Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

MIS003-01 会場:104 時間:5 月 26 日 14:15-14:40

International studies in the East-Siberian Arctic Shelf during the last eleven years (1999-2010): An overview

International studies in the East-Siberian Arctic Shelf during the last eleven years (1999-2010): An overview

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The Arctic Ocean is surrounded by permafrost, which is being degraded at an increasing rate under conditions of warming which are most pronounced in Siberia and Alaska. A major constraint on our ability to understand linkages between the Arctic Ocean and the global climate system is the scarcity of observational data in the Siberian Arctic marginal seas where major fresh water input and terrestrial CNP fluxes exist. The East-Siberian Sea Arctic Shelf (ESAS) has never been investigated by modern techniques despite the progress that has been made in new technologies useful for measuring ocean characteristics of interest. In this multi-year international project which joins scientists from 3 nations (Russia-USA-Sweden), and in cooperation with scientists from other countries (UK, Netherlands), we focus on the ESAS which is a poorly explored area located west from the U.S.-Russia boundary. In this report we overview the main field activities and present some results obtained during the last eleven years (1999-2010).

Siberian freshwater discharge to the Arctic Ocean is expected to increase with increasing temperatures, potentially resulting in greater river export of old terrigenous organic carbon to the ocean. Our working hypothesis was that rivers integrate the variability in the components of the hydrometeorological regime, including soil conditions, permafrost seasonal thaw, and thermokarst development. All these variables determine atmospheric and ground water supply into the rivers and chemical weathering in their watershed. We found that 1) carbon dioxide and methane fluxes are significant (and non-accounted) components of the carbon cycling in the Arctic Ocean; 2) transport of eroded terrestrial material plays a major role in the accumulation of carbon in the ESAS; 3) the seabed is a major CH4 source over the ESAS; 4) eroded carbon is biodegradable; 5) oxidation of eroded carbon onshore and offshore is a strong source of carbon dioxide. Thus, studying carbon cycling in the East Siberian Arctic shelf seas has a high scientific priority for quantification of the regional carbon budget and evaluation of the role of the Arctic in the global carbon cycling. These studies in the coastal zone are of a special importance, because there the characteristics of carbon exchange with atmosphere are not yet known and a redistribution of carbon between terrestrial and marine environments occurs. Initial scientific plan for the next decade will be presented.

Our studies have been supported by the Russian Foundation for Basic Research (since 1994), International (Soros) Scientific Foundation, ISF (1994-1995), Russian Government and ISF (1995), McArthur Foundation (2000-2001), Far Eastern Branch of the Russian Academy of Sciences (since 2003), International Arctic Research Center (since 2001), NSF (since 2003), NOAA (since 2005), Stockholm University (since 2007), and Wallenberg Foundation (since 2008).

キーワード: Arctic Ocean Shelf, carbon cycle, permafrost thaw, methane, East Siberia
Keywords: Arctic Ocean Shelf, carbon cycle, permafrost thaw, methane, East Siberia

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MIS003-02 会場:104 時間:5 月 26 日 14:40-15:00

Methane emission observations and inventory for West Siberian mires
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West Siberia is one of the most paludified regions in the world with the mire area of 68.5 Mha. Since the previously published estimations of the regional CH4 flux varied widely from 2 to 22 MtCH4yr^{-1}, long-term and large-scale investigations of CH_4 emission were established to complement existing data. About 1900 methane flux measurements were made during the summer-autumn of 2007-2010 by a static chamber method. Seasonal variation is observed at one site with automatic chambers for various micro-landscapes. All variety of wetland types was reduced to 8 micro-landscape types: palsas, peat mats, ponds, forested bogs, fens, poor fens, oligotrophic hollows and ridges. Mire micro-landscapes of 36 key sites distributed in 7 zones of West Siberia were observed. Emission data were generalized into a spatial emission model based on a fractional area coverage map of mire micro-landscapes, methane emission periods for each zone and methane flux probability density distributions for each micro-landscape type in these zones. The methane emission map with the resolution 0.5x0.5 deg was created. It was confirmed that palsas, forested bogs and ridges had the lowest methane fluxes (1st/2nd/3rd quartiles are -0.04/0/0.05 mgCH_4m^{-2}h^{-1} for palsas, 0.06/0.26/0.7 mgCH_4m^{-2}h^{-1} for forested bogs, 0.01/0.28/0.67 mgCH_4m^{-2}h^{-1} for ridges) while the peat mats and non-forested mires had the highest ones (2.05/4.1/5.89 mgCH_4m^{-2}h^{-1} for peat mats, 1.23/2.84/5.55 mgCH_4m^{-2}h^{-1} for fens combined with poor fens and oligotrophic hollows). Very high fluxes, reaching hundreds of mgCH_4 m^{-2}h^{-1}, were observed in some ponds (1.44/7.85/33.84 mgCH_4m^{-2}h^{-1}). The version Bc8 of the model estimates the total flux from all Western Siberia mires at 3.91 MtCH_4yr^{-1}.

