Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS03-P01 Room:Convention Hall Time:May 25 14:30-15:15

Change in Terrestrial Ecosystem of Pan-Arctic and effect on Climate

SUGIMOTO, Atsuko[1*], ISHIKAWA, Mamoru[1], KODAMA, Yuji[2], Masafumi Sasaki[3], YAMAZAKI, Takeshi[4], MATSUURA, Yojiro[5], UCHIDA, Masaki[2], Rikie Suzuki[6], IIJIMA, Yoshihiro[6], SAITO, Kazuyuki[6], PARK, Hotaek[6], OHTA, Takeshi[7], HIYAMA, Tetsuya[8], Akira Osawa[9], Takeshi Ise[10]

[1]Environmental Earth Sci Hokkaido Univ, [2]National Institute of Polar Research, [3]Kitami Institute of Technology, [4]Faculty of Sci Tohoku Univ, [5]Forestry and Forest Products Research Institue, [6]JAPAN Agency for marine-earth science and technology, [7]Bioagricultural Sci Nagoya Univ, [8]Research Institute for Humanity and Nature, [9]Faculty of Agriculture Kyoto Univ, [10]Graduate School of Simulation Studies University of Hyogo

Terrestrial ecosystem of Pan-Arctic is an important part of Arctic climate system, which interacts with atmosphere and ocean and greatly affects global climate through a change in surface albedo, emission of green house gases, and so on. Those changes are expected to be caused by the interaction among vegetation, hydrology, and material cycling. Another important aspect of the Pan Arctic terrestrial ecosystem is distributions of permafrost and vegetation, which are very different condition spatially, therefore, a spatially different response to a worming environment is also expected.

Green Network of Excellence (GRENE) Arctic climate program by MEXT has initiated in 2011, and GRENE-TEA (GRENE Terrestrial Arctic Ecosystem) project has started in this program. Observation and research plans of GRENE-TEA project are introduced in our presentation.

Interdisciplinary observations, including permafrost hydrology, ecology, biogeochemistry, meteorology, climatology, dendrochronology, etc. are planned in Svalbard, Finland, eastern Siberia, Alaska, and Canada, to investigate the system. Systematic observation network is also established: long term observations at supersites, observation with mobile system to know a spatial variation near the supersites, and simple system for soil temperature measurements for numbers of sites are planned to obtain systematic dataset, which will promote joint research between observation and modeling works. Cooperation between observation and modeling works is one of the important challenges in the program.

Keywords: Arctic, ecosystem, permafrost, vegetation change, methane

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS03-P02 Room:Convention Hall Time:May 25 14:30-15:15

Analysis of Siberian CH4 flux during 1994-2010

KIM, Heon-Sook[1*], MAKSYUTOV, Shamil[1], Tazu Saeki[1], BELIKOV, Dmitry[1], MACHIDA, Toshinobu[1]

[1]National Insititue for Envionmental Studies

A vast Siberian forest area and the largest West Siberian wetland area in the world play a significant role in the global carbon cycle as a large carbon sink and a major natural source of atmospheric CH4. Moreover the high Siberian Arctic land areas containing thick permafrost layers with carbon rich soils could release high CO2 and CH4 emissions thawing under a warmer climate. In this study, we estimate monthly CH4 fluxes for 43 regions including 4 regions over Siberia during 1994-2010 using a fixed-lag Kalman smoother and investigate the year-to-year variation of Siberian CH4 flux to understand climate-induced changes in Siberian CH4 flux and the significance of Siberia on year-to-year variation of global CH4 budget. Continuous and event measurement data of atmospheric CH4 taken from WDCGG are inverted to optimize CH4 fluxes in this study. Airborne observations of CH4 at three sites over Siberia are used to adjust the magnitude of Siberian CH4 flux with inverse modeling: at Surgut over wetlands and at Novosibirsk and Yakutsk over forests. We use interannually varying CH4 emissions and interannually repeating OH, Cl and O1D radicals provided by TransCom-CH4 project (Patra et al., 2011) in forward simulation by NIES transport model (Belikov et al., 2011).

