice is decreasing resembles the results obtained from the satellite data. The amount of cloud cover increases in October compared with September. This is because the difference in the temperature and the water vapor between the atmosphere cooled due to the seasonal change from summer to autumn and the sea surface becomes large in the region where warm sea surface is exposed due to the decrease in the sea ice. This results in an increase in the amount of heat and water vapor that are conveyed from the sea surface to the atmosphere. In addition, the amount of cloud cover seemed to increase in the near-north pole region, where the decrease in the sea ice is not conspicuous (Figure 2). The change in the water vapor transport field in the lower troposphere and the decrease in atmospheric static stability in

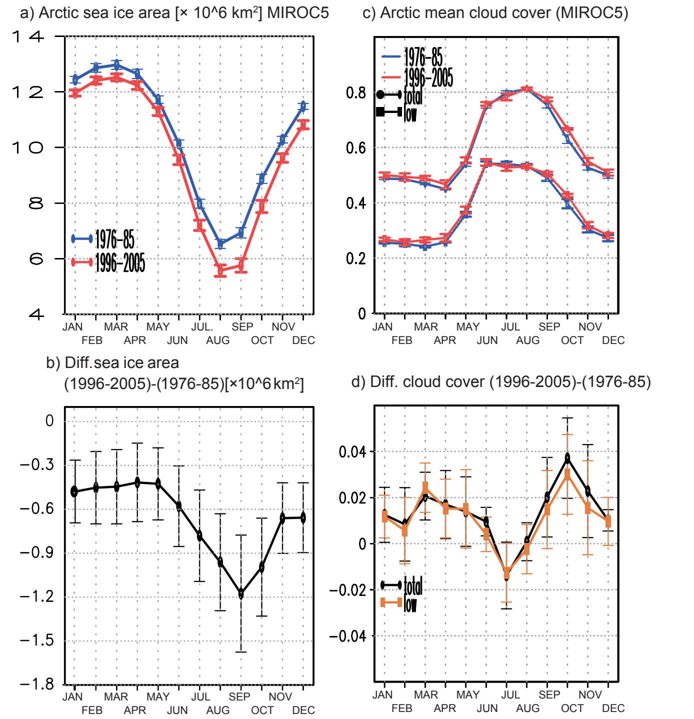


Figure 1: Variations in sea ice and the amount of cloud cover derived from the 20th-century historical simulation with the climate model MIROC5.0.
The seasonal variation in the total amount of cloud cover and the amount of low-level cloud averaged over (a) the area of Arctic Ocean ice and (c) the area of the Arctic Ocean (blue line: annual average for 1976–1985; red line: annual average for 1996–2005). The difference between these two periods: (b) sea ice area and (d) amount of cloud cover (black: total amount of cloud cover; orange: amount of low-level cloud).
The error bar indicates the width of the standard deviations among the 5 ensemble members.
Units: sea ice area [× 10^6 km²]. Amount of cloud cover: dimensionless.

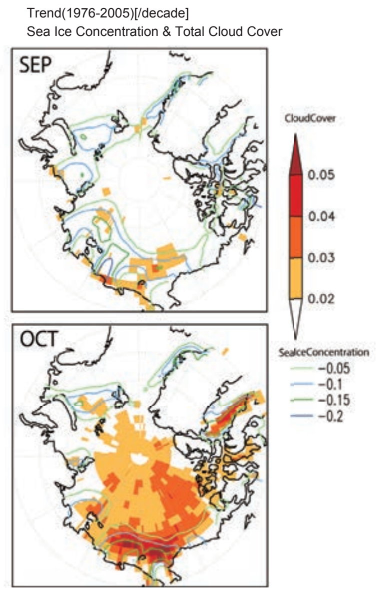


Figure 2: Linear trend of the total amount of cloud cover and sea ice concentration in (a) September and (b) October in the period 1976–2005 from the 20th-century historical simulation with the climate model MIROC5.0.
Units: [/10 years].

the vertical direction are considered to be the causes of this phenomenon. However, it was not clarified which was more effective.