キーワード: emission inventory, methane, flux map, Siberia
Keywords: emission inventory, methane, flux map, Siberia

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MIS003-03 会場:104 時間:5 月 26 日 15:00-15:20

Projected Change in Hydrological Extremes in China Under Climate Change Scenarios
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Over last 40 years, China's climate has undergone noticeable changes. It is particularly evident that North China has seen a persistent decline in annual precipitation amounts. This is accompanied by increases in flooding in South China and overall temperature increase over entire China. In this paper, we look to quantify the changes in precipitation and temperature extremes in China over the past 40 years using observations and model outputs from CMIP3 data archive. We will also investigate how these changes may manifest in the 21st century under various climate change scenarios. We will employ the Bayesian multi-model ensemble methodology developed by Duan and Phillips to obtain the expected changes as well as the uncertainty estimates. The Bayesian multi-model ensemble methodology and preliminary results will be presented at this meeting.

キーワード: Climate change, hydrological extremes, Bayesian multi-model ensemble
Keywords: Climate change, hydrological extremes, Bayesian multi-model ensemble

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MIS003-04 会場:104 時間:5 月 26 日 15:20-15:40

シベリア広域積雪観測による積雪物理量データセット
Data set of physical snow parameters obtained by snow surveys in Siberia

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Snowpack conditions in Siberia are sensitive to a change in a climate because Siberia faces the Arctic Ocean and is underlain by discontinuous permafrost. The snow surveys in Siberia have been carried out for clarifying the differences of snow-cover characteristics in Siberia and Alaska, for better understanding snow processes in the Arctic Climate System and for reducing the uncertainty of reliably estimating the amount of snow in the cryosphere. The traverse lines in Siberia were set to the south of Yakutsk for Neriungri and to the east of Yakutsk for Oymyakon. The snow depth using a sounding rod, the snow water equivalent using a cylindrical snow sampler with a cross-sectional area of 0.005-m2, the snow surface hardness using a push gauge, the snow type and size using a snow grain size gauge, the altitude, latitude and longitude using a handy-type GPS were measured. In addition, the maximum, the minimum, and the mean of the particle size of each snow layer were recorded, and the photograph of the snow particles of each snow layer and the snowpack view is saved. It was found that the types of the upper snow layer in Siberia are composed of decomposing and fragmented precipitation particles and faceted crystals and that of the lower snow layer is typically well-developed depth hoar. The snow water equivalents in Siberia slightly increase with an increase in altitude. The increase ratio of the snow water equivalent due to altitude in the east of Yakutsk for Oymyakon is smaller than that in the south of Yakutsk for Neriungri. This presentation will describe the progress and present preliminary results of snow surveys in Siberia, including this winter. The snow surveys in Siberia are continuously planned. These continuous snow survey data will enable us to further analyze and provide the in-situ date for calibration and validation of satellite observations and climate models.

キーワード: スノーサーベイ, シベリア, 積雪深, 積雪水量, 積雪密度, 雪質
Keywords: snow survey, Siberia, snow depth, snow water equivalent, snow density, snow type

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Changes in Snow Cover Characteristics over the Asian part of Russia
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Since 1881, the annual surface air temperature in Northern Eurasia has increased by 1.5K and in the winter season by 3K. In the Northern Asia and over the interior of the continent (in Siberia) this warming has been ”slightly” weaker in winter and stronger annually and in all other seasons (e.g., during the past 130 years with standard instrumental observations in Siberia, the annual and winter surface air temperatures have increased by 1.8K and 2.4K respectively). Nearby to the north in the Arctic Ocean, the late summer sea ice extent decreased by 40% exposing a near-infinite source of water vapor for the dry Arctic atmosphere in early cold season months. Both large-scale processes, global warming and the Arctic sea ice retreat, substantially affected the cold season climate in this part of the world. Its duration, severity and frequency of cold spells, frequency of thaws and ”cyclonic” days favorable for snowfall (with negative but relatively mild temperatures) have changed in the past several decades causing changes in various snow cover characteristics over the interior regions of Eurasia, first of all over the Russian Federation east of 60E (Asian Russia). Presentation will describe the contemporary changes of these characteristics for the 1966-2010 period.