Keywords: Siberian CH4, inverse modeling

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS03-P03 Room:Convention Hall Time:May 25 14:30-15:15

Linkage between net ecosystem exchange of H2O and CO2 over boreal forest at eastern Siberia

KOTANI, Ayumi[1*], OHTA Takeshi[1]

[1]Graduate School of Agricultural Sciences, Nagoya University

To improve our understanding of C/H2O/energy exchange over eastern Siberia boreal forest, two observation sites at a larch dominated forest in the middle and southern part of Lena basin were compared. One is the Spasskaya Pad station at Yakutsk YK (62.25N, 129.23E). The other station named Elgeeii EG (60.00N, 133.82E) is located at 300 km southeast of Yakutsk. Average of annual precipitation during 1986-2004 is 290mm and 230mm at Ust-Maya, which is the nearest station at a distance of 60km from Elgeeii, and Yakutsk, respectively, while difference of the other meteorological values such as air temperature and humidity is small (Suzuki et al., 2007). The dominant species in the forest is larch (Larix cajanderi), mixed with birch (Betula pendula), willow (Salix bebbiana) and pine (Pinus sylvesrtis). The stand density of larch trees is 1040 trees ha-1 (2600 trees ha-1 including birch, salix and pine) and the mean stand height of upper canopy, which is comprised of larch trees, is around 25m.

The observation during growing season of 2010 and 2011 shows following results: 1) Meteorological condition were not different at the two sites. 2) Seasonal change of ground environment such as soil water and temperature was a little different between the two sites; melting of frozen soil started at beginning of May at both sites, but growing ratio of melting depth (active layer depth) was larger at YK than EG. The soil water content was larger at EG than YK through the season. 3) Evapotranspiration measured by the eddy covariance system showed similar way of seasonal change and total amount was not so different, while Net ecosystem CO2 exchange was 1.5 times at EG compared to YK. 4) Seasonal variation of evaporative coefficient (actual evapotranspiration / potential evaporation), ecosystem water use efficiency (CO2 uptake / evapotranspiration) and their correlation to the environmental variables were not always similar for the two sites.

Keywords: evapotranspiration, carbon cycle, boreal forest

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS03-P04 Room:Convention Hall Time:May 25 14:30-15:15

Socio-economic and land productivity analysis in Central Asia: CACILM SLM IS Inception phase results

KELGENBAEVA, Kamilya[1*], Chris Hatten[2], Peter Hayes[3]

[1]MSEC SLM-IS Specialist/CACILM Phase I, Bishkek, Kyrgyzstan, [2]ADB SLM-IS International Advisor/CACILM Phase I, London, England, [3]Central & West Asia Department, Asian Development Bank, Manila, Philippines

Sustainable land and water management is essential in the five Central Asia States (CAS), Kazakhstan (KAZ), Uzbekistan (UZB), Turkmenistan (TKM), Kyrgyzstan (KYR), and Tajikistan. The rural economies of CAC suffered catastrophic falls over the 1990-2000 period as these countries went from a centralized command system to a free-market system. These changes dwarf any long-term changes due to land degradation or restoration trends. To evaluate these changes in dynamics, three baseline years were chosen: (1) end of Soviet period (1990); (2)end of readjustment period (2000); and (3)the most recent typical year (2007 or 2006). Primary statistical data on demography and landuse, crop and livestock production at the administrative regions (oblast and their sub-divisions, or rayons) levels for KAZ (4 southern oblasts only), KYR, TKM and UZB were collected by National Support Implementation Units of SLM IS teams. Thereafter, within the Central Asian Countries Initiative for Land Management (CACILM) Program, the Inception Phase was implemented. The received data were processed and analyzed to reveal the dynamics of the following socio-economic characteristics: (a) Demographic indicators that include population change, annual population growth, population distribution by area of residence, vital statistics; (b) Agro-ecological potential and food resources that include area of arable lands and pastures, arable land per capita, total yield, crop yield, livestock production and increase and decrease of livestock; (c) Food security characteristics that include wheat and rice production per capita, actual production of wheat and needs per capita, livestock products production; and (d) Anthropogenic pressure on agro-ecological resources (population density per 1sq km of total area, population density per 1sq km of arable area, livestock density per 100 ha of pasture). According to our estimates, in **Kyrgyzstan** during 1991-2007, the arable land area was reduced in the range from 0.5% (Batken oblast) to 33.4% (Osh oblast). About 24.9% reduction of the pasture land was observed in the Osh oblast, while in the rest of the KYR rayons the pasture land was increased from 0.6% (Naryn oblast) to 12% (Chui oblast) and the cattle population density per 100 ha of pastures decreased in Talas and Chui oblasts. In **Uzbekistan**, during 1990?2007: a considerable reduction of pastures in Andijan, Fergana, Bukhara, Syrdarya, Namangan, Samarkand and Khorezm oblasts is observed. In Bukhara, Syr-Darya, and Samarkand oblasts the arable lands were considerably reduced (by 24.9%, 13%, and 11.1%, respectively). In other oblasts the reduction was less prominent. Only in two oblasts, Djizak and Kashka-Darya, increases in arable lands were registered by 6.5% and 1.2%, respectively. The analysis of dynamics of livestock and poultry population during 1990-2007 shows a significant increase of the cattle number (including cows), sheep and goats across all oblasts of the country. In **Turkmenistan**, during the 1991-2007 period, the cattle population has significantly increased nationwide (by 140% from 899 to 2,157.7 thousands). Comparing 2007 versus 1991 and the oblast level, the cattle population has increased in the range from 59.2% (Lebap velayat) to 289% (Dashoguz velayat). The sheep and goat population at the end of the analyzed period (at 2007) has increased by 226.4%. In **Kazakhstan** we present (as an example) the findings for the Kyzyl-Orda oblast (in Southern Kazakhstan). Here, during the 1991-2007 period, the crop land area has reduced by 3.1%. The changes were spatially inhomogeneous. For example, reduction of arable lands is observed in Aral (84.7%), Syr-Darya (16.4%), Kazalin (15.7%), and Karmakshi (12.3%) rayons, but it is increased in Zhalagash rayon by 25.8%. Detailed socio-demographic and land productivity analysis will be given in full paper. The studies in the framework of the CACILM project were supported by GEF Secretariat/Asian Development Bank.

