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

HTT006-01 Room:201A Time:May 25 16:30-16:45

Mapping Snow Cover Area in Afghanistan from Property of SNOW Brightness and Wetness using MODIS 2008 data

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Snow is a type of precipitation within the Earth atmosphere in the form of crystalline water ice. Snow is vital water resource, for example, accumulated snow as like solid reservoirs. Agriculture and animal husbandry is relying heavily on Snow melting water. Tourism role of snow is connection with winter tourism and skiing. And other hand heavy snowstorms often bring disaster to animal husbandry.

Given the importance of knowing the distribution of snow, there has been much progress since 1966 when the first operational snow mapping was done by NOAA. In addition, the snow cover itself is a surface condition that affects radiation and water balance determinations that are inputs to hydrological cycle and climate studies. Qualitative and quantitative information on snow cover is needed for hydrological and climatologically modeling and prediction. Satellite data have accounted for major improvements in the production of reliable global snow cover maps.

MODIS Snow and Ice products are available since September 13, 2000 (NSIDC).

Located in the interior of Asia, Afghanistan has the typical arid to semi-arid climate of the Russian Steppes. At 647,456 km2, Afghanistan is the world's 41st-largest country.

Afghanistan weather is characterized by dry hot cloudless summers and severe winters. The areas lying in the northeastern part of the mountains experience sub-arctic conditions having dry, cold winters. The average temperature is approximately12.6 degree.Highest monthly average temperature is 33 degree in July & August. Lowest monthly average temperature is -7 degree in January. Annual precipitation is 316mm. Average annual relative humidity is 56.3% and average monthly relative humidity ranges from 33% in August to 77% in February.

The mapping snow cover area in Afghanistan were analyzed using MODIS /Terra 8-day composite 7-band 500m, 2008 and Landsat ETM+ 30m, 09/17/2006 (Fig.2 shows used data).

Firstly, doing pre-processing for original MODIS 2008 data, such as cloud remove. Secondly, calculate the Brightness and Wetness for each period data.

Brightness=0.4395∗band1+0.5945∗band2+0.2460∗band3+0.3918∗band4+0.3506∗band5+0.2136∗band6+0.2678∗band7

Wetness=0.1147∗band1+0.2489∗band2+0.2408∗band3+0.3132∗band4-0.3122∗band5-0.6416∗band6-0.5087∗band7

Then, according to the snow property, make threshold for brightness and wetness data. There threshold for brightness is more than 4300 and for wetness is morethan-800.

Thirdly, extract snow cover area in Afghanistan from MODIS data

Finally, using Landsat data were validated the snow cover area.

Fig.4 shows the result of Snow cover area in Afghanistan. There White color indicated snow area.

Future work is considered to Snow Cover Mapping in dense forests area.

Keywords: snow mapping, snow brightness, snow wetness, Afghanistan

Japan Geoscience Union Meeting 2011
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Land cover mapping middle-south Asia and Philippines using MODIS 2008 data

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This land cover mapping is part of Global Mapping Project produced 500m global land cover dataset called Global Land Cover by National Mapping Organizations (GLCNMO).

Land cover is a key for global environmental variable. Development of space technology provides a new source of information about the Earth surface. MODIS 2008 data provides timeliness in the availability of information over large areas and shows great potential in land cover mapping.

The purpose of Land cover mapping is to produce a new 500-m land cover dataset.

There are 20 land cover classes defined using the Land Cover Classification System. 14 classes of them are derived using supervised classification. The other six classes were classified independently: urban, tree open, mangrove, wetland, snow/ice, and water.

Data of this land cover mapping twelve periods of 16-day composite 7-band 500-m MODIS data of 2008.Existing land cover maps (GLCNMO, GLC2000), four seasonal MODIS images, Google Earth, and existing local maps.

Training data for supervised classification and validation data were collected using existing land cover maps (GLCNMO, GLC2000), four seasonal MODIS images, Google Earth, existing local maps. These attempt promoted that training data accuracy.

Land cover mapping classification product using maximum likelihood supervised classification. Respectively, mapping land cover in middle-south Asia and Philippines.

