Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

ACG31-P01 Room:Convention Hall Time:May 26 18:15-19:30

An application of the mass balance model to the Hurlbut Ice Cap, northeastern Greenland

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Many of ice caps and glaciers exist at the margin of the Greenland and their contribution rate to sea level rise by recent temperature warming is large. The northeastern Greenland is one of the the areas which has little of in-situ mass balance observation. Saito et al. (2014) revealed with satellite images that the surface level change of some ice caps in northern Greenland is three times as large as that revealed by Bolch et al. (2013).

We estimated surface mass balance of Hurlbut Ice Cap in northern Greenland by the mass balance model of Hock (1999). The model takes temperature index method. The model shows spatial variation of surface mass balance for the ice cap. The 100m - gridded DEM and surface condition of the ice cap as input of the model were derived from modified ALOS (Advanced Land Observing Satellite) data. The climate data as input of the model was global radiation, air temperature and precipitation at Thule climate station (77.2N, 68.4W), which is one of the long-term running climate stations in Greenland and situates about 100 km south to the Hurlbut ice cap.

The result of the calculation is dependent on the tuning factors for both accumulation and ablation. The result was compared with the change of the surface height by Saito et al (2014). The air temperature at the Thule was increasing after 1990, and this is one of the reasons that mass balance of Hurlbut ice cap was negative.

Keywords: Greenland, mass balance, ice cap, climate change

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Satellite Observations of spring snow melt in the Arctic

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Ice-Albedo feedback system is the main mechanisim of Arctic rapid warming. Spring is the timing of activating this sytem as snow and sun shine both exist in the Arctic. Climate model has uncertainty in the snow melting season. For the terrestrial ecosystem studies, end of snow cover and melt water supply are important conditions. Therefore, snow melting is an important information on climate studies. There are many reseach works of snow survey, however the observation coverage is not enough in the Arctic to describe spatial patterns and teporal cahnges. Satellite remote sensing is available for obtaining snow cover information at the continental scale. at the end before the snow desappers. Diurna amplitude variations (DAV) was used to analyse the melting starts. The data was compared with othe satellite observations.

Keywords: Arctic, snow melting, satellite

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Long term meteor radar observations in Arctic Norway

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Two meteor radars have been operated in Arctic Norway under collaboration between National Institute of Polar Research, Japan and University of Tromso, Norway, for more than 10 years, one at Adventdalen, Spitzbergen (78N,16E) since 2001 and the other at Ramfjordmoen (70N,19E) since 2003 [e.g., Hall et al., 2006]. Based on the continuous data set various atmospheric phenomena in the northern high latitude mesopause region have been studied so far such as links with a stratospheric sudden warming [Kurihara et al, 2010], gravity wave activities [Tsutsumi and Hall, ISAR3, 2012], and long-term changes in mesopause dynamics [Hall and Tsutsumi, 2013]. These results are to be overviewed and further collaboration with other radio and optical observation techniques will be discussed.

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ACG31-P04 Room:Convention Hall Time:May 26 18:15-19:30

Simulating soil carbon dynamics in Alaskan terrestrial ecosystems

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A large amount of soil organic carbon (SOC) is stored in high-latitude boreal permafrost regions, accounting for twice as much as is in the atmosphere at present. In those regions, climate warming has often caused disturbances that may accelerate the rate of permafrost thaw and change SOC dynamics in both organic and mineral soils. In this study, we used a soil carbon dynamics model named Physical and Biogeochemical Soil Dynamics Model to examine how climate-induced disturbances could change SOC pools in the boreal forest and tundra terrestrial ecosystems in Alaska, especially focusing on the effect of fire disturbances on the permafrost soil layers. The results showed that the fire disturbance would reduce SOC stores substantially associated with the fire-induced thawing of permafrost. It is suggested that the vulnerability of the SOC stocks in the boreal region as affected by future warming is closely linked to the sensitivity of permafrost to wildfire disturbance.

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Ground-based remote sensing of clouds and aerosol in the arctic Svalbard

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Ground-based remote-sensing measurements for aerosol and clouds using Sky-Radiometer, Micro-Pulse Lidar (MPL) and All-Sky Camera have been performed continuously in Ny-Alesund, Svalbard on a long-term basis since early 2000's. Further in addition, several new measurements have started with a polarization MPL in August 2013 and a 95GHz Doppler cloud radar in September 2013 for cloud microphysics and phase classification, and a dual frequency microwave radiometer in June 2014 for precipitable water and liquid water path. In this paper, preliminary results from those remote-sensing measurements will be presented in regard to physical characteristics of clouds, aerosol and water vapor, and the relationship in their interaction.