Keywords: CACILM, land use, land degradation, food security, socio-economic analysis

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS03-P05 Room:Convention Hall Time:May 25 14:30-15:15

Very heavy rains and prolonged no-rain periods in the Pacific Sector of the Northern Extratropics

GROISMAN, Pavel[1*], Richard W. Knight[2]

[1]UCAR at NOAA National Climatic Data Center, Asheville, North Carolina, USA, [2]STG, Inc., Asheville, North Carolina, USA

Using the Global Historical Climatology Daily Network data set (GHCN-Daily), we assessed changes in intense precipitation (above 12.7 mm) and prolonged no-rain periods across the Northern Extratropics. Intense precipitation was further partitioned into heavy, very heavy and extreme daily and multi-day rain events. In this presentation, we shall focus on the regions adjacent to the Pacific Ocean: Asian Russia, Japan, Alaska, British Columbia, the western contiguous US, and northern Mexico.

During the past sixty years, increases in very heavy and extreme rainfall were documented in the warm season over most of the Northern Extratropics. In several of them, while the mean seasonal precipitation was decreasing, the frequencies of very heavy and extreme rain events were increasing or have not been changed. Recent updates and infill of precipitation data available through GHCN-Daily allowed us to confirm our previous findings (Easterling et al. 2000) of this behavior for Asian Russia and Japan. Decreases in summer rainfall totals and frequency here are accompanied by increases in the frequency of very heavy daily rain events. Moreover, over most of Northern Asia (Siberia, northeastern China), various characteristics of summer dryness (fire indices, PDSI, no-rain intervals) indicate drier weather conditions in the past several decades.

We conclude that the atmospheric component of the hydrological cycle over the northern extratropical part of the Pacific Rim became more variable in the past decades.

Keywords: intense rainfall, prolonged no-rain periods, Northern Extratropics, Pacific Rim

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS03-P06 Room:Convention Hall Time:May 25 14:30-15:15

Changes in pan and visible evaporation over Asian Russia

SPERANSKAYA, NINA[1*]

[1]State Hydrological Institute, St. Petersburg, Russia

Pan evaporation can be considered as an estimate of potential evaporation because it characterizes seasonal or annual result of thermal and water exchange between the water surface and the atmosphere. By this reason, pan evaporation can be used in estimates of evapotranspiration. Visible evaporation (the difference between pan evaporation and precipitation) is an important characteristic of the regional water cycle. In humid climates, it indirectly indicates the total energy losses due to evaporation over the region. A positive value of visible evaporation indicates a deficit in the regional water budget, and the water demand by the atmosphere exceeds precipitation (so-called ”dry” conditions are perceived). When precipitation exceeds pan evaporation, visible evaporation is negative (which corresponds to ”humid” conditions). The more negative the visible evaporation, the wetter the region, and the excess water remains for runoff and for replenishing the undeground water reservoirs.