We analyzed the vertical profiles of the cloud amount, temperature and specific humidity averaged over the locations where the sea ice decrease in October is conspicuous. As a result, it was confirmed that the relative humidity and the cloud amount tend to decrease according to a strong increase in temperature in the low layer near the sea surface (approximately 450m or less in altitude), and that the cloud amount tends to increase according to an increase in the relative humidity. Regarding such an increase in the cloud amount, there is a tendency for both convective cloud and cloud due to large-scale condensation to increase.

Due to such an increase in the cloud cover, the downward longwave radiation increases, and reduction in the sea ice is promoted. The possibility that such positive feedback occurs strongly in the period from autumn to spring was suggested.

The above are the results of analysis of one climate model experiment, which we were involved in developing. There are multiple climate models worldwide, which are used to predict the future climate. Many problems remain in such climate models regarding the reproducibility and variability of cloud cover and sea ice at high latitudes. In the future, we hope to elevate our understanding of the feedback process of cloud cover and sea ice in the Arctic Ocean by taking the uncertainty in the climate models into account through the use of experimental data from many climate models, and by conducting comparative inspections with available observation data.

Introduction of a new snow process to the Model for Interdisciplinary Research on Climate

Ryota O'ishi
Project Researcher, National Institute of Polar Research (The University of Tokyo)

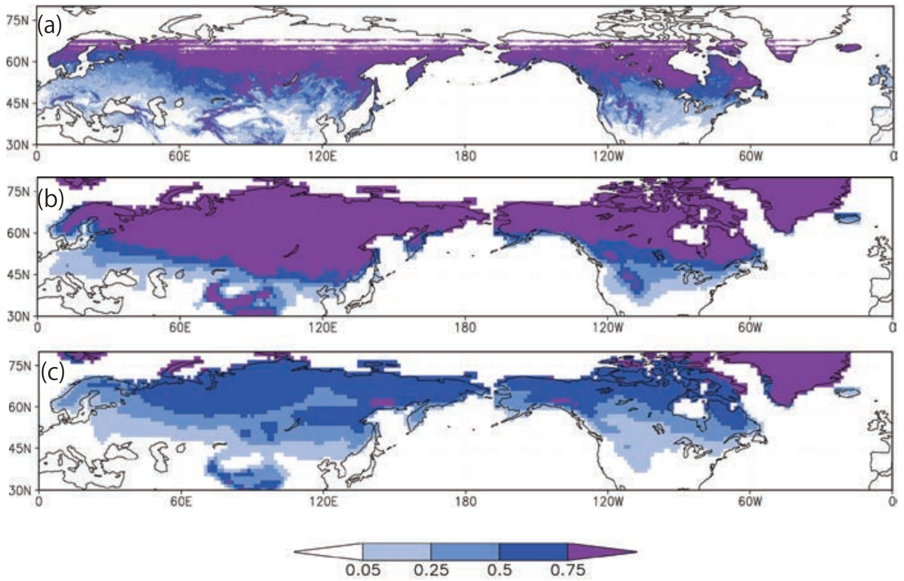


Figure 1: Comparison of snow coverage at high latitudes in the northern hemisphere.
(a) The snow coverage in November averaged over the period from 2001 to 2007 observed by MODIS satellite. Data for the Arctic side are not obtained due to the observation limit of the satellite and the polar night.
(b) The snow coverage on the MIROC land side after the introduction of SSNOWD (November).
(b) The snow coverage on the MIROC land side before the introduction of SSNOWD (November).

In the Model for Interdisciplinary Research on Climate (MIROC), which is used for the future climate projection, the atmosphere, ocean and land throughout the earth are divided according to a small mesh, and computer simulation is carried out based on physical laws. Most of these physical laws have a good record of performance and reliability overall. However, since the features of land areas are highly diverse, and on-site observations for land areas throughout the earth are difficult, in many cases we cannot avoid depending on a simple empirical formula.

