PROGRAM and ABSTRACTS

Third International Symposium on the Arctic Research and Seventh Ny-Ålesund Scientific Seminar

22 - 24 February 2005

Tokyo, JAPAN

Jointly Organized by

National Institute of Polar Research (NIPR)

Ny-Ålesund Science Managers Committee (NySMAC)

The Steering Group of "Study on Climate and Environment Change in the Arctic", Grants-in-Aid for Scientific Research, MEXT

PROGRAM and ABSTRACTS

Third International Symposium on the Arctic Research and Seventh Ny-Ålesund Scientific Seminar

22 - 24 February 2005

Tokyo, JAPAN

Jointly Organized by

National Institute of Polar Research (NIPR)

Ny-Ålesund Science Managers Committee (NySMAC)

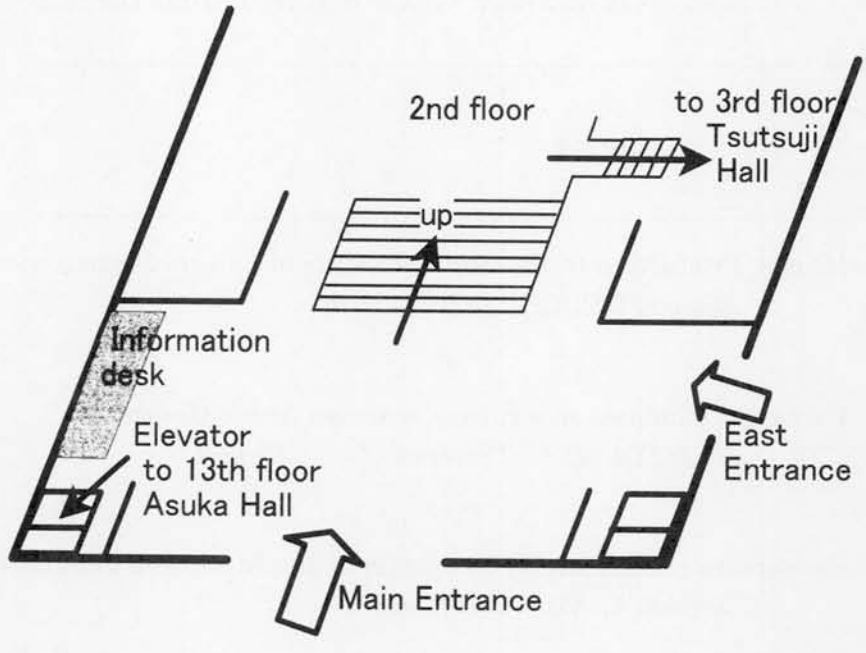
The Steering Group of "Study on Climate and Environment Change in the Arctic," Grants-in-Aid for Scientific Research, MEXT

Program

22 February, 2005 Tue.	Tsutsuji Hall, 3rd floor, Hokutopia
9:30	Registration start
10:30 12:35	**Open Forum**
	Lunch
13:25 15:05	**Open Forum**
	Coffee break
15:20 16:25	**Open Forum**

23 February, 2005 Wed.	Asuka Hall, 13th floor, Hokutopia
9:15	Registration start
10:00 10:05	Opening
	Oral session: Glaciological Environments in the Arctic I **Geoscience in the Arctic**
10:40 11:50	**Oral session: Arctic Marine Ecosystems I**
	Coffee break
12:05 13:00	**Oral session: Arctic Marine Ecosystems II**
	Lunch
14:15 16:00	**Oral session: Arctic Terrestrial Ecosystems**
	Coffee break
16:15 18:15	**Poster session**
18:45 20:45	**Reception** **Tenran-no-ma, 16th floor, Hokutopia**

24 February, 2005 Thur.	Tsutsuji Hall, 3rd floor, Hokutopia
9:00	Registration start
9:30 11:00	**Oral session: Overview** **Glaciological Environments in the Arctic II**
	Coffee break
11:15 12:45	**Oral session: Atmospheric Environment in the Arctic I**
	Lunch
14:00 16:05	**Oral session: Atmospheric Environment in the Arctic II**
	Coffee break
16:20 17:15 17:20	**Oral session: Arctic Upper Atmosphere Environment** Closing



Hokutopia, 1st floor (= ground floor)

first day

22 February 2005 (Tuesday) at Tsutsuji Hall, 3F

Open Forum : Arctic Environment Today

over all expediting: Yoshiyuki FUJII

10:30	**Opening address** *Hiroshi SATO* *(Director, Ocean and Earth Division, Research and Development Bureau, MEXT : Ministry of Education, Culture, Sports, Science and Technology, Japan)* *Hideki SHIMAMURA* *(Director General, NIPR : National Institute of Polar Research, Japan)*
10:45	**1** Roles of IARC in integrating/synthesizing arctic climate change research *Syun-ichi AKASOFU (IARC : International Arctic Research Center, University of Alaska Fairbanks, U.S.A.)* **2** Glacier Ecosystem *Shiro KOHSHIMA (Tokyo Institute of Technology, Japan)* **3** Overview of "Variations of Atmospheric Constituents and their Climatic Impact in the Arctic" *Takashi YAMANOUCHI (NIPR, Japan)* **4** Arctic Study of Tropospheric Aerosols, Clouds, and Radiation - Outline and Results of Arctic Aircraft Campaigns *Andreas B. HERBER (Alfred-Wegener-Institut, Germany)*
12:35	***Lunch***
13:25	**5** Marine Production in the Arctic: Results of Canada-Japan cooperative Research *Mitsuo FUKUCHI (NIPR, Japan)* **6** Polynyas: windows on a future, warmer, Arctic Ocean *Louis FORTIER (Université Laval, Canada)* **7** Researches on terrestrial ecosystem in the Arctic and Japanese activities *Hiroshi KANDA (NIPR, Japan)* **8** The effects of goose grazing and climatic warming on Svalbard tundra productivity *Elisabeth J. COOPER (The University Center on Svalbard, Norway)*

15:05	*Coffee break*
15:20	**9** On our Polar Upper Atmosphere Research in the Arctic *Takehiko ASO (NIPR, Japan)* **10** Svalbard; a platform for Upper Polar Atmosphere research *Asgeir BREKKE (University of Tromsø, Norway)*
16:10 16:25	**Closing of the Open Forum** *Guido di PRISCO (Chair, Ny-SAMC : Ny-Ålesund Science Managers Committee)*

second day

23 February 2005 (Wednesday)

at **Asuka Hall, 13F**

over all expediting: Hajime ITO

10:00	**Opening**
10:05	**Glaciological Environments in the Arctic I** **Geoscience in the Arctic** *chair: Fumihiko NISHIO* **101** Glaciological observations on McCall glacier in Alaska, 2003 - 2004 *Shuhei TAKAHASHI et al.* **102** Lithospheric structure and evolution of Northern Siberia, Arctic Russia, derived from geoscience investigations *Masaki KANAO , Vladimir D. SUVOROV*
10:40	**Arctic Marine Ecosystems I** *chair: Mitsuo FUKUCHI* **103** Structure of the coastal ice ecosystem in the zone of sea - river interactions *Igor A. MELNIKOV* **104** Carbon flux and ecosystem feed back in the northern Barents Sea in an era of climate change (CABANERA) *Paul WASSMANN* **105** Sedimentation of biogenic particles in the Canadian Arctic polynyas *Hiroshi SASAKI , Makoto SAMPEI , Mitsuo FUKUCHI* **106** Strategy for photosynthetic acclimation against the environmental change in psychrophilic phytoplankton inhabiting Arctic polynya as assessed by pulse amplitude modulation method (PAM) *Yasuhiro KASHINO et al.*
11:50 12:05	***Coffee break***

12:05

Arctic Marine Ecosystems II

chair: Hiroshi SASAKI

107 Arctic fjords as climate indicators
Harald SVENDSEN, Haakon HOP

108 The adaptive evolution of polar fish: structure, function and molecular phylogeny of hemoglobin
Cinzia VERDE, Guido di PRISCO

109 Co-variation between climate signals and breeding phenology of high-arctic breeding kittiwakes
Fridtjof MEHLUM

13:00

Lunch

14:15

Arctic Terrestrial Ecosystems

chair: Hiroshi KANDA

110 Syntaxonomical classification and ecological characterization of the high arctic vegetation in Canada and Svalbard
Satoru KOJIMA

111 A survey of soils and soil biological characteristics from Arctic Canada (TNW99)
Manfred BÖLTER, Hans-Peter BLUME

112 Ecosystem development and carbon cycle on a glacier foreland in Ny-Ålesund, Svalbard
Takayuki NAKATSUBO

chair: Manfred BÖLTER

113 Net ecosystem production over a snow-free season on a glacier foreland in Ny-Ålesund, Svalbard
Masaki UCHIDA, Wenhong MO et al.

114 Temporal and spatial differences of methane emission and uptake at Arctic and sub-arctic tundra in Alaska
Yoshinobu HARAZONO et al.

115 Quantification of terrestrial carbon stock and its change in Arctic/boreal zone using airborne laser profiling/scanning
Tatsuo SWEDA, H. TSUZUKI, T. KUSAKABE

16:00

Coffee break

16:15

16:15

Poster Session (16:15～18:15)

P-01 The joint French-German Arctic research platform on Spitsbergen
Roland NEUBER , Franck DELBART

P-02 Present and LGM climate in the Arctic: interaction of ocean and glaciation
Oxana S. SAVOSKUL

P-03 Analysis of ^{7}Be, ^{210}Pb, ^{210}Po and ^{137}Cs air concentrations in Ny-Ålesund (Svalbard) and during Arctic Ocean 2004 Expedition (CHIMERPOL project)
Olivier MAGAND et al.

P-04 Investigation of minor atmospheric mercury depletion events observed at Zeppelin, Ny-Ålesund, in early and late spring 2003
Lucas GIRARD , Torunn BERG , Lars R. HOLE

P-05 Temporal and spatial variations of oceanic partial pressure of CO_2 and air-sea CO_2 flux in the Greenland and Barents Seas
Shin Ichiro NAKAOKA et al.

P-06 Distribution of carbonyl sulfide (COS) concentration in the troposphere and lowermost stratosphere between Japan and the Arctic observed by Arctic Airborne Measurement Program 2002 (AAMP02)
Yayoi INOMATA et al.

P-07 Vertical structure in air temperature of the arctic lower troposphere sounded by dropsonde observation related to AAMP 2002
Naohiko HIRASAWA , Makoto WADA , Takashi YAMANOUCHI

P-08 Influence of sea ice ridges and polynyas on the structure of the polar atmospheric boundary layer
Thomas GARBRECHT et al.

P-09 Monitoring of acid precipitation in central Yakutia (Russia)
Vladimir N. MAKAROV

P-10 The Arctic MPL measurement at Ny-aAlesund for ground truth of the ICESat/GLAS cloud and aerosol measurements
Masataka SHIOBARA et al.

P-11 Characteristics of cloud distribution from All-Sky Camera and Micro-Pulse Lidar measurements at Ny-Ålesund
Masanori YABUKI et al.

P-12 Seasonal variation of precipitating clouds at Ny-Ålesund, Arctic
Hiroyuki KONISHI , Makoto WADA

P-39 Leaf photosynthetic characteristics and net primary production of vascular plant species in high-arctic, Ny-Ålesund, Svalbard
Hiroyuki MURAOKA et al.

P-40 Germination characteristics of Arctic *Polygonum viviparum* in Ny-Ålesund, Svalbard
Satomi NISHITANI, Takehiro MASUZAWA

P-41 Micrometeorological measurements of methane flux at boreal forest in central Alaska
Masahito UEYAMA et al.

P-42 Biological control of environment of far eastern north-east coast
Lyubov S. BUZOLEVA et al.

P-43 Overview of Canadian Arctic scientific research issues, organizations and opportunities
Bob HOWE, Hiroshi KANDA

P-44 Deep structure and tectonics around the Baikal Rift Zone, Russia, from temporary broadband seismic observations
Vladimir D. SUVOROV, Masaki KANAO et al.

P-45 Conversion tectonics and crustal structure around Magadan-Kolymsoe region, Far East, Russia, from deep seismic exploration
Shigeru TODA et al.

P-46 Late quaternary paleoenvironmental change in the Saint Anna Trough, Arctic Russia
Jae Il LEE, Yedong KIM, Ho Il YOON

P-47 Glaciomarine sedimentation and its paleoclimatic implications on the West Spitsbergen fjord (Isfjorden) over the last 15000 years
Ho Il YOON et al.

P-48 Simultaneous observation of ion upflow events using all-sky spectrograph and EISCAT Svalbard radar
Katsuya TSUBONE, Shoichi OKANO

P-49 Seasonal variations of atmospheric gravity wave activities in the Arctic mesopause region
Masaki TSUTSUMI, Takehiko ASO, Chris HALL

18:15

18:45

Reception (18:45～20:45)

at **Tenran-no-ma, 16F**

3rd day

24 February (Thursday)

at **Tsutsuji Hall, 3F**

over all expediting: Hajime ITO

9:30

Overview
Glaciological Environments in the Arctic II

chair: Tetsuo OHATA

116 Coordination of international research in Svalbard - new initiatives from the Research Council of Norway
Fridtjof MEHLUM

117 Evaporative loss of snow cover in Northern Eurasia sub-Arctic region
Yiensheng ZHANG , Tetsuo OHATA , Kazuyoshi SUZUKI

118 Cryobiological ice core analyses in Sofiskiy glacier, Russia
Jun UETAKE et al.

119 Two years of mercury atmospheric chemistry study in Ny-Ålesund, Svalbard. Air to Snow interaction. Seasonal evolution of mercury deposited onto Kongsvegen Glacier
Christophe P. FERRARI et al.

120 Ice thickness and basal reflectivity in Northeast Greenland derived from airborne radio-echo sounding
Daniel STEINHAGE , Uwe NIXDORF , Heinz MILLER

11:00

Coffee break

11:15

Atmospheric Environment in the Arctic I

chair: Roland NEUBER

121 Aerosol optical characteristics in Ny-Ålesund derived from Sky radiometer
Kazuma AOKI , Masataka SHIOBARA , Masanori YABUKI

122 Study of radiative effects of arctic aerosols bases on airborne measurements: a case study for March
Renate TREFFEISEN et al.

123 Arctic aerosol observations using airborne lidar during ASTAR 2004
Iwona Sylwia STACHLEWSKA et al.

124 Origin of new particles in the summer Arctic boundary layer: can simple sulfur chemistry explain observations?
Johan STRÖM et al.

125 Mixing state and spatial distribution of tropospheric aerosols derived from in situ aircraft measurements during ASTAR 2004
Atsushi MATSUKI et al.

12:45 *Lunch*

14:00 **Atmospheric Environment in the Arctic II**

chair: Yoshio ASUMA

126 Microphysical properties of an Arctic stratocumulus cloud observed during ASTAR experiment
Jean - Francois GAYET et al.

127 Microphysical and optical properties of mixed-phase clouds obtained from alternated lidar and in situ measurements
Jean - Francois GAYET et al.

128 Long-term measurements of Arctic trace gases in Ny-Ålesund Spitsbergen by fourier transform infrared spectroscopy; Effects of biomass burning emissions
Voltaire VELAZCO et al.

129 Investigation of how observed methane concentrations in Ny-Ålesund are influenced by atmospheric flow patterns
Ine-Therese PEDERSEN, Kim HOLMÉN

130 A new light-weight balloon borne optical sensor for measuring vertical profiles of stratospheric trace gases
M. WOLFF, Andreas B. HERBER et al.

131 The radiation budget of the atmosphere over the Arctic computed from the ISCCP data set
Ehrhard RASCHKE et al.

132 Sensitivity of hydrological conditions to climate change in Siberian tundra
Tetsuo OHATA et al.

16:05 *Coffee break*

16:20

16:20	**Arctic Upper Atmosphere Environment** *chair: Bjorn GUSTAVSSON*
	133 A study on Arctic mesosphere and lower thermosphere tidal dynamics by meteor, EISCAT and other radar observations *Takehiko ASO , Masaki TSUTSUMI , Chris HALL*
	134 Day-to-day variations of the diurnal and semidiurnal tides in the MLT region simulated by a GCM *Yasunobu MIYOSHI , Hitoshi FUJIWARA*
	135 Gyroharmonic effects in HF radio induced optical emissions *Bjorn GUSTAVSSON*
17:15	**Closing**
17:20	

Abstracts accepted but not presented

A-01 Glaciers of the Russia Arctic. Field studies: science and logistics
Nikolay DORONIN

A-02 Global contaminants and health of Indigenous Peoples of the Russian Arctic
Vitaly KIMSTACH et al.

A-03 An overview of recent research on McCall Glacier, arctic Alaska
Matt NOLAN, Shuhei TAKAHASHI

A-04 Key findings of the Arctic climate impact assessment.
Lars-Otto REIERSEN

A-05 AMAP pollution and climate change activities and plans for the future
Lars-Otto REIERSEN, Vitaly KIMSTACH

A-06 Tectonic pathways of the methane emission from eastern and southern Sakhalin shelf (Okhotsk Sea)
Renat SHAKIROV et al.

A-07 Evolution of the Earth's climatic system: possible reasons and sequences
Valeriy SOSNIN et al

A-08 Application of the video-microscopy (VE-DIC) method for the algae-bacterial interaction study
Valeriya TEREKHOVA et al.

A-09 Characteristics of wave in the upper mesosphere from ground-based airglow measurements in the northern high-latitude
Young-In WON et al.

Abstracts

Oral session

3

Overview of "Variations of Atmospheric Constituents and their Climatic Impact in the Arctic"

Takashi Yamanouchi, Makoto Wada (National Institute of Polar Research)
and Andreas Herber (Alfred-Wegener Institute for Polar and Marine Research)

The research project "Variations of atmospheric constituents and their climatic impact in the Arctic (FY1999-2004)" (Special Scientific Research Program; Mext) has been conducted to clarify the variation of greenhouse gases, aerosols, and clouds in the Arctic troposphere and stratosphere; to explain the transport and transformation processes, source and sink; to compare with the Antarctic and evaluate the radiative effect and then the climate impact. The following specific research has been carried out during the current years.

(1)Long term observations of greenhouse gases, aerosols and clouds have been made at the Rabben observatory in Ny-Ålesund scientific station, Svalbard, based on support by Norwegian Polar Institute. We continued our long term air sampling for greenhouse gases, and continuous measurements of surface ozone and meteorology. Measurements of aerosol optical properties, optical depth, vertical distributions, cloud distributions, and observations of precipitable water, cloud liquid and ice water amount and precipitated snow particles, have also been continued.

(2) Shipborne observations were carried out concerning exchange of carbon dioxide between ocean and atmosphere and data accumulated were analyzed. Greenland Sea and Barents Sea have been estimated to be the region of strong sink area of carbon dioxide.

(3) **ASTAR 2000** (Arctic Study of Tropospheric Aerosols and Radiation): In collaboration with the Alfred-Wegener Institute of Polar and Marine Research (AWI) together with support by other institutions, coordinated airborne and ground-based observations of aerosols (Arctic haze) and radiation were carried out in the Svalbard area through March and April, 2000. AWI aircraft Polar 4 (Dornier 228) was used to measure vertical distributions of aerosols and radiation, while remote sensing, sonde observations and sampling were conducted on ground.

(4) **AAMP 02** (Arctic Airborne Measurement Program): The campaign of airborne observation using jet plane (Gulfstream-II) was carried out in March 2002 with long range stratosphere flights over the Arctic Ocean and local profiling flights in the vicinity of Svalbard. Research objectives were to elucidate spatial distribution, long-range transport and transformation of greenhouse gases and aerosols, related to stratosphere-troposphere exchange and polar vortex; optical properties of aerosols and their radiative forcing; the structure of atmospheric disturbance, especially of polar low, and its microphysical process.

(5) **ASTAR 2004** (Arctic Study of Tropospheric Aerosols, Clouds and Radiation): With the initiative of AWI, another coordinated airborne campaign of aerosols and clouds were carried out through May and June 2004. Two AWI aircrafts Polar 2 and Polar 4 full equipped were used to measure mainly clouds and aerosols, respectively. In comparison to ASTAR 2000, observation term was chosen to cover the transitional season between spring and summer, the end of the Arctic haze season and start of clean summer air, and interactions of cloud and aerosols (indirect effect) were tabled as the second objective. Washout processes of aerosols were expected to be characterized.

101

Glaciological observations on McCall glacier in Alaska, 2003 - 2004

S. Takahashi, K. Sato (Kitami Inst. of Tech.), K. Satow (Nagaoka Inst. of Tech.),
T. Segawa, J. Uetake (Tokyo Inst. of Tech.), T. Yamazaki (NIPR),
A. Takahashi (Geo-Technique Institute Ltd.), M. Nolan (Univ. of Alaska, Fairbanks),
M. Igarashi and Y. Fujii (NIPR)

1. Introduction

McCall glacier has been studied in long period from IGY (International Geophysical Years 1957/58) by mainly University of Alaska group. In this 50 years, McCall glacier considerably retreated, which is a good index of climate change in the arctic area. Whereas, a lot of subjects has been done about mass balance, heat balance and glacier dynamics in this glacier, ice coring work is not so much. We intended to make to make clear recent climate ice by ice core analysis and ice coring and other glaciological works were done at accumulation area in McCall glacier in 2003 and 2004.

2. Shallow ice coring

Snow pit work from surface to 2.2 m depth and a shallow ice coring work was done down to 22.8 m depth were done at the basin of Upper Cirque. From surface to 2.2 mdeep, there were several thick ice layers (about 1 – 5 cm thick ness) in firn layers, which will be annual summer season surface. The cores under 2.2 m depth were all ice. The ice core analysis is on the way.

This shallow ice body must be internally accumulated ice, which is formed by melt-water refreezing in cold glacier body where coldness is stored in winter. To know the feature of this internally accumulated ice, shallow ice coring was done at 6 points along a longitudinal line from the pit work point in a basin bottom to a col of watershed. Though the top of internally accumulated ice was shallow at the basin bottom (2 – 3m), it was deep on a basin slope (6 - 7m) and rather shallow near the col (3-4m). The variation of the depth would depend on melt-water movement, slope inclination, melting rate, snow accumulation rate, glacier flow velocity and basin topography.

3. Ground penetrating radar observation

GPR (ground penetrating radar) observation was done along the longitudinal line from a basin bottom to a col, where ice coring was done, and the transversal lines crossed at ice coring points. Using 800 MHz antenna, ice layers of 2 – 3 cm thickness in firn were detected under the snow surface to the depth of 4-7 m. The layer interval was small on the southward slope and large on the northward slope, which means that snow melting is large on the southward slope and small on the northward.

4. Snow accumulation

Images of a snow stake were taken by an interval digital camera every 3 hours through a year (from August in 2003 to August 2004). By the images the variation of snow accumulation was observed. The snow accumulation was intermittent and stable for a long period: over one month in October, December and January. The maximum snow depth was 100 cm and net snow accumulation from August 2003 to August 2004 was more than -30 cm.

5. Snow/air temperature

On the snow stake for the interval digital camera, 15 data loggers for temperature were installed. The temperature sensors were set at every 10 cm height from -10 cm to 100 cm, at -50 cm and 200 cm in August 2003, which were buried up at 100 cm on the maximum snow depth day, May 2004. The minimum air temperature was about -46 ^{0}C. The snow temperature gradient in winter time was about 0.11 – 0.13 ^{0}C/cm

102

Lithospheric structure and evolution of Northern Siberia, Arctic Russia, derived from geoscience investigations

Masaki Kanao*[1], Vladimir D. Suvorov[2]

(1) Department of Earth Science, National Institute of Polar Resaerch, 1-9-10 kaga, Itabashi-ku, Tokyo 173-8515, Japan
(2) United Institute of Geology, Geophysics & Mineralogy, Siberian Branch of Russian Academy of Science, Koptyg ave. 3, Novosibirsk 630090, Russia

Study on the present structure and past evolution of lithospheric environment on the Arctic Russia, a port of northern Eurasia continent provide an information to reconsider the process of amalgamation and breakup of super-continents in the Earth's history. The knowledge about the lithospheric environment would give rise to a unique speculation on the future super-continent formation. The largest continent on the present Earth, Eurasia, has been formed from an assembly of several sub-continental blocks including Asia, India and Europe: it is also considered to be the nucleus of a future super-continent expected to form 250 m.y. after the present. In this talk, several significant geoscientific topics are presented on the basis of recent progressed studies on Northern Eurasia continent, particularly focused on Northern Siberia, Arctic Russia.

a) Characteristic features in various tectonic provinces from Archean to Phanerozoic ages. These terrains have evolved affecting to each other originated from the nucleus of Precambrian ctratons, followed by adjacent Proterozoic mobile belts (orogens), Mesozoic and Cenozoic tectonic terrains, together with the recent subduction, rift, and lithospheric deformed area. A tentative process of continental growth was demonstrated by investigating architecture of present lithospheric structure.
b) Significant characteristics of deeper part of the crust and topmost mantle were identified beneath Northern Siberian craton, Yatukia region, by deep seismic surveys. Depth and velocity variations can be found in the inner crustal structual boundaries (Basement, Conrad, etc.), attributed by the high correlation between topography and the deeper boundaries. Crust – Mantle boundaries, moreover, have velocity variations in 7.7-9.0 km/s, together with thickened Moho discontinuity particularly in the kinberlite province, Northern Yakutia. Tectonic activation was presumably occurred associated with kinberlite magmatism in Middle Paleozoic age. Deepened crust with high Pn velocities were formed by magmatic underplating.
c) Specific seismic and volcanic activities are distributed within Arctic Eurasia terrains. Recent development in field surveys, laboratory measurements for the supra-crustal rocks, satellite geodetic measurements such as GPS, together with computer sciences have improved the knowledge of ongoing lithospheric activity and deformation processes. Dynamics of the strength on the continental lithosphere are also investigated from modeling simulation and gravity studies. Stress distribution of the elastic lithosphere derived from seismic anisotropy and geological drilling indicate complex features consist from compression, shearing and extension in the individual tectonic province.
d) Remarkable features in the upper mantle can be observed from several seismic techniques, associated with subduction of the oceanic plates (slabs) in the Far East region of Russia, together with continent-continent collision such as India-Himalaya-Tibet area. Beneath the Northern Far East Region, for instance, remnant subducted slabs of the past Kula plate have been found by local seismic tomography. A thermal fluctuation beneath Siberian platform has been revealed by deep seismic sounding from PNE sources with ultra long profiles about 400 km in length. Partially molten and delaminated lithosphere is identified beneath Western Siberian Basin (Morozova et al., 1999). Depression of 410 km seismic discontinuity is also detected associated with high geotherms on the surface of the Basin.
e) The present scheme and formation mechanism of a super-plume have significance in order to learn about the structure, dynamics of deep interior of the Earth. Any scale of heterogeneity, anisotropy at the Core-Mantle Boundary (CMB) and the above D" layer, would help us to know about the chemical / physical interaction between Crust-Mantle system and deeper portion of the Core. Upwelling & downwelling process of a super-plume within the mantle beneath Arctic Eurasia have much significance to obtain clear knowledge of mantle dynamics and development of super-continents.

103

I.A.Melnikov "Structure of the coastal ice ecosystem
in the zone of sea - river interactions"

Structure of the coastal ice ecosystem formation in the zone of river water discharge (February-April 2003, guba Chupa, Kandalaksha Bay of he White Sea) has been studied. It was shown, that in winter in the zone of river/marine water mixing the complex multipart ecosystem is formed to be consist of: (1) the ice with salinity of 0.5–0.8‰ and 4.3–4.5‰, (2) the under ice water-crystalloid layer with salinity of 2.86–3.04‰ and 50-60 cm thick, and (3) seawater layer with salinity up to 27‰. Fresh and brackish water characteristics are remarkable obvious in coastal area, but marine ones – in the middle part of the bay. This "three-floor" water-ice system is steady-stable during the whole winter period and disturbed only with melting in spring. Remarkable differences in species composition were marked in ice phytocenoses: a domination of fresh-water species (mainly Chlorophyta) in the near-shore ice and a prevalence of marine algae of Bacillariophyta in the fast ice. Low abundance of invertebrate animals in zoocenoses has been registered during the whole period of observations.

104

Carbon flux and ecosystem feed back in the northern Barents Sea in an era of climate change (CABANERA)

Paul Wassmann, Norwegian College of Fishery Science, University of Tromsø, N-9037 Tromsø, Norway, paulw@nfh.uit.no

Scenarios of future climatic development predict significant warming in the European Arctic. Changes in the extent of the MIZ and ice thickness will result in significant alterations of the C pump. At present the maximum annual variation in new and export production for cold and warm years is about 30-40 %, but in the MIZ interannual deviations of > 200 % are encountered. The retreat of the winter ice edge and concomitant de-stratification of ice-free waters will increase vertical mixing, primary production, pelagic retention of fresh and export of degraded biogenic matter. In the present MIZ which will widen severely due to the extensive retreat of summer ice, global warming will also give rise to increased primary production and significantly more biogenic matter will be supplied to the benthos on the vast panarctic shelf seas while complex ecological scenarios will be encountered on the ice-free shelf breaks. From these concerns, the Norwegian research project CABANERA proposes two comprehensive questions. How will the distinct changes in extension and duration of the ice cover affect the dissolution and biological C pump on the Nordic shelves fringing the Polar Ocean? What consequence has warming on the atmospheric-ocean CO_2 exchange, C sequestration, food-web responses, food availability of pelagic fish and the pelagic-benthic coupling? To respond of these questions CABANERA has carried out investigations of the physical oceanography, ice cover, primary production, sympagic/pelagic food web dynamics, sympagic/pelagic-benthic coupling and benthic mineralization in the MIZ of the northern Barents Sea, the northern Svalbard Archipelago and adjacent slope waters of the Polar Ocean. The aim is to quantify, comprehend and describe the regulation of the C flux in this sector of the Arctic in order to address the effect of climate change on marine C flux, atmospheric C exchange, biodiversity and fish food. Selected results of the project will be obtainable in a context of other ongoing pan-Arctic research initiatives.

105

Sedimentation of biogenic particles in the Canadian Arctic polynyas

Hiroshi SASAKI[*1], Makoto SAMPEI[*2], and Mitsuo FUKUCHI[*3]
*1: Senshu University of Ishinomaki, Ishinomaki 986-8580, Japan
*2: Laval University, Québec, Qc. G1K 7P4, Canada
*2: National Institute of Polar Research, Itabashi, Tokyo 173-8515, Japan

Abstract

We investigated the seasonal change of particulate flux to know the mechanisms of high planktonic productions occurring in the North Water (NOW) polynya located in the northern Baffin Bay. Long-term deployment of time-series sediment traps at ca. 200m below the surface and 50m above the bottom were made at 5 stations (N2, S5, S4, S2, and D1; 75° to 78° N) from September 1997 through June 1999. The station D1 was covered with ice in winter (outside the polynya). Sinking POC fluxes showed marked seasonal variations with high flux a period from May to September, and a low flux period during winter. The contribution of phytoplankton carbon (PPC), fecal pellet carbon (FPC), and other unidentified particulate carbon (UPC) to total particulate organic carbon (TPOC) collected in sediment traps varied over the two years. UPC fluxes contributed significantly to TPOC fluxes (37~96 %) over the sampling period. FPC fluxes (20~33 mg C m^{-2} d^{-1}) dominated the TPOC fluxes (45~62 %) between July and August 1998, when the highest TPOC fluxes occurred. However, during the period of highest primary production (June) more than 99 % of total fecal pellets produced in the epipelagic zone (74~122 mg C m^{-2} d^{-1}) did not reach 200 m. No marked decreases in fecal pellet production in the upper 50 m and flux at 200 m were observed in July. The changing proportion of FPC flux between June and July suggests that losses of fecal pellets due to fragmentation processes by zooplankton equivalent to 73~121 mg C m^{-2} d^{-1} occurred in the upper mesopelagic layer in June. The fate of sinking particles represented by these fecal pellets can be influenced by the retention processes mediated by coprophagous feeding behavior of zooplankton within the epipelagic layers of the NOW.

106

Strategy for photosynthetic acclimation against the environmental change in psychrophilic phytoplankton inhabiting Arctic polynya as assessed by pulse amplitude modulation method (PAM).

[1]Yasuhiro Kashino, [1]Simpei Aikawa, [2]Makoto Sampei, [2]Sakae Kudoh, [3]Hirosi Hattori, [4]Hiroshi Sasaki, [2]Mitsuo Fukuchi

[1]Graduate School of Life Science, University of Hyogo, [2]National Institute of Polar Research, [3]Hokkaido Tokai University, [4]Ishinomaki Senshu University

The organisms and the environment are mutually dependent. The biological activity of any organisms is restricted by their physico-chemical and biological environments. And, the environmental condition is affected by the biological activity of its including organisms. In the high latitude area, the severer environment for organisms such as low temperature will highly restrict the biological activity of organisms. In the Arctic ocean, however, phytoplankton and ice algae perform photosynthesis efficiently under the environment apparently inconvenient for photosynthetic organisms such as low temperature and low irradiance. The primary production by these organisms supports the fertile ecosystem in the Arctic region. In this study, to understand how these organisms enable highly efficient photosynthesis in the Arctic environments, we analyzed the photosynthetic properties of phytoplankton and ice algae during the expedition cruise of NOW (North Water Polynya Study, 1997-2000) and CASES (Canadian Arctic Shelf Exchange Study, 2003-2005) projects.

