

Korean National Report
To AOSB

Activity Name or Title: The phytoplankton community structure study in Kongsfjorden

Lead PIs, including e-mail addresses: Dr. Sung-Ho Kang shkang@kopri.re.kr

Sponsoring Organization(s): KOPRI

Date Initiated: August 2006

Ending Date if known:

Summary of work accomplished:

Kongsfjorden area is affected by large range of environmental factors, and it is important to measure, characterize and monitor the ecological status. The size structure and species composition have been investigated from 2006, with special attention to small phytoplankton (cells <20 µm in diameter). To aid the interpretation of phytoplankton data, hydrographic data also have been collected. Measurements made on the phytoplankton included size fractionated chlorophyll, photosynthetic pigments by HPLC, cell counts by inverted microscopy, flow cytometry counts, and flow cam. These data were also compared with the lab controlled phytoplankton culture collections in Korea polar institute.

Summary of planned work:

We will visit Kongsfjorden again in this May to investigate biophysical environments and phytoplankton community structure, especially focused on physiological adaptation.

Data: What is the status of acquired data? In what format is it being stored and where can it be obtained?

Some of phytoplankton counting data, phytoplankton pigment data and CTD data are available in excel format. Contact to Dr. Sung-Ho Kang via email.

Activity Name or Title: Integrated research on COMposition of Polar Atmosphere and Climate Change (COMPAC) - Micrometeorological Research

Lead PIs, including e-mail addresses: Dr. Nam Yi Chae cnamyi@kopri.re.kr

Sponsoring Organization(s): KOPRI

Date Initiated: June 2008

Ending Date if known:

Summary of work accomplished:

As a part of the project "Integrated research on COMposition of Polar Atmosphere and Climate Change (COMPAC)," soil CO₂ efflux measurement and calibration and checking of eddy covariance measurement system were conducted near the Dasan station from 23 June to 4 August in 2008. The soil CO₂ efflux measurements was made to investigate quantifying of CO₂ efflux from soil surface to atmosphere and controlling factors using a closed-dynamic chamber system (LI-6400 with LI-6000-9 soil chamber, LI-COR, Inc., Lincoln, Nebraska, USA). The study plot was selected to be within the major footprint area for the tower CO₂ flux measurements. Soil CO₂ efflux was measured at 16 sampling locations in the plot (30 m x 30 m) with soil temperature and soil water content measurement every other day. Averaged soil CO₂ efflux ranged from 0.3 to 0.7 $\mu\text{molm}^{-2}\text{s}^{-1}$ during measurement. And soil temperature and soil water content ranged from 6 to 12°C and from 13 to 27%, respectively. Also, energy, CO₂ and H₂O fluxes have been monitored for the study of interactions between the polar terrestrial ecosystem and the atmosphere using eddy covariance measurement system. Periodical calibration of measurement sensors is essential to long term measurement.

Summary of planned work:

This study aims at conducting the soil CO₂ efflux measurement and checking of eddy covariance measurement system

Data: What is the status of acquired data? In what format is it being stored and where can it be obtained?

Soil CO₂ efflux data, soil temperature data and soil water content data are available in excel format. Contact to Dr. Nam Yi Chae via email.

Activity Name or Title: Integrated research on COMposition of Polar Atmosphere and Climate Change (COMPAC) - Glacier Study

Lead PIs, including e-mail addresses: Dr. Hyun Chul Kim kimhc@kopri.re.kr

Sponsoring Organization(s): KOPRI

Date Initiated: May 2008

Ending Date if known:

Summary of work accomplished:

From satellite observation, a rapid reduction in the Arctic sea ice and glaciers has been observed in recent years. For example, the summer sea ice was observed to be lowest in the year 2007. Even though the satellite covers a large area in global observation, uncertainty is relatively high. As a part of the project t "Integrated research on COMposition of Polar Atmosphere and Climate Change (COMPAC)" operated by Korea Polar Research Institute from 2006 to 2020, this study aims at observing the retreat of glaciers around NyAlesund and eventually finding out the cause of the marked climate change occurred in the Arctic.

The Arctic climate change influences the mid latitude through a tele-connection by the Arctic Oscillation, which impacts the climate change over Asia especially in the winter season. The glacier change is governed by factors such as the change in atmosphere and ocean temperature, which is controlled by the change in surface heat flux and ocean and atmosphere heat advection. In order to achieve this purpose, we have observed the change in glacier change, and the surface energy flux is also measured. The surface ocean temperature information was also gathered by ship measurement. To understand the change in the glacier and its cause, a long term monitoring of these factors is expected.

Summary of planned work:

This study aims at observing the retreat of glaciers around NyAlesund and eventually finding out the cause of the marked climate change occurred in the Arctic.