Since such an empirical formula is utilized in the current estimation of snow coverage of land areas, the observation results can be roughly reproduced to a certain degree. However, there are two problems with regard to the details: (1) the snow area is rather smaller than the observation; and (2) the increase in the snow coverage in an early stage in the snowing season is more moderate than the observation (Figure 1a, 1c). In the present study, we have solved these problems by introducing the sub-grid snow covering scheme developed by Liston (2004) at Colorado State University (SSNOWD).

A "small mesh" was mentioned above, and although this mesh is certainly small compared with the size of the Earth, its size is practically about 100-km squares because of limitations in the calculation speed of computers. Since the average value in the whole grid is treated in this numerical model, phenomena with a smaller scale and geographical features cannot be easily expressed. However, various features such as a partiality of altitudes actually exist in a 100 km-square area. A sub-grid is defined as a grid smaller than a grid (mesh). Small geographical features that cannot be easily expressed (such as the actual altitude distribution in the grid) are substituted by a representative feature (such as the standard deviation of the altitudes in the grid). By reflecting such features in the calculation, the behavior of snow can be estimated more realistically.

By introducing the SSNOWD model, this study realized a more realistic distribution of snow coverage in the model, obtained more realistic seasonal variation, and enhanced reproducibility (Figure 1b). The error in the temperature reproduction for the snow season was also reduced in the numerical model, according to the improvement for the snow cover. Moreover, it is also conceivable that the change in the snow behavior in the model may also change the reduction of the snow area due to global warming and its influence on the atmosphere. In order to confirm these points, we compared the global warming strength according to a numerical model experiment that reproduces the climate Pre-Industrial and a numerical model experiment in which a quadruple concentration of atmospheric carbon dioxide is assumed. The results indicate that warming intensifies on the low-latitude side of the snow area due to the increase in the concentration of carbon dioxide, and warming is weakened on the high-latitude side. On the other hand, however, a significant difference did not appear after averaging over the Earth as a whole.

Furthermore, it was decided that the outcome of this research would be used as the standard scheme of the Model for Interdisciplinary Research on Climate (MIROC) for the global warming projection that will be submitted to the next assessment report of the Intergovernmental Panel on Climate Change (IPCC).

Report

A-CARE 2015 Campaign

Masataka Shiobara
Associate Professor, National Institute of Polar Research

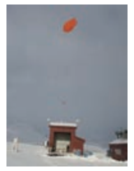


Figure2:Tethered balloon launched at the AWIPEV Observatory.

Figure1:FALCON-A and PMPL installed at Rabben Station .(photos by Shiobara)

As a part of the atmosphere project (PI: Prof. J. Ukita, Niigata University), the Observation Campaign A-CARE 2015 (Arctic Cloud-Aerosol-Radiation Experiment) on mixed-phase clouds was held at Ny-Ålesund in the Svalbard Islands for three weeks, from April 2 to 22, 2015. This project is a succession to the A-CARE 2014 Campaign on water clouds held in 2014. In addition to the participants from National Institute of Polar Research, Chiba University, University of Yamanashi and Tokyo Gakugei University, the United States National Center for Atmospheric Research (NCAR) also participated. A total of seven scientists joined the campaign. The purpose of A-CARE 2015 is to make simultaneous observations of mixed-phase clouds using the 95-GHz Doppler cloud radar (FALCON-A) developed by Chiba University, and the polarization Micro-Pulse Lidar (PMPL), which uses a laser beam with the wavelength of 532 nm. Furthermore, validation by in-situ measurements of cloud microphysical quantities obtained by these observations is also targeted.