Phytoplankton were collected mainly from the surface and the bottom of euphotic zone at stations in Baffin Bay (North Water Polynya) and offshore area of Mackenzie river. The light curves and the non-photochemical quenching parameter were measured using non-penetrating pulse amplitude modulation method (PAM). The photosynthetic pigment composition were determined by high performance liquid chromatography. To support the analysis in the field, cultivated psychrophilic diatoms were also used in the laboratory.

The photosynthetic parameters obtained from light-curves and the non-photochemical quenching parameters were analyzed especially in relation to the light intensity of the habitat. In the CASES study, the change of salinity in the environments was also considered because, at Mackenzie Shelf, plenty of fresh water flow into the offshore area from Mackenzie River in summer season. It was confirmed that the phytoplankton had shade-adapted feature; high quantum yield at low light, low light-intenstiy at the onset of photosynthetic saturation (Ik), large antenna size, low respiration rate. Besides these characteristics, it was found that the phytoplankton utilize effective protection mechanisms of photosystems (xanthophyll cycle) against sudden unexpected high light which would lethal to the shade-adapted phytoplankton. This protection mechanisms seemed to enable the effective shade-adaptation. The xanthophyll cycle dissipates the excess light energy as heat. It was assumed that the drained heat would partly contribute the formation of polynya, which, in turn, leads to the sustainment of the light environment to keep the high photosynthetic production by phytoplankton.

Arctic fjords as climate indicators

Harald Svendsen* and Haakon Hop**

*Geophysical Institute, University of Bergen, Allegt. 70, N-5007 Bergen, Norway

**Norwegian Polar Institute, N-9296 Tromsø, Norway

Abstract

This overview presents the most current knowledge of the physical and biological conditions in the environmental gradient from the glaciers at the head of Kongsfjorden, along the fjord and across the shelf, including the shelf slope. Special focus is given to circulation and exchange processes and the driving forces involved. The effects of circulation and physical gradients on the biological communities are evaluated within the context of climate change.

108

The adaptive evolution of polar fish: structure, function and molecular phylogeny of hemoglobin

Cinzia Verde and Guido di Prisco

Institute of Protein Biochemistry, C.N.R., Via Marconi 12, I-80125 Naples, Italy

Organisms living in the Arctic and Antarctic are exposed to strong constraints, especially temperature. In the respiratory system, the evolution of hemoglobin has included adaptations with implications at the biochemical, physiological and molecular levels. Although both are cold, the northern and southern polar oceans have very different oceanographic characteristics. Indeed, in the Arctic isolation is less pronounced and the range of temperature variations is wider than in Antarctic waters. Arctic fish are characterised by higher biodiversity and, unlike Antarctic notothenioids, have high hemoglobin multiplicity. The blood of the spotted wolffish *Anarhichas minor*, a benthic, sedentary fish of the family Anarhichadidae (superorder Acanthopterygii, suborder Zoarcoidei) contains three functionally distinct major hemoglobin components. High multiplicity and functional differences have also been observed in three gadidae, *Arctogadus glacialis* (arctic cod), *Boreogadus saida* (polar cod) and *Gadus morhua* (Atlantic cod). The remarkable differences in the oxygen-transport system between Arctic and Antarctic fish indicates that distinct evolutionary pathways in the regulatory mechanisms of the fish oxygen-transport system have been followed in the two polar environments. Within the study of the molecular bases of cold adaptation in fish inhabiting the polar habitats, and taking advantage of the information available on hemoglobin structure and function, the evolutionary history of the α and β globins of Antarctic and Arctic hemoglobins has been analysed, under the assumption of the molecular-clock hypothesis, as a basis for reconstructing the phylogenetic relationships among species. Molecular phylogeny indicates that the Arctic globins diverge from those of notothenioids. The globins of major and minor Antarctic hemoglobins form two distinct compact groups, whereas the Arctic globins occupy scattered position in both the α and β trees, suggesting independent evolutionary histories. The different phylogenetic histories of Arctic and Antarctic fish are likely to depend on the respective habitats.

109

Co-variation between climate signals and breeding phenology of high-arctic breeding kittiwakes

Fridtjof Mehlum
Norwegian Polar Institute
Present address: Research Council of Norway
P.O. Box 2600 St. Hanshaugen
N-0131 Oslo, Norway

Climate changes in the Arctic may have important consequences for the breeding of arctic birds. Few studies are available to evaluate possible effects of changes in climate on high arctic birds. However, it has been documented that the breeding phenology of arctic birds varies considerably among years. If this variation can be associated with climate variability, it might be possible to predict possible effects of climate changes to the bird populations.

I present a study on the breeding phenology of Kittiwakes *Rissa tridactyla* breeding at a colony located 6 km from Ny-Ålesund, Svalbard. European kittiwakes are thought to winter over large parts of the North Atlantic. Eleven years of data (in the period 1970-2001) from the Ny-Ålesund colony show no temporal trend in the timing of hatching. However, the spread of the median hatching date among years is 14 days. Median hatching date was negatively correlated with Dec./Jan. NAO-index (North Atlantic Oscillation) and also negatively correlated with local average April ambient temperature.

A similar study on a North Sea colony of kittiwakes also showed a negative correlation between breeding phenology and the winter NAO-index, indicating that this phenomenon is related to large-scale winter climate pattern in the North Atlantic. These observations and recent studies on the relationship between spring arrival date and winter NAO in European migratory birds, indicate that the birds are able to adjust their spring arrival and breeding phenology to large-scale climatic oscillations. These responses happen instantly through phenotypic plasticity.

110

Syntaxonomical classification and ecological characterization of the high arctic vegetation in Canada and Svalbard

Satoru KOJIMA
(Tokyo Woman's Christian University, Tokyo, Japan)

Vegetation of High Arctic Canada has been variously classified and some zonation schemes have been proposed. Among them, are notably Polunin (1951), Zoltai (1977), Bliss (1977, 1988), Edlund (1983) and CCELC (1989), CAVM (2003). That of Svalbard has also been thoroughly studied and well summarized by Rønning (1969), Hartmann (1980), and Elvebakk (1985, 1994).

The present paper briefly reviews those systems and proposes a new syntaxonomical hierarchy for the Canadian high arctic vegetation. Based on the field investigation and literature review, one class (Salicetea arcticae), two orders (Saxifragetalia oppositifoliae and Caricetalia stantis) and four alliances (Papaverion laopponici, Dryado- Salicion arcticae, Cassiopion tetragonae, and Caricion stantis) were recognized. General trends of geographical distribution and extent of these syntaxonimcal units are discussed in relation to environmental conditions. In general, Canadian High Arctic vegetation develops under the extremely frigid and dry climate while that of Svalbard develops under a mild and humid climate comparatively. Indeed, a degree of continentality of climate appeared to be the most decisive factor characterizing the zonal vegetation of Canadian and Svalbard high arctic regions. In the Canadian High Arctic, continentality index of Conrad (1946) is high ranging 40~60, even 61 at Eureka. On the other hand, that of Svalbard is low usually less than 30 or as low as 15 at Barentsburg .

Such climatic characteristics regulate the course of soil development in the respective regions. Soils of the Canadian High Arctic are generally calcareous and those of Svalbard are predominantly acidic. Such climatic and pedological conditions obviously determine vegetation development. As a consequence, zonal vegetation of the Canadian High Arctic is best represented by Dryado integrifoliae - Salicion arcticae whereas Cassiopo tetragonae – Dryadetum octopetalae represents the zonal vegetation of Svalbard.

111

A survey of soils and soil biological characteristics from Arctic Canada (TNW99).

Manfred Bölter and Hans-Peter Blume
Kiel University

This paper presents results from the terrestrial research group from the Swedish-Canadian expedition "Tundra North West 99" (TNW99). The ship-based expedition run from mid July to end of August 1999 through the Canadian Arctic Archipelago. It designed to obtain a synoptic view on Arctic ecological features. The group on terrestrial biology, "biodiversity", was separated into two subunits, the one on large scale vegetation patterns and another on small scale patterns of soils and soil biology of related vegetation units. The aim of this paper is to introduce the individual research goals, and to present descriptions of the locations visited. Characteristics of 15 soil pits and of further 14 top soils are described.
Most top soils show fine granular structure, due to the activity frost action. Sub soils of sandy soils are loamy B horizons with sub angular to angular blocky structure, and C horizons are sometimes coherent. A strong variation in the content of gravel and stones as well as the texture of fine soil is found. Most soils are loamy: loam, clay loam, and silt loam, but also sands and loamy sands occur. Soils show elevated contents of organic matter (> 2 % TOC), especially those of the mesic sites with full vegetation cover. C/N- values lower than 14 correspond with a dominance of annual plant species. In the East, nearly all soils are enriched with carbonates, normally with low differences between topsoil and subsoil. Strong differences in the contents of oxalate extractable iron are observed. Higher values correspond with higher TOC contents in some cases. In most cases the Fe_o/Fe_d- quotients are low, i.e., the dithionite extractable iron (Fe_d) should be mostly lithogenetic. Some soils are red coloured (Munsell 6 to 7 YR), but have low Fe_o- contents: they should be due to hematitic parent rock. Most soils have low salt contents, especially in the topsoil: this is probably an influence from sea water spray. Most soils react alkaline due to higher contents of carbonates. Strong differences in the CEC values between 1 and 28 $cmol_c/kg$ are found. Ca^{2+} dominates under the exchangeable bases very strongly, reflecting the strong influence of carbonates.
Most abundant in many soils are nematodes and collembolans. Surface layers, partly also those layers just underneath them, show the highest records in microbes, extremes are above 10^9 cells g^{-1}. All these data show a community in significant smaller size, based on both, the overall descriptors (number and biomass) as well as on mean cell volumes and surfaces. Small cocci contribute only to low percentages in relation to total number, and even less to total bacterial volume and surface of the bacterial community. The most important group of bacterial cells can be seen in small rod shaped cells (0.25-0.75 µm). This high number is also mostly responsible for the generally uniform pattern of the overall community.

112

Ecosystem development and carbon cycle on a glacier foreland in Ny-Ålesund, Svalbard

Takayuki NAKATSUBO *Graduate School of Biosphere Science, Hiroshima University, Higashi-Hiroshima 739-8521, Japan.*

The Arctic terrestrial ecosystem is thought to be extremely susceptible to climate change. However, because of the diverse responses of ecosystem components to the change, overall response of ecosystem carbon cycle to climate change is still hard to predict. Understanding the contribution of each ecosystem component to carbon flow and the response of the component to environmental parameters is the prerequisite to predict the response of the ecosystem to climate change. Since 1994, we have conducted a series of field and laboratory studies on ecosystem carbon cycle in a deglaciated area of Ny-Ålesund, Svalbard in the high Arctic. This project aims to clarify the pattern of carbon cycle in this area and to construct a compartment model for future prediction of the impact of climate change on the cycle. For these purposes, changes in plant species composition, plant and microbial biomasses, soil carbon flows were examined along the successional series.

Vegetation cover and soil carbon pools tended to increase with the progress of succession. However, development of vegetation cover and accumulation of soil carbon appeared to be very slow, and the organic layer was very thin even in the latter stages of succession. Soil respiration rate also increased with the progress of succession. In the latter stage of succession, belowground parts of vascular plats contributed a significant proportion of the total soil respiration. Cryptogams (mosses and lichens) contributed the major proportion of phytomass in the latter stages. However, because of water limitation, their net primary production was smaller than that of the vascular plant. In addition, a model estimation suggested that net primary production of cryptogams varied widely between years depending primarily on water availability. A compartment model that incorporated major carbon pools and flows suggested that the ecosystem of the latter stage is likely to be a net sink of carbon at least for the summer season. This assumption was supported by the field measurements of net ecosystem production in this study site. Ecological meaning of these results is discussed in relation to the perspective of future research.

113

Net ecosystem production over a snow-free season on a glacier foreland in Ny-Ålesund, Svalbard

Masaki UCHIDA(NIPR), *Wenhong MO (University of Tsukuba), Takayuki NAKATSUBO (Hiroshima University), Hiroyuki MURAOKA (Gifu University), Hiroshi KANDA (NIPR), Hiroshi KOIZUMI (Gifu University) *Graduate School of Life and Environmental Sciences, University of Tsukuba, Tennoudai 1-1-1, Tsukuba, Ibaraki 305-8577, Japan. E-mail: mow@sakura.cc.tsukuba.ac.jp

In the high Arctic, extensive land areas show a 20th-century warming trend in air temperature of as much as 5℃. Moreover, substantial warming and increases in precipitation are projected over the 21th-century by major climate models (IPCC 2001). Matter flow rates in the high Arctic ecosystem are expected to be strongly temperature-limited and thus might be sensitive to the climate warming. However, the factors influencing net ecosystem production (NEP), which is one of the most important matter flow rates in the high Arctic terrestrial ecosystem, are still poorly understood. In this study, we investigated the NEP of a high Arctic ecosystem on a glacier foreland in Ny-Ålesund, Svalbard, Norway (79° N) and, in particular, to reveal biotic and abiotic factors determining the strength of NEP over a snow-free season.

The study site was set on an old moraine in the deglaciated area of the East Brøgger Glacier in Ny-Ålesund, where is dominated by *Salix polaris* (a vascular plant) and *Sanionia uncinata* (a moss species). NEP of the *Salix*-moss community was measured *in situ* using a portable infrared gas analyzer (LI-COR, LI-6400) connected with a clear acrylic chamber (10 cm in diameter and 5 cm in height). The NEP measurements (CO_2 exchange between ecosystem surface and atmosphere) were carried out almost everyday from mid-July to mid-August in 2001 and from mid-August to mid-September in 2003. During measurement the chamber was attached to a soil collar which was inserted to the ground in advance. After each day NEP measurement, the moss samples were collected to determine their water content. Temperatures of *Salix* leaf, green moss layer and soil layer, and photosynthetic photon flux density were recorded continually over the investigating period.

Under *in situ* environmental conditions, NEP values of the *Salix*-moss community varied widely from –44 to 171 (average 43) mg CO_2-C m^{-2} h^{-1} in 2001, and -17 to 13 (average 0.9) mg CO_2–C m^{-2} h^{-1} in 2003. Early in the growing season when *Salix* began to develop leaves, the *Salix*-moss community tended to be net sources of CO_2 to the atmosphere (i.e. NEP < 0) because of the low photosynthetic activity and the small leaf biomass of *Salix*. However soon after the *Salix* leaves fully developed, the *Salix*-moss community turned to be net sink of CO_2 (i.e. NEP > 0). Moreover, the *Salix*-moss community became a large sink of CO_2 after rainy days as a result of the higher photosynthetic activities of the moss in relation to higher moss water content. In late August, the sensitivity of NEP to light intensity was small when the leaves of *Salix* turned to yellow. However, light dependence of the NEP was observed even after the leaves of *Salix* have fallen, if the photosynthetic activity of the moss was high such as in rainy days. These results suggested that the strength of NEP of the *Salix*-moss community in the snow-free season is strongly dependent on the photosynthetic activities of both *Salix* and the moss, and the production area in terms of *Salix* leaf biomass especially during the growing season of *Salix*. It is therefore, the factors controlling NEP of the studied ecosystem are not only the abiotic factors such as temperature, light intensity, precipitation which may directly or indirectly effect photosynthetic activities, but also the biotic factors such as leaf age of *Salix*.

114

Temporal and Spatial Differences of Methane Emission and Uptake at Arctic and Sub-arctic Tundra in Alaska

Yoshinobu Harazono[1], Masayoshi Mano[2], Masahito Ueyama[1], Akira Miyata[2] and Walter C. Oechel[3]

1) International Arctic Research Center, University of Alaska Fairbanks, AK, USA.
2) Ecosystem Gas Flux Research Team, National Institute for Agro-Environmental Sciences, Tsukuba, Japan
3) Global Change Research Group, San Diego State University, San Diego, CA, USA.

Methane (CH_4) is a very effective greenhouse gas, and its major source in nature is anaerobic ecosystem. As high latitude ecosystems such as tundra and wetland pool large amount of organic carbon in the soil layer, which may enhance CH_4 emission in relation to the current arctic warming. However, we have a little information of potential feedback mechanisms on climate change and greenhouse gas emission, thus model parameterization of CH_4 emission is insufficient and the further observational data are required to improve future estimation of global change accurately.

We have measured CH_4 flux at inland wet tundra (Happy Valley) in 1995 & 96 and at coastal wet sedge tundra (Barrow) since 1999. We applied aerodynamic method to determine CH_4 flux, which provides continuous flux as hectare scale under natural condition. CH_4 concentration from two heights at each tundra were sampled and measured continuously by NDVI type gas analyzer (GA360, Horiba) or FID type GA (APHA-360, Horiba), and required eddy diffusivity and atmospheric stability were determined simultaneously by eddy correlation flux measurements of CO_2, heat and momentum.

Daily trend of half hourly CH_4 flux has little relation with soil temperature nor solar radiation at inland and coastal tundra, but the seasonal trend of daily flux changed with soil temperature. Cumulative CH_4 flux during vegetation growing season of wet sedge tundra at happy valley was 8.1 gCH_4m^{-2} in 1995 and that at moist tundra (non-acidic) was 3.3 gCH_4m^{-2} in 1996. At Barrow site, CH_4 flux increased rapidly after snowmelt and the peak flux occurred in mid July. Peak levels in each year showed large temporal differences with 55-205 $mgCH_4m^{-2}d^{-1}$and the cumulative CH_4 flux varied 2.5-6.1 gCH_4m^{-2} during 6 growing seasons between 1999-2004. The carbon ratio of emitted CH_4 to the net ecosystem production of the wet tundra vegetation, NEP was around 3% as seasonal amount basis. Winter CH_4 flux at Barrow was mostly uptake, however, severe winter weather seldom interrupted measurements and the limited winter CH_4 flux was difficult to calculate the seasonal amount of winter flux.

Tussock tundra at black spruce forest interior Alaska showed different seasonal variations of CH_4 flux. Which was clear uptake in mid summer and was both emission and uptake in spring and fall, while it was uptake by snow in winter. CH_4 emission during late spring through early summer was not high level with uptake in some cases, which might be caused by wet soil during snow melt with shallow thaw depth at moss surface. CH_4 uptake in mid summer ranged up to -1.7 $mgCH_4m^{-2}d^{-1}$ which might be great contribution by moss and lichen at tussock tundra in black spruce forest. Therefore, annual CH_4 budget at black spruce forest was quite low compare to other tundra ecosystems.

In order to estimate CH_4 flux as large scale, we are trying to evaluate snow covered period and its distribution by satellite images. Combination of remotely obtained information and field observation data may provide distribution of CH_4 flux with seasonal variation for arctic and sub-arctic ecosystems interior Alaska.

Yoshinobu Harazono y.harazono@uaf.edu
International Arctic Research Center, University of Alaska Fairbanks
Fairbanks, AK 99775

115

Quantification of Terrestrial Carbon Stock and Its Change in Arctic/Boreal Zone Using Airborne Laser Profiling/Scanning

T. Sweda, H. Tsuzuki (Ehime University, Japan)
T. Kusakabe (Waseda University, Japan)

Airborne laser profiling and scanning, the state of the art technology which enables us to measure clearance between the aircraft and whatever the object on the ground beneath at a frequency of up to 100,000 Hz, turned out to be a powerful tool for quantifying terrestrial biomass and its change over time accurately over an extensive range. Our multi-temporal measurements, successively conducted in 2000 and 2003, of the 500 ha Tomakomai National Forest in the boreal region of northern Japan revealed 1) very reasonable estimates of standing timber stock and growth comparable to existing estimates by the Japanese Forest Agency and others as well as 2) an estimate of forest carbon sequestration compatible with that measured by flux tower observation of CO_2 on the same locality. A more extensive multi-temporal measurement of 600 km, N/S-oriented transect in the southern boreal forest region of western Canada in 1997 and 2002 revealed overall decrease in forest biomass in five years, i.e. CO_2 emission, with 1) significant decrease in the central 1/3 portion of the transect due to a major forest fire and 2) a sign of vegetation change in which slight but definite biomass increase in the northern 1/3 of the transect and slight decrease in the southern 1/3 indicate northward shift of the boreal forest zone by climate warming and invasion of the prairies from south in consistency with the projections of climate change and associated vegetation change. The trilogy of accurate measurement over an extensive range with speedy post-processing of data, makes airborne laser profiling/scanning a superb tool to quantify terrestrial carbon stock and its change as well as to monitor possible vegetation change in the entire arctic-boreal zones, where the earliest and most conspicuous climate change is expected in not-so-distant future due to increasing greenhouse gases. Accordingly, a research proposal entitled COCO GRANDE (Complete Carbon Assessment by Ground Ranging and Echoing for Arctic/Boreal Regions), aiming at circumpolar airborne laser profiling/scanning networking for quantifying terrestrial carbon and its flux, and monitoring possible vegetation change, now in preparation under the auspices ICSU/WMO campaign for 2007/08 International Polar Year is introduced.

116

Coordination of international research in Svalbard

— new initiatives from the Research Council of Norway

Fridtjof MEHLUM
Research Council of Norway

117

Evaporative loss of snow cover in Northern Eurasia sub-Arctic region

Yiensheng Zhang , Tetsuo Ohata, Kazuyoshi Suzuki
Institute of Observational Research for Global Change, Yokosuka 237-0061, Japan

Key words: snow cover, sublimation, Northern Eurasia

1. Introduction

In the sub-arctic, like the northern Eurasia cryopshere, the snow cover has commonly recognized to be an important hydrological component to affect the river discharge and regional water resource. However, snowfall, even if it can sustain about half year, has been demonstrated to be range of 50 to 150 mm. Therefore, sublimation from snow cover is a non-negligible hydrological component.

Since 2002, intensive observations to investigate snow sublimation, using pan observation and aerodynamic method, were made both at experimental site of eastern Siberia of Russia, and also in northern Mongolia. This work is attempting to aim of 1) dressing difference of snow sublimation between plain and mountain; and also between in forest and open field, 2) presenting seasonal and inter annual variation of snow sublimation, and 3) reveal its proportion to snowfall.

2. Observation and data

Observations were carried out in the areas of Tynda, Russia and eastern Ulan bator, Mongolia. The former is locating in mountain taiga region of eastern Siberia, where annual air temperature and precipitation were observed to be –7.5° C and 524.2 mm. The later is in southern periphery region of Eurasia cryosphere with annual air temperature, precipitation of –4.1° C and 280 mm.

Several experimental sites were established over study region on different ground surface. The measuring terms at AWS (automatic weather station) were profile of wind, air temperature and humidity, and also snow depth. Transparent plastic pans were used for sublimation measurements as know of Lysimeter method.

Three meteorological stations that near experimental sites have been selected as reference sites of this work, those were of Mogot, which near experimental site of Tynda, of Ulan Bator (plain region) and Terelj (mountain region), which locating study region of Mongolia. Data were used for long time scale estimating of snow sublimation. All data were observed by 3 hours interval.

3. Results and analysis

In the period March 13 to April 22 (48 days), snow sublimation totaled 10.4-15.7 mm at sites in eastern Siberia. The results imply that the forest cover did not affect vaporization processes during atmospheric inversions. Under neutral atmospheric conditions, the effect of forest cover on snow sublimation was clear, with significant differences of sublimation between forested and open areas. From Nov. 2003 to April 2004, snow sublimation was totaled to be 28.8 and 14.6 mm at open site and site in forest of mountains region of Mongolia, but to be 18.5 mm at open site in plain region.

For the bulk equation:

$$E = \rho Ce(q_S - q_Z)U_Z \quad (1)$$

where ρ is air density (kgm^{-3}), q and U are specific humidity ($kgkg^{-1}$) and wind speed (ms^{-1}), respectively. The subscripts 'Z' and 'S' mean 'at reference height' and 'on the snow surface'. Ce is the bulk transfer coefficient for vapor. Estimated results of Ce was similar at open sites of 0.0020, but different at forest sites.

Employing eqs. (1) and Ce=0.0020, using the data from Meteorological Stations, snow sublimation has been estimated in daily basis at 3 reference site for 1980-84 at Mogot; for 1980-2000 at Ulan bator and for 1986-2000 at Terelj. Sublimation was higher both at beginning and ending snow cover period, which can be elucidated by seasonality of wind speed and humidity deficient.

Inter-annual variation of sublimation were stable than that of snowfall at all sites. The stability of proportion of sublimation to snowfall (Es/Pr) was dominant by snowfall.

4. Discussion & Concluding marks

Spatial distribution of snow sublimation in Eurasian could be investigated by relating monthly mean sublimation to wind speed (U) and saturation deficiency (De). In monthly basis, snow sublimation correlate well to wind speed (U) and saturation deficiency (De). When wind speed less than 2 ms^{-1}, saturation deficiency is predominant to determine sublimation. And sublimation increase significantly when wind speed larger than 2 ms^{-1}. Actually, once wind speed larger than 2 ms^{-1}, another component must take into account that sublimation from blowing snow

The results of this show that sublimation from the snow cover in mountain region is higher than that in plain region of 35.8%. In mountain region, sublimation in open field higher than that at forest understory of 29.1-49.3%. Seasonal variation of snow sublimation was similar in mountain and plain region: smaller in middle winter, which relating to seasonal variation of wind speed and humidity deficient. Proportion of sublimation to snowfall was similar around 30% in both mountain and plain region, even if snowfall and sublimation was differences. Inter-annual changes of the partition was dominant by snowfall but not sublimation.

118

Cryobiological ice core analyses in Sofiskiy glacier, Russia

J.Uetake, S.Kohshima(1), F.Nakazawa(2), M.Kohno(3), T.Kameda(4), K.Suzuki(5), S.Alkhipov(6), Y.Fujii(3)

(1) Graduate School of Bioscience & Biotechnology, Tokyo Institute of Technology

(2) Graduate School of Environmental Studies, c/o Hydrospheric Atomospheric Research Center, Nagoya University

(3) National Institute of Polar Research

(4) Kitami Institute of Technology

(5) Department of Environmental Science, Faculty of Science, Shinshu University

(6) Institute of Geography,Russian Academy of Science

Microorganism in the shallow ice core from the Sofiskiy Glacier (25.1m in length, taken at 3,435 m a.s.l.. in Jul, 2001) ,Altai range of Russia, were examined for potential use of biological ice core analyses in this region. The ice core and pit samples collected at the accumulation area contained 6 types of unicellular green algal cells including 2 species of snow algae (*Mesotenium*.sp, *Smithsonimonas abbotii*), one species of unicellular cyanobacteria, 2 species of snow fungi (*Chionaster nivalis*、*Chionaster bicornis*) and unidentified bacteria. Vertical profiles of these microorganisms and Delta ^{18}O in the snow pits show each peaks are in same layer. This result suggests that microorganism will be a maker of summer layers, because these grow well on the surface snow during the melting season (summer). In Sofiskiy glacier, Delta ^{18}O is disturbed at deeper part (below 3m depths), otherwise green algae peaks are kept clearly. The microorganism is larger than isotopes, and may resist the melt-water percolation. This study show Microorganism will be useful indicator of annual layer, in the Sofiskiy glacier. We estimated that ice core contained about 15 annual layers, respectively. Snow algae in the ice core would be accurate boundary markers of annual layers in the ice cores of this region. Furthermore microorganism may indicate the past environmental record, because growth of green algae is affected by the light environment and temperature.

119

Two years of mercury atmospheric chemistry study in Ny-Ålesund, Svalbard. Air to Snow interaction. Seasonal evolution of mercury deposited onto Kongsvegen Glacier.

Christophe P. FERRARI[†,‡,*], Pierre-Alexis GAUCHARD[†], Christian TEMME[§], Olivier MAGAND[†], Enno BAHLMANN[§], Ralf EBINGHAUS[§], Katrine ASPMO[¥], Torrun BERG[¥], Aurélien DOMMERGUE[†], Frédéric PLANCHON[£], Sonia NAGORSKI[†], Carlo BARBANTE[£], Johan STROM[¢] and Claude F. BOUTRON[†,#],

[†] *Laboratoire de Glaciologie et Géophysique de l' Environnement du C.N.R.S., 54 rue Molière, BP 96, 38402 Saint Martin d'Hères, France.*
[‡] *Polytech' Grenoble, Université Joseph Fourier (Institut Universitaire de France), 28 Avenue Benoît Frachon, BP 53, 38041 Grenoble, France.*
[#] *Unités de Formation et de Recherche de Mécanique et de Physique, Université Joseph Fourier (Institut Universitaire de France), BP 68, 38041 Grenoble, France.*
[£] *Environmental Sciences Department, University of Venice, Calle Larga S. Marta, 2137, I-30123 Venice, Italy*
[§] *GKSS Research Centre Geesthacht, Institute for Coastal Research, D-21502 Geesthacht, Germany.*
[¶] *Air Quality Research Branch, Meteorological Service of Canada, Environment Canada, 4905 Dufferin St., M3H 5T4-Toronto, Canada.*
[¥] *Norwegian Institute for Air Research (NILU), Instituttveien 18, P.O. Box 100, N-2027, Kjeller, Norway.*
[¢] *Institute of Applied Environmental Research (ITM), Frescativägen 54, S-106 91 Stockholm, Sweden*

Mercury is present in the environment in various chemical forms and can be transformed to methyl mercury. This organic form constitutes the most hazardous specie of mercury. In the atmosphere, Hg° is the predominant form with concentration about ~1.5 ng/m^3 and has a lifetime of about one year, but some oxidized species of mercury (Hg(II)) are found at lower concentrations (~pg/m^3), as total particulate mercury (TPM) and reactive gaseous mercury (RGM). RGM species are more reactive and soluble than Hg° and can be deposited faster onto earth surfaces. Reactivity of Hg° in the atmosphere is weak except under special conditions in which Hg° can be rapidly oxidized. These fast atmospheric processes known as Atmospheric Mercury Depletion Events (AMDE) have been observed in various places in Arctic regions in Canada, U.S.A. (Alaska), Norway, Greenland, and in Antarctica. During this fast concomitant depletion of mercury and ozone, concentrations of Hg can be strongly enhanced in the snow surface as the result of deposition of oxidized forms of Hg. Not all AMDEs have been explained by local chemical reactions, however. As a result, the Hg contained in the snow can be injected to aquatic ecosystems during snowmelt. In this case, the snow pack acts as an important reservoir of this toxin, bridging the atmosphere with aquatic ecosystems. The scientific research program developed in Ny-Alesund in 2003 and 2004 (with the logistic support of IPEV-AWI) and the years coming consists in: (1) Understanding physico-chemical processes of oxidation of elemental gaseous mercury in the atmosphere during Atmospheric Mercury Depletion Events (AMDE), (2) Evaluating deposition and emission fluxes of mercury to and from the Arctic snow so as to better understand the possible roles of source and sinks of the snow pack, (3) Determining the seasonal deposition of mercury onto the snow pack with determination of Mercury concentration in the well dated layers of Kongsvegen glacier.
In this paper, results obtained during two spring campaigns in 2003 and 2004 are presented for atmospheric monitoring of mercury, snow to air fluxes of mercury and temporal evolution of mercury in snow from the Kongsvegen glacier.

120

Ice thickness and basal reflectivity in Northeast Greenland derived from airborne radio-echo sounding

Daniel Steinhage, Uwe Nixdorf and Heinz Miller

Foundation Alfred Wegener Institute for Polar- and Marine Research
Columbusstrasse, 27568 Bremerhaven, Germany
dsteinhage@awi-bremerhaven.de

Abstract

The Alfred Wegener Institute (AWI) operates since 1994 an especially for use in polar regions designed airborne radio-echo sounding (RES) system on its ski equipped research aircraft *Polar2*, a twin engine Dornier DO-228-101. In summer 1996 the first AWI airborne RES survey has been flown from NorthGRIP (75,1°N; 42,3°W). Since then another four surveys have been flown either from NorthGRIP or from Station Nord (81,7°S; 16,7°W) mapping the ice thickness destribution in the vicinity of the deep ice core drill site NorthGRIP and in the northeast of the Greenland ice sheet, covering the drainage basins of Nioghalvfjerdensfjorden, Zachariae Isstrøm and Storsstrømmen. These ice thickness measurements are used to up-date data sets for modelling studies as well as for modelling studies.

Beside the RES system is the research aircraft *Polar2* equipped with two Trimble 4000SSI GPS receiver, a Scintrex magnetometer and an Optech laser altimeter. This system set-up can be complemented by a modified ships gravitymeter.

