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

HTT034-01 Room:201A Time:May 24 16:30-16:45

Comparative study on Antarctic ice sheet surface temperature derived from MODIS LST Product and AWS

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Recent studies of Antarctic climate change showed that ice sheet near surface temperature is raised by ice sheet surface temperature derived from satellites and Atmospheric surface temperature observed by stations and Automatic Weather Station (AWS).

Two types of temperature are different from the view of radiation balance, however, often used on same time and confused in these studies. In addition, their difference is not considered.

In this study, we show the difference and structure of Antarctic ice sheet near surface temperature from same point and same time comparison of ice sheet surface temperature derived from MODIS Daily Land Surface Temperature Product (MODIS LST Product) and Atmospheric surface temperature observed by AWS.

MODIS LST Product estimates land surface temperature based on split window method using thermal infrared bands. Spatial resolution is 1km and its automatic geometric correction accuracy has improved.

Automatic Weather Station set on the whole region of Antarctica by AMRC, Wisconsin University, and so on. And it is observing Atmospheric surface temperature, pressure, wind speed and wind direction per 10 minutes of 3 meters height. In this analysis, we use 90 points Atmospheric surface temperature since 2002 to 2009.

As a result, ice sheet surface temperature is lower than Atmospheric surface temperature. This difference shows inverse temperature structure from ordinary one in troposphere and it changes seasonally. Especially, the difference is large in summer season night time and winter.

It is considered that the difference is caused by surface inversion layer occurred to balance of solar radiation and radiational cooling. Because, MODIS LST Product is ice sheet surface temperature, however, AWS is Atmospheric surface temperature of 3 meters height. So, their difference of observation height causes temperature difference.

The difference is classified to latitude. Low latitude area, temperature difference is same as the features on whole region. On the other hand high latitude area, temperature difference almost doesn't change during a day.

It is considered that the difference of latitude is caused by changing of solar radiation quantity with changing of solar height.

We simulated that solar radiation quantity (G(h)) on whole points during a year from the equation from Paltridge and Platt (1976).

G(h) = 29.7 ? 298 sin h ^(1/2) + 1542 sin h (h: solar height)

As a result, low latitude area, solar radiation quantity is changing intensely in summer season, midnight sun season. So, temporally surface inversion layer is occurred in summer night time, small solar radiation quantity season. And stable surface inversion layer is occurred in winter, polar night season.

On the other hand, high latitude area, solar radiation quantity is hardly changing in summer season, in other words steady solar radiation exists. So, surface inversion layer is disappeared in summer season because of steady solar radiation. And stable surface inversion layer is occurred in winter same as low latitude area.

To summarize, ice sheet surface temperature derived from satellites and Atmospheric surface temperature observed by observation are different and the difference is changing seasonally because of surface inversion layer. And the features of difference are greatly affected by latitude because of solar radiation quantity change with change of solar height.

In the future work, we will analyze the temperature change on Antarctic ice sheet surface while considering this temperature difference.

Keywords: Antarctic climate, surface inversion, AWS, MODIS

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IC sensor tag application to Ambient network practices

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Among all information and communication technologies (ICTs), IC sensors have increasingly been anticipated from the viewpoints of convenience for widespread use and cost savings. Furthermore, IC sensor miniaturization has recently hastened development of micro-electromechanical systems (MEMS) technology and has reduced their costs. Consequently, large-scale sensor networks can be built for monitoring environment of the earth. We call this network an "Ambient Network". Using this newly developed network with IC sensors, attempts have been made to measure atmospheric CO2 concentrations over wide areas and to measure traffic-induced vibration characteristics of ground and earth structures .

Keywords: IC sensor tag, CO2, Ambient network

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Seasonal Variation Analysis of CO2 Density using CO2 density measurement system

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The present paper proposes a measurement system of CO2 density using the newly developed wireless sensing tag. An attempt was made to carry out the continuous measurement in 2010 in Hitachi-city, Koga-City, Moriya-City, Itako-City and Daigo Town of Ibaraki Prefecture. However, analysis of the correlation becomes particularly important since the wind direction and velocity may influence on the measured density value. Therefore, we analyzed the relationship between wind direction, velocity and CO2 density determined using measurement data observed in 2008 to 2010. The results obtained from this analysis were as follows: (1) We proposed the method of expressing wind direction, velocity and CO2 density in the 2-dimensional chart.(2) It was confirmed that the land use of each wind direction appeared on the 2-dimensional figure. Especially, it was confirmed to receive the influence of the land use distributed far away when the wind velocity was strong.

