# Mixture Analysis of Abandoned Paddies Using Multi-temporal MODIS and Landsat-8 OLI Data

*Asahi Sakuma[1], Hiroto Shimazaki[1]

1.National Institute of Technology, Kisarazu College

Increase of abandoned farmlands is gaining attention in Japan as a problem causing difficulties such as: expansion of breeding habitat potentially preferred by vermin; increase of small parcels where illegal dumping occurs; and deterioration of rural landscapes. To address this problem, it is important to periodically survey the extent and distribution of abandoned farmlands over a broad spatial range. However, conventional surveying methods are labor intensive and time-consuming, requiring surveyors to cover every parcels often situated in hostile locations.
Remote sensing provides us with a low cost, repeatable alternative means for broad-scale mapping of abandoned paddies. A previous study suggested that Normalized Difference Vegetation Index (NDVI) derived from remotely-sensed data could have potential to discriminate an abandoned paddy from a paddy area since the difference in NDVI becomes significant at the period s of one month after planting and two months after harvesting. Normalized Difference Water Index (NDWI) was also applied successfully to detecting changes in agricultural activity in a paddy area. However, the success of previous studies depends on acquiring data not affected by cloud contamination at the suitable timing in terms of crop calendar. To avoid adverse effects of cloud contamination and the variability of crop calendar we proposed the use of MODIS NDVI and NDWI time-series. However, the typical size of abandoned paddy is quite small when compared to the MODIS spatial resolution.
The objective of this study is to assess the detection limit of an abandoned paddy using the time-series data derived from MODIS surface-reflectance products. First we refined the MODIS reflectance time-series by removing the effects of cloud contamination based on the Savitzky-Golay filter applied to NDVI time-series. Second a simple linear mixture model was employed to estimate the reflectance time-series of pure pixel for each of the underlying end-member land-cover types using the landcover map derived from Landsat 8 OLI data as a reference. Third we simulated a set of temporal signatures of NDVI and NDWI for mixed pixels, assuming that areal fraction of abandoned paddy varied gradually from 0 % to 100 % at different end-member compositions. Finally we explored the minimum fraction of abandoned paddy in a pixel, where the signal relevant to cessation of agricultural activity might be detected. Preliminary results showed that successful detection could be limited to the pixel dominated by abandoned paddy areas.

Keywords: Mixture Analysis, Abandoned Paddy, MODIS

# Classification and Regression Tree Analysis of the Relationship between the Yellow Dust Concentration and TOA Reflectance observed with GOSAT CAI Sensor

*Tatsu-hiro Ogawa[1], Hiroto Shimazaki[1]

1.National Institute of Technology, Kisarazu College

Yellow dust, which is also known as yellow sand or Asian dust, is a seasonal meteorological phenomenon commonly observed in East Asia during the months of spring. The dust originates from the deserts of southern Mongolia and northern China and is then carried eastward by prevailing winds, passing over China, North and South Korea, and Japan, as well as parts of the Russian Far East. Although the major components of the dust are sand and materials from the earth’s crust, the possible adverse health effects of high concentration of the dust has been becoming a public concern for the regions in East Asia. To address the problem of transboundary air pollution, collecting and visualizing the data of dust concentrations is of importance as a first step. Satellite remote sensing has contributed to the near real-time monitoring of air pollutants over a broad spatial scale. The Thermal And Near-infrared Sensor for carbon Observation (TANSO) - Cloud and Aerosol Imager (CAI) sensor on board the Greenhouse gases Observing SATellite (GOSAT), which was designed to estimate the types and optical thickness of aerosols, is expected to have capability to detect the Yellow dust concentrations. However, its capability has not yet been confirmed well. This study statistically explored the relationship between the Yellow dust and the top-of-atmosphere (TOA) reflectance of wavelengths from near-ultraviolet (0.380 mm) to near-infrared (1.60 mm) observed by GOSAT CAI sensor, aiming to obtain fundamental information to generate an imagery product that visually enhances the Yellow dust concentrations. First we transformed the radiance in the CAI L1B product to the TOA reflectance, which was considered in this study as a response variable. Second we collected a suite of predictor variables which were expected to have some impact on the variation of TOA reflectance. The predictor variables concerning atmosphere conditions include: (1) the total amount of the Yellow dust above the ground, which was calculated from the estimates of the Chemical weather FORecasting System (CFORS); and (2) the clear-sky confidence level retrieved from the CAI L2 product. The predictor variables regarding land- and sea-surface conditions include: (1) the land-surface reflectance; and (2) sea-surface reflectance data. Both of them were retrieved from the CAI L3 product. Third the response and predictor variables were linked together by match-up processing in terms of time and location. Finally we employed a recursive partitioning approach known as Classification and Regression Tree (CART), where the resulting model could be represented graphically as a decision tree. Preliminary results of the CART analysis with the match-up data showed the relationship between the predictor and response variables to be different for each band. Findings from the resultant decision trees would provide us with a clue of how to deal with each band to generate an imagery product that visually enhances the Yellow dust concentrations over a broad spatial scale.