All RES surveys carried out by AWI in Greenland so far sum up to more than 250 h of flight time and more than 50000 km RES profiles. The presentation will focus on the ice thickness measurements of northeast Greenland. Beside maps of the ice thickness and subglacial topography also the destribution of bed reflections will be presented and discussed.

121

Aerosol optical characteristics in Ny-Ålesund derived from Sky radiometer

Kazuma Aoki

Faculty of Education, Toyama University, Toyama, Japan

kazuma@edu.toyama-u.ac.jp

and

Masataka Shiobara, Masanori Yabuki

National Institute of Polar Research, Tokyo, Japan

High latitudes, especially the Arctic and Antarctic, are regions where various materials are deposited. Arctic haze and Arctic summer stratus strongly influence the global radiative budget. We are seeking in this study information on the aerosol optical characteristics with respect to their temporal and spatial variability in high latitude region.

We started the long-term monitoring of aerosols optical characteristics on April 2000, by using a sky radiometer (Prede Co. Ltd.,) in Ny-Ålesund, Svalbard (*78.93N, 11.86E*). The radiometer includes a sun- and sky- scanning spectral radiometer, a sun sensor, a sun tracker, a control box, and a PC. It measures the direct solar irradiance and the solar diffuse radiance distribution, and seven interference filters (0.315, 0.4, 0.5, 0.675, 0.87, 0.94, 1.02 μm) under clear skies. Data have been analyzed by an inversion software called SKYRAD.pack (Nakajima *et al.* 1996). In our analysis, we used five wavelengths (0.4, 0.5, 0.675, 0.87, 1.02 μm) to monitor aerosols. From these measurements, we analyzed aerosol optical thickness and single scattering albedo at each wavelength, Ångström exponent, size distribution of volume within a vertical column. We are seeking in this data information on the aerosol optical characteristics with respect to their temporal and spatial variability. Further these results will be used to validate retrievals from satellite and model simulations.

The monthly mean value of Aerosol optical thickness at 0.5 μm shows the same trend for each year (2000-2004), with maxima and minima appearing in spring and autumn, respectively. And the monthly mean value of Ångström exponent shows the same trend for each year, with minima and maxima appearing in spring and autumn, respectively. However, effect of clouds and influence of data of low solar angle that exit in our algorithm cannot be completely ignored in high latitude regions. The results will be reported during the symposium.

122

STUDY OF RADIATIVE EFFECTS OF ARCTIC AEROSOLS BASES ON AIRBORNE MEASUREMENTS: A CASE STUDY FOR MARCH

R. TREFFEISEN[1)], A. RINKE[1)], M. FORTMANN[1)], A. HERBER[2)], K. DETHLOFF[1)] and T. YAMANOUCHI[3)]

[1]Alfred-Wegener-Institut für Polar- und Meeresforschung, Telegrafenberg A43, D - 14473 Potsdam, Germany, e-mail : rtreff@awi-potsdam.de

[2]Alfred-Wegener-Institut für Polar- und Meeresforschung, Bremerhaven, Germany

[3]National Institute of Polar Research Tokyo, Japan

Keywords: Arctic aerosols, radiative effect, physical properties, model input parameters

INTRODUCTION

The Arctic is a highly sensitive climate region and changes in the Arctic climate and weather may affect the lower latitudes and ocean circulations. So far, the direct radiative effect of Arctic Haze was investigated based on one-dimensional models (e.g., Wendling et al., 1985; Blanchet and List, 1987; Emery et al., 1992; Shaw et al., 1993). All these studies showed a gain of solar radiation by absorption in the atmosphere by 2-20 W m^{-2} (as daily mean value) and were associated with an atmospheric heating rate of 0.1-1.8 K day^{-1}. Furthermore the shortwave solar net flux at the surface was reduced by 0.2-6 W m^{-2}, which resulted in a surface cooling. The calculated magnitudes were strongly dependent on the assumed optical aerosol properties (determined by the concentration, chemical composition, size number distribution, and atmospheric humidity) as well as on the solar zenith angle and surface albedo. However, the evaluation of the climatic direct and indirect effect of Arctic aerosols requires the use of complex three dimensional climate models. The only existing estimation with a global circulation model (Blanchet, 1989) shows a warming at the surface by 1-2 K for the Arctic region. Due to measurements the Arctic aerosol distribution shows a highly temporal and spatial variation. The coarse spatial resolution of global climate models cannot account for this variation. Therefore, the use of high resolution regional climate models covering the Arctic is recommended in order to study the radiative effect of Arctic aerosols. Regional climate models have a typical horizontal resolution of 15-50 km and provide the same complexity concerning physical processes as global models. The applied regional climate model HIRHAM (Christensen et al., 1996) is a state-of-the-art regional climate model, well validated and widely used for various Arctic climate applications (e.g., Dethloff et al., 1996; Haugen et al., 1999; Rinke et al., 1999; Christensen and Kuhry, 2000; Rinke et al., 2000; Dethloff et al., 2002; Dorn et al., 2003).

METHOD

Accurate modelling of solar radiative forcing due to Arctic aerosols requires adequate spectral resolution and treatment of spatial and temporal variability. These needs contrast with the limited measurements of Arctic aerosol characteristics. Two different methods were applied and compared to incorporate aerosol data in an Arctic regional climate model (method 1: aerosol data based on a global aerosol data set, method 2: aerosol data based on Arctic aerosol measurements provided from the Arctic Study on Tropospheric Aerosol and Radiation (ASTAR) campaign performed during March/April 2000 in the vicinity of Spitsbergen). For the transformation via method 2 data of two days were selected with a high and lower aerosol loading in March 2000. These days were considered to be representative for the Arctic spring aerosol loading.

RESULTS

A successful data transformation for the two selected days with a high and lower aerosol loading in March 2000 could be demonstrated. Thus, an input of the obtained measurements for the regional climate model HIRHAM could be realised. The result in the solar heating rate anomalies demonstrates a promising qualitative agreement with the direct input of measured profiles in the vertical column model. Calculations of the solar heating rate anomaly due to method 2 reveal that the solar heating rate anomaly remains uncertain to approximately ± 25 % due to uncertainties in the assumption within the transformation process. For the two days selected a solar heating rate of the order of 0.05 to 0.3 K day^{-1} were achieved. The calculated heating rate anomalies depend strongly on the assumed aerosol characteristics (absorption characteristics, particle radius, chemical aerosol composition, mass mixing ratio). The performed sensitivity studies showed the strong impact of several initial GADS aerosol characteristics on the calculated solar heating rate anomalies of method 1. It can also be concluded that the obtained differences between the direct input and method 1 are most probably the result of a combination of various influences in the chosen input parameters. The performed study showed the importance of both methods for modelling solar radiative forcing due to Arctic aerosols. Furthermore, the regional climate impact of Arctic aerosols during March 2000 is presented. The aerosol effect is characterized by a substantial spatial variability at the regional scale and varies between a cooling of 2 K in the Baffin Bay and Laptev Sea and a warming of 3 K in the Beaufort Sea.

123

ARCTIC AEROSOL OBSERVATIONS USING AIRBORNE LIDAR DURING ASTAR 2004

I.S. STACHLEWSKA, C. RITTER, R. NEUBER, G. WEHRLE

Alfred-Wegner-Institut for Polar and Marine Research,
Telegrafenberg A43, D-14473 Potsdam, Germany
istachlewska@awi-potsdam.de

Keywords:
field campaign ASTAR 2004, arctic aerosol, 2-stream lidar retrieval, airborne lidar validation

ABSTRACT

The Arctic Study of Tropospheric Aerosols, Clouds and Radiation (ASTAR 2004) was focused on measurements of the polar tropospheric aerosol characteristics. The campaign was performed in May / June 2004 in the vicinity of Spitsbergen in order to investigate the transition period from Arctic spring to Arctic summer aerosol conditions. This contribution presents a selection of results obtained with the airborne lidar AMALi operated onboard of one of the AWI research aircraft Dornier Do228 during the ASTAR 2004 campaign.

Remote sensing with the eye safe, nadir looking, backscatter Airborne Mobile Aerosol Lidar (AMALi), developed at the AWI Lidar Group, allows determination of the horizontal and vertical extend and layering of increased tropospheric aerosol loads during field campaigns. The airborne lidar provides information about the atmosphere between the ground, ice or sea level up to 2700 m altitude with a vertical resolution of 7.5 m and a typical temporal resolution of 10 s, and hence a horizontal resolution between 460 m and 770 m, corresponding to varying between 166 km/h and 276 km/h cruising speed of the aircraft over ground. Results are presented in terms of intensity of background and range corrected lidar signal profiles and backscatter coefficient profiles at 1064 nm and 532 nm wavelengths and, additionally, in terms of depolarisation ratio profiles for the latter wavelength.

An application of the 2-stream inversion method for data evaluation from combined measurements obtained with two AWI lidar systems, airborne AMALi and stationary KARL (Koldewey Aerosol Raman Lidar), is presented. This technique allows calculation of extinction coefficient profiles directly from the lidar signals without any a priori assumptions. With only modest assumptions the data evaluation process can be expanded for a retrieval of backscatter coefficient profiles. Hence, quantitative backscatter information of the AMALi data during the whole flight is provided. The results of the comparison of the 2-stream retrievals (extinction, backscatter and lidar ratio) with the KARL Raman retrievals show very good agreement. Therefore, the 2-stream technique is proved to be successful for the airborne lidar data validation. Moreover, it seems to be a good candidate for the satellite lidar validation and, hence, shall find application during ASTAR 2006 campaign for the CALIPSO satellite data.

124

Origin of new particles in the summer Arctic boundary layer: can simple sulfur chemistry explain observations?

Johan Ström[1], Peter Tunved[1], Kjetil Törseth[2], Andreas Minikin[3], Radovan Krejci[4], Siegrid Debatin[5]

1)Institute for Applied Environmental Research, Air-Pollution Laboratory, Stockholm University, SE-106 91 Stockholm, Sweden
2)Norwegian Institute for Air Research, Kjeller, Norway
3)Deutsches Zentrum fuer Luft- und Raumfahrt
DLR-Institut fuer Physik der Atmosphaere, Oberpfaffenhofen, Germany
4)Department of Meteorology, Stockholm University, Stockholm, Sweden
5)Alfred Wegener Institute Foundation for Polar and Marine Research, Bremerhaven, Germany

The summer period in the Arctic is the cleanest period of the year with the least influence from anthropogenic sources. Almost all trace constituents present minimum concentration during summer, but this is not true for aerosol particles. Total aerosol mass is low but the number density shows a maximum during summer. The origin of the newly formed particles is a matter of debate and this study address this particular issue.

Leck and Bigg (1999), hypothesized that organic films in the surface water of open ice leads should be the origin of new particles in the Arctic summer atmosphere. One of their main arguments was that because there is such low influence from anthropogenic emissions during summer the source of particles has to be of natural origin. Ström et al., (2003), presented data from the Zeppelin station, Svalbard, which extended over the full annual cycle. The authors showed that there is a very strong relation between the amount of solar energy reaching the Arctic and the number density of aerosol particles. This strong relation suggests that photochemical reactions is a key process in the formation of new particles.

In this study we pose a hypothesis that is based on the vertical profiles of aerosol properties performed from aircraft during the ASTAR/TROLL 2004 experiment in May and June of 2004 based in Longyearbyen, Svalbard, and the continuous observations performed at the Zeppelin station, Ny-Ålesund, Svalbard. By using numerical simulations we have tested if particle formation and transformation can be explained by sulfur chemistry alone. First results show that theory predicts a very large source of new particles in the wake of a cloud where a significant portion of the aerosol has been removed by precipitation.

Because the aerosols available for cloud formation are few, the production of new aerosol particles in the Arctic is of great interest. Depending on the underlying mechanisms, relatively small changes in the atmospheric composition may influence the life cycle of clouds and the hydrological cycle.

Leck, C., Bigg, E.K., 1999. Aerosol production over remote marine areas-A new route. Geophysical Research Letters 26, 3577–3580.

Ström, J., J. Umegård, K. Tørseth , P. Tunved, H-C Hansson, K. Holmén, V. Wismann A. Herber, and G. König-Langlo, One year of particle size distribution and aerosol chemical composition measurements at the Zeppelin Station, Svalbard, March 2000–March 2001, Physics and Chemistry of the Earth, 28, 1181–1190, 2003.

125

Mixing State and Spatial Distribution of Tropospheric Aerosols Derived from in situ Aircraft Measurements during ASTAR 2004

Atsushi Matsuki (Nagoya Univ.), Keiichiro Hara (NIPR), Sadamu Yamagata (Hokkaido Univ.), Takashi Yamanouchi (NIPR), Andreas Herber (AWI), Yasunobu Iwasaka (Nagoya Univ.), Makoto Wada (NIPR), Masahiro Nagatani (Nagoya Univ.), Hiroshi Nakata (Nagoya Univ.), Dmitri Trochkine (Nagoya Univ.)
e-mail: matsuki@stelab.nagoya-u.ac.jp

Abstract

A precise evaluation of the radiative impact imposed on the sensitive Arctic climate is hampered by the lack of knowledge on the temporal and spatial variations of the aerosol physical and chemical properties over the region. To address the situation, ASTAR2004 campaign (Arctic Study of Tropospheric Aerosol and Radiation) was initiated to conduct an intensive aerosol study in the Arctic with the coordinated surface-based, airborne and spaceborne measurements. A preceding campaign was held in mid-spring (March-April) of 2000 (ASTAR2000), during which Arctic region experiences highest concentrations of pollutants arriving from mid-latitudes, known as Arctic haze. As its successor, ASTAR2004 is focused on late spring (May-June), to investigate how the aerosol properties evolve as Arctic haze diminishes and background atmosphere prevail over the region.

As part of ASTAR2004 campaign, collection of atmospheric aerosols was conducted in the altitudes ranging 0.1-7.5km over the Arctic region (250km circle around Spitzbergen; 78°15'N, 15°30'E) with the aid of a research aircraft (Polar 4, Dornier 228, AWI). Aerosol particles were analyzed on individual basis by the electron microscopy to determine their chemical composition and mixing states. Such aerosol chemistry is one of the key parameters predicting its radiative property, hence the effect on the Arctic climate system. Of 19 flights conducted during the campaign (May 19-June 7, 2004), clear sky conditions prevailed on 6 cases, allowing measurement of aerosol optical properties at various levels by the onboard sun-photometer (AWI). Hence, this study aims to provide aerosol chemical property and its vertical distribution on those selected cases to meet one of ASTAR2004 objectives, to perform aerosol radiative closure.

The air introduced into the aircraft fuselage through an isokinetic inlet is partly distributed to an Aerosol Impactor Sampler (AIS). The single jet impactor has 50% cut-off diameter at ca. 0.18~0.2μm under the flow of 25L/min. A revolving stage inside AIS replaced the sampling media under the jet on every 5 min. Carbon-coated collodion film supported by a Nickel-grid was selected here as the sampling medium. The film with additional calcium-coating was also employed to aid the detection of acidic SO_4^{2-} in individual particles. Aerosol samples were kept sealed under dry condition until they were put under the morphological analysis by both the transmission electron microscope (TEM: JEOL, JEM-2010), and scanning electron microscope (SEM: Hitachi, S-3000N). Elemental composition of individual particles was then analyzed by an energy dispersive X-ray spectrometer (EDX: Horiba, EMAX-500) equipped with the SEM.

Current study found that the sulfate particles in the external mixing state were predominant (57~97%) in the Arctic troposphere through out the periods of ASTAR2004 (May-June, 2004). Some fraction of sulfates (0~15%) however, was found internally mixed with soot. In contrast to the former campaign (March-April, 2000), externally mixed soot particles were scarce in the Arctic troposphere.

Morphological analysis and chemical test by Ca film indicated that, sulfate particles in late spring (May-June, 2004) take more or less neutralized forms resembling $(NH_4)_2SO_4$. Most of the sulfates in mid-spring (March-April, 2000) on the other hand, showed strongly acidic forms (e.g., H_2SO_4/NH_4HSO_4). It is conceivable that, in general the neutralization of sulfates proceed as seasons change toward summer, since ammonia emission depends highly on ground temperature. However, this may not always be the case especially with little ammonia sources around the Arctic. Interestingly, the fraction of neutralized sulfates tended to increase with increasing altitude, given ammonia sources being distributed mostly at ground levels of the continents. Therefore, further analysis on the air-mass history may attribute the observed acidity variations to the possible changes in the transport patterns of trace gases and particles.

Acknowledgements

This study was supported by Special Scientific Research Program (No. 11208201) and Grant-in Aid (No. 11691138) from the Ministry of Education, Culture, Sports, Science, and Technology of Japan. The authors wish to thank the ASTAR2004 team, especially the airborne members from AWI Bremerhaven/Potsdam, DLR-IPA Oberpfaffenhofen, DLR Flight Operation, NIPR Tokyo, Hokkaido University, MISU Stockholm, LaMP Clermont-Ferrand. We are also grateful for the support provided by the local authorities and companies including Optimare Sensorsysteme AG, Lufttransport, and NPI Longyearbyen.

126

Microphysical properties of an Arctic stratocumulus cloud observed during ASTAR experiment

J-F Gayet, A. Schwarzenboeck, C. Duroure, R. Lefevre, C. Gourbeyre
(LaMP UMR 6016 CNRS, Université Blaise Pascal, France)
A. Minikin (DLR, Oberpfaffenhofen, Germany)
R. Krejci (ITM/MISU, Stockholm, Sweden)
A. Herber (AWI, Bremerhaven, Germany)

During the international ASTAR experiment **(Arctic STudy of Aerosols, clouds and Radiation)** carried out from Longyearbyen (Spitzbergen) from 10 May to 11 June 2004, the AWI Polar 2 aircraft was equipped with a unique combination of instruments for the in situ characterization of microphysical and optical cloud properties. This instrumental setup comprised a Polar Nephelometer, a Cloud Particle Imager (CPI) as well as a Nevzorov and standard PMS probes to measure cloud particle properties in terms of scattering characteristics, particle morphology and size, and in-cloud partitioning of ice/water content. Several situations including glaciated nimbostratus, altostratus and mixed-phase stratiform clouds have been sampled during 14 scientific flights.

The objective of the communication is to present the results of a case study related to a boundary layer stratocumulus cloud topped at about -6°C by a strong temperature inversion. The results show that during the first sampling sequence, the cloud is characterized by only supercooled water droplets with a quasi-adiabatic liquid water content profile. Then very large drops (up to 500 µm diameter) appear near the clod top which are followed by a spectacular and massive glaciation of the cloud layer. The optical and radiative cloud properties are therefore strongly affected by this rapid change of the microphysical structure. The occurrence of big water drops may be explained by a very clean airmass characterized by a aerosol concentration of only a few hundred per cm3. On the contrary the glaciation processes do not appear linked to the aerosol properties since no difference are evidenced during the period of observations. Other hypothesis should therefore be discussed.

127

MICROPHYSICAL AND OPTICAL PROPERTIES OF MIXED-PHASE CLOUDS OBTAINED FROM ALTERNATED LIDAR AND IN SITU MEASUREMENTS

J.-F. GAYET, O. JOURDAN, C. DUROURE, A. SCHWARZENBOECK
LaMP UMR 6016 CNRS, Université Blaise Pascal, France
e-mail: J.F.Gayet@opgc.univ-bpclermont.fr

I.S.STACHLEWSKA, R. NEUBER
Alfred-Wegner-Institut for Polar and Marine Research, Potsdam, Germany
e-mail: istachlewska@awi-potsdam.de

V. SHCHERBAKOV
Insitut of Physics, Minsk, Belarus

Keywords:
field campaign ASTAR 2004, feeder-seeder observations, airborne lidar, in situ cloud particle properties

ABSTRACT

During the international ASTAR experiment (Arctic Study of Aerosols, Clouds and Radiation) carried out from Longyearbyen (Spitzbergen) from 10 May to 11 June 2004, the AWI Polar 2 aircraft was equipped with an unique combination of remote and in situ instruments. The airborne AMALI lidar provided downward backscatter profiles at 1064 and 532 nm wavelengths with the depolarization ratio at 532 nm. The in situ instrumental setup comprised a Polar Nephelometer, a Cloud Particle Imager (CPI) as well as a Nevzorov and standard PMS probes to measure cloud particle properties in terms of scattering characteristics, particle morphology and size, and in-cloud partitioning of ice/water content.

The objective of the communication is to present the results of a case study related to a feeder-seeder observation with ice crystals precipitating down to supercooled boundary layer stratocumulus. The flight pattern was predefined in a way that firstly the AMALi lidar probed the cloud tops to guide the in situ measurements into a particular cloud formation. Three kinds of clouds with different microphysical and optical properties have therefore been quasi-simultaneously observed: precipitating ice crystals, mixed-phase cloud and water layer cloud with large drops. The signatures of these clouds are clearly evidenced from the in situ measurements and from the lidar profiles in term of backscatter and depolarization ratio. Accordingly, typical Lidar ratios (backscatter to extinction ratio) are derived from the measured scattering phase function combined with subsequent particle shapes and size distributions. The remote extinction profiles can therefore be retrieved under favourable conditions of low optical density and compared with the direct in situ measurements. This experimental strategy prefigures the method to be carried out during the next ASTAR experiment in 2006 for the validation of the CALIPSO satellite cloud observations.

128

Long-Term Measurements of Arctic Trace Gases in Ny-Alesund Spitsbergen by Fourier Transform Infrared Spectroscopy; Effects of Biomass Burning Emissions

Voltaire Velazco[1], Justus Notholt[1], Thorsten Warneke[1] and Otto Schrems[2]

[1]Institute of Environmental Physics, University of Bremen, Germany
[2]Alfred Wegener Institute for Polar and Marine Research, Bremerhaven Germany

Atmospheric trace gas measurements are being conducted at the NDSC (Network for the Detection of Stratospheric Change) station in Ny-Alesund, Spitsbergen (79°N, 12°E) since 1992 using a Fourier Transform Infrared (FTIR) spectrometer. Vertical concentration profiles and total columns of about 20-30 different trace gases can be determined. This technique also allows the determination of vertical profiles of a few trace gases up to approximately 30 km with a vertical resolution of about 4 km. Observed trace gases include CO, HCL, C_2H_6, C_2H_2, CH_2O and COS. Long-term measurements reveal dramatic enhancements of CO concentration profiles during intense biomass burning events. Biomass burning also influences the concentration of other trace gases such as HCN and C2H6, which also shows enhanced column concentrations in phase with forest fire events. Biomass burning emissions have profound influences on the composition of the arctic atmosphere by transporting pollutants from lower latitudes to the Arctic. With high-resolution measurements of the vertical concentration of trace gases, we can gain more information on the transport of pollution and its effects on the fragile Arctic atmosphere.

129

Investigation of how observed methane concentrations in Ny-Ålesund are influenced by atmospheric flow patterns

Ine-Therese Pedersen[a,b] and Kim Holmén[b]

[a] *Department of Meteorology, Stockholm University (MISU), S-106 91 Stockholm, Sweden.*
[b] *Norwegian Institute for Air Research (NILU), N-9296 Tromsø, Norway.*
E-mail: itp@nilu.no

Methane is an important greenhouse gas and a key molecule in tropospheric photochemistry. The global burden of atmospheric methane has risen dramatically since the preindustrial era, and recent measurements show global methane mixing ratios continuing to rise although the rate of increase has slowed over the past decade. Numerous factors influence the methane concentration at Zeppelin station. A 4-year trajectory climatology of long-range atmospheric transport to Svalbard has been used to study how the atmospheric flow patterns influence the observed methane at the Zeppelin station (475 m.a.s.l.) in Ny-Ålesund (78°58′ N, 11°53′ E). The flow patterns were determined by calculating 5-day back-trajectories arriving at Ny-Ålesund twice a day (00 and 12 UTC) for the period 2000-2003. We studied trajectories arriving at pressure level 850 hPa. They were classified into transport patterns through the use of cluster analysis. The calculated clusters provide an indication of source regions and transport pathways during the year. Eight cluster patterns were obtained and used in the analysis of the continuous methane measurements from a GC FID at Zeppelin station. The trend and seasonal variation were subtracted from the dataset to identify methane anomalies for Ny-Ålesund. These anomalies have been analysed in the different cluster patterns and for all seasons. Elevated levels of methane are mainly seen in clusters with transport from Europe and Russia compared to transport within the Arctic Basin. This can be expected since some of the largest sources of methane are in the regions of Europe and Russia and in wintertime and long-range transport of pollutants towards the Arctic are more common. The vertical motion of the trajectories have been investigated and show that the highest positive anomalies are associated with trajectories that have been in contact with the surface before arriving in Ny-Ålesund. This is consistent with previous similar studies of CO_2 and of other anthropogenic species. Some seasonal variation in trajectory frequency can be seen although periods studied here are far too short for definite conclusions. More and longer time series are needed to better understand the sources and transport of methane in the Arctic.

Keywords : methane; Arctic; tropospheric photochemistry; trajectory; Svalbard

130

A new light-weight balloon borne optical sensor for measuring vertical profiles of stratospheric trace gases

M. Wolff, A. Herber, H. Gernandt, W. Ruhe, J. Hoops, O. Schrems, and S. Okano

In order to measure simultaneously vertical profiles of ozone and further trace gases (e.g. NO_2), which are relevant in stratospheric ozone chemistry, we have developed a new balloon-borne optical sonde. Its measuring principle is based on the detection of sun light intensity with a miniature spectrometer over a wide wavelength range (200 – 850 nm) during the ascent. Four new sondes were successfully launched during a first measurement campaign in June 2004 at the German Polar Research Station Koldewey, Ny-Ålesund, Svalbard.

A control unit in the sonde evaluates and preprocesses the data already on-board. Every ten seconds parts of the measured spectrum, meteorological values, and GPS information are transmitted to the ground. Height-dependent column densities of the considered trace gases can be determined using radiative transfer calculations and their inversion leads to the vertical concentration profiles.

The implementation of new light-weight components and innovative techniques results in a payload weight of 2 kg, thus reaching up to 40 - 45 km altitude with comparable small balloons. It can be operated by a two men team and is suitable for field-work with limited logistic possibilities.

The new sonde closes the gap between the electrochemical sonde ECC, the world-wide standard for routine ozone measurements, and sophisticated optical sensors used on large size stratospheric balloons. Due to the necessary logistics, these balloon experiments are very expensive and can only be carried out from special balloon launching facilities.

We will present the detailed measurement concept, and show trace gas profiles up to 42.5km, obtained during the Arctic campaign.

131

The radiation budget of the atmosphere over the Arctic computed from the ISCCP data set

E. Raschke
University of Hamburg, Germany
Visiting Professor at the NIPR Tokyo
and
M. Shiobara, M. Wada and T. Yamanouchi
National Institute for Polar Research, Tokyo

It is the non-uniform distribution of the gain of solar radiative energy over the globe which drives all circulation processes within the atmosphere, where local and regional redistributions are responsible for respective particularities. As a final result of this steady force and redistribution, both polar regions occur as steady sinks of radiative energy loosing more energy to space than they gain, whereas the regions equatorward of about 35 degrees latitude are the corresponding surplus regions.

This principle spatial structure of the planetary radiation budget over the entire globe is known for many decades from early climatological studies and later also confirmed by respective satellite data. The latter provided interesting and very new regional details and allowed in particular estimates of the cloud effects. However more recent analyses of concurrent satellite and direct observations allow also detailed computations of the radiation budget components at ground and consequently also of the vertical divergence within the atmosphere as well as the effect of cloud fields on all these quantities with spatial and temporal details of better than 200 km and weeks, respectively. The uncertainty ranges for fluxes at TOA and at the surface are still high and range between 10 to 10 Wm^{-2}.

In this study we present such results, which are obtained within the International Satellite Cloud Climatology Project (ISCCP), with a regional resolution of about 250 km and for the four seasons. Particular details are discussed for the Arctic area. Their components at ground are compared with direct measurements at stations of the Baseline Surface Radiation Network (BSRN) at also of other networks whose data are compiled in the Global Energy Budget Archive (GEBA). Considerable disagreement is still found between satellite derived and measured data sets calling for more intensive validations.

In general we found, that all clouds in this region reduce on the one side the loss of infrared radiative energy to space. On the other side they enhance only by small amounts (between about 3 and 6 Wm^{-2}) the absorption of solar radiation over both poles. There are significant seasonal variations, where during the northern summer the arctic region at ground is considerably heated by radiation which explains in part the known seasonal retreat of the sea ice.

Various regional and temporal details are unfortunately not reproduced by climate models leaving much room for their further improvement. Both the models and our data set do not consider the various direct and indirect effects of aerosols on the radiative transfer characteristics of cloud fields, where in particular the absorbing aerosol components are not considered.

132

Sensitivity of hydrological conditions to climate change in Siberian tundra

Tetsuo Ohata[1] , Hiroyuki Hirashima[2] ,Hironori Yabuki[1] and Yoshiyuki Ishii[3]
1: Institute of Observational Research for Global Change, JAMSTEC, Yokosuka, Japan.
2: Snow and Ice Research Group, National Research Institute for Earth Science and Disaster Prevention, Nagaoka, Japan.
3: Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan.

Specific vegetation exists on the surface and there are sub-surface structure occurring from existence of permafrost in tundra regions. They affect the hydrological cycle through determining the evaporation and sub-surface runoff processes. One concern is the variability of hydrological cycle in these regions through The authors has been studying these issues since 1997 under the GAME-Siberia project and Frontier project in JAMSTEC. Most of such studies have been made in the tundra regions of North American Continent, but the present study is the first time for Siberian tundra. In the present presentation, the general conditions of hydrological cycle in Siberian tundra, development of land hydrological model and variability of hydrological cycle will discussed. The study was made near a drainage at Tiksi, near the mouth of Lena River facing the Arctic Sea.

As for the general conditions, inter-annual variability of hydrological terms (precipitation, evaporation, runoff, storage) will be shown based on observation. Year to year stability of evaporation, peculiar behavior of seasonal variation of runoff will be discussed.

Land hydrological model was developed to be applicable to annual cycle including winter and summer season. Most of the basic processes were taken from various studies made by past studies. Importance of winter redistribution of snow due to strong wind conditions and high sublimation amount was shown. Simulation of sensitivity of hydrological cycle due to global warming using IPCC scenarios shows different tendency than generally discussed for mid latitudes.

133

A study on Arctic mesosphere and lower thermosphere tidal dynamics by meteor, EISCAT and other radar observations

Takehiko Aso*, Masaki Tsutsumi* and Chris Hall**
* National Institute of Polar Research, Itabashi, Tokyo, 173-8515, Japan and ** Tromsø Geophysical Observatory, University of Tromsø, N-9037, Tromsø, Norway

During last several years, an intensive study has been made in the Arctic area on the mesosphere and lower thermosphere dynamics of wind and waves by running meteor radars in close collaboration with EISCAT and other atmospheric radars at polar regions. Throughout the observations over the years, both short-term variabilities and climatological features of atmospheric tide have been made clear, including very well-defined seasonal contrast of diurnal component and inherent variability of semidiurnal and short-period tidal components at polar latitudes. One of the interesting results includes the inferred asymetry in the behavior of semidiurnal component in summer time due possibly to the disparity of stationary planetary wave activity at lower heights in the opposite winter polar regions. Details will be presented at the meeting.

134

Day-to-day Variations of the diurnal and semidiurnal tides in the MLT region simulated by a GCM

Yasunobu Miyoshi (Kyushu University)
and
Hitoshi Fujiwara (Tohoku University)

The diurnal semidiurnal tide plays important role on the general circulation of the atmosphere in the mesosphere and lower thermosphere (MLT). A new general circulation model (GCM) which contains the region from the ground surface to about 500 km height has been developed and used to investigate behavior of the diurnal and semidiurnal tides in the MLT region. We investigate day-to-day variations of the diurnal and semidiurnal tide in the MLT, and their relation with variations of the general circulation in the lower atmosphere. The results indicate that day-to-day variations of the diurnal and semidiurnal tide amplitudes are closely related with variations in the general circulation in the troposphere and lower stratosphere. Effects of solar cycle variations on the behavior of the diurnal and semidiurnal tides in the mesosphere and thermosphere are also examined.

135

Gyroharmonic effects in HF radio induced optical emissions

Bjorn GUSTAVSSON
Swedish Institute of Space Physics

Abstract

Optical emissions and incoherent scatter radar data obtained during high frequency (HF) electromagnetic pumping of the ionospheric plasma from the ground give data on electron energization in an energy range from 2 to 100 eV. Optical emissions at 427.8 nm from N_2^+ require electrons with energies above the ionization energy of 18 eV and give the first images ever of pump-induced ionization of the thermosphere. The optical emission intensity at 427.8 nm is asymmetric around the ionospheric electron gyro-harmonic as seen when the pump frequency is stepped in small steps around the gyro-harmonic, being stronger above the gyro-resonance. This contrasts with emissions at 630.0 nm from OID requiring significantly lower electron energies and of electron temperature enhancements, which both have a minimum at the gyro-harmonic but no apparent asymmetry. The present direct evidence of pump-induced ionization contradicts previous indirect results that indicated ionozation when the pump frequency was below the gyro-harmonic.