Pan evaporation observations in the USSR began in the middle of 1950s. At the peak of the network extent (in the middle of 1980s) more than 200 stations performing these observations operated in Asian Russia. From 1990s the number of stations was significantly reduced, and at present data up to 2008 are available only at 90 stations, (up to 1999, at 110 stations).

Precipitation changes for the study territory were analyzed on the base of data from the archive created in the Russian Research Institute for Hydrometeorological Information that contains data from about 800 stations at the Asian Russia territory for 1966-2008.

Using all available data, the territory of Asian Russia was zoned according to the specific features of the dynamics of the pan evaporation totals during the warm period (May-September). Visible evaporation changes are estimated for each of selected region from 1966 to 2008. Analysis of visible evaporation changes during the past 40 years shows significant changes practically over the entire Asian Russia and the changes are most evident in the gions with permafrost.

Keywords: Pan evaporation, Visible Evaporation, Northern Asia, Russia

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS03-P07 Room:Convention Hall Time:May 25 14:30-15:15

Observed effects of integrated water vapor on long-term diurnal temperature range changes over China

ZHAO, Tianbao[1*]

[1]Key Laboratory of Regional Climate-Environment Research for East Asia, IAP/CAS

Diurnal temperature range (DTR) is one of important index used to describe the climate change and variability. The decline in DTR has been observed over most global land areas in recent decades due to a faster increasing in daily minimum temperature (Tmin) than daily maximum temperature (Tmax). The changes of the DTR in different region generally are determined by many different factors. In this study, we will quantitatively assesses the strong damping effects of column-integrated water vapor on the long-term DTR over China using more homogenized datasets of observed daily extreme 2-meter temperature and the daily precipitable water (PW) derived from the radiosonde dataset. The result shows that the DTR derived from daily homogenized extreme temperature shows downward trends decreasing by about 0.2-0.5oC decade-1 over most of China during 1960-2010 and by more than 0.5o/decade over northern China in winter. The long-term DTR change is also significantly correlated with the tropospheric column-integrated water vapor (r?0.60), with a dPW/dDTR slope of ˜-9.7% K-1, which is particularly higher in summer and autumn.

Keywords: Diurnal temperature range, Water vapor, Observed effects, China

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

MIS03-P08 Room:Convention Hall Time:May 25 14:30-15:15

Representing subgrid snow cover and snow depth variability in a global land model: offline validation

NITTA, Tomoko[1*], YOSHIMURA, Kei[2], TAKATA, Kumiko[3], O'ISHI, Ryouta[2], Shinjiro Kanae[4], OKI, Taikan[5], Glen E. Liston[6]

[1]School of Engineering, The University of Tokyo, [2]Atmosphere and Ocean Research Institute, The University of Tokyo, [3]Japan Agency for Marine-Earth Science and Technology, [4]Department of Mechanical and Environmental Informatics, Tokyo Institute of Technology, [5]Institute of Industrial Science, The University of Tokyo, [6]Cooperative Institute for Research in the Atmosphere, Colorado State University

Seasonal snow cover is a key variable in the global climate system because of its large impact on surface temperature and surface energy and water budgets. In the present study, we incorporated a subgrid snow cover parameterization, SSNOWD (Liston, 2004), into a land surface model, MATSIRO (Takata et al., 2003). SSNOWD assumes that the subgrid snow water equivalent (SWE) distribution follows a lognormal distribution function, accounting for the physical processes that produce subgrid SWE variability. Two sets of 29-year offline simulations were performed: one with and one without SSNOWD. The simulations were forced with a global meteorological dataset (Kim et al., 2009) which combined the JRA25 atmospheric reanalysis data (Onogi et al., 2007) with 5 observed-precipitation datasets. The simulated monthly snow cover fractions were compared with satellite-based MODIS snow cover fraction data (Hall et al., 2006). For the Northern Hemisphere, daily snow-covered area was also validated using the IMS snow analysis (National Ice Center, 2008). Both of these comparisons show that the original MATSIRO underestimates the snow cover fraction, especially for the accumulation season and/or the regions with relatively small amounts of snowfall. In contrast, the inclusion of SSNOWD improved the spatial pattern of snow cover fraction. The SSNOWD simulation agrees well with the IMS snow analysis and led to an improved seasonal cycle of snow-covered area in the Northern Hemisphere. This is because SSNOWD formulates snow cover fraction differently for accumulation season and ablation season, and represents the hysteresis of snow cover fraction for different seasons. The effects of incorporating SSNOWD on surface energy fluxes and hydrological properties were also examined using 5 ensemble runs with different precipitation forcing.