Keywords: Land cover, mapping, MODIS

Japan Geoscience Union Meeting 2011
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HTT006-03 Room:201A Time:May 25 17:00-17:15

Distribution of crop patterns in Mekong delta - Application of remote sensing -

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Mekong delta is the most important rice production area in Vietnam. About 35 years, from 1975 to 2009, rice production in Mekong delta increased from 5.141 million ton to 21.2 million ton (412%), while cropland area increased only from 2.039 million ha to 2.340 million ha (115%). Green Revolution and Vietnamese Government Revolution in 1986 were considered as the causes of this growth. In common with apply high-yielding varieties of cereal grains, expansion of irrigation infrastructure, distribution of hybridized seeds, synthetic fertilizers and pesticides to farmers, increasing the number of crops is also important factor for rice product inrease.

Under monsoon climate, Mekong delta has clear rainy season (May to October) and dry season. Until 1976, the haverst was only one in all Mekong delta, naturally, was carried on rainy season. After that, to insurance for food security, Vietnamese Government forced increase the number of crops to 2 or 3 per year and expansion cropland area. Increasing number of crops was thought that made soil become poorer and easy to pestilent insect consequence the quality and quantity of rice become worst. On fact, 2 or 3 crops per year has been carried on untill now and to be seen as right policy of Vietnamese Government. The matter is only how to choose the conformable land for 3 crops.

With development of remote sensing, the distribution of crop land and crop growing period monitoring has many of achievement. In this study, by using MODIS data and application of Normalized Difference Vegetation Index (NDVI), the number of crops in Mekong delta was extracted per year, from 2000 to 2010. From the spatial distribute of number of crops, by using GIS and we analysised the factors of meteorology, soil-land, hydrology and transport in choosing 3-crops-per-year-land. This result will be helpful for administrators to plan cropland in Mekong delta.

Keywords: Vietnam, Mekong Delta, crop calender, remote sensing, MODIS, NDVI

Japan Geoscience Union Meeting 2011
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HTT006-04 Room:201A Time:May 25 17:15-17:30

Analyses on Cultivated Land Changes in North-East China by Satellite Remote Sensing

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In China, shortages of fresh water and food resources in 21st Century will become very serious. To avoid food shortage problems, the increase of the yield of grain must take first priority. Therefore, the redistribution of existing farmland is essential, being followed by expansion of cultivated land area. The North-East China is most important food producing area. But at the same time, those are also the area of limitless grassland and forest. Therefore, in the near future, it is expected that vast area will be utilized to the limit as farmland and the grassland will be converted into grain yielding fields. Land use and land cover have changed and keep changing in the foreseeable future, which would cause to environmental problems, such as, climate warming and biodiversity loss as well as land degradation. The land use and land cover change and its driving forces become a worldwide important issue. Many studies address this subject, in which the socioeconomic driving forces are dealt as most important factors for land-use changes. The land use in North-East China has largely changed in recent decade due to rapid population increase and socioeconomic growth.

In this paper, we try to identify both spatial and temporal land-use changes and to analyze the relationship between land-use change and socioeconomic growth in North-East China using the state Statistic data and Satellite Remote Sensing data. Here, the North-East China includes Liaoning, Jilin and Heilongjiang Provinces.

This study calculated NDWI (Normalized Difference Water Index), NDVI (Normalized Difference Vegetation Index) and NDSI (Normalized Difference Soil Index) of SPOT/VEGETATION Data. NDVI at cultivated land is characterized by sharp increase in early summer. In 2000, NDWI had increased at 14th ten-days. NDWI had Decrease at 18th ten-days. NDVI had increased at 16th ten-days. This signal can be used to extract paddy field form sequence of NDVI imageries. Based on the rice phenology, the area of paddy field is extracted by SPOT/VEGETATION NDVI and NDWI imageries, and changes between 1999 and 2007 are examined. In 2000, NDSI had increased at 10th ten-days. NDSI had Decrease at 17th ten-days. NDVI had increased at 16th ten-days. This signal can be used to extract field form sequence of NDVI imageries. the area of field is extracted by SPOT/VEGETATION NDVI and NDSI imageries, and changes between 1999 and 2007 are examined. This study uses the SPOT / VEGETATION data from 1999 to 2007 to make the spatial distribution chart of cultivated land in North-East China. The area of cultivated land educed from the distribution chart the is roughly the same as the area of that calculated according to agricultural statistics.

