Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

ACG06-P01 Room:Poster Time:April 29 18:15-19:30

Detection of regional extent of permafrost thawing and waterlog damage area in boreal forest in eastern Siberia during w

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Wet climate with largely increased in rainfall during summer and snow accumulation during winter had perennially continued since 2004 in eastern Siberia. Soil moisture in the active layer had been rapidly increased corresponding with thawing permafrost near the surface during following years. The perennially water-logged active layer furthermore exacerbated the boreal forest habitat, namely withered and dead forests widely extended in this region. In the present study, we have attempted to extract the region of degraded boreal (larch) forest based on the analysis of satellite data (ALOS-AVNIR2 and PALSAR) in the left and right banks of the central Lena River Basin near Yakutsk, along with expansion of the water-logged forest floor in relation to permafrost degradation.

Keywords: ALOS, permafrost, wet climate, boreal forest, degradation, eastern Siberia

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ACG06-P02 Room:Poster Time:April 29 18:15-19:30

A potential map of precipitation area using the geostationary meteorological satellite for the GSMaP

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The Global Satellite Mapping of Precipitation (GSMaP) produces accurate precipitation data with high time and spatial resolution (per 1hour, 0.1 degree) by utilizing the satellite microwave radiometer. At the time and place which all microwave radiometer satellites are not available, the GSMaP estimates where the precipitation area observed before that time will moves by using a cloud moving vector retrieved from the infrared brightness temperature (IR Tb) observed by the geostationary meteorological satellite (GMS) (GSMaP_MVK, GSMaP_NRT; v5.222.1). However this method has some possibility of missing the convective precipitation which develops quickly (Ushio et al. 2009), and uses only IR1 channel (10.5~11.5μm) of the GMS observation to calculate the cloud moving vector. Therefore, this study made more accurate data of estimated precipitation area by using multi-channel GMS observation, called potential map, and then improved the accuracy of GSMaP_MVK and GSMaP_NRT precipitation areas by utilizing the potential map.

As a precipitation area index of the GMS, we used difference of the Tb between IR1 channel and water vapor (WV) channel (6.5~7.0μm). This index is based on the assumption which a deep convective cloud with precipitation probably occurs at the area with a small Tb difference of IR1 and WV (Ohsawa et al. 2001). Moreover since almost all of geostationary satellites have the IR1 and WV channel, the index is available globally on a long-term basis. We used near surface rain observed by the precipitation radar of the Tropical Rainfall Measurement Mission (TRMM) (PR; 2A25, V7) and the rainfall intensity retrieved from ground-based precipitation radar of Japan Meteorological Agency (JMA) as the truth of the precipitation area and converted the Tb of the GMS to the probability of precipitation with simultaneous observation between the GMS and the precipitation radar.

At first we compared the precipitation area obtained from the GSMaP and the precipitation radar, and found that the GSMaP_MVK overestimated the precipitation area over the ocean without the microwave observation. And therefore we tried to identify the area which the GSMaP precipitation was less than 1.0 mm per hour and the possibility of precipitation obtained of the potential map was less than 15 % as non-precipitation area. As the result the threat score of the GSMaP_MVK precipitation detection was improved from 0.37 to 0.41 over the ocean without the microwave observation. As it is considered that the threat score of GSMaP_MVK with the microwave observation is 0.45, this improvement is regarded as significant. On the other hand, the GSMaP_NRT underestimated the precipitation area over the land and coast without the microwave observation. And then we identified the area which the potential map was more than 40 % as precipitation area. As the result the threat score of the GSMaP_NRT was much improved from 0.27 to 0.34 over the land and coast without the microwave observation. In these areas and conditions, we can expect that the GSMaP estimates the precipitation area more accurately by utilizing the potential map.

Keywords: microwave radiometer, GSMaP, GMS, precipitation radar, high time resolusion, mid-high latitude

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ACG06-P03 Room:Poster Time:April 29 18:15-19:30

A study of multi-pixel and multi-parameter satellite remote sensing for aerosol properties

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We have developed a new satellite remote sensing algorithm to retrieve the aerosol optical characteristics using multi-pixel information of satellite imagers. In this algorithm, the inversion method is a combination of the MAP method (Maximum a posteriori method, Rodgers, 2000) and the Phillips-Twomey method (Phillips, 1962; Twomey, 1963) as a smoothing constraint for the state vector. Retrieved parameters in our algorithm are aerosol optical properties, such as aerosol optical thickness (AOT) of fine mode, sea salt, and dust particles, a volume soot fraction in fine mode particles, and ground surface albedo of each observed wavelength. We simultaneously retrieve all the parameters that characterize pixels in each of horizontal sub-domains consisting the target area. Then we successively apply the retrieval method to all the sub-domains in the target area.