FALCON-A and PMPL were put into observation at Ny-Ålesund from September 2013 and March 2012, respectively. Although it took time before the observations came on track due to some instrumental troubles, the simultaneous observation by these instruments came to be smoothly operated at the Japanese Rabben Station in Ny-Ålesund before the start of A-CARE 2015 (Figure 1). As an example of the simultaneous observation, the result from measurements of stratus and cirrus clouds on April 12, 2015 is shown in Figure3. (From the top: FALCON-A measured cloud reflectivity, PMPL measured relative backscatter and the depolarization ratio.)

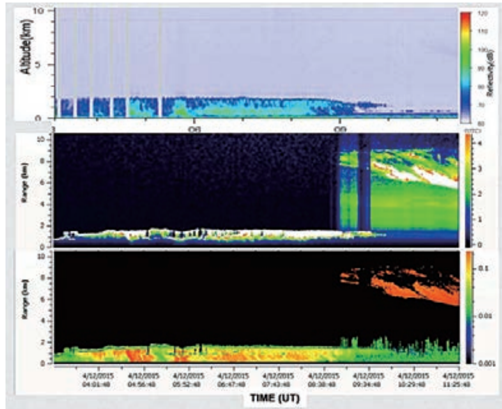


Figure3:Simultaneous measurements of FALCON-A and PMPL for stratus and cirrus clouds on 12 April 2015. Top: FALCON-A cloud reflectivity, middle: PMPL relative backscatter, bottom: PMPL depolarization ratio.

A cloud particle microscope (CPM) developed by University of Yamanashi and cloud particle video imager (VIPS) developed by NCAR were mounted on a tethered balloon with the aim at a validation experiment for the ground-based remote sensing observation, and in-situ measurement of cloud particles was conducted. The tethered balloon observation was conducted using the balloon launching facility in the joint French-German Arctic Research Base (AWIPEV) as collaborative research with the Alfred Wegener Institute for Polar and Marine Research (AWI) in Germany (Figure 2).

During the observation period, clouds appeared frequently, and the tethered balloons were launched as many as 16 times. However, data that can be used for analysis were available for only four days in final.

Combined analysis of the simultaneous observation data from FALCON-A and PMPL are now in progress, mainly by the group at Kyushu University. This analysis makes effective use of the cloud particle information (microphysical properties such as the shape and concentration) obtained by the present tethered balloon observation and by the observation at Zeppelin Observatory, which is located at an altitude of 475 m. It is expected that the microphysical properties of clouds above Ny-Ålesund will be clarified by making a combined analysis of the simultaneous FALCON-A/PMPL data acquired so far.

Report of the ECS

Study on Arctic clouds at McGill University

Tadayasu Ohigashi
Designated Assistant Professor, Nagoya University

Barrow(photo by Ohigashi)

Cloud particles that are not frozen even below the freezing point are frequently observed in the upper air in the Arctic region, regardless of the coldness of the air. Under Early Career Scientist Fellowships (ECS) for Arctic Environmental Research, I stayed at McGill University in Montreal, Canada for 6 months in order to study this strange clouds in the Arctic region. McGill University is among the world' s leading universities in cloud physics, which deals with the formation and growth of particles such as cloud droplets, raindrops and snow inside clouds. It had been my dream to do research at McGill University. I think that the symbol of cloud physics research at McGill University is the Marshall-Palmer distribution. In the field of cloud physics, the Marshall-Palmer distribution is very famous. It showed that fundamental quantities such as the frequency distribution of raindrop diameters become a beautiful exponential distribution. This name is derived from the names of the two authors from McGill University who published it in a two-page paper in 1948.

I stayed in the Department of Atmospheric and Oceanic Sciences, which has research groups related to cloud physics, including a group that is strong in numerical modeling, and several groups that mainly utilize radars. Since the precipitation intensity is small in Arctic clouds, I joined the research group that utilizes the so-called "cloud radar." I was able to use the radar data obtained at the observation facility of the US Department of Energy in Barrow, located at the northern end of Alaska. Owing to the rich data obtained by this observation facility since 1997, I could conduct my research satisfactorily. I also learned a method for extracting the supercooled liquid zone using radars, which will greatly support my research in the future.