Keywords: Classification and Regression Tree, Yellow dust, GOSAT CAI

# Mapping Bamboo Forest Distribution using Multi-temporal Landsat-8 OLI Data and Random Forest Classification Algorithm

*Naoki Hara[1], Hiroto Shimazaki[1]

1.National Institute of Technology, Kisarazu College

In recent years, the spatial distribution of bamboo forest has been expanding rapidly in various areas in Japan, resulting from cessation of appropriate forest management. Expansion of bamboo forest is considered as a problem that will cause difficulties such as: increase of the breeding habitat potentially preferred by vermin; and deterioration of traditional rural landscapes. To address this problem, it is essential to have a reliable information about the spatial distribution of bamboo forest over a broad spatial scale. Satellite remote sensing is expected to have potential to periodically identify the extent and distribution of bamboo forest over a nationwide scale. This study estimates land-use and land-cover (LULC) class using Landsat-8 OLI data to generate a LULC map product including a bamboo forest class. We used the Landsat-8 OLI multi-temporal imagery acquired in the period from 2013/09/01 to 2014/08/19. Random Forest classification algorithm was employed for each scene first, and a set of multi-temporal classification results were then aggregated based on probably vector approach. Classification accuracy of the final LULC map was accessed in terms of Cohen's Kappa coefficient. The result showed that the classification accuracy was fair to good (Kappa coefficient = 0.65), which was lower than expected. Future work includes: (1) refining the training data; (2) exploring the best combination of features; and (3) assessing the appicability of our approach to other areas.

Keywords: Landsat-8 OLI, Land Use and Landcover, Random Forest

# Accuracy Assessment of Geospatial Data obtained using an UAV-based System with Autonomous Flight Capability

*Jun-nosuke Okamoto[1], Hiroto Shimazaki[1]

1.National Institute of Technology, Kisarazu College

Unmanned Aerial Vehicle (UAV) has been increasingly becoming an important tool for collecting geospatial data in various industrial and research domains. Very high spatial-resolution imagery acquired from UAV has made the land surveying in small areas more flexible and cost-effective, as compared to conventional methods with a Total Station or a Terrestrial Laser Scanner. However, the UAV specifically designed for land surveying applications is still expensive and having exaggerated specifications and, this might be an obstacle to introduce UAV into educational institutions. To improve the educational opportunity of the UAV surveying method, reliable UAV equipment at reasonable cost are needed.
This study preliminary evaluated the positional accuracy and attribute accuracy of geospatial products derived from a set of digital imagery, which was obtained using a commercially-available inexpensive small UAV-based system. First, ground control points (GCPs) to be used for georeferencing geospatial products and reference points to be used for validation of positional accuracy were deployed over the entire study site, and their 3-dimensional coordinates were measured with static GNSS surveying method and radiation method with Total Station. Second, three types of geospatial products, i.e., (1) orhtomosaic image, (2) Digital Surface Model (DSM), and (3) landcover map, were generated using a set of imagery obtained by Ricoh GR mounted on Phantom 2 Vision +. Third, positional accuracy of orthomaic image and DSM was assessed based on the Root Mean Square Error (RMSE) between the Photo Identifiable Features (PIFs) on the geospatial products and the reference points. Fourth, attribute accuracy of landcover map was assessed based on Cohen's kappa coefficient. Preliminary results showed that the positional accuracy and attribute accuracy were both acceptable for educational purposes.