Abstracts

Poster session

P-01

The Joint French – German Arctic Research Platform on Spitsbergen

Roland Neuber[1] and Franck Delbart[2]

[1]Alfred-Wegner-Institut for Polar and Marine Research (AWI)
[2]Institute Polaire Francais Paul Emile Victor (IPEV)

Germany and France both have a long record of polar research enterprises on Spitsbergen, which date back to the early 20th century. During recent years, both France and Germany have established modern polar research stations in Ny-Ålesund, Kongsfjord, on Spitzbergen. Since May 2003 AWI and IPEV, the operators of the German and French stations in the Ny-Ålesund area, have joined their highly complementary activities and have formed the Joint French – German Arctic Research Platform. It combines in a joint administration the Koldewey, Rabot and Corbel stations in Ny-Ålesund and Kongsfjorden.

The platform facilitates a wide range of research activities and a rich observational programme. Research facilities are dedicated to the areas of marine and terrestrial biological, atmospheric, geophysical, and glaciological sciences. Most of the research topics are related to various aspects of Climate Change and its effects on the biota.

Building on the infrastructural support which is provided in Ny-Ålesund by Kings Bay AS, the platform is concentrated on providing offices, various laboratories and instrumentation for short term projects, as well as dedicated observatories for a range of long term measurements of environmental and climate parameters. Today, up to 24 scientists can work simultaneously on the platform. They are supported by two – three station staff, who work permanently in Ny-Ålesund, and by additional personnel from AWI and IPEV, who work temporarily on site.

The following are the main, but not exclusive research areas:

Climate change
The atmospheric monitoring systems for climate parameters, ozone and UV radiation provide a continuous data record since 1991. They comprise the atmospheric observatory, which constitutes a "Primary Station" within the Network for the Detection of Stratospheric Change (NDSC) and which contributes to the WMO programmes GAW and BSRN. In addition, geophysical observatories of seismic activities, and of permafrost parameters are operated.

Atmospheric chemistry
Investigations of the chemical properties of the atmosphere in the Arctic, dealing with anthropogenic pollutants and their transformations, as well as the reaction of atmospheric trace gases with the snow and ice layer. Such topics are mainly carried out at the new Clean Air station "Jean Corbel", which is located a few kilometres up the fjord from Ny-Ålesund.

Marine biology
Investigations of the effects of increased UV radiation on marine life in the Kongsfjord have been a large research topic recently and have significantly contributed to the understanding of the ecosystem of Kongsfjorden. AWIPEV platform supports the new international marine biology laboratory in Ny-Ålesund.

Terrestrial biology and geomorphology
Studies on bird ecophysiology, and energy consumption during incubation and chick feeding period are running since 1998 on two species. Recent morains re-colonisation by plants, linked notably with local geomorphology dynamic processes are also yearly studied.

For additional information and how the platform can serve your research needs, please visit
http:// www.ipev.fr/awipev
or contact R. Neuber or F. Delbart at awipev@awi-potsdam.de

P-02

Present and LGM climate in the Arctic: interaction of ocean and glaciation

Savoskul, Oxana S.

Institute of Geography, Russian Academy of Sciences, Staromonetny 29, Moscow, Russia. E-mail: osavos@yandex.ru

The most prominent feature of the present glaciation of Arctic is an extroordinary assymentry of the geographic distribution of the ice masses. The overwhelming part of the Arctic ice is concentrated in a huge ice sheet covering Greenland, that is located in relatively low altitudes. A number of significantly smaller ice caps found on the archipellagoes to the east and to the west, are located much further to the north. To the east from 110°E and to the west from 110°W there are no ice masees, exept for the alpine glaciers in Alaska, Chukotka, and Kamchatka. The sectorof the ice cap occurence roughly mark the areas with high precipitation, while the area of the lowest annual temperatures and relatively modest precipitation in the northern hemisphere is in Easter Siberia, i.e. in an opposite sector of the Arctic, marked by the broad distribution of perennial permafrost. During the LGM, the ice masses distribution was characterised by a drastic assymetry as well. The vaste continental ice sheets were covering large parts of North America and Europe, but the major part of Asia was free from ice or hosted only relatively modest alpine glaciation. The pattern of precipitation and temperature fields was assymetric too: the highly precipitated was the area adjacent to the North Atlantic, the fields of the minimal temperature were associated with the central parts of the continental ice sheets and, like at present, the Eastern Siberia.

Since present climate can be considered representative of an interglacial, while LGM represents a typical glacial stage, one may conclude, that the assymetry of precipitation and temperature fields in the Arctic is a persistant climate feature peculiar to the Northern hemisphere throughout the entire glacial-interglacial cycle. The other prominent feature of the Arctic climate which is in sharp contrast with Antarctic is instability of the climate during glacial – interglacial cycle. In present paper, possible mechanisms that could lead to this geographic abnormality are discussed. The principle discussion follows several lines: climate – glaciation interaction, influence of the marine ice cover, influence of the ocean circulation, ocean – glaciation interaction, distribution and shape of the land masses in northern hemisphere.

P-03

Analysis of ^{7}Be, ^{210}Pb, ^{210}Po and ^{137}Cs air concentrations in Ny-Alesund (Svalbard) and during Arctic Ocean 2004 Expedition (CHIMERPOL project)

Olivier MAGAND [†], Christophe FERRARI [†], Pierre-Alexis GAUCHARD [†], Xavier FAIN[†] & Pierre AMATO [§]

[†] *Laboratoire de Glaciologie et Géophysique de l'Environnement du CNRS, Grenoble, France*
[§] *Laboratoire de Météorologie Physique du CNRS, Université Blaise Pascal (Clermont-Ferrand II), Aubière, France*

One of the main goal of the CHIMERPOL program is to discriminate the key physical and chemical parameters occuring during Atmospheric Mercury Depletion Events (AMDE), and this, through the monitoring of gazeous elemental mercury, ozone, particulate mercury, and particles and/or aerosols of different sizes. The AMDE origin is studied, with a particular attention to back-trajectories of the air masses in order to determine the geographical origin of depleted mercury air masses, but also thanks to radioactive tools.

During the 2004 campaign (artic spring corresponding to artic haze build-up), aerosol samples were collected from 14 April to 07 May 2004, every 12 hours, in Ny-Alesund (78°56'N – 11°52'E; 10m asl), Svalbard (with the logistic support of IPEV-AWI). The samples were analyzed for ^{210}Pb and ^{7}Be radioactivities, by gamma spectrometry using a very low background germanium detector (germanium diode N type) (Pinglot and Pourchet, 1994). Alpha emitter ^{210}Po was also analyzed by Alpha spectrometry. From ancillary information on the synoptic structures associated with transport and trajectory analysis, along with concentrations and activity ratios of ^{210}Pb, ^{210}Po and ^{7}Be, we will expect to get better insight on the sources of air masses in Arctic atmosphere in Svalbard, and we will try to determine the main factors that will influence ^{7}Be and ^{210}Pb distributions.

Measurements were also carried out on board of RV "Polarstern" during a cruise from Bremerhaven (Germany) to the North Atlantic between June and August 2004 (ARK – XX /1+2). The cruise comprised latitudes from 54°N to 85°N including a cross section on 75°N from 16°E to 16°W (Greenland Sea) and at 78°N (Fram Strait). The preliminary observations of airborne ^{210}Pb and ^{7}Be are reported in the following.

P-04

Investigation of minor atmospheric mercury depletion events observed at Zeppelin, Ny-Ålesund, in early and late spring 2003.

Lucas Girard – Master student at the *University Centre on Svalbard (UNIS)* and the *Norwegian Institute for Air Research (NILU)* (lucasg@unis.no)
Torunn Berg (NILU, tbe@nilu.no), **Lars R. Hole** (UNIS, larsh@unis.no)

Mercury (Hg) is a major pollutant of the arctic environment. High concentrations of Hg, tending to increase have been detected in arctic marine ecosystems as well as in the native populations of the arctic regions (AMAP 2002). Atmospheric mercury depletion events (AMDE), which were first observed in the spring 1995 at Alert, Canada (Schroeder *et al.*, 1998), are likely to participate in the elevation of mercury concentrations in the arctic.

At the Zeppelin station, close to Ny-Ålesund, AMDEs have been studied since 2000, using continuous measurements of gaseous elemental mercury (GEM) and manual measurements of AMDE products (reactive gaseous mercury RGM, particulate mercury (Hg-P) and total mercury in snow) released during the spring campaign in April-May. The major depletion events have been investigated and discussed in Berg *et al.* (2003a and 2003b) more recently in Gauchard *et al.* (2004). This study is focussed on the minor depletion events of 2003, from early and late spring, which have not been investigated yet.

Four depletion events were identified (01/04 (1), 09/04 (2), 16/05 (3), 25/05 (4)) and their characteristics were discussed using meteorological data (both local and surface analysis), backward trajectories (Hysplit) and BrO maps (IUP Bremen). On the whole, the depletions from early spring (1 and 2) happened to be the result of more local chemistry than the depletions from late spring (3 and 4).

According to back trajectory calculations, BrO maps, and surface analysis, the reactions leading to depletions 1 and 2 probably occurred in the area around Svalbard, possibly extended to Fram Strait (between north-east Greenland and Spitsbergen) and Franz Joseph islands. Depletions 3 and 4 are likely to be transport events, resulting of the advection of air masses that reacted around north-west Greenland 3 or 4 days before arriving in the Svalbard area. The late events (second half of May) being the result of transport chemistry, the possibility of a longer "AMDE season" elsewhere is discussed.

No correlation was found between GEM and particle variations (particle data from the DMPS instrument at the Zeppelin station). The annual mean concentration of GEM at Zeppelin is 1.60ng/m^3 for 2003, which is in the range of the previous observations (Berg *et al.*, 2003b). No trends in the GEM concentrations have been observed at Zeppelin during the whole measurement period (1995-2003).

References

AMAP (Arctic Monitoring and Assessment Programme), 2002. www.amap.no

Berg, T., Sekkesæter, S., Steinnes, E., Valdal, A.-K., and Wibetoe, G. 2003a. **Springtime depletion of mercury in the European Arctic as observed at Svalbard.** *The science of the Total Environment*, 304, 43-51.

Berg, T., Sommar, J., Wängberg, I., Gardfeldt, K., Munthe, J., and Schroeder, B. 2003b. **Arctic mercury depletion events at two elevations as observed at the Zeppelin Station and Dirigible Italia, Ny-Ålesund, spring 2002.** *J. Phys. IV France*, 107, doi: 10.1051/jp4:20030265.

Gauchard, P.-A., Aspmo, K., Temme, C., Steffen, A., Ferrari, F., Berg, T., Ström, J., Dommergue, A., Bahlmann, E., Magnand, O., Planchon, F., Ebinghaus, R., Banic, C., Nagorski, S., Baussand, P. and Boutron, C. 2004. **Characterizing atmospheric mercury depletion events recorded during an international study of mercury in Ny-Ålesund, Svalbard, spring 2003**. *Submitted to Atmospheric Environment*

Schroeder, W. H., Anlauf, K., Barrie, L. A., Lu, J. Y., Steffen, A., Schneeberger, D. R., and Berg, T. 1998. **Arctic springtime depletion of mercury.** *Nature*, 394, 331-332.

P-05

Temporal and spatial variations of oceanic partial pressure of CO_2 and air-sea CO_2 flux in the Greenland and Barents Seas

S. Nakaoka[1], S. Aoki[1], T. Nakazawa[1], H. Y. Inoue, S. Morimoto[2], G. Hashida[2]

[1] Center for Atmospheric and Oceanic Studies, Tohoku University, Sendai, 980-8578

[2] Marine and Atmospheric Chemistry, Hokkaido University, Sapporo, 060-0810

[2] National Institute of Polar Research, Tokyo 173-8515

In order to elucidate seasonal and interannual variations of oceanic CO_2 uptake in the arctic part of the Atlantic Ocean, the partial pressure of CO_2 in the surface ocean (pCO_2^{sea}) have been measured in the Greenland and Barents Seas during the period from 1992 to 2001 by using the Norwegian research vessel LANCE and a fishery boat. Because the observed data covered only limited areas and periods, we tried to reconstruct temporal and spatial distributions of pCO_2^{sea} using the relationship between pCO_2^{sea} and SST. Although SST is a good predictor for pCO_2^{sea}, the pCO_2^{sea}-SST relationship varied temporally within time scale of a few months. Therefore we reconstructed pCO_2^{sea} distributions from SST data of NCEP/NCAR reanalysis using seasonally different pCO_2^{sea}-SST relationships, and then calculated distributions of air-sea CO_2 flux.

The reconstructed pCO_2^{sea} was lower than pCO_2 in the atmosphere (pCO_2^{air}) throughout the year, and annual air-sea CO_2 fluxes in the Greenland Sea and the Barents Sea were evaluated to be 52 ± 31 and 46 ± 27 gC m^{-2} yr^{-1}, respectively. The maximum air-sea CO_2 flux occurred in winter and minimum in summer. Consequently, oceanic CO_2 uptake was estimated to be 0.055 ± 0.033 GtC yr^{-1} for the area covered by this study (70-80°N, 20°W-40°E).

We found that annual mean CO_2 uptake varied positively with North Atlantic Oscillation Index (NAOI). According to our analysis, NAOI affected positively in the wind field in this area and negatively in ΔpCO_2 (= pCO_2^{aie} - pCO_2^{sea}) and areas of sea ice cover. As a result of competition of these variables, the interannual CO_2 uptake correlated positively with NAOI. The result indicates that the wind speed plays a major role in determining the interannual variation of CO_2 uptake in this area, and to some extent ΔpCO_2 and areas of sea ice cover.

P-06

Distribution of carbonyl sulfide (COS) concentration in the troposphere and lowermost stratosphere between Japan and the Arctic observed by Arctic Airborne Measurement Program 2002 (AAMP02)

Y. Inomata[1)], S. Morimoto[2)], Y. Iwasaka[1)], M. Wada[2)], T. Yamanouchi[2)]

1) Nagoya University, Division of Earth and Environmental Sciences, Nagoya

2) National Institute of Polar Research, Tokyo

In order to investigate the transport and exchange of COS in the troposphere and lowermost stratosphere under the presence of the polar vortex, air samples were collected between Japan (35°N, 135°E) and Spitsbergen (78°N, 15°E) on 5-14 March 2002 during the Arctic Airborne Measurement Program 2002 (AAMP02). Measurement of COS was performed by cold trap–GC–FPD (Shimadzu GC–8A) analysis system. The air volumes were 1000–1800 mL. The standard deviation of duplicate analysis of air samples was ± 6 %. Isentropic backward trajectories, potential vorticity, and O_3 concentrations are used to interpret the distribution of COS. The concentrations of COS in the lowermost stratosphere over Spitsbergen and Barrow (72°N, 157°W), where the regions were located inside the polar vortex, were decreased with increasing altitudes. The vertical gradient of COS concentrations over Spitsbergen was steeper compared with those measured over Barrow. The difference should indicate that air masses subsidence in the polar vortex has significant effect on distribution of COS concentrations. The latitudinal distribution of COS concentrations between Japan and Spitsbergen at altitudes 11-13 km were highly fluctuated. The relationship between COS and O_3 concentration suggest that concentrations of COS in the lowermost stratosphere are influenced by the horizontal transport of tropospheric air masses and by the downward transport of upper stratospheric air masses.

P-07

Vertical structure in air temperature of the arctic lower troposphere sounded by dropsonde observation related to AAMP 2002

Naohiko Hirasawa, Makoto Wada and Takashi Yamanouchi
National Institute of Polar Research, Kaga 1-9-10, Itabashi,
Tokyo 173-8515, Japan

In the AAMP (Arctic Airborne Measurement Program) 2002 held in late winter of 2002, we carried out dropsonde observation approximately every 5° in latitude. The vertical structure in air temperature from Barrow through the north pole to Svalbard is presented here. In comparison with those from objective analysis data, some finer structure can be seen especially in the lower troposphere.

The highest temperature in the arctic lower troposphere appears around the level of 900 to 800hPa (Fig.1). In the European Arctic a temperature inversion layer appears below about 900hPa (the profile E85). In the Alaskan Arctic, on the other hand, two layers of inversion around 900hPa and near surface appear (A85). This character is commonly seen other two points at 80N and 75N (not shown). The feature of the difference between the European and Alaskan Arctic might reflect those of surface condition or atmospheric circulation in whole troposphere such as position of polar vortex.

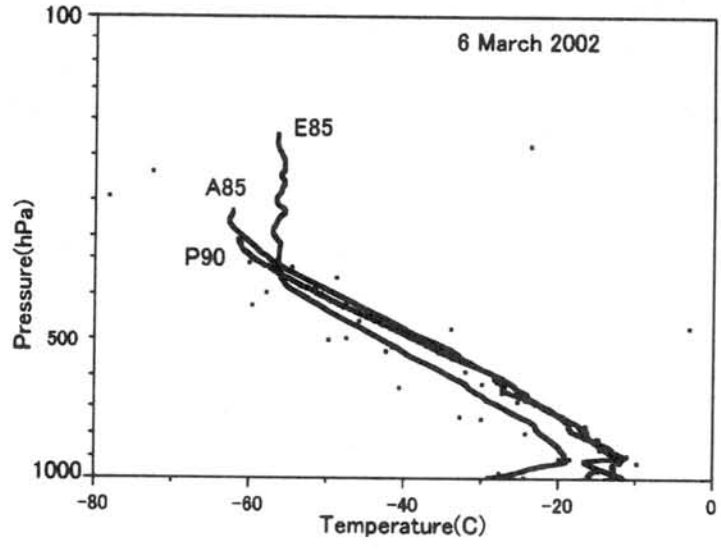


Figure 1. Air temperature profiles sounded by dropsonde observation on 6 March 2002. The sounding points here are 85N and 155W (A85), north pole (P90) and 85N and 25E (E85).

P-08

Influence of Sea Ice Ridges and Polynyas on the Structure of the Polar Atmospheric Boundary Layer

- Third International Symposium on the Arctic Research, Tokyo, 2005 -

Thomas Garbrecht[1], Jörg Hartmann[2], Christof Lüpkes[2], Timo Vihma[3]

[1] *OPTIMARE Sensorsysteme AG, Bremerhaven, Germany*
[2] *Foundation Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany*
[3] *Finnish Institute of Marine Research, Helsinki, Finland*

Observations by aircraft and by ship as well as process studies with mesoscale models have been carried out over the Storfjord region and the central Arctic ocean to study the influence of ice ridges and leads on the near surface boundary layer.

In the central Arctic, observations of turbulent fluxes of momentum and heat were obtained during the summer 1996 cruise of RV Polarstern from a bow mast with 5 sonic anemometers. The measurements have been used to verify and improve a parameterisation of the vertical turbulent fluxes of momentum over sea ice, which is based on the drag partitioning concept by Arya (1975). It expresses the total drag as the sum of a skin drag and of a form drag caused by ridges. This parameterisation was extended from adiabatic to diabatic conditions. The observations over leads clearly show that an internal boundary layer develops over open water. Both upward and weak downward heat fluxes were observed, the latter during conditions with a sea surface temperature close to 0^0 C and water of -1.8^0 C.

On March 16, 1998, simultaneous airborne measurements of atmospheric turbulence and ice ridge statistics were performed with the polar research aircraft Polar2 over compact ice cover Southeast of Svalbard. Along a flight track of 150 km, the ice ridge statistics changed from mean ridge heights of 0.35 m and mean distances of 30 m to mean values of 0.6 m and 10 m, respectively. This increase of the sea ice roughness is reflected by increasing atmospheric turbulence along the flight track. Measured drag coefficients are in very good agreement with parameterised values, even for diabatic conditions that occured during the flight.

The parameterisation of the form drag was implemented to mesoscale models, and the influence of the form drag on the wind field, temperature field, and on the surface fluxes was studied. It was found that the form drag of ice ridges has a strong influence on the structure of the entire boundary layer.

Contact:

Dr. Thomas Garbrecht, OPTIMARE Sensorsysteme AG,
Am Luneort 15a, D - 27572 Bremerhaven,
Germany

Email: thomas.garbrecht@optimare.de
Fon: ++49 - 471 - 4836121
Fax: ++49 - 471 - 4836111

P-09

MONITORING OF ACID PRECIPITATION IN CENTRAL YAKUTIA (RUSSIA)

V.N.Makarov
Institute Permafrost Resirch, Yakutsk, Russia

In the last 20 years acid precipitations in many countries of the world (Northern America, Eastern and Western Europe, China, Korea, Japan) has become not just a curious scientific matter, but a serious problem that causes anxiety and considerable debates of the whole society. Problems that are connected with possible unfavourable effects of them are not restricted by several individual confined territories, but they are of regional, national and international importance. Acid deposition, trace gases and some products of their chemical reactions are thought to have a wide range of adverse impacts. Among the possible environmental consequences are harmful effects on human health, acidification of surface waters and soils, decrease in forest productivity, erosion and corrosion of industrial materials, and lessening of atmospheric transparence.

The results of monitoring acid precipitations showed that subacid-alkalescent precipitations, acidity of which varies in close limits (pH 5,89 - 7,36) prevail in Yakutsk region. Acidity of solid precipitation is very similar to acidity of rain precipitations and comprises 6,70-7,22 for operating pH of rain precipitations (6,85 in average) and 5,89 - 7,36 for solid precipitations (6,71 in average). The most considerable deviations of acidity-alkalinity of solid precipitation from the average value are observed at the beginning and in the middle of winter period: maximal acidity in October (pH=5,89) and maximal alkalinity in December and January (pH=7.32-7.36).

Those pH values for atmospheric precipitations that were observed in Yakutsk are close to the values that were observed in Ulan-Bator's station (Mongolia).

Increased pH values in atmospheric precipitations are due to high concentration of carbonate in aerosols and atmosphere dust in Central Yakutia. The content of Ca and Mg carbonates in atmospheric aerosols in this region is tens and hundred times higher then, for example, in central regions of Alaska. The reason of this is a specific character of industrial processes geochemistry as well as an increased concentration of carbonates and halogens in natural aerosols due to specificity of geologic profile, which has a lot of carbonate and halogen formations.

According to the monitoring results we made an evaluation of the value of chemical components fall-out in atmospheric precipitations. Annual inflow of H^+ ions from atmosphere to the earth surface is much less then critical load for the forest and water ecosystems. Maximal values of sulfur compounds (0,51 г/м^2) and nitrogen (2,07 г/м^2) fall-out at the monitoring station fall on June and exceed ecostandard and parameters of ecological emergency situation in a volume of nitrogen precipitations.

P-10

The Arctic MPL measurement at Ny-Aalesund for ground truth of the ICESat/GLAS cloud and aerosol measurements

M. Shiobara[1)], M. Yabuki [1)], R. Neuber[2)], J.D. Spinhirne[3)], E.J. Welton[3)], J.R. Campbell[3)], T.A. Berkoff[3)], and W.D. Hart[3)]

1) National Institute of Polar Research, Kaga 1-9-10, Itabashi-ku, Tokyo 173-8515, Japan
2) Alfred Wegener Institute for Polar and Marine Research, Telegrafenberg A43, Potsdam D-14473, Germany
3) NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA

Abstract

It is generally recognized that clouds and aerosol have important roles in the global climate system due to their radiative effects to the earth's radiation budget. Remote sensing is a good technique to know physical and optical properties of clouds and aerosol. And further the active remote sensing is more powerful and coming popular not only for ground based but also satellite measurements.

Geoscience Laser Altimeter System (GLAS) is a single sensor on board the Ice, Cloud and Land Elevation Satellite (ICESat), and was successfully launched on 12 January 2003. The lidar observation by a near-polar orbit with an inclination of 94 degrees provides a global coverage of vertical profiles of clouds and aerosol including polar regions. GLAS has two channels of 532 and 1064 nm. Data products include thin cloud and aerosol optical depth. GLAS data validation issues include the sensitivity of cloud detection and optical depth accuracy.

Micro-pulse Lidar (MPL) is a portable laser radar system to acquire long-term datasets of backscatter profiles of clouds and aerosol. Intended for monitoring the vertical structure and optical properties of clouds and aerosol in bi-polar regions, we are operating MPLs at Ny-Aalesund, Svalbard in the Arctic and at Syowa Station, Antarctica. These sites are part of the NASA Micro-Pulse Lidar Network (MPLNET). The Arctic MPL is placed at the German Koldewey Station in Ny-Aalesund (79N, 12E) since June 2003. The Arctic MPL measurement includes GLAS overpasses in 2003 and 2004. For the overpass experiment, ICESat pointed directly to the Ny-Aalesund site when within five degrees off nadir. And then simultaneous measurements of clouds and aerosol from MPL and GLAS were successfully performed for 6 overpasses over Ny-Aalesund. In this paper, preliminary results from the Arctic MPL measurement will be shown and discussed for ground truth of the ICESat/GLAS cloud and aerosol measurement.

P-11

Characteristics of cloud distribution from All-Sky Camera and Micro-Pulse Lidar measurements at Ny-Alesund

Masanori Yabuki [1], Masataka Shiobara[1], Makoto Wada,
Takashi Yamanouchi [1], Daiki Kobayashi [2], and Roland Neuber [3]

1) National Institute of Polar Research, Kaga 1-9-10, Itabashi-ku, Tokyo 173-8515, Japan
2) Hokkaido University, Kita 13 Nishi 8, Kita-ku, Sapporo 060-8628, Japan
3) Alfred Wegener Institute for Polar and Marine Research, Telegrafenberg A43, Potsdam D-14473, Germany

Abstract

In order to investigate the characteristics of cloud distribution over Arctic, simultaneous measurements with All-Sky Camera and Micro-Pulse Lidar (MPL) were started at Ny-Alesund (79N, 12E) on March 2004. Fine distributions of clouds and their temporal changes were observed by All-Sky Camera with a 10-min interval and MPL with a 1-min average. On the basis of these measurements, we attempted the estimation of the cloud properties such as the cloud base height, the cloud amount, the thin cloud optical thickness and the cloud type. Results from the preliminary analysis indicated some differences of cloud properties between spring and summer. Some features obtained in this study are as follows: the mean cloud cover ratio on March and July is 0.6 and 0.8, respectively. Low-level stratus clouds were observed particularly in summer. On the other hand, frequency of clear sky days is relatively high and higher clouds such as cirrus clouds are rather dominant in spring. The ratio of the optically thin cloud of which optical thickness is less than 0.5 is also predominant in early spring.

P-12

Seasonal variation of precipitating clouds at Ny-Ålesund, Arctic

Hiroyuki Konishi (Osaka Kyoiku Univ.) and Makoto Wada (NIPR)

Seasonal variation of the precipitating clouds were investigated by using the data of the vertical pointing radar collected for about seven years (from December in 1997 to June in 2004) at Ny-Ålesund in the Arctic. The results show that the rate of appearance time of the precipitating echo was about 25% every month except February and July, when the rate was less only 15% and 5% respectively.

The amounts of cloud coverage were also investigated from the radiation temperature measured upward to the sky. The seasonal tendency of the amount of cloud coverage was similar to that of the air temperature. The maximum monthly mean rate was beyond 70% observed in a summer season and the minimum one was about 40% observed in February. Therefore in February both of the appearance time of the precipitating echo and the cloud amount are smallest in a year. Since the Arctic region around Ny-Ålesund is usually covered by the cold winter air with a few amounts of water vapor in February, the cloud activity will be weakest in a year. On the other hand the cloud appeared frequently in July, but the precipitating echo does not appear frequently. Since the radar is only able to detect a densely clouds with precipitation particles, a lot of non-densely clouds will be appeared in July.

The frequency of the height of the each echo top was investigated with a seasonal change of the precipitating clouds in detail. Apparent frequencies of each echo top height shows that the precipitating clouds lower than 2km height were the predominant height through a year and more than 50% appeared in this height. Therefore the many precipitating clouds will be grown due to convective activity in a mixing layer over the sea. However the careful investigation show that there are some seasonal differences in the frequent height. The echo top height was mainly lower than 1km in summer time, however, that was mainly higher than 1.8km in late winter. It is interesting that the predominant height of the echo top in winter was slightly higher than that in summer. The seasonal tendency of the height of echo top will be consistent with that of depth of a mixing layer. The mixing layer will become thick and the clouds will develop thick when air temperature is lower.

The clouds that echo tops were higher than 5km only appears in summer from July to September, and hardly appears in other seasons. And, many clouds that echo top were about 4km appeared well in not spring but winter. Because these high clouds were mainly accompanied by mid latitude cyclone, the frequency of high clouds were occurred due to the activity and the number of the cyclones.

P-13

OPC, LPC and Lidar observations of stratospheric aerosol over Ny-Aalesund in the winter of 2002-2004

K. Shiraishi[1], M. Hayashi[1], M. Fujiwara[1], T. Shibata[2], Y. Iwasaka[2], K. Yamashita[1], K. Ozuka[1], K. Saga[1], Y. Kamiya[1], S. Noma[1], Y. Tobo[2], T. Miyazawa[2], T. Tsuduki[2], R. Neuber[3] and T. Yamanouchi[4]

1:Fukuoka Univ., 2:Nagoya Univ., 3:AWI, 4:NIPR

Polar stratospheric clouds (PSCs) that develop at polar regions in winter play an important role in the ozone depletion through the conversion of chlorine compound from inert into reactive forms by the heterogeneous reaction on the particle surface and the denitrification by the gravity sedimentation.

We installed a lider system at Ny-Aalesund, Svalbard(79° N, 12° E), and have observed stratospheric aerosols every winter since January 1994. We detected many PSC events under low temperature condition. Moreover, observations of stratospheric aerosols by Balloon-borne Optical Particle Counter(OPC) in cooperation with the Alfred Wegenar Institute, Germany had been performed in some winters.

Observation by LPC, a new type of OPC, which could be measured to a smaller particle size than usual one, was performed with usual OPC in winter of 2002 and 2003. The usual OPC with a diode laser as the source of light measures particle concentrations in five particle size ranges (r>0.15, 0.25, 0.4, 0.6, and 1.8 μm in radius). The new one with He-Ne laser is for the measurement of five size ranges (r>0.0056, 0.075, 0.1, 0.125 and 0.15 μm in radius). We could not detect the PSC in winters of 2002 and 2003, because the temperature of the stratosphere was high. However, the detail information of size distribution of the stratospheric background aerosol, which act as nuclei of PSC, were obtained. The result of OPC and LPC observation indicate the features of stratospheric aerosol as follows:

The stratospheric aerosol in the winter 2002 was measured from the tropopause (8km) to 25.5km height. The size distributions of aerosol show bimodal type at several km above the tropopause and mono-modal type above the height. The maximum number densities in deteced by OPC appeared at 14-15km heights, while those detected by LPC appeared in the height range of several km just above the tropopause. The particle number concentrations detected by OPC decreased rapidly above 20km height in every size ranges but those detected by LPC exist dominantly. Such a tendency could also be seen in the observation in 2003.

We performed lidar observation this winter(2004) and detected many PSC layers under low temperature condition. The OPC (usual type) observation of PSC was also performed. In our presentation, we will show the result of observation in recent three winters (2002-2004) and discuss the possibility of the generation of solid PSC from the background aerosol.

P-14

Sensor network for polar research aircraft

- Third International Symposium on the Arctic Research, Tokyo, 2005 -

Thomas Garbrecht[1], Andreas Herber[2], Daniel Steinhage[2], Oliver Zielinski[1]

[1] *OPTIMARE Sensorsysteme AG, Bremerhaven, Germany*

[2] *Foundation Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany*

Airborne operation is a crucial element of polar research activities. Scientific observations from the fields of geophysics, meteorology, air chemistry and oceanography can be realized by means of airborne sensor systems over large and remote areas and up to high altitudes. However the reliable operation of such sensors and their data acquisition in environmental conditions of the Arctic and Antarctica demand for specialized technologies and strategies.

The Alfred-Wegener-Institute for Polar and Marine Research (AWI) owns two research aircraft of Type Dornier 228-101 for scientific and logistic applications during Arctic and Antarctic surveys. Since May 2001 OPTIMARE Sensorsysteme AG, located at the regional airport of Bremerhaven, Germany, is responsible for the scientific equipment onboard both aircraft. The main task of this contract is the maintenance and integration of existing and new sensors together with the operation on polar expeditions. Additionally the new data acquisition system MEDUSA-P was developed and integrated.

The acquisition and synchronization of all measured data within the aircraft, being it from AWI sensors or from other expedition participants, as well as the power supply is the task of the data acquisition system. The integrated sensors are grouped by aspects of application and location within the aircraft. Each of these groups is supplied with an individual sensor-processor. This unit is a rugged computer hardware which measures, digitalizes and temporally stores the data of the sensors.

The data rate of sensors within these applications is 20 or 100 Hz. Especially the analysis of turbulent structures or geophysical surveys demands for an exact synchronization of different sensors which has to be met by the data acquisition system. Therefore central time information generated by the time server (connected to a GPS-Receiver) is distributed throughout the aircraft via optical fibers. Each sensor-processor links the sensor data to the time signal and transfers the coupled data-time-information via network to the central operating unit (COU). Here the information is stored in a database and transferred to a graphical user interface (GUI) for the operator. Due to redundant data storage on the sensor processor and the COU database a high reliability is achieved.