It was unprecedentedly cold this winter in Montreal. The lowest temperature at the end of February, when I started my stay there, often fell below -20℃. However, such coldness conversely indicated a season that instantly shifts from winter to summer, passing through the beginning of May with abundant sprouting. It may also symbolize my research, in which interest is growing rapidly. It has already been decided that the General Assembly of the International Union of Geodesy and Geophysics (IUGG) will be held in the summer of 2019, four years from now, in Montreal. I believe that the participants will be able to enjoy the beautiful streets with their greenery and history, as well as fruitful discussions.

● The 2nd. Open Lecture

Toward the sustainable commercial use of the Arctic sea routes

November 6, 2015
Rakusuikaikan, Tokyo University of Marine Science and Technology


Greeting by Project Manager Yamanouchi on the outcome summary


Presentation by Prof. Yamaguchi on the work of the Arctic sea routes study

The group of Sub-Research Project, "Sea ice prediction and construction of an ice navigation support system for the Arctic sea routes" (Principal Investigator: Hajime Yamaguchi, The University of Tokyo), held a seminar to report the outcome of their study of Arctic sea routes continuing from last year.

There were many participants in this seminar from various fields, including private enterprises which have been carefully watching the potential of Arctic sea route businesses, such as marine transportation, shipbuilding, communications, general trading, and construction companies. Other participants included central government organizations and local self-governing bodies, embassies in Japan of Arctic Ocean coastal countries, representatives of the mass media, and students. Such participation indicated the high interest in Arctic sea routes.

The presentations in the first session were about research approaches, future prospects, and sea ice forecasting and monitoring. In the second session, the current status of research on sailing performance in sea ice and its safety were discussed. In the third session, the level of current utilization of the optimal route searching method for navigation support, cost performance analysis, and transportation scenarios were discussed.

Finally, a presentation was made on research related to Arctic sea routes under the Arctic Challenge for Sustainability Project, which will become the successor project.

In line with each presentation, demonstrations were conducted regarding data visualization of the optimal route finding system, and so on, using the Arctic Data archive System (ADS).

Questions were raised by the participants about the utilization of Arctic sea routes. These included questions regarding navigation planning included, countermeasures against ship icing and the degree to which weather conditions be reflected in mid-term forecasts, as well as pragmatic questions regarding the utilization of Arctic sea routes, such as developments in neighboring countries such as Korea.

Since the utilization of Arctic sea routes has deep connections with the global economy and the situation in international society, there was great interest in changes in the situation since the seminar held last year. We closed the session under the recognition of the importance and the necessity of proactively transmitting information to society, and of expectations for research based on future utilization.

The presentation of research outcomes in the final fiscal year is now underway

Seminar Symposium

● ECOARCS Symposium

Clarification of the changes in the Arctic marine ecosystem so far:
What will happen to the ecosystem and aquatic fishery resources when sea ice decreases?

November 9, 2015
Kokuyo Hall, Tokyo


Dr. Hiroko Sasaki making a presentation on the changes in the catch of benthic organisms


Panel discussion

A symposium on Arctic marine ecosystem was held by the group of Research Project, "Ecosystem studies on the Arctic Ocean with declining sea ice," Principal Investigator Dr. Takashi Kikuchi (JAMSTEC), to report the latest outputs of their study on the influence of sea ice reduction on the ecosystem and fisheries. More than 100 people participated in this symposium from various fields: not only researchers and students, but also business persons from marine products, fisheries trading, natural conservation, and marine disaster.