Keywords: Unmanned Aerial Vehicle, Geospatial Data, Accuracy Assessment

# Study on the changes in farming calendar of winter wheat in North China Plain

Jiang Yu[1], *Akihiko Kondoh[2]

1.Graduate School of Science, Chiba University, 2.Center for Environmental Remote Sensing,Chiba University

Variation of farming calendar needs to be considered in global warming. Except rice, as the second crop, there are large cultivation areas and production amounts of wheat in China. North China Plain is one of the main wheat produce base. In this study, the objectives are to clarify variation of farming calendar, crop acreage of winter wheat and changes reasons using satellite remote sensing data in North China Plain. As results, from PAL and SPOT/VEGETATION NVDI data, variation of farming calendar and annual crop acreage changes of winter wheat are cleared from 1982 to 2012. Sowing season is delayed owing to autumn mean temperature, precipitation and breed improvement.And then temperature change in autumn got impact on the winter wheat which sowing in September, make them grow too fast can not against the cold in winter.And because of that ,winter wheat can not grow well in green up time.It agrees with previous research results. Green seasons become faster as the increasing temperature in spring. In addition, crop acreage changes correspond to statistical data, and spatial and temporal distribution of winter wheat is also cleared.

Keywords: North China Plain, farming calendar, winter wheat

# Study on land use change of Horqin area using Multitemporal LANDSAT images

*BAOYIN BUHE[1], GERILE HASHEN[2], Akihiko kondoh[1], Chiharu Hongo[1], Eisaku Tamura[1]

1.Center for Environmental Remote Sensing, Chiba University, 2.Graduate School of Science, Chiba University

Since 2000, a series of aggressive environmental protection policies, such as ecological emigration, returning farmland to grassland and forest, and grazing prohibition, have been implemented in Inner Mongolia Autonomous Region of China. At the same time, Inner Mongolia has been designated a target area under China's Western Development Strategy, Consequently, the region’s land use and cover types after 2000 have been strongly affected by the socioeconomic development. In this study, using remote sensing data, the author analyzed the changes in vegetation cover, including the agricultural land use change, in Inner Mongolia Autonomous Region since 2000.

Keywords: Horqin area, land use change, Landsat, Inner Mongolia Statistical Yearbook, ArcGIS

# Prediction of the Forest Fire Danger in Indonesia using Remote Sensing and Spectral Measurements

*Hikaru Suzuki[1], Yuito Takahashi[1], Tetsushi Ota[1], Asahi Hashimoto[1], Natsumi Kamada[1], Moka Akita[1], Yuka Ogino[1], Hasegawa Yoko[1], Nobuyasu Naruse[1,2], Yukihiro Takahashi[2,3]

1.Global Science Campus, Hokkaido University, 2.Institute for the Advancement of Higher Education, Hokkaido University, 3.Graduate School of Science, Hokkaido University

To minimize forest fires in tropical area is extremely important, because the fire has a large influence on global warming or biodiversity. Although most of the forest fires are caused artificially, the surface soil water, reflecting the amount of precipitation in the area, would be also related to the fire. Furthermore, plants under a drying stress can be the cause of fire. If we observe the degrees of surface soil water and the level of the stress, we can predict where the forest fire occurs.

In the previous study, Furumoto et al. showed that NDVI (Normalized Difference Vegetation Index) values differ between the wet and the dry season in Kalimantan Island in Indonesia. They found the correlation between the NDVI values and the amount of precipitation in the area. They also pointed out there's a time lag of 1-2 months between the change of rainfall and NDVI values. However, this makes it difficult for us to judge immediately whether the forest fire will occur. On the other hand, the degrees of surface soil water are also related to the fire; since Indonesia is covered with peat moss, the soil also burns when the fire occurs. The degrees of surface soil water have been detected by infrared satellite images with a poor spatial resolution so far, which is not enough to discuss in detail the correlation between the degrees of surface soil water and the cause of the forest fires. Thus, we have to consider the degrees of surface soil water in a high spatial resolution for the prediction of the fire.

The purpose of this research is to predict the region of the forest fires in Indonesia using satellite imaging and spectral measurements. To develop a new index of higher correlation with the forest fires, we actually grow Indonesian plants in a different degree of soil water condition.