Keywords: remote sensing, North-East China, cultivated land, LUCC, agriculture

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The changes in water area and wetland vegetation and water pollution in Baiyangdian, China

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Baiyangdian is the closed lake located in North China Plain, about 150 km to the south of Beijing. The lake provides domestic and industrial water to surrounding area. The lake has functions of flood mitigation, water purification, conservation of biodiversity, that is ecosystem services. However, water shortage and pollution becomes serious problem, and ecosystem services are deteriorated.

Recent economical development in China leads increase in local industries, and population is increasing in the surrounding area. Water demand is also increasing, that lead to decreased storage and dry up of Baiyangdian lake.

The study area include Baiyangdian lake extending N38:40-N39:05, E115:35-E116:10. Baiyangdian collects nine streams from Taihangshan mountains and effluent stream flows into Bohai Bay. Swamp area include about 3,700 of creeks connecting 146 water areas through channels. Total area is about 366 km2 including 36 villages in the swamp area. The climate is temperate monsoon climate, which has dry and cold winter, and hot and moist summer. Average annual precipitation is 563.9 mm, and annual average pan evaporation reaches 1369 mm. About 80% of precipitation is concentrated from June to September.

Baiyangdian as natural wetland has many functions, namely ecosystem services. Proper conservation is required to maintain local agriculture and industries. The final goal of the study is conservation of ecosystem services of natural wetland. In this paper, we report the interannual and seasonal changes in water area and wetland vegetation in Baiyangdian by using satellite remote sensing. Field survey of water quality had conducted in 2010. The relationship between the condition of surface water and vegetation and water quality is investigated.

Water area and vegetated area in the lake has a decreasing tendency between 1989 and 2001. This is caused by housing and agricultural developments in the reclaimed land. Especially the upper part of Baiyangdian suffers development activities. On the other hand, it is proved that large water areas of Baiyangdian had been separated.

Field survey was carried out on April, June and September in 2010. Total nitrogen, total phosphorus, nitrate-nitrogen were measured at plural sampling points. The concentrations of the items are high at the inlet channel of Baiyangdian lake. It seems wetland vegetation (mainly reed grass) absorb the nutrients. The concentration in September is the lowest in the season. This is considered to be the absorption of the nutrients by vegetation in the growing season. It remains as the next point to discussion. Moreover, the observation months results are compared. The absorption rate of the nutrients in September is more high than it in April and June. One the reasons is that reed grass absorb the nutrients in the growing season from April to July.

In this time of the research, interannual variation of water area and wetland vegetation are clarified. Distribution of T-N, T-P, and NO3-N are also clarified, and apparent relationship the both is recognized. In the next stage of the study, we will plan the evaluation of the function of ecosystem services.

Keywords: China, Baiyangdian, remote sensing, closed lake, ecosystem services, nitrogen and phosphorus

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Analyses of erosion and sedimentation around the mouth of Ganges in Bangladesh

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Recent changes in coastal line and river banks at around the mouth of Ganges are analyzed by using satellite remote sensing with shorter time periods. Synthetic Aperture Radar (SAR) on board JERS-1 satellite,Geocover TM Mosaic data by NASA and Terra/ASTERs are used to map the changes in coastal line and river course.SAR images has predominance of night and day observation and multiweather observation. It increases the observation frequency, and also increase the chance of coastal line and river course observation.Geocover TM image is geometrically corrected mosaiced LANDSAT TM imageries in circa. 1990 and circa. 2000 provided by NASA. These images can be used for base image to rectify SAR images, and also time change detection between 1990 and 2000 is possible. Terra/ASTER image is the latest image in this study that observes the mouth of Ganges area. From the analysis of Geocover TM images, large topographic changes at river course of Ganges and at coastal line and island around the mouth are recognized. In the river bank, erosion was dominated in 1990s, and sandbar has developing. However, ASTER image show the alteration between erosion and sedimentation at some place in river courses. On the other hand, coast line of land and island around river mouth has consistent trend of erosion or sedimentation at the same place. Northern end of Hatia Island experienced about 79 km2 of coastal erosion, and erosion rate has been changing during the observation period. Comparison between erosion rate and monthly precipitation at Dhaka reveals clear correlation. Precipitation in Dhaka may be the index of regional precipitation and discharge amount of Ganges, and large flow quantity may leads to large erosion at Hatia Island. At the left bank of Ganges, sedimentation was dominated during the observation period. Especially, during 1989 and 2005 shows about 10 km of regression, however, the rate was different at the place to place.