The symposium started with a greeting from Dr. Motoyoshi Ikeda (Professor Emeritus, Hokkaido University). In the first session, Arctic Ocean freshening, acidification, increase in primary production and other impacts of sea ice reduction were presented based on observational findings in the Bering and Chukchi seas. In the second session, presentations were made mainly by young researchers on observed changes in zooplankton, benthos, seabirds, and whales, and also future predictions by numeric modeling using JAMSTEC Earth Simulator.

Finally the panel discussion was held by Mr. Tomoaki Wada (Senior Director at Kobe Science Museum), Dr. Takashi Kikuchi, Dr. Naomi Harada (JAMSTEC), and Dr. Mitsutaku Makino (National Research Institute of Fisheries Science, Fisheries Research Agency). The importance of conveying research outcomes to society in response to the growing interest in Arctic research are recognized, as well as the need of further research efforts to clarifying the questions which are found in this project.

In addition to the oral presentations on research outputs, 14 posters were presented, as well as exhibitions of the observation equipment used in this project and a demonstration of ADS. Many participants showed their interests in these presentations during the break time.

Many young researchers had oral and poster presentations; therefore free atmosphere was highly evaluated. This symposium was able to provide the opportunity to specifically introduce the influence of Arctic environmental change on the marine ecosystem mainly associated with sea ice reduction in the Arctic Ocean, as research efforts and outcomes.

● The Sixth Symposium on Polar Science

[S] Warming in the Arctic and Its Influences
—GRENE Arctic Climate Change Research Project and the Next New Directions —

[IA] Rapid Change of the Arctic Climate System and its Global Influences
— New research results from GRENE Arctic Climate Change Research project, 2015 —

November 18~19, 2015
NIPR, Tokyo

Seminar Symposium

[IA] Oral presentation

[IA] Poster presentation


The Sixth Symposium on Polar Science was a forum for the interaction of scientists and information exchange in the field of polar science. It was held at NIPR for four days from Monday, November 16 to Thursday, November 19.

This year we prepared two sessions on the Arctic region: a special session [S] on the 18th and an interdisciplinary session [IA] on the 19th. We welcomed in excess of 100 participants every day, including many scientists from overseas. The major parts of the presentations were given by our project group members. There were many presentations and discussions aimed at the outcome summary of the project in the final fiscal year.

Presentations were made and many questions were raised on points including the purpose of this project, what became clear and what remained unclear, the extent to which the strategic research targets and research tasks had been achieved.

The international and domestic situation in the Arctic region is changing, and the project organization will change accordingly. This Symposium also aimed to discuss the target of the next Arctic research project, "Arctic Challenge for Sustainability."

On taking office as Chairman of the JCAR Steering Committee

Teruo Aoki
(Meteorological Research Institute)

Four years have passed since JCAR began, and the third administrative board started from June 2015. During this period, the membership of JCAR increased to as many as 399, including researchers in a wide range of areas such as the atmosphere, oceans, snow and ice, land areas, ecology, biology, the upper atmosphere, and the humanities and social sciences, as well as the mass media and other participants at large. JCAR has grown to be a community consisting of people from a variety of backgrounds. In the second period, the Long-Term Plan for Arctic Environment Research was published. I think this long-term plan has clarified the target of research, encouraged many people to participate in this work, and consequently made them aware of the actual activities of JCAR. In addition, the Arctic Science Summit Week (ASSW), which is an international Arctic research conference, was held in Toyama City in April 2015, with 708 participants from 26 countries and region around the world. JCAR also played an important role in this conference. I think such horizontal partnerships in the research community, comprising researchers from various fields, are crucial for the promotion of Arctic research in Japan. For this reason, JCAR plans to continue or newly establish working groups in the areas of human resource development, research exchange, information communication, data, revision of the agreement and system examination, and to advance activities in the coming two years of the third period. As a big future event, ISAR-5 will be held in the 2017 fiscal year, and JCAR will also be involved in the preparations. In preparation for the future post-GRENE period, JCAR will have to change the system that enables its independent activities. For this purpose, the Steering Committee is planning to examine specific policies such as an appropriate state of the organization and fundraising methods, via its working group for system examination.