MEDUSA-P is the advancement of the network concept MEDUSA, which has proven its capabilities during longtime operational application in maritime surveillance and pollution control over North and Baltic Sea. Especially the environmental conditions during polar missions such as operational temperatures below -40°C and flight altitudes of up to 24.000 ft were considered for the new concept of MEDUSA-P. Up to now the system has been applied on seven surveys in the disciplines of meteorology, air chemistry and geophysics.

Contact:
Dr. Thomas Garbrecht,
OPTIMARE Sensorsysteme AG, Am Luneort 15a, D - 27572 Bremerhaven, Germany
Email: thomas.garbrecht@optimare.de, Phone: ++49 - 471 – 4836121, Fax: ++49 - 471 - 4836111

P-15

The long term hydrological and meteorological monitoring on Tundra region near Tiksi, eastern Siberia.

Hironori Yabuki, Tetsuo Ohata

Institute of Observational Research for Global Change / JAMSTEC, Yokosuka 237-0061, JAPAN

Abstract

As a part of GAME-Siberia project, Frontier Observational System for Global Change (FORSGC) and Institute of Observational Research for Global Change (IORGC/JAMSTEC) , hydrological and meteorological observations for a basin water/energy balance have been carried out in Siberian tundra region near Tiksi, Sakha Republic, Russian Federation from 1997 to 2004.

Siberia is the largest cold terrestrial surface in Northern Hemisphere which is composed of snow cover, permafrost and typical vegetation and soil. The partition of precipitation falling on the tundra surface into evaporation and runoff in a certain area, compose quite much part of runoff from the large continental rivers which supplies large amount of fresh water into the Arctic Ocean. This fresh water supply is said to influence the climate formation in this region and the surrounding areas, and is stressed as one major issue related to climate change (WMO, 1995; Wadhams, 2000; IPCC, 2001).

These tundra regions have a unique water cycle due to the existence of frozen ground and tundra vegetation and surface melts in summer but the thawed layer is said to be shallow. Snow cover exist from late September to early June, period depending on sites. These components affect the thermal response, which is usually expressed in the form of heat balance of the land surface. In order to evaluate the effect of the tundra land surface to the climate formation and the role of these land surfaces during the expected global warming, detail information on heat flow components itself and factors affecting this flow is needed.

In this study, climate features of Tiksi and meteorological condition during the observational period ware clarified. To clarify the water and energy exchange at the atmosphere-land surface interaction with tundra, a catchments scale study with one-dimensional observation on water and energy flux at representative tundra surface using a Automatic Climate Observation System (ACOS) has observe at Tiksi in Tundra region.

P-16

Studies of physical properties of Arctic aerosols

T. Petelski, T. Zielinski, A. Rozwadowska, R. Neuber*

Institute of Oceanology, Polish Academy of Sciences
E-mail: petelski@iopan.gda.pl/tymon@iopan.gda.pl/rozwadowska@iopan.gda.pl

*Alfred Wegener Institute, Germany
E-mail: rneuber@awi-potsdam.de

Abstract

The aerosol studies during the four Arctic Experiment (AREX) campaigns were carried out onboard the r/v *Oceania* research ship between 1996 and 2004. During each campaign the r/v *Oceania* cruised for seven weeks (June-August) in the area of the Arctic between 0 and 14°E and 69 and 79°N. In 2002 the measurements were also carried out, for 3 weeks, from the station in Ny-Alesund on Spitsbergen. The aerosol studies were conducted using an ensemble of instruments, including the FLS-12 lidar, laser particle counter CSASP-100-HV-SP, sunphotometers and ozonometer (Microtops II). The laser particle counter was placed on a mast of the vessel and moved vertically, which facilitated the determination of the vertical structure of aerosol concentrations and their size distribution at altitudes of up to 20 m a. s. l. Simultaneously lidar FLS-12 provided the vertical profiles of aerosol concentrations at altitudes of up to 600 m a. s. l. Those were further used for the calculation of aerosol optical thickness.

Such a measurement set up facilitated the obtaining of data with good accuracy, since the laser counter data were used for the calibration of the lidar data. The full meteorological coverage (wind speed, direction, relative humidity, air temperature, etc.) was provided by the ship meteo station, which collected data every 10 seconds. Additionally air mass backtrajectories were obtained for each selected day analyzed from the British Atmospheric Data Center.

The preliminary results show that local emissions are not always most important factors, which influence the composition of marine aerosol in the near water atmospheric layer, even for the coarse mode aerosols, also known as the sea salt mode. The air mass history must be taken into consideration.

The aerosol optical thickness obtained from the measurements varied from 0.02 up to 0.5 depending on air mass history. The high values of aerosol optical thickness indicate the impact of aerosol particles of continental origin or, in some cases, perhaps presence of thin cirrus clouds, invisible to the measurement performer. However, in majority of cases, the air mass trajectories for such days show that the particles were carried from over the land. The ozone contents varied from very low values of 180 DB up to 520 DB, indicating a very high variability over the period of 60 days of measurements.

P-17

New project of WCRP "Climate and Cryosphere (CliC)"

Tetsuo Ohata (Institute of Observational Research for Global Change, JAMSTEC)

CliC is a new core project of WCRP initiated in order to strengthen the cryopsphere studies in order to improve the understandings of the climate system and future climate prediction. This would be an overall framework for hydro-climatological studies in cold region study including studies in the future in cold regions from Arctic to Antarctic including the cold regions of Eurasian Continent including Arctic region to Tibetan Plateau. WCRP has initiated a core program called CliC (Climate and Cryosphere) from year 2000, and will start its implementation next year with the first Science Conference. This program has the following four main objectives (WCRP, 2001).

1. Improve understanding of the physical processes and feedbacks through which the cryosphere interacts within the climate system.
2. Improve the representation of cryospheric processes in models to reduce uncertainties in simulations of climate and predictions of climate change.
3. Assess and quantify the impacts of past and future climatic variability and change on components of the cryosphere and their consequences, particularly for global energy and water budgets, frozen ground conditions, sea level change, and maintenance of polar sea-ice covers.
4. Enhance the observation and monitoring of the cryosphere in support of process studies, model evaluation and change detection.

This project is planned to continue for 15 years, under many types of collaboration between countries, and study groups. One stress is laid on the measurement network which need to be established at early time in order to monitor the change under the on-going global warming. There are cryosphere components measured well by satellites such as glacier area and snow area. However, sub-surface ice and moisture conditions, snow characteristics, ice condition of glaciers are not well measured. As for such components, much effort is needed to establish observation network. A better measurement network is necessary for this purpose even in northern Eurasia.

P-18

Title: Dust transport, deposition, and variations on Mt. Wrangell, Alaska, and their implications to material circulation

Authors:

Teppei J. YASUNARI (EES, Hokkaido Univ.),

Takeo HONDOH, Takayuki SHIRAIWA (ILTS, Hokkaido Univ.),

Yoshiyuki FUJII, Makoto IGARASHI (National Institute of Polar Research),

Carl S. BENSON (Geophysical Institute, Univ. of Alaska Fairbanks),

Syosaku KANAMORI (ILTS, Hokkaido Univ.),

Koji YAMAZAKI (EES, Hokkaido Univ.),

E-mail: teppei@hms.lowtem.hokudai.ac.jp

Address: Ice Core Research Group, Institute of Low Temperature Science
Hokkaido University, Kita 19 Nishi 8, Sapporo, Hokkaido 060-0819, Japan

Abstract:

Atmospheric dust affects to radiative balance in the atmosphere. However, their effects still have large uncertainty. It is partly because mechanism of material circulation has large uncertainty too. Therefore we need to know the detailed material circulation processes under present climatic condition. At this time, we analyzed dust variations by laser light scattering method in surface and atmospheric snow at the summit of Mt. Wrangell, Alaska, where two snow and ice core were drilled in 2003 and 2004. Then trajectory analysis was done for understanding transport processes, and consequently we determined their dust origins. Next, we also measured dust variations in 50m shallow ice core drilled in 2003. Dating was done with the data of tritium, delta D, and the Large Particle Ratio (LPR) of dust. The core covers about 10 years, from 1992 to 2002. Then we determined their sources of dust based on the in situ aerosol monitoring in the field. It was found in the field observation that fine dust (< 1μm) came from East Asia by 10 days long range transport, coarse dust (> 1μm) was supplied by Mt. Wrangell's volcanic activities with less number of fine dust, and the least number of dust was supplied by snowfall with the air mass from the North Pacific region. In conclusion, we determined dust origins by each size and number of dust. In the core analysis, we detected large dust events at fine size in the summer of 1998 and 2002. These may correspond to the extensive forest fires in East Siberia. We also found that coarser size dust particles supplied to Alaska in spring, although the amount varied. Coarser dust was relatively more in the spring of 1994, 2001, and 2002. These years correspond to the years when frequent Asian dust events were observed in Japan. The amount of coarse dust in 2001 was especially large. Therefore, we speculate that Asian dust was transported to Alaska intensively in the spring of 2001. We also found the high timely correlation between tritium and the LPR peaks in spring. The increases of tritium which origin is mainly the stratosphere, and coarse dust which origin is mainly the troposphere, may be connected by atmospheric pressure pattern such as blocking or strong meandering of westerlies with cyclonic activities. This result indicates that material circulation is reinforced in the stratosphere and troposphere both in spring season.

P-19

Detailed density profiles in Mts. Logan and Wrangell – meaning as climate signals –

Syosaku Kanamori[1], Takayuki Shiraiwa[1], Kumiko Goto-Azuma[2], Carl S. Benson[3] and Renji Naruse[1]

1. Institute of Low Temperature Science, Hokkaido University, Japan
2. National Institute of Polar Research, Japan
3. Geophysical Institute, University of Alaska Fairbanks, U. S. A.

e-mail: kanasyo@pop.lowtem.hokudai.ac.jp

Detailed density measurements using X-ray transmission method were carried out for ice-cores which were drilled at King Col, Mt. Logan (60°35'20"N, 140°36'15"W; 4135m a.s.l.; Shiraiwa et al., 2003) and Mt. Wrangell (62°00'N, 140°03'W; 4100m a.s.l.; Shiraiwa et al., 2004). The accuracy of the measurement is 1% and the resolution is 1 mm along core length (Hori et al., 1999).

The detailed density profiles show periodic fluctuations. In the profile of Mt. Logan core, the number of density fluctuations agrees well with the age of the ice core estimated by tritium content that nuclear experiment seemed to produce. In addition, oxygen isotope profile shows similar frequency with the density profile. It suggests that density fluctuations indicate seasonal signal. On the other hand, in the density profile of Mt. Wrangell, the number of fluctuations is quite different from that of the hydrogen isotope profile. The density fluctuations in Mt. Wrangell do not seem to reflect seasonal signals. We estimate Firn/ice transition depths to be 50 m in Mt. Logan and 90 m in Mt. Wrangell from the density profiles. In the density profile of Mt. Logan, there is a bending point at 35 m-depth and densification rate seem to be accelerated at the point. The age of this depth correspond to late 1970s. There was a change of atmospheric circulation in the North Pacific in 1976 (Trenberth, 1990) and we speculate that the bending relates climate change. Such bending was not shown in Mt. Wrangell profile.

From density and stable isotope profiles of the ice-cores, we estimated averaged accumulation rates to be 1.1 m w. e. a^{-1} from 1961 to 2002 in Mt. Logan and 2.5 m w. e. a^{-1} from 1991 to 2003 in Mt. Wrangell. One of the authors (C. B.) observed accumulation rate in Mt. Wrangell in 1960s-1970s and the value was 0.86 – 1.3 m w. e. a^{-1}. Thus the accumulation rate increased largely recent years. This tendency is not shown in Mt. Logan.

Mt. Logan and Mt. Wrangell are in same Wrangell-St. Elias Mountains and the two sites are similar in elevation, latitude and temperature. However, their density profiles have large difference. The difference of accumulation rate should be one of the factors that cause different density profiles. Additionally, we speculate that wind condition also affect the difference of the density profiles. King Col, Mt. Logan is saddle shape and the topography may concentrate winds. It may cause erosion and thicken the snow at the surface. Contrastively, the ice-coring site in Mt. Wrangell was huge flat caldera and the wind condition seems relatively calm.

P-20

Stratigraphical studies in accumulation area of McCall glacier, Alaska, 2003 - 2004

Kazuhide Satow (Nagaoka Natl Coll. of Tech.), Jun Uetake (Tokyo Inst. of Tech.),
Shuhei Takahashi, Kengo Sato (Kitami Inst. of Tech.),
Tetsuhide Yamazaki (NIPR), Akiyoshi Takahashi (Geo-Technique Institute Ltd.),
Matt Nolan (Univ. of Alaska, Fairbanks),
Makoto Igarashi and Yoshiyuki Fujii (NIPR)

1. Introduction

Observations of McCall glacier in Alaska had been carried out for a long time since IGY (International Geophysical Years 1957/58) by mainly University of Alaska group. In the 50 years, the big retreat of this glacier has been reported. Many subjects of the observation in this glacier had be done, but ice coring works is not so much. To get more environmental information on precipitation and air, glaciological studies were made in accumulation area of McCall glacier in 2003 and 2004.

2. Stratigraphical Studies

In Upper Cirque, the surface firn depth to the glacier ice by digging up with the hand auger was examined at 6 points along a longitudinal line from the basin bottom to a ridge of watershed. And a snow pit work from the surface to 2.2m depth and a ice coring work to 24m depth were conducted at 1 point in the basin bottom. This glacier has a feature that internally accumulated ice develops under the firn layer. The thickness of the firn layer on the surface to the ice body of the glacier is 2-3 m in basin bottom and 6-8 m on a basin slope with higher altitude.

The measurements of firn temperature and density, snow sampling for the analysis of oxygen isotope, pH, electric conductivity, major anion/ cation ion concentration, snow algae and pollen density in the firn were done by the 2.2 m deep pit work on May 17, 2004.

The surface snow temperature was 0· when the pit work was done, and the boundary temperature between firn layer and internally accumulated ice was -10.1·. Major ice layers which are formed by melt-water refreezing were found in three depth of 50 cm, 110 cm and 170 cm. Particle density also is high in these layers.

The variation of snow accumulation by using the interval digital camera was observed near the pit. The maximum snow accumulation was 100 cm in snow depth from August 2003 and to August 2004. The seasonal variation of firn layer and the decision of annual layer are discussed from profile data of snowfall depth, concentration of chemical composition, particle density, snow algae and pollen density.

P-21

Reconstruction of mean summer air temperature variations by using an ice core from a wet-snow zone on a summer-accumulation-type glacier.

F. Nakazawa and K. Fujita

This study proposed a reconstruction method for mean summer air temperature variations by using an ice core from a wet-snow zone on a summer-accumulation-type glacier. In July of 2001, a 25.1-m-deep ice core was recovered on the accumulation area of Sofiyskiy Glacier (49° 47' N, 87° 43' E; 3435-m a.s.l.), located in the Southern Chuyskiy Range of the Russian Altai Mountains and a 4.5-m-deep pit was excavated about 50-m northwest of the drill site. The observation site has a positive balance even during summer season when melting occurs because Sofiyskiy Glacier is a summer-accumulation-type glacier. Each summer balance during the years 1990-2000 was estimated from Pinaceae and *Artemisia* pollen peaks in these samples. Pinaceae pollen marks spring whereas Artemisia pollen marks autumn. Thus, the ice between these pollen peaks in the same year was considered as summer balance. The reconstructed summer balance variations showed a good negative correlation with mean summer air temperature variations ($r = -0.72$). For summer-accumulation-type glaciers such as Sofiyskiy Glacier, it has been argued that the most important climate factor controlling glacier's surface mass balance is mean summer air temperature that affects the amount of melting. Because melting occurs in summer season, then it seems to directly control the summer balance. Therefore, an ice core from a wet-snow zone on a summer-accumulation-type glacier is useful to reconstruct mean summer air temperature variations.

P-22

Snow algae and pollen in the snow pit samples from Mt. Logan, Canada

Segawa, T., Kohshima, S. (Tokyo Institute of Technology), Matoba, S. (National Institute for Environmental Studies), Goto-Azuma, K, Fujii, Y. (NIPR), Shiraiwa. T., Kanamori, S. (Institute of Low Temperature Science)

Snow algae and pollen in the snow samples of 4 snow pits (1.0 – 4.5 m depth) collected at Mt.Logan, Canada, were examined for potential use in ice core analyses of this area. The snow pit samples were collected in May or June 2001 at 2,300 m, 3,200 m, 4,135 m, and 5,430 m a.s.l., respectively.

Though species identification is still not completed, the samples contained at least two species of snow algae (5 – 10 μm in cell diameter) and tree pollen (*Picea* spp.).

Vertical profiles of the algal biomass and that of Delta ^{18}O in the snow pits suggests that these snow algae grew in the surface snow during the melting season. The layers with algal peaks corresponded to high Delta ^{18}O values and the layers without snow algae corresponded to lowest Delta ^{18}O values. This suggests that the layers with algal peaks were formed during thawing period and the layer without such peaks were formed during cold period without melt-water. Many algal peaks indicate that the algal growth was often interrupted by much snowfall during the growth season.

The snow algal biomass contained in the samples decreased with altitude, probably due to the colder condition in the higher altitude. It ranged 0 – 170 $\mu m^3/ml$ at 2,300 m, 0 – 160 $\mu m^3/ml$ at 3,200 m, 0 – 60 $\mu m^3/ml$ at 4,135 m and 0 – 20 $\mu m^3/ml$ at 5,430 m, respectively.

Peaks of snow algal biomass also tended to correspond with those of pollen and MSA. In northern Canada and Alaska, Picea pollen is reported to be produced from May to June. MSA, a proxy of the marine algal production is thought to increase from spring to summer and decrease in winter in this area. Therefore, these results also indicated that these algae found in these snow pit samples are snow algal species that grow in the snow during thawing periods. Now, we are trying to identify the algae in the samples by DNA analysis.

Our results suggested that the snow algae, pollen and MSA can be used for ice core dating in this area.

P-23

Change of glaciers in Spitsbergen observed with surface photographs

Miki YOSHIOKA (Hosei University, Tokyo)
Hajime ITO (National Institute of Polar Research, Tokyo)

The state of glaciers in past, when no satellite or airborne data were yet available can be investigated with pictures taken on the ground. To utilize these old data source in comparative study, aiming to reveal the long term glacier change, the pictures of the identical glaciers taken at later year are necessary.
In 1933, a Japanese geographer, Kouji IIZUKA, visited Spitsbergen Island, Svalbard islands and took photographs of the coastal glaciers, shipboard.
After 60 years, in 1993, authors took sequential photographs of the coastal topography around Spitsbergen Island.
It was found, some old pictures have their modern counterparts; same glaciers were photographed at similar spots and in similar angle once again after 60 years. The pairs of pictures consisted of old and new photographs were used for comparison. Most glaciers investigated decreased their thickness and area at their terminal parts in the 60 years.

Preliminaly comparison indicated the trend of the glacier change.
1. Tuna-breen, Tempel Fjorden
Tuna-breen locates at the center of Spitsbergen Island, at the end of Tempel Fjorden. The thickness of the glacier decreased and the position of the terminal retreated in 60 years. It is a surge glacier.
2. Waggonway-breen and other glaciers flowing into Magdalene Fjorden
Magdalene Fjorden locates at northwestern part of Spitsbergen Island. Several glaciers flow into the fjord. Most of them decreased their thickness. Some of them decreased their area as well and their terminals retreated from the sea onto the land.

It is known that some glaciers in Spitsbergen Island surge. Glaciers investigated might have not retreated monotonously during 60 years, but have repeated advance and retreat. To investigate also short term phenomena, the authors took photographs of the glaciers in 2004, 11 years after the observation in 1993.

Reference

Kouji IIZUKA, 1938: "79° North". Sanseido, Tokyo (in Japanese).
ITO H. and YOSHIOKA M., 1994: Oceanographic survey around Spitsbergen island useing coast liner. Journal of The Japan Society for Marine Surveys and Technology, 6(2): 57-59, (in Japanese).
J. O. HAGEN, et al., 1993: Glacier atlas of Svalbard and Jan Mayen. Norsk Polarinstitutt Meddelelser Nr. 129. Oslo.

P-24

Geochemistry of the nival-glacial complexes of Eurasian Arctic

S.M. Arkhipov [1], H.-W. Hubberten [2], B.G. Vanshtein [3], H. Meyer [2]

1 Institute of Geography RAS, Staromonetny per., 29, Moscow 109017, Russia
2 Alfred Wegener Institute for Polar and Marine Research, Potsdam, Germany
3 VNIIOkeangeologia, St.-Petersburg, Russia

The origin of buried tabular ice is still an open problem. One possible way of its solution is to determine the regular differences in composition of modern surface and ground ice of different but definite and known origin.

We consider very useful the elaboration of a general model for isotope-geochemistry transformation of accumulated solid precipitation into relatively solid ice and formation of melt water run-off. The estimates of the content, quality, and consequently, possible anthropogenic pollution of natural waters in general are also of widespread interest to researchers.

We studied the main isotopic- geochemical characteristics ($\delta^{18}O$, δD, pH, HCO_3^-, CO_3^{2-}, SO_4^{2-}, Cl^-, Na^+, Mg^{2+}, Ca^{2+}, K^+) and their variability for different water-ice objects of Svalbard and Novaya Zemlya: snow and firn cover, snow patches, glacier (including congelation and buried ice), wedge ice, icings, river, lake and bog waters. The emphasis has been on the study of marginal parts of glaciers (including proglacial areas) as the most probable sites of glacier ice burial in recent, present and future times.

All types, almost all classes and families of natural ice (modern and buried) and waters shows individual set of geochemical characteristics.

Variations of these characteristics within majority of the families are extremely large as 10-20 and even >100 times.

P-25

Isotopic composition and origin of snow over Siberia

* Naoyuki Kurita[1], Atsuko Sugimoto[2], Yoshiyuki Fujii[3], Tatsuya Fukazawa[4], Vladimir N. Makarov[5], Okitsugu Watanabe[2], Kimpei Ichiyanagi[1], Atusi Numaguti[2], and Naohiro Yoshida [6]

1:Institute of Observational Research for Global Change, JAMSTEC, Yokosuka, Japan
2:Graduate School of Environmental Earth Science, Hokkaido University, Sapporo, Japan
3:National Institute of Polar Research, Tokyo, Japan
4:Graduate School of Engineering, Hokkaido University, Sapporo, Japan
5:Permafrost Institute, Russian Academy of Sciences, Moscow, Russia
6:Frontier Collaborative Research Center, Tokyo Institute of Technology, Yokohama, Japan

Abstract

The spatial isotopic distribution of the snowpack over Siberia, where winter temperatures are as cold as those of the polar regions, was observed by the Trans-Siberian Snow Survey (TSSS) and Trans-Verkhoyansk Snow Survey Expedition (TVSSE) in March 2000 and March 2001. The results show inland δD depletion and a slightly increasing deuterium excess value, d, in the snowpack over Siberia. To explore the relationship between source region variability and the isotopic composition of snow, a model simulation was performed that reproduced the observed isotopic composition of snow. Moisture sources for Siberian precipitation were estimated using the Center for Climate System Research/National Institute for Environmental Studies (CCSR/NIES) atmospheric general circulation model (AGCM). A simple isotopic model was used to evaluate the total isotopic changes during transport from the designated source region to the region of precipitation.

The results showed that the variability of the contribution of each source to the snow results in large isotopic variability, and the fact that the model reproduced the observed inland depletion of δD in snowpack suggests that GCM-predicted source contributions were verified by observed values. However, the modeled d values did not match observed d values over Siberia. Observations of d values in precipitation show an increase during autumn towards a maximum in late autumn and then a decrease during winter; however, the modeled d value reached a maximum in early autumn and decreased toward a minimum in winter. The simple isotope model does not consider additional moisture evaporation joining an airmass moving from a source region. Therefore, the disagreement between the modeled and observed d values of snow suggests that moisture supplied from the land surface during transportation significantly contributes to autumn snow. The increased d values of Siberian snow show that evaporation from open water or from the soil surface, which are accompanied by isotopic fractionation, are more important than transpiration flux, which does not change the isotopic content. The contribution of land-derived moisture that has evaporated from open water plays an important role in eastern Siberian snow.

P-26

The Arctic Marine Laboratory in Ny-Ålesund, Svalbard Norway

Kjersti DALE

Kings Bay AS

Abstract:
The Arctic Marine Laboratory in Ny-Ålesund will be an international laboratory with researchers from many nations, and will be available for use from June 2005. The laboratory will be an experimental laboratory for research in marine ecology, physiology, biochemistry, as well as some physical sciences like oceanography, marine geology and ice physics. The laboratory is constructed with smaller rooms and laboratories with equipment for different purposes. The laboratory is owned by Kings Bay AS, which will rent out space in the laboratory on a commercial basis. All use of the laboratory will be under Kings Bay AS administration and supervision.

P-27

Comparative study on deficiency of N-nutrient deduced from Beaufort and Laptev Sea expedition data (JWACS and NABOS cruises)

Nori Tanaka1, M. Nitishinsky2, A. Murata1, and L. Timokhov2
1: JAMSTEC, Japan, 2: AARI, Russia

Arctic shelf and its vicinity are posted to be the most active area for denitrification in the world ocean. The recent stable nitrogen isotope study suggests that there is no appreciable evidence for denitrification in water column although there is substantial deficiency in nitrogen in water column. Nitrogen isotope study revealed that the water column deficiency is due to unidirectional nitrogen uptake by sediments, which is driven by sedimentary denitrification (T. Tanaka et al., Cont. Shelf Res., 2004). Nitrogen loss by dinitrification in the area was posted as large as 20 Tg-N/year, which corresponds 15-25 % of nitrogen loss in the world ocean, if the entire shelf area in arctic and its vicinity is active in denitrification.

JWACS (Joint Western Arctic Climate Study) and NABOS (Nansen & Amundsen Basin Observational System) have been carried out hydrographic observation cruises by Japanese R/V Mirai, Canadian icebreakers and Russian icebreaker in the last 3 years to understand Arctic Ocean response to the climate change and its feed back to the global climate system. Those cruises gave us an unique opportunity to examine nutrient dynamics in surface stratified water layers. In this study, N*=(Nitrate+Nitrite-16xPhosphate+2.9)x0.89 is estimated in Laptev Sea , Bering Sea, Chukchi Sea and Beaufort Sea. N* in Laptev Sea shows relatively larger values averaged at 0.6, indicating typical Atlantic surface layer signature. Whereas N* values in Beaufort, Chukchi and Bering Seas showed startling negative values as low as -13. The lowest value was found in the nutrient maximum subsurface layer with almost freezing water temperature (Cold Halocline Layer). N* -phosphate diagram and N*-nitrate diagram revealed remarkably weak denitrification signature in Laptev Sea.

P-28

Photosynthetic properties of phytoplankton inhabiting the Mackenzie Shelf.

Shimpei Aikawa[1], Atushi Matsuoka[2], Shinya Yamamoto[3], Ryosuke Makabe[4], Makoto Sampei[5], Takashi Ohta[4], Toshikazu Suzuki[6], Hiroshi Hattori[7], Hiroshi Sasaki[4], Mitsuo Fukuchi[5], Kazuhiko Satoh[1], Sakae Kudoh[5] and Yasuhiro Kashino[1].

[1]Graduate School of Life Science, University of Hyogo, [2]Hokkaido University, [3]Soka University, [4]Ishinomaki Senshu University, [5]National Institute of Polar Resesrch (NIPR), [6]Nagasaki University, [7]Hokkaido Tokai University.

Polynya is known to be a high productive oceanic area in high latitudes. The overall productivity of the polynya depends on the photosynthesis of phytoplankton and ice algae. Among such polynyas, the polynya in Mackenzie Shelf, where is the research area in CASES study (Canadian Arctic Shelf Exchange Study), has a unique feature. Into this offshore area, fresh water flows from Mackenzie River and the amount of flow increases drastically in summer. At Mackenzie Shelf, not only the salinity but also temperature and light intensity fluctuate remarkably in summer. Such kind of environmental fluctuations seem to cause suppressive effects on the photosynthesis of phytoplankton. However, the productivity in the polynya is high in summer. We can assume that the phytoplankton inhabiting the Mackenzie Shelf acclimate expertly and quickly to these environmental changes to maintain effective photosynthesis. In this work, we analyzed the influence of the change in the environmental physico-chemical conditions on the photosynthetic properties of phytoplankton inhabiting the Mackenzie Shelf.

This study was carried out on board Amundsen in CASES study located in offshore area of Mackenzie River during the summer in 2004 (from May 13 to Aug 04, 2004). At around 60 stations of various distances from the mouth of Mackenzie River, we collected phytoplankton samples from the surface and the bottom of euphotic zone. The photochemical and non-photochemical quenching of fluorescence was measured by PAM (pulse-amplitude-modulation) method using Phyto-PAM Fluorometer (Walz, Germany). Based on these quenching data, we calculated the electron transport rate, quantum yield of PSII and xanthophyll cycle activities to estimate the photosynthetic properties of phytoplankton. Those characteristics were influenced by physico-chemical conditions such as salinity, temperature and light intensity in a complex manner.

P-29

Succession of microzooplankton and their grazing activity in the Canadian Arctic winter (CASES2004)

Takashi Ota (Senshu Univ. Ishinomaki), T. Suzuki (Nagasaki Univ.), H. Sasaki (Senshu Univ. Ishinomaki), H. Hattori (Hokkaido Tokai Univ.), M. Sampei and M. Fukuchi (NIPR)

In the winter cruise of the CASES 2004 program we are focusing on how do microzooplankton overwinter and how do they function in the Arctic winter ecosystem. For this purpose we investigated the succession of microzooplankton community under the sea-ice and measured their grazing activity with the dilution technique at the overwintering station (70° 02.71' N 126° 18.06' W) in the Amundsen Gulf of the Canadian Arctic during 27 February and 10 May 2004.

For enumeration of microzooplankton (ca. >10 μm), surface water samples were collected every 6 days from three depths (3, 5, 10m) using a 5L Go-Flo bottle. 1000 ml of sea water was fixed with acid Lugol's solution (2% final conc.). To distinguish plastidic and non-plastidic cells under the epifluorescence microscope, another 100 ml of sample was fixed with glutaraldehyde (2% final conc.), filtered onto black Nuclepore filter with pore size of 0.8 μm after staining with DAPI. In addition, dilution experiments were carried out every 6 days from 27 Feb. to 30 April to investigate the microzooplankton grazing activity.

Chlorophyll *a* concentration, which was relatively low below 0.06 μg l^{-1} until middle of March, increased at the beginning of April and kept to the level between 0.20 and 0.25 μg l^{-1} afterwards. This increase is mostly due to small organisms less than 2 μm in size. Abundance of microzooplankton, which were very low less than 100 cells/l at the end of February, showed gradual increase and reached 2250 l^{-1} at 10-May. Microzooplankton community was dominated by ciliates and dinoflagellates throughout this study. Grazing rates of microzooplankton ranged from negligible to 0.36 d^{-1} (avg. 0.18 d^{-1}) and it seemed not to respond quickly with increasing small algae (<2μm). In the size fractionated results, balanced rates between growth and grazing were observed in the 2-10μm size category. This indicate that herbivorous activity of the microzooplankton had already begun in the low right condition under the sea-ice and they mainly consumed 2-10μm size phytoplankton. These considerations will be supported by the fact that microzooplankton observed between early March and mid April often contained several types of nano-sized algae in their food vacuoles. On the other hand, some ciliates found in 10 May were containing equal-sized pennate diatoms. This qualitative evidence implies that the prey-predator relationship between ice algae and microzooplankton occurred in late spring. Beside heterotrophic organisms, small autotrophic ciliate *Mesodinium rubrum* was most abundant (more than 1,000 cells/l) among total micro-sized plankton throughout this study except ice algae. Therefore, *Mesodinium rubrum* may have a significant contribution to the primary production under very low light condition and possibly be an important food source for microzooplankton as well as mesozooplankton in the Arctic winter.

P-30

Sequential zooplankton trap and its preliminary result obtained in the Amundsen Gulf, Canadian Arctic in the CASES 2003-2004.

Hattori, H. (Hokkaido Tokai Univ.), Sampei, M. (NIPR), H. Sasaki, (Senshu Univ. Ishinomaki), and M. Fukuchi (NIPR)

Canadian Arctic Shelf Exchange Study (CASES) has been carried out in the area covering between off Mackenzie River and the Amundsen Gulf since 2002. In particular, a year round continuous study was done from September 2003 to August 2004 on the NGCC Amundsen. In the CASES area, a large Polynya expected high biological production was usually observed in the central part of the Amundsen Gulf from early spring. Seasonal change in the population dynamics of herbivorous copepods is important factor for understanding arctic ecosystem because they are key species in the arctic food web. Downward looking trap (50 cm in diameter at the mouth) with time series sequential12 cups for collecting zooplankton upward swimmer was set at 100 m above the bottom of the central part to the Amundsen Gulf (depth: 401 m) during 280 days from 13 October 2003 to 18 July 2004 to observe the ontogenetic vertical migration of copepods.