We conducted numerical tests for the retrieval of aerosol properties and ground surface albedo for GOSAT/CAI imager data to test the algorithm for the land area. The result of the experiment showed that AOTs of fine mode and dust particles, soot fraction and ground surface albedo are successfully retrieved within absolute. We discuss the accuracy of the algorithm for various land surface types. Our future work is to extend the algorithm for analysis of AGEOS-II/GLI and GCOM/C-SGLI data.

Keywords: GCOM/C-SGLI, Aerosol, Satellite remote-sensing

ACG06-P04 Room:Poster Time:April 29 18:15-19:30

Estimation of Phytoplankton Group-Specific Primary Production in Kuroshio Waters Using Ocean Colour Remote Sensing

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The ocean is a major sink of carbon dioxide released into the atmosphere. Phytoplankton conducting primary production plays a significant role on temporal and spatial variability in the absorption of the carbon. Also phytoplankton transfers carbon to higher trophic levels in a marine ecosystem, and the carbon pathways to the higher trophic levels affect vulnerability of food web, or the ecosystem, against external forcings. Tremendous efforts to measure primary productivity of the total phytoplankton community in the global oceans have been made historically. On the other hand, measurements of primary productivity of individual phytoplankton groups composing of the total community are relatively sparse. This is partly due to methodological difficulties to differentiate such productivity of individual groups in situ, on top of practical circumstance that in situ observation requiring ship time is usually expensive. Therefore, it is of great interest if satellite remote sensing can overcome these problems, given that a number of earth observation satellites have been and will be launched. Especially, it is a great advantage of satellite observation that one can hindcast primary productivity of individual phytoplankton groups using historical remote sensing data, once a remote sensing methodology/algorithm is developed. In this presentation, we show a primitive result of development of such methodology to estimate primary productivity of diatoms and haptophytes in Kuroshio waters using ocean colour remote sensing.

Keywords: Ocean Colour, Satellite Observation, Phytoplankton, Primary Production

ACG06-P05 Room:Poster Time:April 29 18:15-19:30

NICT Calibration and Validation experiment for DPR/GPM

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The GPM core satellite is scheduled to be launched on February 28, 2014. It carries the Dual-Frequency Precipitation Radar (DPR) developed by Japan Aerospace Exploration Agency (JAXA) and National Institute of Information and Communications Technology (NICT), which consists of two radars: Ku-band precipitation radar (KuPR, 13.6 GHz) and Ka-band radar (KaPR, 35.5 GHz). NICT is planning the GPM/DPR onboard calibration experiment at NICT Koganei. The beam matching of two radars will be evaluated. NICT is also planning the post-launch ground validation (product validation) experiment at two locations, NICT Kobe (NICT Advanced ICT Research Institute) and NICT Okinawa (Okinawa Electromagnetic Technology Center). NICT is developing two X-band phased array radars (PANDA: Phased Array radar Network DAta system) and will install at NICT Kobe and Okinawa. PANDA can scan three-dimensionally in thirty seconds. We can compare the radar directly and simultaneously. At NICT Okinawa, the C-band polarimetric Doppler radar (COBRA) is also installed. The differential reflectivity (ZDR) can be used to validate the rain drop size distribution parameter (D_0). The cross-correlation coefficient (ρHV) can be used to validate the melting layer flag. Using the ground-based rain drop size measurements, the two-dimensional Video disdtrometer (2DVD), Joss-type disdrometer, and Laser Optical disdrometr (Parsivel), and so on, the characteristics of DSD itself are analyzed and the k-Z relationship is estimated for evaluation and improvement of the GPM/DPR algorithm.

Keywords: GPM, DPR, Beam maching, Ground Validation, PANDA (Phased Array radar Network DAta system), COBRA

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ACG06-P06 Room:Poster Time:April 29 18:15-19:30

Ground-based Validation of GPM/DPR

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The Global Precipitation Measurement (GPM) mission is an expanded follow-on mission to TRMM (Tropical Rainfall Measuring Mission) and GPM core satellite carries dual frequency precipitation radar (DPR) and GPM Microwave Imager on board. The DPR is expected to advance precipitation science by expanding the coverage of observations to higher latitudes than those of the TRMM/PR, measuring snow and light rain by the KaPR, and providing drop size distribution information based on the differential attenuation of echoes at two frequencies. After launch of GPM core satellite JAXA will perform evaluation of DPR L2 products, for example, precipitation rate, measured radar reflectivity, and drop size distribution. Those physical values will be compared with ground-based observations. This poster presentation will show the preliminary report of DPR evaluation comparison between DPR products and ground-based instruments during the first 2 months after launch, including a ground-based Ka-band radar system.