Keywords: Bangladesh, Ganges delta, remote sensing, changes in topography, synthetic aperture radar

Japan Geoscience Union Meeting 2011
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HTT006-07 Room:201A Time:May 25 18:00-18:15

Coastal Zoning Process for Land Protection on Majuro Atoll

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Intergovernmental Panel on Climate Change (IPCC) opened the Fourth Assessment Report to public in May, 2007. In the report of the Working Group1, there is the indication of the following 2 points on the environment of coastal zone. 1) The mean sea-level will increase up to 18-59cm by the end of this century. 2) The strength of the tropical cyclone will be intensified. The report of the Working Group2 showed that coral bleaching will frequently occur because the sea surface temperature will rise up to 1-3 degrees. For example, in particular, atoll islands in the South Pacific, where the highest part is only several meters above the sea-level, will suffer from the risk of inundation due to the sea-level rise. In such islands, countermeasures against the sea-level rise would be quite important.

Our research group went to Tuvalu and Marshall islands in 2005, 2006, 2007,2008 and 2009, and did the field investigation for the measurement of the flow in the lagoon and the investigation of the land use these several years. In this investigation, a decrease in the coastal vegetation was remarkable, and it had been found that a lot of eroded area seen in the decrease region neighborhood. In this paper, it was proposed that the evaluating method for eroded and accumulated area by using geographic information.

Keywords: climate change, atoll, satellite image, landuse

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A method for estimating threshold wind speed of dust outbreaks using thermal inertia over a non-vegetated surface

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1. Introduction

Soil moisture is one of the important surface conditions of dust outbreak. An operational estimation of potential areas of dust outbreak will be demanded for estimating and forecasting source, transport, and sink of aeolian dust over regional and continental scales. Among methods for estimating soil moisture, methods using thermal inertia is a confidential one using the radiative land surface temperature in an infrared band. Matsushima et al. (submitted) developed a thermal inertia method using a two-layer surface heat budget model incorporating field data, and showed the model has practical feasibility to estimate subsurface soil moisture with an accuracy of 3-4 vol.% when data frequency was equivalent to that of routine meteorological observations and polar orbit satellites.

This study aims to clarify that the threshold wind speed over a non-vegetated surface can be estimated by the thermal inertia retrieved from the model. Thermal inertia is theoretically and practically a function of the soil moisture. Namely, subsurface thermal inertia can be a proxy of subsurface soil moisture for estimating the threshold wind speed of dust outbreak.

2. Materials and Methods

2.1 Site description

The experimental site was located in a flat field with some senescent grass in Bayan Unjuul, Mongolia. Data analysed in this study were obtained 27 April through 24 May 2008 during the 2008 Dust-Vegetation Interaction Experiment (DUVEX) (Shinoda et al.,2010, SOLA). In this site, 4-component radiation, wind speed, temperature and humidity of air, soil moisture, and dust concentration (PM10) were measured.

2.2 Model

A linear surface heat budget model was employed in this study. This model is a two-layer model consisting of vegetation canopy and underlying soil surface, which requires diurnal time series of the insolation, the longwave radiation, air temperature, wind speed, and specific humidity as input variables with associated land surface parameters. The model calculates time series of the surface radiative temperature employing the finite difference method. The simplex algorithm is employed for optimizing model parameters to retrieve thermal inertia. All parameters including the optimized parameters kept constant in a calculation of one diurnal change. Details are referred to Matsushima (2007, J. Hydrology).

2.3 Threshold wind speed of dust outbreak

The threshold wind speed of dust outbreak of PM10 using the following statistical method. Each sample of dust concentration (1 minute average) in an event of dust outbreak was categorized by corresponding wind speed by every 1 m/s. Distribution of the PM10 concentration in each category was fit by a logarithmic normal distribution function. There existed the point of 10 % significant level on the side less than the average concentration of every distribution function. The threshold wind speed was determined as the point at which the curve connecting the 10 % levels intercepted the criterion of dust outbreak which was defined as 0.05 mg/m^3 of the PM10 concentration.