JCAR is a science community for accelerating Arctic studies in Japan. The rapidly changing Arctic environment constitutes a big concern for all of humanity, as well as having short-term and long-term influences on Japan. In order to cope with such common problems of humanity, we will appreciate understanding of and participation in JCAR activities.

Now is the time to summarize the Project

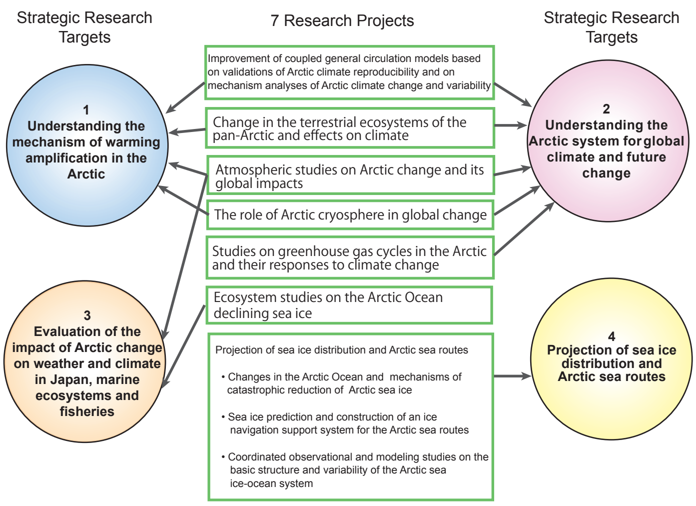
Preparation of the Progress Report, meeting to report progress and public lecture

Photo:Ecoutezbien / Kohei Gorai

Project Manager: Takashi Yamanouchi

Project Prof., National Institute of Polar Research

Now is the time to summarize the Research Project on Arctic Climate Change. This Project started in 2011, with the goal of rallying Arctic studies in Japan, which had previously been conducted on a dispersed basis. The Project is now in the final stage. This Project has been advanced by many participants under a system that encompasses nearly all of Japan. Various groups related to Arctic environment research have participated, linked up beyond specialties and targeted grand concepts to form a coalition between observation and modeling. Following examination by the Committee, four strategic research targets were presented in a top-down manner from the Ministry of Education, Culture, Sports, Science and Technology. In order to analyze these targets, seven bottom-up research tasks were selected , and research by observation, analysis and modeling were advanced. Now is the last year of this five-year Project. In order to make a summary, we are making an effort to complete the progress report.



In the first place, the special session of this Project was held in the Symposium on Polar Science in the National Institute of Polar Research in November, in order to advance the discussions to make a summary. It had the role of extracting the essence of the research progress report, including items such as what kind of results were obtained from each research task, and how this contributed to the strategic research target. The final meeting of the research progress group will be held in March next year. The report will include items on what research progress was obtained in each task, and how this contributed to the strategic research target. Furthermore, a public open lecture will be held for general participants to explain what was clarified by the GRENE-Arctic Project, what has been left un-clarified, and what will be expected in the next new project.

The research progress report will naturally be finished by compiling these items. How was it possible to make a coalition among fields such as the atmosphere, snow and ice, sea ice, oceans, the terrestrial environment and marine ecology? The questions are: How much could the observation contribute to the modeling? How much could the observed result be incorporated into the model? We are greatly looking forward with excitement to receiving the answers, which will have a keen awareness of issues about Arctic warming and its impacts. Furthermore, we hope that this research will lead to the future development of Arctic research.

Information

GRENE-Arctic Symposium & Public Open Lecture, 2016

The research outcome reporting symposium for this project and open lectures for public participants will be held in Tokyo in March 2016. The details will be released on our website as soon as they are decided.

March 3-4: GRENE-Arctic Symposium
March 5: Public Open Lecture

www.nipr.ac.jp/grene/e/

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