Keywords: CO2, seasonal variation, landuse

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Experiment on soil retentivity intended for coastal vegetation

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In the country of South-Pacific Island, the coastal erosion due to sea-level rise with global warming is a remarkable concern. When the adaptation plan in the island country is considered, the land-use change based on human activities and decrease in the coastal vegetation becomes an important issue. In this study, it was examined how the soil retentivity was different according to the wood species.

Keywords: coastal vegetation, atoll, erosion

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Possibility of PALSAR data for forest extraction

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Recently, it has become possible to extract various kinds of environmental information using Synthetic Aperture Radar (SAR) in the remote sensing. SAR data widely used for observing the rain forest areas because of the advantage that do not affected by cloud and weather condition. From last 20th century, global warming has become a severe problem over the world. According to the existing studies on global warming, most of the researchers concluded that the main factor is the mass of the emission of CO_2. The trees has a function of absorbing CO_2through photosynthesis, but the carbon storing in the trees will give out again when the trees have been cut down. Correct identification of the forest distribution and its changes are important information for the carbon cycle research. However, when we review the existing forest maps that derived from SAR data, many studies have used optical sensors with SAR data. It means that the results have effected by nighttime or cloud covers.

Objective of this study is to examine the distinction ability between forest and other vegetations only using PALSAR data. The study area covers for central Africa. Used data are 50m resolutions of PALSAR mosaic data in 2008, Google Earth and 500m resolution MODIS data (2008) ,and 1 km resolution Percent tree map (ROKHMATULOH, 2003) for validation data. To confirm the distinction ability between forest and other vegetations, following five types of land covers have selected; forest, herbaceous, cropland, cropland/other vegetation mosaic and urban. Training points for above classes were collected using Google Earth. In this study, two kinds of polarization waves of PALSAR data which called HH polarization wave and HV polarization wave were used and the threshold method was applied when decide the ranges of backscattering factor (BF) for forest on the images. Backscattering factor for forest in the HH image (FH) was ranged -9.754<FH<-2.135. In this range, herbaceous cover have ranged from -9.754<FH<-4 while Cropland and Cropland/other vegetation mosaic were ranged for -9.754<FH<-4.5 and -9.754<FH<-2.5, respectively. Urban have coincided ranges with forest backscattering factor in HH image. Also, scattering factors in HV image for each land covers were extracted, because forest could not extracted with only single polarization. Forest scattering factor was about 14<FV<-6, while herbaceous and cropland/other vegetation mosaic were included from-10<FV<-1. Part result for the urban have same value with above HH image. Based on the above analysis, we conclude that:

1, <Forest> and <Cropland> can be classified very well; 2,It is easy to classify <Forest> and <Herbaceous> or <Forest> and <Cropland/other vegetation mosaic>; 3,It is very difficult to classify <Forest> and<Urban>. At the end of the analysis of backscattering factor, the range of the forest backscattering factor is decided to A -B (A is when [-9.754<FH<-2.135] and moreover [-14.535<FV<-6.309], B is [-9.754<FH<-8.180] and moreover [-14.535<FV<-11.540]).

Our next step is to extract the urban area included in forest area. NDVI data that calculated from band1 and band2 for MODIS would be used in this step. Collected training data for forest and urban area would be used for deriving NDVI values. Finally, we extracted forest map from PALSAR data together use with NDVI values and the extracted result was checked by the training data of Percent Tree .

Keywords: PALSAR data, forest extraction

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HTT034-06 Room:201A Time:May 24 17:45-18:00

Spatio-temporal variation of food production in Xinjiang Uygur Autonomous Region, China and its causal analyses

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Xinjiang, China has a great agricultural production, and population to be fed is large. Agriculture is the main industry in Xinjiang economy. Interannual changes in food production are delineated from printed materials, such as statistic year book of the province. The data are visualized by using geographic information systems (GIS), and spatio-temporal changes in food production are analyzed.

Food production in Xinjiang shows consistent increase from 1949 to 2008. Based mainly on the policy of the Chinese government, temporal changes are divided into following four intervals, (1) 1949 – 1967, (2) 1968 – 1974, (3) 1975 – 1995, and (4) 1996 – present.

Stage 1 is the steady development era, and further divided into (i) rural economy recovery period (1949 – 1955), and (ii) large agricultural development by people's commune and major advance campaign. Annual increase rate is about 6.3%, and food production increased from 848,000 ton in 1949 to 2711000 ton in 1967.

Stage 2 is stagnation era during 1968 and 1974. The Cultural Revolution between 1968 and 1974 had an effect to food production, and it fluctuate around 3 million ton.

Stage 3 is a slightly fast development era. Economic reform in rural area started from late 1978, and liberalization of agronomic market set up in 1985 stimulate the motivation of farmers to increase production. Total amount of food production increased from 3.11 million ton in 1975 to 7.3 million ton in 1995. Food production doubled during this period.