3. Results and Discussion

The curve of the 10 % level of the PM10 concentration was almost an envelope of the scatters of the samples. The threshold wind speeds of 18 events were determined and ranged between 7 and 9.5 m/s.

The estimated threshold wind speed showed an almost linear relation to the daily values of the subsurface thermal inertia retrieved from the model. Threshold wind speed was correlated well with subsurface thermal inertia (r = 0.74) even when the data frequency was equivalent to the routine observations and the polar orbit satellites. On the other hand, the correlation between threshold wind speed and the soil water content was comparable (r = 0.67). Therefore, thermal inertia can be a proxy of soil moisture as a criterion of dust outbreak, which implys feasibility of estimating potential areas of dust outbreak by using the heat budget model incorporating field and remote sensing data.

Keywords: thermal inertia, thershold wind speed, dust outbreak, heat budget model, radiative surface temperature

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The Relationship between Outbreak of Asian Dust and Ground Condition

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In East Asia, Dust is called yellow sand, and spring in particular has much outbreak. Not only from a scientific viewpoint but also from a standpoint of environmental problems, it is considered as an important problem to discuss the generation factor. It is thought that although dust is a natural phenomenon, the human activities are related to the outbreak.

According to the observeed total days of dust in Japan, which has been made public by the Japan Meteorological Agency, the observation days are greatly different depending on the year. The number of dust events observed in Japan increased in 2000, and continued to 2002, following sharp drop in 2003. There must be some causes in such a rapid change. It is thought that the factor includes both an atmospheric side and the ground level side. In this study, we will focus on the state of the ground level, aim to clarify the change in the ground condition, which corresponds to the changes in the dust observation days. So, we discussed the relationship between outbreak of dust and the ground condition, with monitoring the state of ground level by satellite data and analyzing the changes in meteorological condition.

As satellite data, we used SPOT/VEGETATION 1-km spatial resolution data, which can be downloaded free of charge from the following URL http://free.vgt.vito.be/. Each data file is composed 10-day maximum-value composite (MVC) NDVI bands. The sensor has 4 spectral bands: blue, red, near-infrared (NIR) and mid-infrared (MIR). We can extract the information on the snowfall and vegetation from these bands data. The red and NIR bands are used to characterize vegetation with normalized difference vegetation index NDVI=(NIR-R)/(NIR+R). The foliation of vegetation made the period of a map each year by expediently using NDVI=0.1 as a threshold, and the red and MIR bands are used to characterize snow with normalized difference snow index NDSI=(MIR-R)/(MIR+R). A value of 0.2 was used as a threshold based on Kondoh and Suzuki (2005) for the identification of the snowfall region and non-snowfall region.

In the semiarid area in east Asia, the period of bare land is able to be calculated to make a map by taking the difference of thaw and foliation in each year. There seems to be a good correlation between the two when the length of the bare land is compared with the dust observation total days each year. So, we select the meteorological observation station in Inner Mongolia of China, to do the same. As the results, when the length of bare land was long, the frequency of dust observation was high.

As a statistic of the yellow sand outbreak using SYNOP data, in the year of the longer bare land duration, the thaw was earlier, and the average temperature of spring was higher. Therefore, it is thought that is related between the earlier thaw and the higher temperature of the snow melting period. On the other hand, the foliation in the year of earlier thaw is later. In East Asia spring is dry season when precipitation is a little. In the semiarid area, the growth of herbs depends on the moisture condition (Kondoh et al., 2005). Therefore, in the year of earlier thaw, it is possible that dryness controls the germination and growth of the herbs vegetation.

As a result of having added more detailed examination, it became clear that an earth surface characteristic to be concerned with yellow sand outbreak every area was different, that, in addition, inter-annual variations was big. Therefore, adding the examination of the topography condition and the consideration of ecology zone, the reexamination result of the yellow sand outbreak condition will be reported from a viewpoint of time and space.

Keywords: Asian dust, outbreak, remote sensing, ground conditions, vegetation, snow