Keywords: GPM, DPR, validation

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ACG06-P07 Room:Poster Time:April 29 18:15-19:30

Optimal choice of surface reflectance and aerosol types for Multi-Spectral Imager on board EarthCARE

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EarthCARE is a satellite which will be launched in 2016. EarhtCARE is a joint mission between Europe and Japan. Four instruments such as CPR, ATLID, MSI and BBR will be equipped. MSI is a multi-spectral imager, and the purpose of it is to get the horizontal structure of aerosol and cloud. We are developing the aerosol retrieval algorithm for MSI. MSI aerosol products are consists of optical thickness over land, optical thickness over ocean, and Angstrom Exponent over ocean. Over ocean we implement two channel method with 0.68 um and 0.86 um (Higurashi and Nakajima, 1999) and we retrieve optical thickness and Angstrom Exponent. Over land we estimate the surface reflectance at 0.68 um from longer wavelength. Kaufman et al (1997) used 2.2 um to estimate the surface reflectance at 0.68 um. In this study we tried to use 1.6 um to estimate the surface reflectance at 0.68 um. This is because there is a possibility to get better estimation than to use 2.2 um and we can use this method for sensors which don't equip 2.2 um such as GOSAT/TANSO-CAI or CAI2. We have made a scatter plot of the reflectance between 0.68 um and 1.6 um. As reflectance data set, we used AERONET data of 0.68 um and GOSAT/TANSO-CAI's reflectance data of 1.6 um. We found that there are some correlations between these two reflectances when we classified by NDVI. The correlation is larger when the NDVI is large. The error induced by this parameterization is calculated. The standard error is 0.009 when 0.5 $<$NDVI $<$0.7, and the standard error is 0.007 when 0.7 $<$NDVI. We also calculated the error as aerosol optical thickness. The error as aerosol optical thickness at 0.5 um is 0.18 when 0.5 $<$NDVI $<$0.7, and that is 0.14 when 0.7 $<$NDVI. We will also develop aerosol models for each area by use of cluster method and linear classifier method.

Keywords: aerosol, remote sensing, EarthCARE

Japan Geoscience Union Meeting 2014
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ACG06-P08 Room:Poster Time:April 29 18:15-19:30

Helicopter-borne observation with portable microwave radiometer in the Southern Ocean and the Sea of Okhotsk

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It has been recently recognized that sea ice production in the polar regions is controlled by the thin sea ice area with thickness of less than 0.2 m. Spatial distribution of thin ice area and its variability are important information to better understand the reduction of the sea ice covered region in a changing climate environment. We have developed a thin ice thickness algorithm for satellite passive microwave data of the Advanced Microwave Scanning Radiometer-EOS (AMSR-E) and Special Sensor Microwave Imager (SSM/I). Although the microwave skin depth of bare sea ice is about several cm at most, microwave brightness temperatures correlate with the surface salinity (brine volume fraction), which is sensitive to thin ice thickness. Here, we present in-situ observations using a helicopter-borne portable passive microwave radiometer that has the same specifications as the satellite AMSR-E and AMSR-II sensors (36 GHz-vertical and -horizontal channels), to validate and improve our thin ice thickness algorithm. This study estimates the relationship between the microwave brightness temperatures (both satellite and helicopter-borne portable sensors) and in-situ observations of sea ice thickness.

We present data from two airborne missions, one in early austral spring 2012 during the Sea Ice Physics and Ecosystem eXperiment (SIPEX-2) of the Australian Antarctic Program in East Antarctica, and one from the Sea of Okhotsk in mid-winter 2009. These microwave data are compared with the satellite AMSR-E and AMSR-II data and ice thickness estimated from Moderate-Resolution Imaging Spectroradiometer (MODIS) data, helicopter-borne IR sensor data, and ship-borne downward looking camera data. High-resolution airborne microwave brightness temperatures show good agreement with low AMSR-E and AMSR-II brightness temperatures, despite the significant resolution mismatch. In the thin ice region, the polarization ratio of 36 GHz vertical and horizontal temperatures (PR-36) is found to be well correlated with ice thickness, supporting the validity of the AMSR-E thin ice algorithm which was developed previously by our group. We also discuss the microwave characteristics of fast versus pack ice, with a view to improving a satellite fast ice detection algorithm.

Keywords: passive microwave, heli-borne portable radiometer, thin ice region, in-situ validation, Southern Ocean, Sea of Okhotsk