Stage 4 is the fast development era. The great development policy to western part of China issued in 1998 gave the chance to alter agronomic structure in Xinjiang area. Total amount of food production reached 9.1 million ton in 2008, that is the largest.

The statistic data are compiled by using geographic information systems (GIS) to enable spatial analyses of food production in Xinjiang. Major producing center was southern Xinjiang in 1990's, however, the center moved to north Xinjiang until 2008. The production area expand all Xinjiang area recently.

Principle analyses reveals that four factors, they are (i) planting area, (ii) irrigation facility, (iii) increase in unit area production and fertilizer, (iv) agricultural machine, can characterize the four periods.

In addition to results of statistic analyses, agriculture monitoring in Xinjiang by satellite remote sensing will be presented in the assembly.

Keywords: China, Xinjiang Uygur Autonomous Region, food production, spatio-temporal changes, GIS, remote sensing

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HTT034-07 Room:201A Time:May 24 18:00-18:15

Study on the spatio-temporal variations of precipitation and soil moisture in Xinjiang, China

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Xinjiang Uygur Autonomous Region is the arid land located in western part of China. Tian Shan Mountains divides south and north Xinjiang. Taklimakan is the largest desert in Asia, and is located in south Xinjiang. Climate of Xinjiang is arid due to large distance from oceans and leeward effect of Karakorum and Kunlun Mountains. Annual average precipitation is below 500 mm, however, rainfall intensity is large. Xinjiang is water scarce region based on the water budget, however, snowmelt water from mountains supports arid land agriculture and sometimes suffered by flash flood.

Soil moisture and its spatio-temporal variation affect regional water and energy budget. It is an important subject in climate change studies, and closely relate to the life of local people. This paper analyzes the characteristics of precipitation and soil moisture distribution, and their correlation.

Hydrological data in desert region hardly be obtained in such a sparsely populated region. Satellite observation should be utilized to monitor hydrological elements, such as precipitation and soil moisture. In this study, APHRODITE (Asian Precipitation - Highly-Resolved Observational Data Integration Towards Evaluation) is used to analyze the characteristics of precipitation. APHRODITE (Yatagai, 2007) is high spatial resolution (0.25 deg.) daily precipitation dataset. Ground observed data combined with satellite observation are used to interpolate point data to get gridded data. By using APHRODITE, maximum no-precipitation period, annual average precipitation, and relative precipitation intensity (RPI) are calculated and made distribution maps. RPI is a ratio of maximum daily precipitation over annual average precipitation.

Daily soil moisture datasets by AMSR-E (Kaihotsu et al., 2009) is used to characterize soil moisture distribution. Soil moisture distribution and its temporal variation is compared to APHRODITE's precipitation distribution.

Annual average precipitation in Xinjiang is ranged from 20 to 500 mm. Maximum no-precipitation period reaches 130 days. Relative precipitation intensity is more than 100 % in most area in Xinjiang. This shows large precipitation event is the characteristics in Xinjiang, and implies the occurrence of flash flood events.

Correlation between APHRODITE's precipitation and soil moisture by AMSR-E is high in summer and low in winter. Correlation is high in north Xinjiang. The characteristics of the both datasets will be presented in the JpGU meeting.

Keywords: Xinjiang Uygur Autonomous Region, precipitation characteristics, soil moisture, spatio-temporal variation, APHRODITE, AMSR-E

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Macroscopic analyses on habitat environment by remote sensing and GIS - example of raccoon and snapping turtle-

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To consider conservation of biodiversity is the same as to consider future of human and ecosystem. It is urgent issue in international community as can be seen from the COP10 of biodiversity treaty in Nagoya. Factors that determine the existence of a living thing is extremely various. Understanding is possible by examining the relationship among many factors, however, it is very difficult in actually. Geographic Information Systems (GIS) enables such a complicated analyses.

Various land information are accumulated on the basis of so called 1km mesh(3rd mesh) in national standard mesh system of Japan. These data are open to public as national numerical land informations. Various attributes on land surface can be extracted from these data by using GIS.

Biodiversity center, Chiba Prefecture, stores information of the existence of many species on the 3rd mesh as biodiversity database. Land information can be added to the database, and it enables the analyses on the condition that determines the existence of a living thing.

We collect many numerical informations on 3rd mesh, they are information of topography, land use, road density and length, climate, population, vegetation. More layer will be added to the system continuously. Raccoon and snapping turtle are taken as examples of analyses, and results will be presented in the meeting.

Keywords: biodiversity, Chiba biodiversity database, geographic information systems, remote sensing, raccoon, snapping turtle