Data: What is the status of acquired data? In what format is it being stored and where can it be obtained?

Glacier change observing data, surface energy flux data and surface ocean temperature are available in excel format. Contact to Dr. Hyun Chul Kim via email.

Activity Name or Title: Integrated research on COMposition of Polar Atmosphere and Climate Change (COMPAC) - Atmospheric Composition Study

Lead PIs, including e-mail addresses: Dr. Young Joon Yoon yjyoon@kopri.re.kr

Sponsoring Organization(s): KOPRI

Date Initiated: January 2008

Ending Date if known:

Summary of work accomplished:

The Dimethylsulfide (DMS) measurement system, which has been installed at the Zeppelin station, was demounted and shipped to Korea in March. This system will be reinstalled at the Zeppelin station in March 2009 after modification.

Summary of planned work:

To install Dimethylsulfide (DMS) measurement system

Data: What is the status of acquired data? In what format is it being stored and where can it be obtained?

Dimethylsulfide (DMS) data are available in excel format. Contact to Dr. Young Joon Yoon via email.

Activity Name or Title: Sea-ice, snow, glacier bacteria & microalgae study - Ecophysiology of low-temperature organisms

Lead PIs, including e-mail addresses: Dr. Sung-Ho Kang shkang@kopri.re.kr

Sponsoring Organization(s): KOPRI

Date Initiated: March 2008

Ending Date if known:

Summary of work accomplished:

The KCCPM (culture collection for polar microorganisms) is the culture collection of phytoplankton and bacteria especially focused on low temperature adapted organisms, and it is an integral part of the KOPRI. The KCCPM has around 150 strains from Antarctic and Arctic, the preponderance marine diatoms, but chlorophytes, small flagellates, and freshwater organisms are as well included.

The field works to collect low-temperature adapted organisms were done on sea ice, snow and glacier in the early spring of 2008. These collections were moved to KCCPM

and isolated to species level. Some of organisms were tested in controlled environment (light, nutrient and so on) laboratory to study ecophysiology. Around 10 of new phytoplankton species were isolated and added to KCCPM from this spring field work and tested for anti freezing material study.

Summary of planned work:

To collect low-temperature adapted organisms and research the ecophysiological mechanisms of those organisms in the Arctic area

Data: What is the status of acquired data? In what format is it being stored and where can it be obtained?

Around 10 of new phytoplankton species were isolated and indoor controlled ecophysiological data are available in excel format. Contact to Dr. Sung-Ho Kang via email.

Activity Name or Title: Sea-ice, snow, glacier bacteria & microalgae study - The community structure and function of marine and terrestrial ecosystem during summer season

Lead PIs, including e-mail addresses: Dr. Sung-Ho Kang shkang@kopri.re.kr

Sponsoring Organization(s): KOPRI

Date Initiated: June 2008

Ending Date if known:

Summary of work accomplished:

The 2008 activities in Ny-Alesund area were designed to study the structure and functioning of this ecosystem and to test several hypotheses regarding the interaction of biological and physical processes. The field and laboratory works were done on near-

shore water and terrestrial organisms. Marine bacteria, microalgae, and terrestrial organisms were sampled from several stations to study community structure and to elucidate environmental parameters determining the structure. Assemblages, biomass and production of organisms were measured in the near-shore waters.

For the long-term Arctic marine ecosystem research a marine ecosystem monitoring site designated. Existing data were examined to identify key environmental parameters of major biological significance which require long-term monitoring. Physical and chemical factors have been included changes in temperature, salinity, nutrients, and sea-ice dynamics; biological factors such as biomass and composition of phytoplankton, bacterial and protozoa were considered. The current abundance and spatial distribution of key environmentally-sensitive species in marine communities and habitats to define a baseline for monitoring long-term changes were determined. The marine biological programs contributed to monitoring and detection of change in the Arctic. The main objective was to identify key organisms, biological processes, and interactions that are most likely to be influenced by changes in the climatic regime of the Arctic marine ecosystem.

Summary of planned work:

To identify key organisms, biological processes, and interactions

Data: What is the status of acquired data? In what format is it being stored and where can it be obtained?

Temperature, salinity, nutrients, sea-ice dynamics data and biomass, composition data of phytoplankton, bacterial and protozoa are available in excel format. Contact to Dr. Sung-Ho Kang via email.