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Development of Online Visualization System (VISION)

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We are constructing an online archive system of data about Arctic research that many researchers and institutes have collected, which is named ADS (Arctic Date archive System). We aim at that the many researchers to specialize in the various fields of the Arctic research - such as atmosphere, ocean, land, physical and chemical analysis and computer simulation, etc - can become to mutually use their data across their own fields through our data archive. For this purpose, it is necessary for us not only to manage data systematically, but to build the system where researchers can easily grasp the contents of the data archive.

However, it is difficult to exactly understand contents of data that others made. The researchers try to understand the contents of the data of their own fields and succeed in many cases. But it is not easy for them even to judge about the contents of the data out of their fields. Therefore, we developed GUI-based online data visualization application named “VISION” , which all the researchers engaged in the Arctic research can easily operate. It can be expected that “VISION” facilitates an understanding the data of the various fields of the Arctic research among the researchers, then the researchers become also use the data out of their own fields.

In this lecture, we will introduce a structure and function of “VISION” and demonstrate an operation of this system.

Keywords: Online Visualization, Satellite data, AMSR2, SSMI

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Methane Oxidation of Arctic Wetland Soil of a Taiga-Tundra Ecotone in Northeastern Siberia

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Arctic wetlands are significant sources of atmospheric methane and the observed accelerated warming of the arctic causes increased methane formation in water-saturated tundra soil with deepened permafrost thawing. Methane oxidation is the key process to regulate methane emission from wetlands. In this study we measured the activity of methane oxidation rate of the wetland soils of a Taiga-Tundra transition zone in Northeastern Siberia by an incubation experiment and flux measurement combined with the inhibitor of methane oxidation. Surface peat soil samples (0-10 cm) collected from the wetland covered with tussocks of sedges and Sphagnum spp. demonstrated a high methane oxidation rate (70 and 190 nmol h^{-1} g^{-1} dw at 15 oC) when incubated in the bottle with methane at the initial concentration of 0.5-0.8 %v/v showing no time lag. Active methane oxidation was observed over the depths including the water-saturated layers. On the other hand, difluoromethane, the inhibitor of methane oxidation, did not alter the methane flux from the sedge and moss vegetation, indicating the undetectable levels of methane oxidation associated with the peat plants. The difference in methane oxidation activity between in the incubation experiment and the flux measurement may suggest 1) methananotrophs in the peat soils keep the potential activity in situ even under the unfavourable conditions including anoxia, or 2) there might be other sources of oxygen than diffusion from the atmosphere and plants that sustain the activity of methanotrophs in the waterlogged peat soil.

Keywords: methane oxidation, incubation experiment, flux measurement, CH2F2, tundra

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Upper atmosphere cooling over the past 33 years

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Theoretical models and observations have suggested that the increasing greenhouse gas concentration in the troposphere causes the upper atmosphere to cool and contract. However, our understanding of the long-term trends in the upper atmosphere is still quite incomplete, due to a limited amount of available and well-calibrated data. The European Incoherent Scatter (EISCAT) radar has gathered data in the polar ionosphere above Tromso for over 33 years. Using this long-term data set, we have estimated the ?rst significant trends of ion temperature at altitudes between 200 and 450 km. The estimated trends indicate a cooling of 10-15 K/decade near the F region peak (220-380 km altitude), whereas above 400 km the trend is nearly zero or even warming. The height profiles of the observed trends are close to those predicted by recent atmospheric general circulation models. Our results are the ?rst quantitative confirmation of the simulations and of the qualitative expectations.

Keywords: EISCAT, global warming, thermosphere, upper atmosphere

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Upgrading the sodium lidar in the Arctic region for the measurement of the MLT region

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The sodium LIDAR installed at the EISCAT Tromso site has been successfully operated for four winter seasons (i.e., October to March) since October 2010. We had almost no system trouble in each season, and the fact clearly proved the high performance of the all solid-state (Nd:YAG) laser stability. Five-direction observation is also the best performance that the high power laser (4W) at 589 nm made possible. In the next step, we are conducting the following topics for upgrading the lidar performance; (1) simulation of a narrow-band optical filter for the daytime observation, (2) multi-direction observation targeting aurora with EISCAT radars, (3) reconfiguration of the laser frequency shifter for switching the frequency pulse by pulse and for optimizing temporal resolution.

In this talk, we show the calculation and experimental results for each topic.