First, using Landsat 7 and 8 images, we calculated the NDVI and SAVI (Soil Adjusted Vegetation Index). The study area was 100×250 m around Martapura, in South Sumatra Island in Indonesia. We found that the vegetation indices obtained from the areas covered with grass are lower than those of tree area. In addition, both indices dropped significantly in the year of El Niño happened. The fact indicates that the decrease of precipitation can be influenced on the vegetation indices around the area. There was a meaningful difference between SAVI and NDVI values. Moreover, the change rate of vegetation indices from the grass was larger than that of the tree, which is suggested that the reflection spectra obtained from the grass is strongly affected by the drying stress.

Next, we compared the forest fire regions in 2015, using the website of NGO "Eyes On The Forest", with the area having low vegetation index. The satellite images having 0-0.3 values of SAVI corresponded to the area that forest fire happened.

Keywords: Indonesia, forest fire, vegetation index, surface soil water, spectrum, remote sensing

# Elucidation of changes of reindeer travel-route around Lena River by satellite remote sensing

*Takeru Sakka[1], Tatsuya Tashiro[1], Hinako Telengut[1], Haruki Takanashi[1], Mahki Takanari [1], Itsuki Kida[1], Fiolenta Marpaung[1], Takahiro Yoshii[1], Yuka Ogino[1], Masataka Imai[1,3], Nobuyasu Naruse[1,2], Yukihiro Takahashi[1,3]

1.Global Science Campus, Hokkaido University, 2.Institute for the Advancement of Higher Education, Hokkaido University, 3.Graduate School of Science, Hokkaido University

There are nomads who hunt reindeers for a living in the Arctic Circle of Siberia. The trade of the meat and the fur has become one of the most important industries. Recently, the reindeer, which has an animal behavior going along the conventional route for pasture, has been changing the travel-route. Thus, the livelihood of nomads who lives by hunting them has been menaced. The reason of changing the travel-route must be a global warming resulting from the vegetation change of the pasture. To track the travel-route, some reindeers were installed GPS devices in Sakha Republic in Russia [1]. Almost all positions of reindeer groups, however, remain unclear, because Siberia is a vast field.
The aim of this study is to elucidate changes of wild reindeer travel-route in Siberia by satellite remote sensing; 1) through the seasonal change of vegetation of the pasture, and 2) through the direct survey of reindeer groups by satellite image analyses. The study area was selected around Lena River and Olenyok valley in Sakha Republic, Russia. This work focused on 1).
First, We have investigated the effects of climate change on vegetation around Lena River where the travel-route of wild reindeer was observed. Although there is a report that the annual difference of vegetation discussed using MODIS data in Siberia, we use Landsat 7,8 images to distinguish the travel-route in higher special resolutions. We have calculated the normalized difference vegetation index (NDVI) from satellite images of the corresponding area of 2010-2015. From the result, only in 2010 and 2015, the period that NDVI value becomes a peak, had clearly shifted by about one month. It is reported that El Niño occurred during these years, leading to abnormal summer weather in the region. This result supports that the change of the wild reindeer travel-route frequently occurs due to the change in activation timing.

Keywords: Vegetation, Remote sensing, NDVI, Reindeer, Lena river

# Correlation between forest fires in Indonesia and soil water content through the satellite imaging and the direct spectral measurements of soil

*Asahi Hashimoto[1], Moka Akita[1], Tetsushi Ota[1], Yuito Takahashi[1], Natsumi Kamada[1], Hikaru Suzuki[1], Yoko Hasegawa[1], Yuka Ogino[1], Nobuyasu Naruse[1,2], Yukihiro Takahashi[1,3]

1.Global Science Campus, Hokkaido University, 2.Institute for the Advancement of Higher Education, Hokkaido University, 3.Graduate School of Science, Hokkaido University