Activity Name or Title: Sea-ice, snow, glacier bacteria & microalgae study - Study on the biodiversity and cold-adaptation of the Arctic organisms inhabiting around Korean Arctic Research Station, Dasan

Lead PIs, including e-mail addresses: Dr. Il-Chan Kim

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Sponsoring Organization(s): KOPRI

Date Initiated: July 2008

Ending Date if known:

Summary of work accomplished:

To study the biodiversity of various organisms around the Korean Arctic Research Station, we sampled plants, mosses, lichens, small animals and microorganisms from land soils, sea and fresh water. The organisms are being grouped by conventional observation for their morphology and identified by phylogenetic analyses. Their physiological characteristics will be assessed to understand adaptation in polar environments and roles in nutrient cycling. We are analyzing ITS and 28S rDNA sequences for lichen samples to understand phylogenetic and evolutionary relationships of Arctic lichen with lichens of Antarctic and other areas of the earth.

For study on the cold-adaptation of organism, we are screening bioactive metabolites and cold-active enzymes from plants, small animals and microorganisms, which have evolved specifically for low temperature. Organisms living in polar regions are known to have adapted to and survived in such low-temperature environments due to their particular metabolites and high specific enzyme activities. Thus, the bioactive metabolites and cold-active enzymes have a great potential in biological research field. For this reason, we are trying to obtain any useful bioactive metabolites from plants and mosses using various extraction methods, and identify their structure. Now the studies for relationship between biological function and structure are in progress. Also, we are trying to obtain psychrophilic microorganisms from Arctic samples using a traditional culture method and a high-throughput screening method. Subsequently, we will amplify several genes for cold-active enzymes by PCR, clone to expression vector, and then characterize them through various biochemical experiments.

Summary of planned work:

To obtain any useful bioactive metabolites from plants and mosses using various extraction methods, and identify their structure.

Data: What is the status of acquired data? In what format is it being stored and where can it be obtained?

ITS and 28S rDNA sequences data are available in excel format. Contact to Dr. Il-Chan Kim via email.

Activity Name or Title: Sea-ice, snow, glacier bacteria & microalgae study - Optimum Utilization of Satellite Data for Polar Research

Lead PIs, including e-mail addresses: Dr. Byung-Kwon Park bkpark@kopri.re.kr

Sponsoring Organization(s): KOPRI

Date Initiated: June 2008

Ending Date if known:

Summary of work accomplished:

Optimum utilization of satellite ocean-color, Moderate Resolution Imaging Spectroradiometer (MODIS) and Sea-viewing Wide Field-of-view Sensor (SeaWiFS), is required to study an influence of climate change for Polar region. Satellite ocean-color can measure spatial spectra of radiance from the sea surface. Chlorophyll-a can be retrieved from these spectra. Chlorophyll-a is used to estimate the level of biological activity of Arctic Ocean.

Ocean bio-optical property, chlorophyll-a, suspended sediment, colored dissolved organic matters, and particle absorption etc. were measured to improve an accuracy of ocean-color for Polar region through ship survey around Ny-Alesund. The long-term Arctic marine ecosystem can be monitored by satellite remote sensing. In-situ sampled data and

satellite data were examined to identify environmental variation in Arctic marine ecosystem.

Summary of planned work:

To identify environmental variation in Arctic marine ecosystem using satellite ocean-color.

Data: What is the status of acquired data? In what format is it being stored and where can it be obtained?

Ocean bio-optical property, chlorophyll-a, suspended sediment, colored dissolved organic matters, and particle absorption data are available in excel format. Contact to Dr. Byung-Kwon Park via email.

Activity Name or Title: Sea-ice, snow, glacier bacteria & microalgae study - Petrology / Paleoclimate

Lead PIs, including e-mail addresses: Dr. Ho Il Yoon hiyoon@kopri.re.kr

Sponsoring Organization(s): KOPRI

Date Initiated: July 2008

Ending Date if known:

Summary of work accomplished:

The 2008 activities in Longyearbyen and Ny-Alesund areas were designed to study the patterned ground and thermal history of sedimentary basin. Patterned ground is a group term for the more or less symmetrical geomorphic features formed by cyclic freezing and thawing of decimeter- to meter-thick soil layers in polar and high alpine environments.

Despite the problems of process identification and accurate dating, patterned ground still has potential value as a climatic indicator in Quaternary sediments. Patterned ground is well developed over large areas in the ice-free regions of Ny-Alesund. The goal of survey is to date the formation age of the patterned ground distributed in Ny-Alesund area. Although a considerable number of studies on sedimentology and petrology have been performed in Svalbard area, little is known about the thermal history of sedimentary basin. In this year, various rock samples, mainly shale and sandstone samples were also collected to reconstruct the thermal and uplift history of the sedimentary basin.

Summary of planned work:

To date the formation age of the patterned ground distributed in Ny-Alesund area.

Data: What is the status of acquired data? In what format is it being stored and where can it be obtained?

Various rock samples, mainly shale and sandstone samples data are available in excel format. Contact to Dr. Ho Il Yoon via email.