For our analyses we used the NOAA snow cover satellite monitoring data from October 1966 to 2010, a standard suite of synoptic observations that for snow cover includes snow depth, snow type, state of the ground at the meteorological site and its surroundings and the national snow survey dataset archived at the Russian Institute for Hydrometeorological Information. This dataset has routine snow surveys run throughout the cold season each decade (during the intense snowmelt, each 5 days) at all meteorological stations of the former USSR, thereafter, in Russia since 1966. Prior to 1966 snow surveys are also available but the methodology of observations had substantially changed at that year. Therefore, this analysis includes only data of stations within the Asian part of Russia (i.e., east of 60E) from 1966 to 2010. Surveys run separately along all types of environment typical for the site for 1 to 2 km, describing the current snow cover properties such as snow density, depth, water equivalent, and characteristics of snow and ice crust.

During the past several decades, the following changes in snow cover characteristics over Asian Russia have been observed: (a) in autumn the dates of the onset of snow cover have not changed noticeably despite the strong temperature increase in this season; (b) in late spring, snow cover extent has decreased over most of the region (but somewhat increased in the southeastern areas of Asian Russia); (c) in the cold season, maximum snow depth and snow water equivalent (SWE) at open areas have increased, and (d) days with winter thaw became more frequent. The snowmelt process over Asian Russia can be lengthy but even the first such melt initiates a process of snow metamorphosis on its surface changing snow albedo and generating snow crust as well as on its bottom, generating basal ice crust layer. In the Asian part of Russia, the entire process of the spring snowmelt has become shorter in duration and (taking into account a parallel rise in the maximum snow depth and snow water equivalent) more intense.

キーワード: snow cover, snow water equivalent, snow depth, Siberia, climatic change
Keywords: snow cover, snow water equivalent, snow depth, Siberia, climatic change

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Northern Eurasia Earth Science Partnership Initiative (NEESPI): An Overview of the Current Studies in Northern Asia
Northern Eurasia Earth Science Partnership Initiative (NEESPI): An Overview of the Current Studies in Northern Asia

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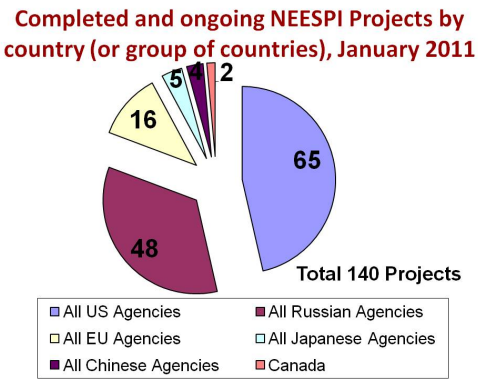
Six years ago NEESPI was launched with the release of its Science Plan (http://neespi.org). Gradually, the Initiative was joined by numerous international projects launched in EU, Russia, the United States, Canada, Japan, and China. Throughout its duration, NEESPI served and is serving as an umbrella for more than 140 individual research projects (always with an international participation) with an annual budget close to 15 million US dollars (cf., Figure, where international NEESPI projects are grouped by the major national funding source). Currently, the Initiative is in full swing. A new crop of NEESPI projects was launched in 2010 to compensate for the projects that have been completed and the total number of the ongoing NEESPI projects (76) changed but slightly compared to its peak (87 in 2008). Since 2008 NEESPI has been receiving an intergovernmental level of support in Russia, the United States, and Ukraine.

The past year was extremely productive in the NEESPI outreach. In 2010, more than 100 peer-reviewed papers and/or book chapters were published or are in press (this list is still incomplete and is anticipated to nearly double). A suite of 34 peer-reviewed NEESPI articles were published in the third Special NEESPI Issue in Environmental Research Letters (ERL; 2009, No. 4, and 2010, No.1). Several books and White Papers were published by Springer (Baltzer ed., 2010; Gutman and Reissell eds., 2010), and the National Academy of Science of Ukraine (Lyalko, ed. 2010), and FAO (Matyas, ed., 2010). Two more books devoted to Siberia and Eastern Europe prepared by the members of the NEESPI team are scheduled to appear before the end of this year. Preparations have been started to complete the circle of regional monographs on Environmental Changes in the NEESPI domain with a book focusing on the dry land areas of Northern Eurasia. Submissions, reviews, and publication process for a new Special NEESPI ERL Issue "Environmental, socio-economic and climatic changes in Northern Eurasia and their feedbacks to the Global Earth System" are ongoing.

The description of the NEESPI Program will be complemented with an overview of the results presented in book "Regional Environmental Changes in Siberia and Their Global Consequences" scheduled to be submitted to Springer at the time of this Symposium.



キーワード: NEESPI, Northern Asia, environmental changes, climate changes, international projects
Keywords: NEESPI, Northern Asia, environmental changes, climate changes, international projects