Seasonal change in the upward migration was obtained every 15 days other than the first two periods from 13 October to the end of 29 February. Upward migration was mainly observed in adult *Calanus hyperboreus*. And seasonal change in upward migration was clearly obtained in this species showing low rate before January and relatively high rate was observed from January to March. Maximum upward migration rate about 3 individuals m^{-2} day^{-1} was observed during April. Just after this adult peak, nauprii of *C. hyperboreus* took major part of migrants. This reveals that reproduction and generation change was occurred at early May. This result shows ontogenetic upward migration began from January and completed until April with maximum rate in April. The timing of the upward migration seems to be earlier than that observed in the subarctic. It is not certain why this species shows earlier upward migration in the Arctic. However, it will be clear when we compare the seasonal changes in its feeding activity and ice algal and microzoo productions as well as environmental data such as water temperature, salinity and light in the CASES area.

P-31

Spatial changes in the particle fluxes in the southeast Beaufort Sea.

M. Sampei (NIPR), H. Sasaki (Ishinomaki Senshu Univ.), H. Hattori (Hokkaido Tokai Univ.), S. Kudoh, M. Fukuchi (NIPR)

Downward fluxes of mass dry weight (DW), particulate organic carbon (POC) and nitrogen (PON) were measured using moored sediment traps in the Beaufort Sea. Time-series sediment traps were deployed at ca. 70 and 200 m below the sea surface at two stations (CA 7 and 8) from September 2002 through August 2003.

Annual fluxes of DW, POC and PON at CA 8 under the Amundsen Gulf polynya were higher than those of CA 7 off the shelf break of Mackenzie shelf (Table). At ca. 70 m, all of annual fluxes at CA 8 were four times higher than those of CA 7. Chlorophyll *a* standing stock at CA 8 was also higher than CA7. It seems particle fluxes at ca. 70 m sympathized with biological productivity. However, all of annual fluxes at ca. 200 m were only two times higher. CA7 is cited at off the continental shelf break. These suggest that horizontal transport of resuspended particles was occurred at ca. 200 m at CA7. Thus, sinking process at off the continental shelf break is influenced with vertical transport at ca. 70 m and with vertical and horizontal transport at ca. 200 m.

Table. The annual fluxes of DW, POC and PON at two stations. These fluxes are presented as g m^{-2} y^{-1}.

	CA7		CA8	
	69 m	199 m	58 m	188 m
DW	36.8	80.7	170.2	123.0
POC	4.2	3.4	15.0	6.0
PON	0.6	0.4	2.1	0.8

P-32

Swim speed of male and female great cormorants in relation to prey escape speeds

Yan Ropert-Coudert[1*], David Grémillet[2], Akiko Kato[1]

There is a growing concern in Europe that cormorant populations may have a negative impact on fisheries because these birds feed on commercially-exploited fish species. To assess the exact influence that cormorants may have on fish populations knowledge of the foraging behaviour, especially the speed at which cormorants swim in the wild, is crucial since the birds speed range condition the range of fish species that can be targeted. We measured the swim speed of 12 (6 males and 6 females) free-ranging great cormorants *Phalacrocorax carbo*, foraging off the Greenland coast during the summer of 2003, using miniaturized data-loggers. A total of 2948 dives were recorded over the whole deployment period. There were no sexual differences in the recorded foraging patterns. Birds travelled down to the maximum depth of dives at an average speed of 1.22 ± 0.22 m s^{-1}, a speed similar to that measured in captive cormorants in previous studies. Although bursts of up to 2.82 m s^{-1} were recorded, speed usually decreased during the deepest phase of dives, being on average 0.61 ± 0.23 m s^{-1}. Speeds measured here are partly underestimated because of an impact of the loggers on bird swimming performance. However, low speeds at the bottom of dives probably resulted from the fact that great cormorants in Greenland mainly feed on bottom-dwelling sculpin *Myoxocephalus scorpioides*, for which camouflage between rocks may be the most appropriate anti-predator strategy. More generally, great cormorants appear fast enough to target most fish species present in European water bodies.

P-33

Characterization of soil microflora on a successional glacier foreland in Ellesmere Island using phospholipid fatty acid analysis

Shinpei Yoshitake[1], Masaki Uchida[2], Takayuki Nakatsubo[1], Hiroshi Kanda[2]

[1]*Graduate School of Biosphere Science, Hiroshima University*
[2]*National Institute of Polar Research*

Properties of soil microorganisms have a significant impact on soil formation and therefore progress of primary succession through decomposition and mineralization of organic matter. However, little is known about changes in soil microflora with progress of succession in the high arctic. In this study, we studied microbial biomass and community structure in a primary successional chronosequence in Oobloyah Valley (80°50', 82°45'W), Ellesmere Island, high arctic Canada. Phospholipid fatty acid (PLFA) in soil was analyzed to investigate the microbial biomass and community structure. The PLFA analysis, achieved by qualitative and quantitative analyses of fatty acids derived from phospholipid (located in the cell membranes), provides us information about both the size of the soil microbial biomass and its composition.

In the deglaciated area in Ooblyah Valley, vegetation development over a fairly long term (more than 20000 years) is observed on moraines. Five plots of different age (from 250 to 25000-35000 years old) were set along the successional gradient. Soils of 0-0.5, 0.5-2.0, and 2.0-5.0 cm layers were collected from five points per each plot in July 2004. These samples were freeze-dried and brought back to Japan and then used for the PLFA analysis.

The measurements of total PLFAs content indicated that the microbial biomass was lowest in the youngest plot (about 250 years old) and tended to be higher in older plot. However, in each plot, remarkable differences in PLFAs contents were detected between points with different type of vegetation cover were detected.

Site-to-site differences in microbial biomass and community structure are discussed in relation to vegetation, age of moraine, and contents of carbon and nitrogen in the primary successional chronosequence.

P-34

Net photosynthesis, respiration and primary production of the lichen *Cetrariella delisei* in Ny-Ålesund, Svalbard.

*M. Uchida (NIPR), T. Nakatsubo (Hiroshima Univ.), H. Kanda (NIPR), H. Koizumi (Gifu Univ.) *National Institute of Polar Research, 9-10 Kaga 1-chome, Itabashi-ku, Tokyo 173-8515, Japan. E-mail: uchida@nipr.ac.jp

As part of a study on carbon cycling in the high Arctic, we aimed to estimate the primary production of the dominant lichen *Cetrariella delisei* in a deglaciated area in Ny-Ålesund, Svalbard (79°N).

The effects of abiotic factors such as light incidence, temperature and water content on the net photosynthesis (*Pn*) and dark respiration (*R*) rates were examined in the snow-free season in 2000 using an open-flow gas exchange system with an infrared gas analyzer (LI-COR, LI-6252). At the same time, the thallus temperature, PPFD and radiation were recorded in the field.

The response curve of *Pn* to lichen temperature was typically broad. *Pn* decreased gradually with increasing temperature in a temperature range of 4 to 20°C. The optimal temperature for net photosynthesis was estimated as around or lower than 4°C. On the other hand, *R* increased with increasing temperature with Q_{10} of 2.3. Although the *Pn* of *C. delisei* dropped below the detectable limit at 25% thallus water content, it increased rapidly from 25 to about 100% thallus water content. The maximum *Pn* was maintained at a water content of about 300%.

We constructed a model for estimating the net primary production (*NPP*) of lichen based on the relationships between abiotic factors and the CO_2 exchange rate. The mean, minimum, and maximum *NPP* values in the snow-free season, estimated using meteorological data obtained from 1995-2003, were 2.2, 0.4 and 3.6 gC m^{-2}, respectively. These results suggest that the contribution of lichen to carbon input is small compared with that of dominant vascular plant (49.2 gC m^{-2} snow-free $season^{-1}$; Muraoka et al., 2002) and moss (7.4 gC m^{-2} snow-free $season^{-1}$; Uchida et al., 2002) in the study site.

P-35

Growth pattern of a common feather moss, *Hylocomium splendens* from contrasting water regimes in a high arctic tundra

Takeshi Ueno and Hiroshi Kanda (National Institute of Polar Research, Japan)

Abstract

Hylocomium splendens, a common feather moss, is one of the major plant species found in the high arctic tundra. It occupies various habitats ranging from exposed dry grounds to swampy grounds. To clarify the effect of water regime on growth pattern of *H. splendens*, the shoot morphology of *H. splendens* growing in contrasting water regimes, i.e. wet site (stream edge), mesic site (outwash terrace) and dry site (moraine) dry site (moraine) was investigated using retrospective analyses of growth. Growth parameters of *H. splendens* were different among sites. The growing period in wet, mesic and dry sites was 1 year, 2 year and 3 year, respectively. The growth rate in wet, mesic and dry sites was about 7 mm/year and 3 mg/year, about 5 mm/year and 2 mg/year, and about 3 mm/year and 2 mg/year, respectively. Growth form of *H. splendens* was also different among sites. The proportion of sympodial growth form in wet site was higher than that in mesic and dry sites. These results suggest that water regime has great influences on the growth pattern of *H. splendens* in a high arctic tundra.

P-36

Primary succession and soil development on a glacier foreland in Ny- Ålesund, Svalbard

Toshiyuki OHTSUKA[1], Masaki UCHIDA[2], Shinpei YOSHITAKE[3] and Takayuki NAKATSUBO[3]

1 Laboratory of Ecology, Ibaraki University, 2 National Institute of Polar Research

3 Graduate School of Biosphere Sciences, Hiroshima University

【Introduction】

Ecosystem change in the Arctic may be of crucial importance in rising CO_2 concentration and future global warming. We studied community structures and soil conditions in the deglaciated area in Spitsbergen, Svalbard as the first step towards to realize Arctic ecosystems. We examined the relationships between soil development and community structural changes during the primary succession in the high Arctic region.

【Methods】

The study site was located at the foot of the East Brøgger glacier near Ny-Ålesund in the northwestern part of Spitsbergen, Svalbard (78°55′ N, 11°51′E), Norway. Five line transects were set on the deglaciated area from the edge of the glacier to the sea. Twelve to fourteen plots (each 4 m×4 m) were selected on the each transect every 200 m. Floristic composition and community structure were investigated in each plot. Coverage (%) of vascular plants and bryophytes was measured by species. Coverage of lichens and algal crust was also measured. Soil conditions, such as coverage of surface rocks, pH, soil depth and coverage of animal droppings, were measured at each plot. Soil samples were taken at each plot to determine soil carbon and nitrogen contents.

【Results and Discussion】

A total of 43 vascular plant species appeared in the 64 plots. *Saxifraga oppositifolia* was distributed widely not only in the older deglaciated areas but also in the younger areas. *Salix polaris* and *Oxyria digynain* were distributed widely in the older areas, though they did not occur younger areas at all. Soil pH was very high (8 – 8.5), and organic soil layer did not developed in the early stages of primary succession with high coverage of surface rocks. Soil depth and organic N and C contents gradually increased with the successional series. Soil pH decreased to nearly neuter in the later stages of primary succession.

Canonical correspondence analysis (CCA) shows two dimensional ordination of all plots demarcated with the seven community types, which were distinguished by TWINSPAN. A few vascular plants, such as *S. oppositifolia*, with some moss species which can tolerate to harsh conditions can colonize to early stages of succession. Development of soils along the primary succession, such as decreasing rock cover and soil pH, increasing soil resources of older deglaciated sites might allow many vascular plants to establish. Moreover, plant community types diverged in the older deglaciated areas with the topographical conditions such as south facing dry slope and wet valley. We need to further study the environmental heterogeneity of topographical conditions, including nutrient availability, water contents and snow cover and so on, in the older deglaciated areas.

P-37

Initial recruitment and establishment of vascular plants in relation to topographical variation in microsite conditions on a recently-deglaciated moraine in Ellesmere Island, high arctic Canada.

Akira Mori, Takashi Osono (Kyoto Univeristy), Shogo Iwasaki (Hokkaido University), Masaki Uchida and Hiroshi Kanda (NIPR)

We investigated the effects of topographical positions (ridge, upper part of side slope and lower part of side slope) within a recently-deglaciated young moraine near a retreating glacier on initial recruitment and establishment of vascular plants. Compared with moraine ridge, upper slope had similar/higher abundance of vascular plants in terms of coverage, frequency occurrence, species number, and density/biomass of a dominating species *Salix arctica*. This implies a higher probability of vascular plant recruitment on the upper slope, where seems less stable than on the ridge. Further, the microsite with greater vascular plant abundance, *S. arctica* density and *S. arctica* aboveground biomass cumulated more organic materials in all three topographical positions, and such an organic accumulation was deepest on the upper slope, suggesting that relatively-successful plant establishment occurs on this site. This can be further supported by *S. arctica* population structure, which implies relatively-constant juvenile supply on the upper slope. Along a slope, unstable sedimentary rocks/boulders are easy to fall down to the lower. This topographical process may cause large rock/boulder size and a high coverage by rocks/boulders on the lower slope. On the upper slope, the coverage by rocks/boulders had therefore become smaller, leading to a high coverage by fine-grained sediments. The fine-grained sediments would enhance the vascular plant emergence, probably resulting in the higher tendency in vascular plant abundance, *S. arctica* density and *S. arctica* aboveground biomass on the upper slope. Accordingly, this study suggests that, during the primary succession following deglaciation in the high arctic, the upper slope of newly-formed moraine may be one of important location for initial recruitment and establishment of vascular plant species.

P-38

Chemical property of plant leaves in a polar oasis in high-arctic Canada: comparison between xeric and mesic deglaciated chronosequences

T. Osono, A. Mori (Grad. Sch. Agric., Kyoto Univ.), M. Uchida & H. Kanda (NIPR)

Contents of nutrients (C, N, P, K, Ca, Mg) and organic chemical components (lignin, total carbohydrates, extractives) were measured in live and dead leaves from 14 plants, including 4 woody shrubs (*Cassiope tetragona, Dryas integlifolia, Salix arctica, Vaccinium uliginosum*), 4 herbs (*Papaver lapponicum, Epilobium latifolium, Oxyria digina, Polygonum viviparum*), 4 grasses (*Carex* spp., *Luzula confusa, Arctagrostis lactifolia, Alopecurus alpinus*), and 2 mosses (*Rhacomitrium lanuginosum, Hylocomium splendens*). The study area was located in a high-arctic deglaciated area in Ellesmere island, Canada. In the study area, five moraine groups were identified based on the relative age of deglaciation. Vegetation cover and biomass, species richness, and soil C accumulation increased in relation to ecosystem development in this choronosequence. Plant samples were collected from xeric habitats on upper to ridge parts of moraines and from mesic habitats on bottom parts between moraines of each terrain age. Five individuals were chosen for each plant species on each habitat and live leaves and attached- or detached-dead leaves were collected. Leaves from five individuals were then combined to make one sample for each species from each habitat. Thus, a total of 102 samples were collected during the expeditions in summer of 2003 and 2004. Habitats (xeric or mesic) and life forms (woody shrub, herb, grass, moss) significantly affected the contents of C and N in live and dead leaves, whereas no effect of terrain age was detected. Carbon contents in live and dead leaves were in order of: woody shrubs > grasses, mosses > herbs. Nitrogen contents in live leaves were higher in grasses, herbs, and woody shrubs than in mosses. Nitrogen contents in dead leaves were in order of: herbs > woody shrubs > grasses > mosses. Carbon contents were lower and N contents were higher in live and dead leaves from mesic habitat than in those from xeric habitat. Higher N content in mesic habitats may be attributed to the occurrence of species with higher N contents (e.g., more herbs and grasses from mesic habitats) and to the within-species variability of N contents (e.g., leaves of *S. arctica* had higher N content in mesic habitats than in xeric habitats). These results suggested that chemical property of plant leaves were affected by life form and moisture condition of microhabitat rather than the stage of ecosystem development.

P-39

Leaf photosynthetic characteristics and net primary production of vascular plant species in high-arctic, Ny- Ålesund, Svalbard.

*Hiroyuki Muraoka (Gifu University), Masaki Uchida (NIPR), Toshiyuki Ohtsuka (Ibaraki University), Takayuki Nakatsubo (Hiroshima University) and Hiroshi Koizumi (Gifu University) *: Institute for Basin Ecosystem Studies, Gifu University, 1-1 Yanagido, Gifu, 501-1193 Japan. muraoka@green.gifu-u.ac.jp

Current global warming predictions indicate that warming will be more pronounced at high latitudes in the Northern Hemisphere (IPCC 2001). Revealing the mechanisms of carbon exchange by terrestrial ecosystems in the arctic region is thus of great importance. Evaluation of the carbon cycle and its probable changes due to meteorological shifts requires qualitative and quantitative knowledge about the relationships between biotic and environmental components of the system. Plant ecophysiological properties, such as photosynthetic and respiratory responses to environmental factors and their seasonality, are basic components determining carbon balance.

Since 1994, we have been trying to reveal the ecosystem carbon dynamics and budget in the deglaciated area of Ny- Ålesund, Svalbard. Research has been made for soil respiration, plant distribution and biomass, and plant ecophysiology. In this paper, we will show the leaf photosynthetic gas exchange characteristics of major vascular plant species; *Salix polaris*, *Dryas octopetala* and *Saxifraga oppositifolia*, and their potential net primary production (NPP) which is the key parameter of carbon fixation capacity of the ecosystem.

Intensive measurements of leaf photosynthetic characteristics of *Salix polaris* revealed that (1) the photosynthetic capacity changes dramatically with leaf phenology, (2) photosynthetic rate saturates at relatively low light intensity which can be obtained even on cloudy days, and (3) photosynthetic rate can achive its maximum under broad temperature conditions of 10 – 15 °C. These data suggest that (1) *Salix* has effective photosynthetic response characteristics to light and temperature which highly fluctuate in the natural habitat of Ny-Ålesund, and (2) leaf phenology plays a great role in determining photosynthetic productivity of the vascular plants having very short growing season (about 1.5 months). A simple model simulation using the ecophysiological data, biomass distribution and meteorological data estimated that the NPP of *Salix* under current environemntal conditions to be about 26.1 gC m^{-2}, and that rising temperature would reduce NPP due to a large increase in respiration.

To reveal the contribution of species-specific photosynthetic productivity to the ecosystem carbon fixation, we made further research on the leaf photosynthetic characteristics of three vascular plant species; *Salix polaris*, *Dryas octopetala* and *Saxifraga oppositifolia*. According to the data on the phenological change in photosynthetic capacity gained from the previous study, measurements were made in late July in which photosynthetic capacity is expected to be close to the maximum level over the season. Light-saturated rate of photosynthesis on the basis of leaf biomass of the three species differred remarkably; about 124.1 nmol CO_2 g^{-1} s^{-1} for *Salix*, 57.8 for *Dryas* and 24.4 for *Saxifraga*. Distribution of *Salix* and *Dryas* is restricted to the area where soil nutrient availability is high. *Saxifraga* can be established on the front of glacier where nutrient availability is low, while this species tends to be covered by other vascular plants in the area of high nutrient availability. These research suggest that responsible plant species for ecosystem CO_2 uptake changes with successional status of the arctic terrestrial ecosystems.

P-40

Germination characteristics of Arctic *Polygonum viviparum* in Ny-Ålesund, Svalbard.

Satomi NISHITANI (Nippon Medical School)
Takehiro MASUZAWA (Shizuoka University)

Polygonum viviparum (Polygonaceae) is a summer-green perennial herb. The inflorescence bears variable numbers of flowers and bulbils, but fruit set is very rare, hence the population is considered to be maintained almost exclusively by recruitment from bulbils. We examined bulbil germination characteristics as an important aspect of the life history strategy of this species. The aim of the study was to estimate germination phenology and survival probability during the winter, based on the laboratory experiments. We also aimed at assessing if there were within-species variations in these characteristics.

Bulbils were collected at three sites in the vicinity of Ny-Ålesund (NA1, NA2, and NA3) in early August 2002. NA1 and NA2 are on the same moraine slope and only in a few meters distance, but snowmelt in spring is earlier and soil moisture in summer is lower in NA1. NA3 is about 1 km distant from these two sites. At each site, bulbils were collected from two morphotypes which are represented by their bulbil colors; red and yellow. Germination tests were carried out in November 2002 for bulbils which had been stored in sealed plastic tubes at 5℃ and in the following May for bulbils which had been stored under 4 simulated winter conditions; -5℃ moist, -5℃ air-dried, -25℃ moist and -25℃ air-dried. Germination was tested under 7 conditions with the combination of temperature (5℃, 15℃ and 5/15℃; 12hrs alternation) and light (50 μ mol/m^2・s with R/FR≒7, 50 μ mol/m^2・s with R/FR≒0.3 and darkness). Forty to 50 bulbils were examined under each condition without replication. Emergence of the shoot and roots were recorded weekly for 4 weeks.

In November, the final germination (percentage of bulbils with roots or a shoot or both) was high at 15℃ especially in darkness (more than 90%) in all bulbils, but germination at 5℃ varied among bulbils from different sources (28-90%), with red bulbils showing higher germination than yellow ones at all sites. Bulbils stored under -25℃ moist condition suffered high mortality, which varied among bulbils from different sources (75-100%), and were excluded from the experiment in May. On the other hand, nearly all bulbils survived through the other three winter conditions. Final germination in the experiment in May was generally high, yet with some variations among the storage conditions and among sources of bulbils; delayed shoot development at 5℃ in yellow bulbils (compared with red ones) and in bulbils stored under the air-dried conditions (compared with the moist condition).

In terms of the germination phenology our results suggest that 1) germination in the field occur mainly in spring but the possibility of autumn germination is not excluded and that 2) at the habitat with little snow cover, shoot development in spring may be delayed compared with the habitat with sufficient snow cover. Our results also suggest within-species variations in germination characteristics and freezing tolerance.

P-41

Micrometeorological measurements of methane flux at boreal forest in central Alaska

Masahito Ueyama, Yoshinobu Harazono, Ryo Okada*, Eiji Ohtaki** and Akira Miyata***

International Arctic Research Center, University. of Alaska Fairbanks,
* Tsukuba University, ** Okayama University, *** National Inst. for Agro-Environ. Sci., Japan

Methane (CH_4), secondary strong greenhouse gas, is emitted from anaerobic ecosystems and is decomposed at aerobic ecosystems. High latitude terrestrial ecosystems have important roles on global warming because the ecosystem includes large area of wetland and its responses to current global warming are non-linearity, especially in carbon budget.

The research site was located at a typical taiga forest in central Alaska (66°52'N, 147°51'W), where is a sparse black spruce stand over tussock tundra at discontinuous permafrost. Observation site was established since November 2002, and fluxes of CO_2, H_2O, energy, and CH_4 were measured continuously by micrometeorological methods. CH_4 flux was determined by using a modified gradient method and other fluxes were determined by eddy correlation method. CH_4 concentration at two heights (8 & 2 m) of a tower was measured by a flame-ionized detector CH_4 analyzer (FIA-510, Horiba), in which air-sample lines from the two heights were switched at every 3 minutes and each 30-min averages were used. Micrometeorology such as temperatures, humidity, radiation, wind speed and so on were also measured out, and the 30-min averages of which were applied to calculate CH_4 flux accurately.

Results from two years measurements showed that methane flux was not only emission but also uptake, which varied within a day and showed clear seasonal variation. In early spring when it began to snow-melt, methane flux was emission, suggesting that snow-water made soil an anaerobic condition under shallow active layer. On the contrary, during mid summer, from July to August, methane flux showed obvious uptake with clear diurnal patterns, in which methane flux was mostly negative(sink) during daytime while methane flux was near zero or slightly positive emission during nighttime. The methane CH_4 uptake increased with increase of surface temperature. However, under drought condition CH_4 uptake was restricted. The mean CH_4 uptake rate during mid summer were -1.0 in 2003 and -1.6 mg CH_4 m^{-2} d^{-1} in 2004. We found that surface temperature and precipitation are important meteorological factors of methane uptake in boreal forest during mid summer.

P-42

BIOLOGICAL CONTROL OF ENVIRONMENT OF FAR EASTERN NORTH-EAST COAST

Buzoleva L. S., Bezverbnaya I. P., Babich T.V., Smirnova M.A.,Terehova V.E.

Far Eastern State University, 690600, **Vladivostok,** Russia, Oktyabrskaya,27
тел.: (7-423-2) 45-77-79; факс: 42-95-10; E-mail: buzoleva@mail.ru

Ecological problems become more important for sub arctic and arctic marine ecosystems because of their high sensitivity to anthropogenic load. Because of low water temperature the speed of microbial degradation in the arctic seas considerably less then in seas of temperate zone. It can be a real danger, as toxicants accumulate in different components of marine ecosystems. Microorganisms have a unique possibility to transform and utilize nearly all the existing toxic organic combinations and adapt to changing environmental conditions. Microorganisms, adapted to new chemical combinations which pollute the sea, dominate in community structure and become indicative. The aim of work is the estimation of ecological condition of Okhotsk Sea and Avachinsky Bay in conditions of constant pollution by the microbial indication methods. To count the number of indicative microorganisms we used the method of limited cultivation with the help of McKredy tables.

It was shown that littoral waters of Okhotsk Sea and Avachinsky Bay are considerably polluted. In the Avachinsky Bay microbial indication revealed pollution with the domination of heavy metals (Pb, Cd, Cu) and oil. In the North-West waters of Sakhalin Island we revealed the dominating amount of phenol oxidizing bacteria, and in the North–East part dominating were destructors of hydrocarbon and stable to heavy metals (Cu, Cd, Ni) microorganisms. In Holmsk, Petropavlovsk-Kamchatsky and Magadan ports we discovered a strong pollution by entero bacteria. In the regions which are rather far from shore we did not reveal any of indicative microorganisms. So the foundation of microorganisms adapted to concrete pollution substances reflected not only general pollution of seawater, but also indicated the concentration of separate pollutants. And statistics of microbial indication coincided with statistics of chemical analysis of researched water samples.

The work supported by Award No.- REC-003 of the CRDF and the Ministry of Education of Russian Federation (Y-1-B-03-04) and by the Russian Foundation for Basic Research (project no. 02-05-65188) .

P-43

Title – Overview of Canadian Arctic scientific research issues, organizations and opportunities.

Author – Bob Howe (PBCP), Hiroshi Kanda (NIPR)

This paper intends to present an overview of the following topics and issues;

1. Canadian Arctic issues --- (A) Climate change and the impacts of a warming arctic. (B) Oil and gas development and the potential future environmental, economic and social consequences. (C) Sovereignty questions and possible future challenges. (D) Pollutants in the Canadian Arctic.

2. Canadian Arctic organizations --- (A) Government(s) both federal and territorial, whose mandates and/or jurisdictions extend into the Canadian Arctic. (B) Institutions, including universities, commissions, councils and networks whose scope includes arctic Canada.

3. Canadian Arctic research opportunities and activities --- (A) A brief description of the current status of Canadian Arctic scientific research. (B) An overview of the wide range of scientific research activities being conducted in arctic Canada. (C) A concise summary of the challenges and opportunities.

P-44

Deep structure and tectonics around the Baikal Rift Zone, Russia, from temporary broadband seismic observations

Vladimir D. Suvorov[1], Masaki Kanao*[2], Gennady I. Tatkov[3] and Toubanov Tsyren[3]

(1) United Institute of Geology, Geophysics & Mineralogy, Siberian Branch of Russian Academy of Science, Koptyg ave. 3, Novosibirsk 630090, Russia
(2) Department of Earth Science, National Institute of Polar Resaerch, 1-9-10 kaga, Itabashi-ku, Tokyo 173-8515, Japan
(3) Geological Institute, Siberian Branch of Russian Academy of Science, 6a, Sakhyanova str. Ulan-Ude 670047, Russia

Temporary broadband seismic observations have been carrying out at the Baikal Rift Zone (BRZ), Russia, from January 2004 in order to study the lithospheric structure and evolution of Siberian Craton - Baikal Rift Zone – Mongolia Okhotsk mobile belt. The observations have been conducting by the cooperative program between Institutes of Siberian Branch, Russian Academy of Science (RAS) and the National Institute of Polar Research (NIPR); they will continue until the end of 2005. The observation system consists of a broadband seismometer (CMG-40T), with continuous recording by 24-bit A/D data-logger (LS8000-WD). The station was installed at Makcumuxc (MXM), where located at the center of southern coast of Lake Baikal, with maintained by RAS staff.

The BRZ is considered to have formed lastly in Cenozoic ages by both active and passive origins. Crustal extension associated with the regional phenomena underlying mantle plumes is suggested as the active origin (Zorin et al., 1989; Gao et al., 1994). On the contrary, extension related with the India - Eurasia collision is demonstrated as the passive source (Molnar and Tapponnier, 1975; Petit et al., 1997). A formation scheme of the BRZ, moreover, is controlled by three factors: i.e., 1) mantle plumes, 2) older (pre-rift) linear lithosphere structures positioned relative to the plumes, and 3) favorable orientation of far-field forces (Zorin, et al., 2003).

Crustal thickness beneath BRZ was obtained as more than 50 km from the deep seismic surveys (Suvorov et al., 2002). This evidence is almost opposite feature in the thin-skinned tectonics to form generally understood rift zones. Why these characteristic features of the think crust created? This thick crust at BRZ is also supported by the combined interpretation for the crustal section derived from both geophysical and geological information (Zorin et al., 2002). Several big sutures and large pre-Cenozoic thrusts are supposed to exist associated with the past collision tectonics between Siberian Platform and Mongolia-North China continent (Sharyzhalgay suture, Sayan-Baikal suture, Mongol-Okhotsk suture, etc.).

Regarding these tectonic information from previous studies, several scientific targets are proposed by using broadband seismic data at BRZ. By utilizing the teleseismic waveforms, velocity structure in the crust and the uppermost mantle is expected from the analysis of receiver functions and shear wave splitting, etc.

a) Determine the crustal thickness and lowermost velocities beneath BRZ; The most significant problem to be solved is the confirmation of thickened crust beneath BRZ. Relatively high velocities such as 7.5 km/s shall be observed in the deepest part of BRZ, when the 'crustal root' preserved after continent-continent collision associated with the presence of eclogite facies rocks. Additionally, if any kinds of magmatic underplating exist beneath the adjacent Archean - Early Proterozoic crustal blocks in order to form BRZ, the lovermost part of the crust can be identified as also high velocities.

b) Detect the suture zones & large pre-Cenozoic thrusts; When seismic anisotropy is possessed by mylonites in suture and thrusts, low velocity layers would be detected by seismic rays perpendicular to the mylonite foliation. A difference in receiver function structure is expected associated with the back-azimuth variations.

c) Comparison with surrounded tectonic province; By making a comparison with the other IRIS station data around Siberia, such as Tayan (TLY), Uranbaatar (ULN), Chita (HIA), and Yakutsk (YAK), broader crustal structure of the Siberian Craton - BRZ – Mongolia Okhotsk mobile belt shall be obtained. It provides new and unique understanding concerning tectonic evolution of the region.

d) Upper mantle structure; Deeper part of the mantle lithosphere is also expected by analyzing long period receiver functions to define exact scheme of the underlying plume tails beneath BRZ.

Additionally, the obtained data have a usage for the RAS studies, such as hypocentral determination and detection of seismicity for the local events, together with a construction of a precise regional velocity model.

P-45

Conversion tectonics and crustal structure around Magadan-Kolymsoe region, Far East, Russia, from deep seismic exploration

Shigeru Toda*[1], Alexey Liseikin[2], Masaki Kanao[3], Vladimir D. Suvorov[4] and Arisa Gennady[5]

(1) Aichi University of Education, 1 Hirosawa, Igaya, Kariya, Aichi, 448-8542, Japan
(2) Geophysical Survey, Siberian Branch of Russian Academy of Science, Acad. Koptug Prospect, 3, Novosibirsk 630090, Russia
(3) Department of Earth Science, National Institute of Polar Resaerch, 1-9-10 kaga, Itabashi-ku, Tokyo 173-8515, Japan
(4) United Institute of Geology, Geophysics & Mineralogy, Siberian Branch of Russian Academy of Science, Koptyg ave. 3, Novosibirsk 630090, Russia
(5) Geophysical Survey, Siberian Branch of Russian Academy of Science, 6b, Skujidine str. Magadan 685000, Russia

Deep seismic exploration have been conducting around the at Magadan – Kolymsoe region, Far East, Russia, from 2001 summer season to investigate the crustal structure and conversion tectonics of Kolymsoe pratform - Chukotsk Peninsula. The total seismic profiles are planning to be extended about 2,000 km in length, divided into several short-sections of the profiles operated in a few years of summer seasons.

Southern end of the profile start at the margin of Okhotsk Sea (Magadan), extend into Kolymsoe pratform, Chukotsk Mountains, Chukotsk Sea, then terminate at the Wrangel Island. The profile crossed the plate boundary between Okhotsk Plate (south) and North America Plate (north). In the western part of this Peninsula, there is a triple junction between the Eurasia Plate and the above two plates. In southern portion of the profile, the Okhotsk Plate is undergoing deformation as it is compressed as a result of the convergence of North American and Eurasian plates. On the other hand, northern plate boundary between North American and Eurasian plates has an extensional activity to be caused the proposed Moma rift system, along with the Kolyma River basin.

In the eastward adjacent Siberian craton, Yakuia region of the northern Sakha Republic, significant characteristics of deep crust were identified by the other deep surveys (Suvorov, et al., 1997). Depth and velocity variations can be found as the inner crustal boundaries (such as Conrad), with signature of high correlation between topography and the deeper boundaries. The Moho discontinuity, additionally, have velocity variations in 7.7-9.0 km/s, together with thickened Moho particularly in the Northern kinberlite province. Tectonic re-activation occurred associated with kinberlite magmatism in Middle Paleozoic age.

The scientific purpose of the exploration is to define the present crustal velocity structure in order to have a better understanding of the formation of Kolymsoe pratform - Chukotsk Peninsula region chiefly formed in Mesozoic age. One of the main targets is to find the 'crustal roots' of the complicated system in geological terrains and micro-continents. In this area, Mesozoic collision structures (not only mountain area) are disposed. In the upper mantle beneath the Chukotsk Peninsula, moreover, remnant subducted slabs of the ancient Kula plate (Northern past plate adjacent to Pacific Plate) are suggested by local seismic tomography (Gorbatov, 2004).

From the report of RAS regional network, high seismicity around southern part of the profile (i.e., Chersky seismic belt) within the Okhotsk Plate was observed. Lithospehric deformation and compression have formed a convergence of North American and Eurasian plates to originate the relatively high seismicity (Mackey, et al., 1998). Crustal thickness derived from travel-time inversion using local natural events has a variation in 36-40 km in southern half of the profile (Mackey, et al., 1998). Accordingly, it is also significant to define the precise crustal structure of the Chukotsk area, associated with hypocentral distribution and origin of local seismicity.

The observation system consists of triggered recording data-loggers as independent stations (number of 20-30, by RAS) with short period seismometers. Some parts of the stations used multi-channel geophones to get coherent signals by staking waves. In the next survey, moreover, we are planning to increase the number of stations (20-100) by joining the other type of 16bit data-logger prepared from NIPR. The seismic signals were originated from a total of six tons of dynamite explosive shots at both end of the profile, combined with several shot points by vibrator cars (40 tons of weight) in the middle of each survey line.

In 2001 and 2004 summers, profiles of 800 km and 300 km in length were conducted, respectively. To obtain a whole imaging of the crustal section, remained portion of the profiles are planned in near future.

P-46

Late Quaternary paleoenvironmental change in the Saint Anna Trough, Arctic Russia

Jae Il Lee*, Yedong Kim, and Ho Il Yoon

Gravity core samples obtained from the Saint Anna Trough in the Russian Arctic were analyzed for the paleoceanographic reconstruction. Sedimentary facies were identified with the aid of X-radiography, and bulk and clay mineralogy was investigated using X-ray diffraction analyses. Water content, magnetic susceptibility, organic matter content, total nitrogen and sulfur content, and grain size distribution were analyzed, too. To understand change in sedimentary provenance, trace and rare earth element concentrations were measured.

Dark gray massive diamicton facies, glacial in origin, were observed in the lower part of two cores. The diamicton facies from the two cores differ in the mineral composition and the trace and rare earth element concentrations, implying different sediment sources. The provenance of the core sediment collected near the Novaya Zemlya changed during glacial to post-glacial transition time. Type of organic matter in the core sediments also changed from dominantly terrestrial to marine during this glacial-to-post-glacial transition, reflecting a drastic change in sedimentary environment accompanied with climate change.

P-47

Glaciomarine sedimentation and its paleoclimatic implications on the West Spitsbergen fjord (Isfjorden) over the last 15000 years

[1]Ho Il Yoon, [1]Yeadong Kim, [2]Matthias Forwick and [2]Torre O. Vorren

[1]Korea Polar Research Institute, Ansan P.O. Box, 29, 425-600, Korea
[2]Department of Geology, University of Tromso, N-9037 Tromso, Norway

Analyses of sedimentological and geochemical parameters from radiocarbon-dated sediment cores (JM98-818-PC and JM98-818-PC) retrieved from the central parts of Isfjorden, West Spitsbergen reveal a detailed paleoclimatic and/or paleoceanographic history over the last 15,000 radiocarbon years. The overconsolidated diamicton at the base of core JM98-845-PC is supposed to be a basal till deposited during the Last Glacial Maximum. Deglaciation of the fjord commenced since the glacial maximum, marked by the deposition of interlaminated sand and mud in the ice-proximal zone, and lasted for about 4,000 years with decreasing C/N ratio. A return to colder conditions occurred at around 9,300 yr BP with a drop in TOC content, which is probably coincident with the Younger Dryas event in the North Atlantic region. At this time, an abrupt increase in percentage of TOC content as well as a decrease in C/N ratio suggests increased terrigenous input due to the glacial advance. A climatic optimum is recognized between 7,500 and 2,500 yr BP, coinciding with a 'mid-Holocene climatic optimum' from several other Northern Hemisphere sites, e.g. the Laurentide Ice sheet. During this time, as the glacial system receded from the fjord, enhanced primary productivity occurred in open marine conditions, resulting in the deposition of organic-enriched pebbly mud with evidence of TOC maxima and C/N ratio minima and causing post-depositional dissolution of calcium carbonate component in sediments. Around 2,500 yr BP (the onset of *Neoglacial*), pebbly mud characterized by a decrease in TOC as well as an increase in sand content, reflects the formation of more extensive and seasonally persistent sea ice, which might cause increased terrigenous input, as evidenced by an increase in C/N ratio. Our results provide evidence of climatic change on the West Spitsbergen fjords that helps to refine the existence and timing of late Pleistocene and Holocene millennial-scale climatic events in the Northern Hemisphere.

P-48

Simultaneous Observation of Ion Upflow Events using All-sky Spectrograph and EISCAT Svalbard Radar

Katsuya Tsubone and Shoichi Okano

Planetary Plasma and Atmospheric Research Center
Tohoku University, Sendai, JAPAN

Ion upflow event associated with plasma heating is frequently observed in the polar ionosphere. Typical upward velocity of ions is a few hundred m/sec, which is less than the escape velocity of the Earth's gravitational field. Therefore, ions cannot flow out into the magnetosphere without further acceleration or heating. However, ion upflow itself is still important as a source for ions that flow out to higher altitudes.

Precipitation of soft electron is regarded as a major cause to create ion flow. It is suggested that electron temperature in the ionosphere is increased because of soft electron precipitation, and thereby intensified bipolar electric field drives up ions. However, if soft electron precipitation alone can explain enhancement of electron temperature is not clear yet. It is suggested that the heat flux coming from the magnetosphere also increases electron temperature. On the other hand, it is known that soft electron precipitation efficiently excites auroral OI630nm and OII732/733nm emissions. Therefore, corresponding relation between such auroral emissions and ion upflow is expected. However, there have been very few report on such relationship based on simultaneous observation of optical aurora and ionospheric parameters.

In order to see such relation and to invetigate origin of electron temperature increase, simultaneous observation was carried out at Longyearbyen (78.2°N, 16.0°E, λ_m=75.2°) using an all-sky spectrograph (ASG) and EISCAT Svalbard Radar (ESR). On December 8, 2001, at times when OI630nm and OII732/733nm emissions were intensified at the magnetic zenith, ion upflow events associated with soft electron precipitation were also observed. Ionospheric parameters observed with ESR were compared with the energy of precipitating electrons which were estimated using observed intensity ratio of OI630nm to OI558nm and model calculation. It is shown that soft electron precipitation agrees well with the temporal variation of ion upflow velocity, and also that the less the energy of precipitating electrons, the more the ion upward velocity, and the higher the electron temperature. In addition, the forces acting on ions were calculated using observed ionospheric parameters. It is shown that the force due to electron pressure gradient is well correlated with upward velocity of ions. These results indicate that the bipolar electric field plays a major role in driving ions upward.

P-49

Seasonal variations of atmospheric gravity wave activities in the Arctic mesopause region,

M. Tsutsumi, T. Aso,
National Institute of Polar Research, Japan
and
C. Hall
Tromsoe Geophysical Observatory, Norway

Results of atmospheric gravity wave analysis using operational Nippon/Norway Tromsoe Meteor Radar (NTMR) are presented. This is the first comprehensive gravity wave analysis of this kind using a small meteor radar, which is so far possible only with a powerful radar system such as an MST radar.

The targets of the radar are ionized meteor trails produced at 70-110 km altitude by meteor bodies, which impinge onto Earth's atmosphere, collide with atmospheric molecules and ionize them along their paths. After its formation, the meteor trail follows the motion of the ambient neutral atmosphere, that is, winds. The trail also expands rapidly due to molecular diffusion, which is a function of atmospheric temperature and density. Wind velocity and diffusion coefficient are estimated from Doppler frequency shift and echo power decay involved in observed radar meteor echoes, respectively. Atmospheric temperature fluctuation due to gravity waves can be further estimated from the diffusion coefficient under an assumption called Boussinesq approximation, which is known to be mostly valid for waves with relatively short vertical scales such as gravity waves.

NTMR has been in continuous operation since November 2003 in Tromsoe (69N). One of the major advantages of the present meteor radar system is its very high echo rate (6000-20000 echoes a day) despite the relatively small transmitting power (7.5kW peak). Horizontal winds and temperature fluctuations can be measured with time and height resolutions better than 1 hour and 1km, high enough for the study of inertial gravity waves in the mesopause region. Using a theoretical phase relation between the horizontal winds and temperature fluctuation, horizontal propagation characteristics of gravity waves were studied. The estimated propagation directions are mostly opposite to those of back ground mean winds below 90 km. This shows good agreement with results of previous studies based on powerful radar systems that gravity waves generated in the lower atmosphere carry wave energy and momentum flux high into the mesosphere and then release them so that they decelerate and reverse the prevailing winds above 90 km. More detailed gravity wave analyses focusing on the relation of gravity waves with short-term background wind variations, planetary scale waves and tidal waves are to be conducted by fully utilizing the continuous data set.

Abstracts

accepted but not presented

A-01

Glaciers of the Russia Arctic. Field studies: Science and Logistics

Nikolay Doronin, "EcoShelf" Company, ST. Petersburg, Russia

Glaciers preserve information such as the atmospheric and environmental history from which past climate variability and the response of anthropogenic activity can be extracted. Regular monitoring of the state of the Arctic environment, identification of anthropogenic pollutants, and the study of climate change due to increased UV radiation as a result of ozone depletion were given a special priority for future research. Paleoclimatic records of the last thousand years show strong variability in the Arctic.

There are several glaciers significant for climate research located in the Russian Arctic. They are distributed in the area from 45°E to 165°E. This is approximately one third of the circumpolar belt. Glaciers cover Frants Josef Land Archipelago, the Northern part of Novaya Zemlya, islands of Severnaya Zemlya, and De-Long Islands.

A number of deep ice cores have been obtained from different ice caps in the High Arctic. These sites are particularly attractive because there is little or no surface melting to complicate the stratigraphy and chemistry and often a temporal resolution of 1-2 years is possible for the upper layers covering the past few centuries. Glaciers in the western part of the Russian Arctic are better investigated. "EcoShelf" company has got experience of organization of international expeditions to Frants Josef Land and Severnaya Zemlya. In those expeditions research vessels, airplanes and helicopters were employed. Most complicated was Russian-German field mission to Akademii Nauk Ice Cap. The major task was throughout drilling of the glacier that had thickness about 800 m with ice coring and evacuation of the core in solid form to the mainland and its subsequent transportation to Germany. This expedition lasted 3 seasons and was successfully completed.

Although a number of ice cores drilled in the Eurasian High Arctic from Svalbard to Severnaya Zemlya have provided paleoclimatic and environmental information, a clear data gaps remains. It is likely that a carefully sited ice-core from one or more of the glaciers in the Eastern Eurasian High Arctic will provide a unique record of environmental conditions. From this point of view De-Long Islands are an important site. De-Long Islands constitute the northern group of New Siberian Islands and are located eastern sector of the Russian Arctic far from a navigable line of Arctic ocean. These islands are surrounded by marine ice during whole year. De-Long Islands consist of five small islands. The three most northern islands are called Bennett, Henrietta, Jeannette and the two southern islands are called Zhokhov and Vilkitskiy.

Though the glaciers on these islands have less thickness than on Severnaya Zemlya organization of an expedition to that remote area is more complicated from logistic side. Preparation of an international expedition comprises both bureaucratic issues such as governmental permission to visit the Russian Arctic area, customs procedures for import/export of foreign scientific equipment, and export of ice samples, and transport operations with airplanes and helicopters, organization of fuel depot and manned camps on islands. A preliminary scheme of logistic support is suggested.

A-02

GLOBAL CONTAMINANTS AND HEALTH OF INDIGENOUS PEOPLES OF THE RUSSIAN ARCTIC

Vitaly Kimstach, Valery Chashchin, Lars-Otto Reiersen and Takehiro Nakamura

The GEF project "Persistent Toxic Substances (PTS), Food Security and Indigenous Peoples of the Russian North" was initiated as a follow-up of the Arctic Monitoring and Assessment Programme (AMAP) findings that some Arctic indigenous populations are subject to some of the highest exposure levels to some global contaminants of any population groups on earth. The scope of the project included persistent organic pollutants, including PCB, organochlorine pesticides, dioxins/furans, brominated flame retardants, PAHs and such heavy metals as mercury, cadmium and lead. The project covered several pilot areas of the Russian Arctic, from the West (Kola peninsula) to the Far East (Chukotka), inhabited by different indigenous peoples with different lifestyle and traditional diet.

The project objectives were not only to assess exposure to PTS and their effects on human health, but to develop recommendation on reduction of health risk associated to these contaminants. To reach these objectives, the following activities were implemented:

- Assessment of long-range atmospheric and riverine transport of PTS to the areas inhabited by the indigenous peoples;
- Assessment of local pollution sources in the vicinity of the indigenous communities;
- Assessment of contact sources, including indoor and occupational environment;
- Study of pollution levels in the environment and biotic species used for traditional food;
- Dietary and lifestyle surveys;
- Survey of PTS levels in humans;
- Assessment of PTS effects on human health;
- Development of recommendations.

The project documented that, although overall PTS levels in the natural environment of the Russian Arctic are at moderate levels compared to the other Arctic regions, the levels of human exposure to PTS in this region, specifically to HCB and HCH, and, in some cases, also to DDT and PCB, is one of the highest reported for all the Arctic. The highest PTS exposures and associated health risks are documented for the coastal areas of Chukotka, where the traditional diet of the indigenous population is largely based on marine mammals and fish.

The presentation will provide an overview of the main scientific finding of the project, and comparison with data on the other Arctic areas obtained during preparation of the AMAP assessments.

A-03

An overview of recent research on McCall Glacier, arctic Alaska

Matt Nolan
University of Alaska Fairbanks
matt.nolan@uaf.edu

Shuhei Takahashi
Kitami Institute of Technology
shuhei@mail.kitami-it.ac.jp

Since the International Geophysical Year of 1957-58, McCall Glacier has been home to many glaciological investigations and thus has the longest history of research of any arctic glacier in Alaska. We are currently in year two of a five year study to place this history in the context of the past 200 years of climate change in this region. To do this, we have installed 11 automatic weather stations, a network of 65 velocity/mass-balance stakes, 7 thermistor strings in the ice, several time-lapse cameras, as well as cored the firn and ice, measured ice thickness and basal properties with ice penetrating radar, and undertaken a variety of modeling efforts. These investigations have led to a considerable understanding of the glacier's dynamics. The current warming in this region began around 1890, based on lichenometric and photographic evidence, and has caused the glacier to lose mass at a rate that is increasing with time, with the greatest increases in rates beginning in the 1970s. The glacier is polythermal, with regions of the bed at the melting point and sliding considerably. Due to surface melting in the accumulation area, the latent heat released by refreezing within the firn layer causes the ice here to warmer than –2C, despite a mean annual air temperature of about –12C. Surface energy-balance modeling based on our local weather measurements has revealed that in 2004 that 75% of the melt was due to the radiation balance and 25% due to turbulent fluxes, with a negligible amount of sublimation. Isotope measurements of firn and ice cores reveals significant variations in d18O between seasons and over the past 30-75 years. In the future we hope to use our local measurements to construct a transfer function that will allow us to better interpret a deep ice core, not yet acquired, to understand the transition to the warmer climate we are now experiencing.

A-04

KEY FINDINGS OF THE ARCTIC CLIMATE IMPACT ASSESSMENT.

Lars-Otto Reiersen

The Arctic Council called for the Arctic Climate Impact Assessment (ACIA) to have the latest and best information available regarding ongoing changes in the Arctic. To implement this work, the Arctic Council charged two of its working groups; the Arctic Monitoring and Assessment Programme (AMAP) and the Conservation of Arctic Flora and Fauna (CAFF), along with the International Arctic Science Committee (IASC). It has involved an international effort by hundreds of scientists over four years, and also the traditional knowledge of indigenous peoples.

The main ACIA findings were presented to the Arctic Council Ministerial meeting in November 2004.

The key ACIA findings are the following:

1. Arctic climate is now warming and much higher changes are projected.
2. Arctic warming and its consequences have worldwide implications.
3. Arctic vegetation zones are likely to shift, causing wide-ranging impacts.
4. Arctic species' diversity, ranges and distribution will change.
5. Many coastal communities and facilities face increasing exposure to storms.
6. Reduced sea ice is very likely to increase marine transport and access to resources.
7. Thawing ground will disrupt transportation, buildings and other infrastructure.
8. Coastal communities and facilities face increasing exposure to storms.
9. Elevated ultraviolet radiation levels will affect people, plants and animals.
10. Multiple influences interact to cause impacts to people and ecosystems.

The presentation will present an information that ground the above findings, and give an overview of the policy document adopted by the Arctic Council Ministerial meeting as a follow-up of the ACIA Report.

A-05

AMAP POLLUTION AND CLIMATE CHANGE ACTIVITIES AND PLANS FOR THE FUTURE

Lars-Otto Reiersen and Vitaly Kimstach

Arctic Monitoring and Assessment programme (AMAP) was established by the governments of the eight Arctic countries in 1991 as an integral part of the Arctic Environmental Protection Strategy (AEPS). In 1996, with the establishment of the Arctic Council, all AEPS bodies, including AMAP, work under its umbrella. The Arctic Council Ministers have requested AMAP to:

- produce integrated assessment reports on the status and trends of the conditions of the Arctic ecosystems;
- identify possible causes for the changing conditions;
- detect emerging problems, their possible causes, and the potential risk to Arctic ecosystems including indigenous peoples and other Arctic residents; and to
- recommend actions required to reduce risks to Arctic ecosystems.

In addition to activities for monitoring, data collection, exchange of data on impacts and assessment of the effects of contaminants and their pathways, effects of increased UV-B radiation due to stratospheric ozone depletion, and climate change on the Arctic are also under the AMAP mandate. Among pollution issues, persistent organic pollutants, heavy metals, radioactivity, acidification and hydrocarbons are determined as the AMAP priorities.

The first AMAP Assessment Report was published in 1997/1998, and its findings were used, from one side, as a background for the 2nd phase of AMAP and, from the other side, for development of remedial actions to eliminate pollution in the Arctic. In particular, its results were widely used to justification and development of the Stockholm Convention of Persistent Organic Pollutants, and are currently used by the arctic Council Action Plan to eliminate Pollution in the Arctic (ACAP).

In 2002, AMAP presented its 2nd Assessment Report, which provided more comprehensive information on pollution issues covered by the previous report and new issues of concern for the Arctic environment and population. Special attention was paid to mercury transport, deposition, levels and effects in the Arctic, and such new anthropogenic contaminants as brominated flame retardants. In parallel with preparation of the 2nd Assessment Report that was followed by 5 volumes of the scientific reports, AMAP actively participated in the Arctic Climate Impact Assessment presented to the Arctic Council Ministerial meeting in 2004.

At the forthcoming period AMAP, following the request of the Ministers, will continue pollution and climate change monitoring activities and improve knowledge needed to assess effects of multiple stressors on ecosystems and human health, with special focus on the Arctic indigenous peoples. Based on the ministerial request AMAP will present in 2006 a assessment report on acidification and, in collaboration with the other Arctic Council working groups, assessment report on perspectives and effects of oil and gas activities in the Arctic.

A-06

Tectonic pathways of the methane emission from eastern and southern Sakhalin shelf (Okhotsk Sea)

Renat Shakirov[1], Anatoly Obzhirov[2], Erwin Suess[3], Nicole Biebow[4], Valeriya Terekhova[1] and Hitoshi Shoji[1]

[1]Kitami Institute of Technology, Kitami, Japan, ren@poi.dvo.ru
[2]Pacific Oceanological Institute FEB RAS, Vladivostok, Russia
[3]Leibniz Institute for Marine Sciences, Kiel, Germany
[4]Alfred-Wegener-Institute for Polar and Marine Sciences, Bremerhaven, Germany

The study of geological conditions of modern submarine methane emission regime from fossil hydrocarbon resources is an important concerning methane concentrations growth in atmosphere and resources conservation state. Methane anomalies, investigated during Russian-German Projects KOMEX I-II (1998-2002) on the eastern-southern Sakhalin shelf water column, are a direct signs of methane migration from local's hydrocarbon deposits. In the present study we set out to analyze main tectonic features favorable for methane emission from Sakhalin shelf area.

In case of natural gas emission the basic hazard occupies permeable zones, generated by the neotectonic movements, seismic activity and stressed state of the some areas.

Eastern-southern Sakhalin shelf controlled by 4 tectonic depressions: North Sakhalin, Pogranichniy, Terpeniya and Aniva. Each of them has special tectonic features of methane emission. Among of them some basic types can be separated as general: gas escape structures/single local vents, mud volcanoes, fault grids and abrasion zones of the folded structures (wide area methane emission).

Fault pattern are different in mentioned depressions and, accordingly, features of methane emission are characteristically changing. Decreasing of tectonic disruptions density and oil-gas deposits amount from north toward south along eastern Sakhalin shelf cause a smoothly lowering of methane anomalies intensity. The anomalies maximums fixed above oil-gas deposits. For instance, the highest methane concentration for the Sakhalin shelf (10,000 nl/l) was observed above Lunskoe deposit in near bottom water layer. This deposit located in the anticline fold, which one broken by faults for several blocks. Abrasion zone (methane anomalies up to 2,000 nl/l) was reviewed in Pogranichniy Depression.

It is reasonably to assume that tectonically generated pathways are the main condition for significant methane emission. Some features of the methane anomalies (e.x. distribution and their intensity) in water column strongly vary in different tectonic environment in study region.

A-07

Evolution of the Earth's climatic system: possible reasons and sequences

Sosnin[1] V., Vasilevskaya[1] L., Plotnikov[1] V., Biebow[2] N., Lembke[3] L.

1-Pacific Oceanological Institute, Vladivostok, Russia (sosnin@poi.dvo.ru)
2-AWI, Bremerhaven, Germany (nbiebow@awi-bremerhaven.de)
3-GEOMAR, Kiel, Germany (llembke@geomar.de)

Modern climate change is thought to be connected with anthropogenic influence and the effects of "greenhouse gases". But climate has changed long before human activity occurs, so, there must be a more general reason for the cyclical variability of the Earth's climate. This is a key question for understanding of changes in the climatic system in orbital and suborbital time scales.
It is well known that the variability of solar irradiance in orbital time scale leads to the appearance of ice sheets on the continents. The variability of solar radiation, which comes from physical changes of Sun itself1 (from 2 to 2400 years), has been proved to influence climate changes in suborbital time scales.

The last stage of rapid Tibetan plateau uplift approximately 2.5 Myr ago resulted in the onset of periodic glaciations in the Northern Hemisphere, the abrupt freshening of the subarctic Pacific ocean and the onset of a permanent halocline, and strengthening of the East Asia winter monsoon. All these events coincided strictly in time producing the modern pattern of the climatic system. We strongly suspect that atmosphere is a main climate driver and plays a leading role in the climate system. It is well known that extremes in solar activity (e.g. annual sunspot number) correlate highly with variations of atmospheric pressure in centers of atmosphere action and with their geographic locations. High solar activity corresponds to low pressure in the Siberian High, but lower solar irradiance is in agreement with increased atmospheric pressure of Siberian High and its expansion. As a result the general atmospheric circulation can change dramatically producing shifts of all centers of atmospheric action. The influence of solar irradiance on the changes of climatic system is of the same character for orbital and suborbital time scales: low solar activity drives the cold winters of 11-year periodicity, little ice ages, and glacial periods.
We consider that atmosphere plays a leading role in climatic system and drives the climatic changes on the Earth. The main reason for this is the variability of atmosphere circulation forced by the influence of astronomical reasons (variability of solar irradiance in different time scales). Proper terrestrial factors (tectonic motions) define changes of climatic system in geological time scales through the reconstruction of sea level pressure pattern and subsequent changes of atmospheric circulation of the Earth. They precede all following changes in other links of climatic system.
Such approach allows reconstruct the pattern of surface atmosphere pressure for the Northern Hemisphere for the Last Glacial Maximum according to the main features of that time: positions of subarctic frontal zones in the oceans and sea ice extension, coast lines of continents due to low sea level, positions of ice sheets on the continents.
The map supports the idea of a more continental climate for the Sea of Okhotsk with lower temperatures, lower wind speeds and velocities of drift currents during winter seasons in comparison with modern situation and complete ice melting during summer period.

A-08

Application of the video-microscopy (VE-DIC) method for the algae-bacterial interaction study

Valeriya Terekhova[1,5], Aleksandr Karpenko[2], Nina Aizdaicher[2], Lubov Buzoleva[3,5], Renat Shakirov[1], Nicole Biebow[4], George Somov[3] and Hitoshi Shoji[1]

[1] Kitami Institute of Technology, Kitami, Japan
[2]Institute of Marine Biology, FEB RAS, Vladivostok, Russia
[3]Institute of Epidemiology and Microbiology, SB RAMS, Vladivostok, Russia
[4]Alfred-Wegener-Institute for Polar and Marine Sciences, Bremerhaven, Germany
[5]Far Eastern National University, Vladivostok, Russia

High-resolution video-enhanced differential interference contrast (VE-DIC) light microscopy allows obtaining high quality images of low-contrast objects without coloring and fixating them (Weiss, 1986; Salmon, Phong, 1998). The VE - DIC microscopy based on the fact, that the TV-camera entraps gentle contrast variations better, than the man's eye. During image generation the brightness differences is strengthen and the television picture's mean brightness is decreased. The results were videotaped in an online regime.

The possibilities of this method we studied on an example of interaction between opportunistic pathogenic bacteria *L. monocytogenes* and marine benthic diatom *Navicula* sp. in joint cultivation.

The parasitic character of the *Listeria* interrelation with the diatoms has been established (Haskel, 1949). The analysis of algae-bacterial interaction video records has allowed revealing features of this parasitism.

The direct observation has shown that Listeria (regardless of strain) attacked *Navicula* sp. cells and destroyed them. The mechanism of alga disintegration as follows. Listeria is tightly adhered to an algae surface and perforated its cell wall. Cell substance escapes by the small balls through the cell wall defect under the intercellular pressure. After pressure leveling, bacteria penetrate into an alga cell, disintegrating a cell substance and silicic skeleton. Finally, as a result of alga cell destroying, remained cell's substance was observed as an oval cluster. During all observation period in control culture *Navicula* sp. (without Listeria) the destructive changes of algae cells were not found. Literary data about described phenomena were not found.

Thus, was revealed that *L. monocytogenes* is an ectoparasite of benthic diatom *Navicula* sp for the first time. Application of VE - DIC microscopy method not only allow revealing algae-bacterial interaction type, but study interspecies interrelation mechanism as well.

A-09

Characteristics of waves in the upper mesosphere from ground-based airglow measurements in the northern high-latitude

Young-In Won[1], Yeadong Kim[2], Irfan Azeem[1], and G. G. Sivjee[1]

[1] Department of Physical Science, Embry-Riddle Aeronautical University
600 S. Clyde Morris Blvd., Daytona Beach, FL 32114, U.S.A.

[2] Korea Polar Research Institute, KORDI
1270 Sa-Dong, Ansan 425-170 Korea

e-mail: won408@erau.edu

Terrestrial nightglow emissions in the near infrared region have been monitored from several ground-based optical observatories in the northern high latitude; Kiruna, Sweden (67.90° N, 21.10° E), Eureka (80.0° N, 85.9° W), and Resolute Bay (74.68° N, 94.90° W), Canada. Spectral analysis of the derived rotational temperatures yields the periodicities of the atmospheric waves that are known to propagate upward from the lower atmosphere and perturb the airglow brightness and the rotational temperatures in the upper atmosphere. Spectral features at various periods are found and investigated in relation to atmospheric tides and planetary waves. The commonly observed features are waves near the tidal periods, i.e. 6, and 8 and 12 hour oscillations. The data also show fluctuations at longer periods of 4-day and quasi-16 day waves. Harmonic analysis is also performed to seasonal data sets to identify the amplitudes and phase information of the major oscillations over season.

List of participants

(Pre registered by 5th February 2005)

Symposium Planning Committee

Chair: Hideki Shimamura (NIPR, Japan)
Guido di Prisco (CNR, Italy)

Members: Kim Holmen (NILU, Norway)
Syun-ichi Akasofu (IARC, U.S.A.)
Jan-Gunnar Winther (NP, Norway)
Kim Yeadong (KORDI, Korea)
Zhan Zhanghai (PRIC, China)
Roland Neuber (AWI, Germany)
Asgeir Brekke (Univ. Tromsø, Norway)
Yasunobu Iwasaka (Nagoya Univ., Japan)
Shuhei Takahashi (Kitami Inst. of Tech., Japan)
Hiroshi Kanda (NIPR, Japan)

Local Organizing Committee

Chair: Yoshiyuki Fujii (NIPR)

Members: Takashi Yamanouchi (NIPR)
Kokichi Kamiyama (NIPR)
Takehiko Aso (NIPR)
Mitsuo Fukuchi (NIPR)
Hiroshi Kanda (NIPR)
Makoto Wada (NIPR)
Shinji Morimoto (NIPR)
Tsuneo Odate (NIPR)
Masaki Uchida(NIPR)
Kaoru Sato (NIPR)
Masaki Tsutsumi (NIPR)
Hideki Miura (NIPR)
Hajime Ito (NIPR) (Secretary)

Family Name: AIKAWA First Name: Shimpei
Institute: Hyogo University
Address: 2-1, Kouto 3, Kamiguncho, Hyogo, Japan
Phone: 0791-58-0815 e-mail: rj04j001@stkt.u-hyogo.ac.jp

Family Name: AKASOFU First Name: Syun-ichi
Institute: International Arctic Research Center, University of Alaska Fairbanks
Address: 930 Koyukuk Dr. P.O. Box 757340, Fairbanks, AK99775-7340, U.S.A.
Phone: 907-474-6012 Fax: 907-474-5662 e-mail: sakasofu@iarc.uaf.edu

Family Name: AOKI First Name: Kazuma
Institute: Toyama University, Faculty of Education
Address: 3190 Gofuku, Toyama 930-8555, Japan
Phone: +81-76-445-6374 Fax: +81-76-445-6264 e-mail: kazuma@edu.toyama-u.ac.jp

Family Name: ARKHIPOV First Name: Serguei
Institute: Institute of Geography, Russian Academy of Sciences
Address: Staromonetny pereulok, 29, 109017, Moscow, Russia.
e-mail: arhipov@1system.ru

Family Name: ASO First Name: Takehiko
Institute: NIPR
Address: Kaga 1-9-10 Itabashi, Tokyo 173-8515 Japan
Phone and Fax: +81-3-3962-4756 e-mail: t-aso@nipr.ac.jp

Family Name: ASUMA First Name: Yoshio
Institute: Hokkaido University
Address: Kita-10 Nishi-8, Kita-ku, Sapporo 060-0810
Phone: +81-11-706-2763 Fax: +81-11-706-2763 e-mail: asuma@ep.sci.hokudai.ac.jp

Family Name: BÖLTER First Name: Manfred
Institute: Institute for Polar Ecology, Kiel University
Address: Wischhofsk 1-3, Bldg.12, D-24148, Kiel, Germany
Phone: +49-431-6001249 Fax: +49-431-6001210 e-mail: mboelter@ipoe.uni-kiel.de

Family Name: BREKKE First Name: Asgeir
Institute: Department of physics
Address: University of Tromsø, N-9037 Tromsø, Norway
Phone: +47 776 45 167 Fax: +47 77 64 55 80 e-mail: Asgeir.Brekke@phys.uit.no

Family Name: BUZOLEVA First Name: Lyubov
Institute: Far East University
Address: 27, Oktyabrskaya str., Vladivostok,690600, Russia
Phone: (4232) 452-327 Fax: (4232) 432568 e-mail: buzoleva@mail.ru

Family Name: COOPER First Name: Elisabeth J.
Institute: UNIS
Address: PO BOX 156, N-9171 Longyearbyen, Svalbard, Norway.
Phone: +47-79023343 Fax: +47-79023301 e-mail: elisabeth.cooper@unis.no

Family Name: DALE First Name: Kjersti
Institute: Kings Bay AS
Address: PB 18, 9173 Ny-Ålesund, Norway
Phone: +4779027252 Fax: +4779027201 e-mail: forskning@kingsbay.no

Family Name: DELBART First Name: Franck
Institute: French Polar Institute (IPEV)
Address: Technopole Brest Iroise 29280 PLOUZANE, France
Phone: 00 33 2 98 05 65 56 Fax: 00 33 2 98 05 65 55 e-mail: fdelbart@ipev.fr

Family Name: di PRISCO First Name: Guido
Institute: Institute of Protein Biochemistry, CNR
Address: Via Marconi 12, I-80125 Naples, Italy
Phone: +39 081 7257 242 Fax: +39 081 593 6689 e-mail: g.diprisco@ibp.cnr.it

Family Name: DORONIN First Name: Nikolay
Institute: "EcoShelf" Company
Address: Novoderevenskaya Str. 19, Pushkin, St. Petersburg, Russia
Phone: +7-812-115-56-11 Fax: +7-812-476-44-92 e-mail: office@ecoshelf.ru

Family Name: FERRARI First Name: Christophe
Institute: Laboratory of Glaciology and Geophysics of Environment (LGGE / CNRS)
Address: 54, Rue molière BP 96 – 38402 SAINT MARTIN d'HERES Cedex, France
Phone: (+33) 4 76 82 42 39 Fax: (+33) 4 76 82 42 01 e-mail: ferrari@lgge.obs.ujf-grenoble.fr

Family Name: FORTIER First Name: Louis
Institute: Department of Biology, Laval University
Address: Room 2078, Pavillon Vachon, Université Laval, Québec (Québec) G1K 7P4 Canada
Phone: (418) 656-5646 Fax: (418) 656-2334 e-mail: Louis.Fortier@bio.ulaval.ca

Family Name: FUJII First Name: Yoshiyuki
Institute: National Institute of Polar Research
Address: Kaga 1-9-10 Itabashi, Tokyo 173-8515 Japan
Phone: +81-3-3962-4742 Fax: +81-3-3962-5701 e-mail: fujii@pmg.nipr.ac.jp

Family Name: FUKUCHI First Name: Mitsuo
Institute: National Institute of Polar Research
Address: Kaga 1-9-10 Itabashi, Tokyo 173-8515 Japan
Phone: +81-3-3962-6031 Fax: +81-3-3962-4914 e-mail: fukuchi@nipr.ac.jp

Family Name: GARBRECHT First Name: Thomas
Institute: Optimare sensor systeme AG
Address: AM Luneort 15a, D-27572 Bremerhaven, Germany
Phone: +49-471-4836121 Fax: +49-471-4836111 e-mail: Thomas.garbrecht@optimare.de

Family Name: GAYET First Name: Jean - Francois
Institute: LaMP UMR 6016 CNRS
Address: Université Blaise Pascal, 24 avenue des Landais, 63 177 Aubière France
Phone: (33) 4 73 40 73 62 Fax: (33) 4 73 40 51 36 e-mail: gayet@opgc.univ-bpclermont.fr

Family Name: GERNANDT First Name: Hartwig
Institute: Alfred Wegener Institute for Polar and Marine Research
Address: Am Handelshafen 12, d – 27570 Bremerhaven, Germany
Phone: +49-471-4831-1160 Fax: +49-471-4831-1355 e-mail: hgernandt@awi-bremerhaven.de

Family Name: GIRARD First Name: Lucas
Institute: Norwegian Institute for Air Research / University Centre on Svalbard
Address: Postbox 1088, 9171 Longyearbyen, Norway
Phone: +47 79 02 33 19 Fax: +47 79 02 33 01 e-mail: lucasg@unis.no

Family Name: GUSTAVSSON First Name: Bjorn
Institute: Swedish Institute of Space Physics
Address: Box 812, SE-981 28 Kiruna, Sweden
Phone: +46 980 79000 Fax: +46 980 79091 e-mail: bjorn@irf.se

Family Name: HANSEN First Name: Kjell tore
Institute: Svalbard Science Forum
Address: P.O. Box 506, N-9171 Longyearbyen, Norway
Phone: +47 7902 2616 Fax: + 47 7902 2604 e-mail: ssf@npolar.no

Family Name: HARAZONO First Name: Yoshinobu
Institute: International Arctic Research Center, University of Alaska Fairbanks
Address: 930 Koyukuk Dr., Fairbanks, Alaska, 99775, USA
Phone: 1-907-474-5515 Fax: 1-907-474-2691 e-mail: y.Harazono@uaf.edu

Family Name: HATTORI First Name: Hiroshi
Institute: Hokkaido Tokai University
Address: 1-1, 1 go-jyo, Minamisawa, Minami-ku, Hokkaido, Japan
Phone: 011-571-5111 e-mail: hattori@dm.htokai.ac.jp

Family Name: HERBER First Name: Andreas b.
Institute: AWI Bremerhaven
Address: Am Handelshafen 12, 27570 Bremerhaven, Germany
Phone: +49 47148311489 Fax: +49 47148311425 e-mail: aherber@awi-bremerhaven.de

Family Name: HERBER First Name: Andreas B.
Institute: AWI Bremerhaven
Address: Am Handelshafen 12, 27570 Bremerhaven, Germany
Phone: +49 47148311489 Fax: +49 47148311425 e-mail: aherber@awi-bremerhaven.de

Family Name: HIRASAWA First Name: Naohiko
Institute: National Institute of Polar Research
Address: Kaga 1-9-10, Itabashi-ku, Tokyo 173-8515, Japan
Phone: 03-3962-5904 Fax: 03-3962-5704 e-mail: hira@nipr.ac.jp

Family Name: HOLMÉN First Name: Kim
Institute: Norwegian Institute of Air Research
Address: NILU, Polar Environmental Centre, NO-9296 Tromsø, NORWAY
Phone: +47 77750386 Fax: +47 77750376 e-mail: kjh@nilu.no

Family Name: HOWE First Name: Robert
Institute:
Address: 216 Frazier Road, Salt Spring Island, British Columbia, Canada. V8K 2B5
Phone: 250-653-4542 Fax: 250-653-4540 e-mail: bhowe@saltspring.com

Family Name: INOMATA First Name: Yayoi
Institute: Nagoya University, Division of Earth and Environmental Sciences
Address: c/o Solar-Terrestrial Environment Laboratory, Nagoya University,
Chikusa-ku, Nagoya, 464-8601, Japan
Phone: 052-789-4304 Fax: 052-789-4301 e-mail: inomata@stelab.nagoya-u.ac.jp

Family Name: ITO First Name: Hajime
Institute: National Institute of Polar Research
Address: Kaga 1-9-10, Itabashi, Tokyo 173-8515 Japan
Phone: +81-3-3962-5690 Fax: +81-3-3962-5701 e-mail: hajime@pmg.nipr.ac.jp

Family Name: KAMIYAMA First Name: Kokichi
Institute: National Institute of Polar Research
Address: Kaga 1-9-10, Itabashi-ku, Tokyo 173-8515, Japan
Phone: +81-3-3962-4702 Fax: +81-3-3962-5719 e-mail: kamiyama@pmg.nipr.ac.jp

Family Name: KANAMORI First Name: Syosaku
Institute: Institute of Low Temperature Science, Hokkaido University
Address: Kita 19 Nishi 8 Kita-ku, Sapporo 060-0819, Japan
Phone: 011-706-5505 Fax: 011-706-7142 e-mail: kanasyo@pop.lowtem.hokudai.ac.jp

Family Name: KANAO First Name: Masaki
Institute: NIPR
Address: 1-9-10, Kaga, Itabashi-ku, Tokyo 173-8515, Japan
Phone: 03-3962-3275 Fax: 03-3962-5741 e-mail: kanao@nipr.ac.jp

Family Name: KANDA First Name: Hiroshi
Institute: National Institute of Polar Research
Address: 9-10, Kaga 1-chome, Itabashi-ku, Tokyo 173-8515
Phone: +81-3-3962-4761 Fax: +81-3-3962-1525 e-mail: kanda@nipr.ac.jp

Family Name: KASHINO First Name: Yasuhiro
Institute: University of Hyogo, Department of Life Science
Address: 3-2-1 Kohto, Kamigohri, Ako-gun, Hyogo 678-1297, Japan
Phone: 0791 58 0185 Fax: 0791 58 0185 e-mail: kashino@sci.u-hyogo.ac.jp

Family Name: KIM First Name: Yeadong
Institute: Korea Polar Research Institute
Address: 1270 Sa-2-dong, Sangrokgu, Ansan 426-744, Korea
Phone: +82-31-400-6400 Fax: +82-31-408-5825 e-mail: ydkim@kopri.re.kr

Family Name: KIMSTACH First Name: Vitaly
Institute: Secretariat of the Arctic Monitoring and Assessment Programme (AMAP)
Address: Strømsveien 96, P.O. Box 8100 Dep., N-0032 Oslo, Norway
Phone: +47 23 24 16 34 Fax: +47 22 67 67 06 e-mail: vitaly.kimstach@amap.no

Family Name: KOHSHIMA First Name: Shiro
Institute: Tokyo Institute of Technology, Graduate School of Bioscience and Biotechnology, Dep. Biological Sciences
Address: 2-12--W3-43 Ookayama Meguro-ku, Tokyo 152-8551 Japan
Phone: +81-3-5734-2657 Fax: +81-3-5734-2946 e-mail: kohshima@bio.titech.ac.jp

Family Name: KOJIMA First Name: Satoru
Institute: Tokyo Woman's Christian University
Address: 2-6-1 Zempukuji, Suginami-ku, Tokyo, Japan
Phone: +81-3-5382-6410 Fax: +81-3-5382-0803 e-mail: kojima@lab.twcu.ac.jp

Family Name: KONISHI First Name: Hiroyuki
Institute: Osaka Kyoiku University
Address: 4-698-1, Asahigaoka, Kashiwara-shi, Osaka, 582-8582, Japan
Phone: +81-729-78-3640 Fax: +81-729-78-3554 e-mail: konishi@cc.osaka-kyoiku.ac.jp

Family Name: Kurita First Name: Naoyuki
Institute: Institute of Observational Research for Global Change (IORGC),
Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
Address: 2-15 Natsushima-cho, Yokosuka, Japan
Phone: +81-46-867-9822 Fax: +81-46-867-9255 e-mail: nkurita@jamstec.go.jp

Family Name: LEE First Name: Jae Il
Institute: Korea Polar Research Institute
Address: KORDI, P.O.Box 29, Ansan, 425-600, Korea
Phone: +82-31-400-6434 Fax: +82-31-408-5825 e-mail: leeji@kopri.re.kr

Family Name: MAGAND First Name: Olivier
Institute: Laboratory of Glaciology and Geophysics of Environment (LGGE / CNRS)
Address: 54, Rue molière BP 96 – 38402 SAINT MARTIN d'HERES Cedex, France
Phone: (+33) 4 76 82 42 81 Fax: (+33) 4 76 82 42 01 e-mail: magand@lgge.obs.ujf-grenoble.fr

Family Name: MAKAROV First Name: Vladimir
Institute: Permafrost Research Institute
Address: Yakutsk, 677010, Russia
Phone: 7-4112-334237 Fax: 7-4112-334476 e-mail: makarov@mpi.ysn.ru

Family Name: MATSUKI First Name: Atsushi
Institute: Graduate School of Environmental Studies, Nagoya University
Address: Furocho, Chikusaku, Nagoya, 464-860†, Japan
Phone: +81-52-789-4304 Fax: +81-52-789-4301 e-mail: matsuki@stelab.nagoya-u.ac.jp

Family Name: MEHLUM First Name: Fridtjof
Institute: Research Council of Norway
Address: P.O. Box 2700 St. Hanshaugen, N-0131 Oslo, Norway
Phone: +47 95 82 77 82 Fax: +47 22 03 73 62 e-mail: fme@rcn.no

Family Name: MELNIKOV First Name: Igor
Institute: P.P.Shirshov Institute of Oceanology
Address: Nakhimovsky pr., 36, Moscow 117996, Russia
Phone: 7 (095) 124 5996 Fax: 7 (095) 124 5983 e-mail: migor@online.ru

Family Name: MIURA First Name: Hideki
Institute: National Institute of Polar Research
Address: Kaga 1-9-10 Itabashi, Tokyo 173-8515 Japan
Phone: +81-3-3962-8095 Fax: 3962-5741 e-mail: miura@nipr.ac.jp

Family Name: MIYOSHI First Name: Yasunobu
Institute: Kyushu University, Faculty of Sciences
Address: 6-10-1 Hakozaki, Higashiku, Fukuoka, Japan
Phone: +81-92-642-2683 Fax: +81-92-642-2684 e-mail: miyoshi@geo.kyushu-u.ac.jp

Family Name: MO First Name: Wenhong
Institute: University of Tsukuba
Address: Tennoudai 1-1-1, Tsukuba, Ibaraki, 305-8577, Japan
Phone: 0298-53-4531 Fax: 0298-53-6614 e-mail: mow@sakura.cc.tsukuba.ac.jp

Family Name: MORI First Name: Akira
Institute: Kyoto University, Laboratory of Forest Ecology, Graduate School of Agriculture
Address: Oiwake-cho, Kitashirakawa, Sakyo-ku, Kyoto, 606-8502, Japan
Phone: +81-75-753-6080 Fax: +81-75-753-6080 e-mail: akkym@kb3.so-net.ne.jp

Family Name: MORIMOTO First Name: Shinji
Institute: National Institute of Polar Research
Address: Kaga 1-9-10 Itabashi, Tokyo 173-8515 Japan
Phone: +81-3-3962-4806 Fax: +81-3-3962-5719 e-mail: mon@nipr.ac.jp

Family Name: MURAOKA First Name: Hiroyuki
Institute: Institute for Basin Ecosystem Studies, Gifu University
Address: 1-1 Yanagido, Gifu, 501-1193 Japan
Phone: 058-293-2064 Fax: 058-293-2062 e-mail: muraoka@green.gifu-u.ac.jp

Family Name: NAKAOKA First Name: Shin Ichiro
Institute: Center for Atmospheric and Oceanic Studies, Tohoku University
Address: Aoba Aramaki-Aza Aoba-ku Sendai-City Miyagi-Pref. Japan
Phone: +81-22-217-5793 Fax: +81-22-217-5797 e-mail: syn@caos-a.geophys.tohoku.ac.jp

Family Name: NAKATSUBO First Name: Takayuki
Institute: Graduate School of Biosphere Science, Hiroshima University
Address: Kagamiyama 1-7-1, Higashi-Hiroshima 739-8521, Japan
Phone: 082-424-6514 Fax: 082-424-0758 e-mail: kuyakat@hiroshima-u.ac.jp

Family Name: NAKAZAWA First Name: Fumio
Institute: Nagoya University, Graduate School of Environmental Studies
Address: c/o Hydrospheric Atmospheric Research Center,
Furo-cho, Chikusa-ku, Nagoya 464-8601, Japan
Phone: +81-52-789-3488 Fax: +81-52-789-3436 e-mail: nakazawa@ihas.nagoya-u.ac.jp

Family Name: NEUBER First Name: Roland
Institute: Alfred Wegener Institut
Address: Telegrafeuberg A43, D-14473 Potsdam, Germany
Phone: +49-331-2882129 Fax: +49-331-2882178 e-mail: neuber@awi-potsdam.de

Family Name: NISHIO First Name: Fumihiko
Institute: Center for Environmental Remote Sensing, Chiba University
Address: 1-33, Inage-ku, Yayoi-cho, Chiba City
Phone: 043-290-383 Fax: 043-2903857 e-mail: fnishio@ceres.cr.chiba-u.ac.jp

Family Name: NISHITANI First Name: Satomi
Institute: Nippon Medical School
Address: Kosugi 2-297-2, Nakahara, Kawasaki 211-0063 Japan
Phone: +81-44-733-3592 Fax: +81-44-722-1231 e-mail: satomi-n@nms.ac.jp

Family Name: NOLAN First Name: Matt
Institute: University of Alaska Fairbanks
Address: 455 Duckering Bldg, Fairbanks, Alaska 99775-5860, USA
Phone: 907 474 2467 Fax: 907 474 7979 e-mail: matt.nolan@uaf.edu

Family Name: NOLAN First Name: Matt
Institute: University of Alaska Fairbanks
Address: 455 Duckering Bldg, Fairbanks, Alaska 99775-5860, USA
Phone: 907 474 2467 Fax: 907 474 7979 e-mail: matt.nolan@uaf.edu

Family Name: ODATE First Name: Tsuneo
Institute: National Institute of Polar Research
Address: Kaga 1-9-10 Itabashi, Tokyo 173-8515 Japan
Phone: +81-3-3962-4363 Fax: +81-3-3962-5743 e-mail: odate@nipr.ac.jp

Family Name: OHATA First Name: Tetsuo
Institute: Institute of Observational Research of Global Change, JAMSTEC
Address: 2-15 Natsushima-cho, Yokosuka-shi, 237-0061, Japan
Phone: +81-46-867-9250 Fax: +81-46-867-9255 e-mail: ohatat@jamstec.go.jp

Family Name: OHTSUKA First Name: Toshiyuki
Institute: Ibaraki University, Lab. of Ecology
Address: 2-1-1 Bunkyo, Mito, Ibaraki, 310-8512 Japan
Phone: +81-29-228-8384 Fax: +81-29-228-8384 e-mail: toshi@mx.ibaraki.ac.jp

Family Name: OSONO First Name: Takashi
Institute: Graduate School of Agriculture, Kyoto University
Address: Kitashirakawa Oiwake-cho, Sakyo, Kyoto 606-8502 Japan
Phone: 075-753-6079 Fax: 075-753-6080 e-mail: fujijun@kais.kyoto-u.ac.jp

Family Name: OTA First Name: Takashi
Institute: Senshu University of Ishinomaki
Address: 1 Shin-mito, Minamisakai, Ishinomaki, Miyagi, 986-8580, Japan
Phone: 81-225-22-7716 Fax: 81-225-22-7746 e-mail: otakashi @isenshu-u.ac.jp

Family Name: PEDERSEN First Name: Ine-Therese
Institute: Norwegian Institute for Air Research (NILU)
Address: Polar Environmental Centre, NO-9296 Tromsø, Norway
Phone: +47 77750388 Fax: +47 77750376 e-mail: itp@nilu.no

Family Name: RASCHKE First Name: Ehrhard
Institute: NIPR
Address: Kaga 1-9-10 Itabashi, Tokyo 173-8515 Japan
e-mail: raschke@pmg.nipr.ac.jp

Family Name: REIERSEN First Name: Lars-Otto
Institute: Arctic Monitoring and Assessment Programme (AMAP)
Address:

Family Name: ROPERT-COUDERT First Name: Yan
Institute: National Institute of Polar Research
Address: 1-9-10 Kaga Itabashi-ku Tokyo 173-8515 JAPAN
Phone: +81 3 3962 4530 Fax: +81 3 3962 5743 e-mail: yan@nipr.ac.jp

Family Name: SAMPEI First Name: Makoto
Institute: National Institute of Polar Research
Address: 9-10, Kaga 1, Itabashi-ku, Tokyo Japan
Phone: 03-3962-4569 e-mail: sampei@nipr.ac.jp

Family Name: SASAKI First Name: Hiroshi
Institute: Senshu University of Ishinomaki
Address: 1 Shin-mito, Minamisakai, Ishinomaki, Miyagi, 986-8580, Japan
Phone: 81-225-22-7716 Fax: 81-225-22-7746 e-mail: sasaki@isenshu-u.ac.jp

Family Name: SATO First Name: Hiroshi
Institute: Ministry of Education, Culture, Sports, Science and Technology,
Ocean and Earth Division, Research and Development Bureau
Address: 2-5-1 Marunouchi Chiyoda-ku, Tokyo 100-8959 Japan

Family Name: SATO First Name: Kaoru
Institute: National Institute of Polar Research
Address: Kaga 1-9-10 Itabashi, Tokyo 173-8515 Japan
Phone: +81-3-3962-4717 Fax: +81-3-3962-5701 e-mail: kaoru@nipr.ac.jp

Family Name: SATOW First Name: Kazuhide
Institute: Nagaoka National College of Technology
Address: Nishi-katakai 888, Nagaoka, 940-8532 Japan
Phone: 0258-34-9277 Fax: 0258-34-9700 e-mail: ksatow@nagaoka-ct.ac.jp

Family Name: SAVOSKUL First Name: Oxana
Institute: Institute of Geography Russian Academy of Sciences
Address: Staromonetny 29, 109017 Moscow, Russia
Phone: +7(095)1331967 Fax: +7(095)9590033 e-mail: osavos@yandex.ru

Family Name: SEGAWA First Name: Takahiro
Institute: Tokyo Institute of Technology
Address: Dep. Biological Sciences, Graduate School of Bioscience and Biotechnology,
Ookayama 2-12-1-W3-43, Meguro-ku, Tokyo 152-8551, Japan
Phone: 81-3-5734-3383 Fax: 81-3-5734-2946 e-mail: takasega@bio.titech.ac.jp

Family Name: SHAKIROV First Name: Renat
Institute: Kitami Institute of Technology
Address: 165 Koen-cho, Kitami 090-8507, Japan
Phone: 090 5226 1007 Fax: 81 - 157 - 26 - 9534 e-mail: renat@snow2.civil.kitami-it.ac.jp

Family Name: SHIMAMURA First Name: Hideki
Institute: National Institute of Polar Research
Address: Kaga 1-9-10 Itabashi, Tokyo 173-8515 Japan
Phone: +81-3-3962-0150 Fax: +81-3-3962-4759

Family Name: SHIOBARA First Name: Masataka
Institute: NIPR
Address: Kaga 1-9-10, Itabashi-ku, Tokyo, Japan
Phone: 03-3962-4740 Fax: 03-3962-4914 e-mail: shio@nipr.ac.jp

Family Name: SHIRAISHI First Name: Kouichi
Institute: Fukuoka University
Address: 8-19-1 Nanakuma, Jyounan-ku, Fukuoka, Japan
Phone: 092-871-6631(ex.6181) Fax: 092-865-6030 e-mail: siraisi@fukuoka-u.ac.jp

Family Name: SOSNIN First Name: Valeriy
Institute: Pacific Oceanological Institute, Russian Academy of Science
Address: 43 Baltiyskaya Str., Vladivostok, 690041, Russia
Phone: (4232) 31-2597 Fax: (4232) 31-2573 e-mail: vsosnin@poi.dvo.ru

Family Name: STACHLEWSKA First Name: Iwona Sylwia
Institute: Alfred Wegener Institute for Polar and Marine Research
Address: Telegrafenberg A45 room209, 14473 Potsdam, Germany
Phone: +49-331-288-2149 Fax: +49-331-282-2196 e-mail: istachlew@awi-potsdam.de

Family Name: STEINHAGE First Name: Daniel
Institute: Alfred-Wegener-Institut
Address: Columbustrasse, 27568 Bremerhaven,
Phone: +49-471-4831-1198 Fax: +49-471-4831-1926 e-mail: dsteinhage@awi-bremerhaven.de

Family Name: STRÖM First Name: Johan
Institute: Department of Applied Environmental Science, Stockholm University
Address: Frescativägen 54, S-106 91 Stockholm, Sweden
Phone: + 46 8 674 7287 Fax: + 46 8 674 7325 e-mail: johan@itm.su.se

Family Name: SVENDSEN First Name: Harald
Institute: Geophysical institute, University of Bergen
Address: Allegaten 70, N-5007 Bergen, Norway
Phone: +47 55 58 26 44 Fax: +47 55 58 98 83 e-mail: harald.svendsen@gfi.uib.no

Family Name: SWEDA First Name: Tatsuo
Institute: Ehime University
Address: 3-5-7 Tarumi, Matsuyama 790-8566 Japan
Phone: +81-89-946-9878 e-mail: Sweda@agr.ehime-u.ac.jp

Family Name: TAKAHASHI First Name: Shuhei
Institute: Kitami Institute of Technology
Address: Koen-cho 165, Kitami, 090-8507, Japan
Phone: 0157-26-9494 Fax: 0157-25-8772 e-mail: shuhei@mail.kitami-it.ac.jp

Family Name: TANAKA First Name: Noriyuki
Institute: IARC/EORC-JAXA
Address: University of Alaska, Fairbanks,
930 Koyukuk Dr. PO Boc 757340, Fairbanks, AK 99775-7340, USA
Phone: 907-474-2687 Fax: 907-474-2691 e-mail: norit@iarc.uaf.edu

Family Name: TEREKHOVA First Name: Valeriya
Institute: Kitami Institute of Technology
Address: 165 Koen-cho, Kitami 090-8507, Japan
Phone: 090 5226 1007 Fax: 81 - 157 - 26 - 9534 e-mail: lera@snow2.civil.kitami-it.ac.jp

Family Name: TODA First Name: Shigeru
Institute: Aichi University of Education
Address: 1 Hirosaw, Igaya, Kariya, Aichi 448-8542, Japan
Phone: 0566-26-2377 Fax: 0566-26-2310 e-mail: shigeru@auecc.aichi-edu.ac.jp

Family Name: TREFFEISEN First Name: Renate
Institute: AWI Potsdam
Address: Am Telegrafenberg A 45, D-14473 Potsdam, Germany
Phone: +49-331-288-2167 Fax: +49-331-288-2196 e-mail: rtreff@awi-potsdam.de

Family Name: TSUBONE First Name: Katsuya
Institute: Planetary Plasma and Atmospheric Research Center, Tohoku Univ.
Address: Aramaki-aza-aoba, Aoba-ku, Sendai 980-8578 Japan
Phone: +81-22-217-6367 Fax: +81-22-217-6406 e-mail: tsubone@pparc.geophys.tohoku.ac.jp

Family Name: TSUTSUMI First Name: Takuya
Institute: Hokkaido Northern Regional Building Research Institute
Address: Higashi1-3-1-20 Midorigaoka,Asahikawa,Hokkaido,Japan
Phone: +81-166-66-4211 Fax: +81-166-66-4215 e-mail: tutumi@hri.pref.hokkaido.jp

Family Name: TSUTSUMI First Name: Masaki
Institute: National Institute of Polar Research
Address: 1-9-10 Kaga, Itabashi-ku, Tokyo, 173-8515, Japan
Phone: +81-3-3962-5094 Fax: +81-3-3962-5742 e-mail: tutumi@nipr.ac.jp

Family Name: UCHIDA First Name: Masaki
Institute: National Institute of Polar Research
Address: Kaga 1-9-10, Itabashi-ku, Tokyo 173-8515, Japan
Phone: 03-3962-4369 Fax: 03-3962-5743 e-mail: uchida@nipr.ac.jp

Family Name: UENO First Name: Takeshi
Institute: National Institute of Polar Research
Address: Kaga 1-9-10, Itabashi, Tokyo, Japan
Phone: +81-3-3962-4569 Fax: +81-3-3962-5743 e-mail: tueno@nipr.ac.jp

Family Name: UETAKE First Name: Jun
Institute: Tokyo Institute of Technology
Address: W3-43 Kohshima-Lab 2-12-1 Ookayama Meguro Tokyo 152-8551, Japan
Phone: 03-5734-3383 Fax: 03-5734-2946 e-mail: juetake@bio.titech.ac.jp

Family Name: UEYAMA First Name: Masahito
Institute: International Arctic Research Center, University of Alaska
Address: 930 Koyukuk Dr., Fairbanks, AK 99775 USA
Phone: 909-474-7337 Fax: 909-474-2691 e-mail: ueyama@iarc.uaf.edu

Family Name: van EYKEN First Name: Tony
Institute: EISCAT Scientific Association
Address: Box 164, SE-98123 Kiruna, Sweden
Phone: +46 980 78703 Fax: +46 70 321 7 321 e-mail: Tony.van.Eyken@eiscat.se

Family Name: VELAZCO First Name: Voltaire
Institute: Institute of Environmental Physics, University of Bremen
Address: Otto-Hahn Allee1, 28359 Bremen, Germany
Phone: 0049-421-2188617 Fax: 0049-421-2184555 e-mail: voltaire@iup.physik.uni-bremen.de

Family Name: VERDE First Name: Cinzia
Institute: Institute of Protein Biochemistry, CNR
Address: Via Marconi 12, I-80125 Naples, Italy
Phone: +39 081 7257 234 Fax: +39 081 593 6689 e-mail: c.verde@ibp.cnr.it

Family Name: WADA First Name: Makoto
Institute: National Institute of Polar Research
Address: Kaga 1-9-10 Itabashi, Tokyo 173-8515 Japan
Phone: +81-3-3962-5580 Fax: +81-3-3962-5719 e-mail: wada@pmg.nipr.ac.jp

Family Name: WANG First Name: Yong
Institute: Chinese Arctic and Antarctic Administration
Address: No.1 Fuxingmenwai Street, Beijing, 100860 P.R.China
Phone: +86 10 68036469 Fax: +86 10 68012776 e-mail: chinare@263.net.cn

Family Name: WASSMANN First Name: Paul
Institute: Norwegian College of Fishery Science, Univ. Tromsø
Address: 9037 Tromsø, Norway
Phone: +47-776-44459 Fax: +47-776-46020 e-mail: paulw@nfh.uit.no

Family Name: WON First Name: Young-In
Institute: Dept. of Physics, Embry-Riddle Aeronautical University
Address: 600 S. Clyde Morris Blvd Daytona Beach, FL 32114 U.S.A.
Phone: +1-386-226-6714 Fax: +1-386-226-6621 e-mail: won408@erau.edu

Family Name: YABUKI First Name: Masanori
Institute: National Institute of Polar Research
Address: Kaga 1-9-10, Itabashi-ku, Tokyo 173-8515, Japan
Phone: +81-3-3962-5582 Fax: +81-3-3962-5719 e-mail: yabuki@pmg.nipr.ac.jp

Family Name: YABUKI First Name: Hironori
Institute: Institute of Observational Research for Global Change / JAMSTEC
Address: 2-15 Natsushima-cho, Yokosuka,237-0061, JAPAN
Phone: +81-46-867-9268 Fax: +81-46-867-9255 e-mail: yabuki@jamstec.go.jp

Family Name: YAMANOUCHI First Name: Takashi
Institute: National Institute of Polar Research
Address: Kaga 1-9-10, Itabashi-ku, Tokyo 173-8515, Japan
Phone: +81-3-3962-5680 Fax: +81-3-3962-5701 e-mail: yamanou@pmg.nipr.ac.jp

Family Name: YASUNARI First Name: Teppei J.
Institute: Graduate School of Environmental Earth Science, Hokkaido University
Address: Ice Core Research Group, Institute of Low Temperature Science, Hokkaido University, Kita-19 Nishi-8, Sapporo, Japan
Phone: 011-706-5482 Fax: 011-706-5505 e-mail: teppei@hms.lowtem.hokudai.ac.jp

Family Name: YOON First Name: Ho Il
Institute: Polar Research Institute of Korea Ocean Research and Development Institute
Address: Ansan P.O. Box 29, 425-600, Seoul, Korea
Phone: +82-31-400-6419 Fax: +82-31-408-5825 e-mail: hiyoon@kopri.re.kr

Family Name: YOSHIOKA First Name: Miki
Institute: Hosei University, Graduate school of Geography
Address: Ichigaya-tamachi 2-15-2, Shinjuku, Tokyo 162-0843, Japan
e-mail: hokkyoku@nipr.ac.jp

Family Name: YOSHITAKE First Name: Shinpei
Institute: Graduate School of Biosphere Sciences, Hiroshima University
Address: 7-1 Kagamiyama 1-chome, Higashi-Hiroshima 739-8521, Japan
Phone: +81-82-424-6514 Fax: +81-82-424-758 e-mail: synp@hiroshima-u.ac.jp

Family Name: ZHANG First Name: Yiensheng
Institute: Institute of Observational Research for Global Change (IORGC)
Address: 2-15 Natsushima-cho, Yokosuka-city, 237-0061, Japan
Phone: +81-46-8679273 Fax: +81-46-8679255 e-mail: yszhang@jamstec.go.jp

Family Name: ZIELINSKI First Name: Tymon
Institute: Institute of Oceanology, Polish Academy of Sciences
Address: ul. Powstancow Warszawy 55, 81-712 Sopot, Poland
Phone: 48 58 551 72 81 ext. 301 Fax: 48 58 551 20 31 e-mail: tymon@iopan.gda.pl