In recent years, the smoke caused by the forest fires in Indonesia has become a serious problem. It affects the arrival and departure of airplanes. Moreover, a health problem has occurred in neighboring countries. Especially, El Niño in 2015, which scaled one of the largest, has reduced the precipitation in Indonesia, consequently increasing the forest fire significantly. Although most of the forest fires are caused artificially, the surface soil water, reflecting the amount of precipitation in the area, would be also related to the fire. Since Indonesia is covered with peat moss, the soil also burns when the fire occurs, and this makes the fire last for a long time. In the previous study, Furumoto et al. estimated the amount of soil water in Indonesia using the typical vegetation index of NDVI (Normalized Difference Vegetation Index). However, there's a time lag of 1-2 months between the change of rainfall and NDVI values, which makes it difficult for us to judge immediately whether the forest fire will occur. The degrees of surface soil water have been detected by infrared satellite images with a poor spatial resolution so far. It is not enough to discuss in detail the correlation between the degrees of surface soil water and the cause of the forest fires.
This study aims to establish a method to discover the correlation between the regions of the forest fires and the surface soil water with a high spatial resolution using remote sensing. Our approach is 1) the direct spectral measurements of soil with a several soil water content and 2) the satellite image analysis.
First, three areas of satellite images were used; Blang Pidie, Riau, and Martapura. Each area locates in Pulau Smatera. We estimated the soil water content using NDWI (Normalized Difference Water Index), NDSI (Normalized Difference Soil Index). The seasonal change of NDWI and NDSI was observed by about 0.3. This result indicates that we can distinguish between the wet and dry season. We found that the forest fires occur a lot in each area from September to October (the end of dry season). This suggests that there is a correlation between the forest fires and the soil water content. We also made the two dimensional maps of NDWI and NDSI, to make sure the correlation between the forest fires and the indices. Moreover, considering that the land of Indonesia is covered with peat moss, we measured the spectra from peat moss actually.

Keywords: Forest fire, Indonesia, Soil water, Remote sensing, Reflection spectrum

# Development of monitoring method of coffee leaf rust *(Hemileia vastatrix)* using remote sensing

*Naoya Katsuhama[1], Kazuyuki IKEDA[1], Takahiro Yoshii[1], Fiolenta Marpaung[1], Masataka Imai[1,3], Kensuke Watanabe[1,3], Nobuyasu Naruse[1,2], Yukihiro Takahashi[1,3]

1.Global Science Campus, Hokkaido University, 2.Institute for the Advancement of Higher Education, Hokkaido University, 3.Graduate School of Science, Hokkaido University

The value of coffee is the second largest followed by oil in the world trade market, and coffee has been a major crop in a number of countries. However, since 2008, coffee rust fungus *(Hemileia vastatrix)* has expanded its infection in Latin America and become a major threat to the coffee industry. Coffee leaf rust infection spreads fast through the air. Early logging and burning infected trees are only effective countermeasures against the infection, as there is no effective pesticide or breed that satisfies both coffee leaf rust resistance and flavor. Research on the coffee leaf rust has been paid attention for a long time. However, many of the studies remained in developing coffee leaf rust resistance breeds or ecology of coffee leaf rust. Remote sensing by satellite can monitor the wide range of fields cheaper and faster. Researchers on monitoring coffee leaf rust using remote sensing technology have been carried out since 1970s. However, their accuracy have been unsatisfied, and therefore more precise researches using up-to-date satellite images are expected.
Purpose of this research is to develop effective discovering method of coffee leaf rust infected areas using remote sensing. First, NDVI (Normalized Difference Vegetation Index) around the Cuchumatanes Mountains, Republic of Guatemala, was computed using Landsat7 satellite images. Based on previous researches, fields with different damage stages were set as test sites. As a result, seasonal changes, i.e. dry and rainy season, of NDVI were observed in all test sites regardless of their damage stages. In addition, NDVI of test sites with damages tended to be lower than the sites without damages as time advances. NDVI obtained from no damage sites tended to show a constant value except for the seasonal changes regardless passage of time. These results support that NDVI is lowered by infection of coffee leaf rust. The monitoring method in this research could be applied to other crops and vegetation.

Keywords: Republic of Guatemala, coffee leaf rust, remote sensing, NDVI

# Estimation of the rice-planting field in Bangladesh by satellite remote sensing

*Genta Suzuki[1], Eiki Furuta[1], Masato Yamazaki[1], Tomomi Teraoka[1], Tadashi Okami[1], Hirokazu Fujiwara[1], Nobuyasu Naruse[1,2], Yukihiro Takahashi[1,3]

1.Global Science Campus, Hokkaido University, 2.Institute for the Advancement of Higher Education, Hokkaido University, 3.Graduate School of Science, Hokkaido University

The increase of rice production has been saved many people in the world. Bangladesh has also continued to increase. The amount of rice production in Bangladesh is 5 times as much as that of one in Japan. Recently the problem arises that rice price has been instable due to a large increase of rice production. Maintaining a high rice price can be also a political issue, because rice agriculture is one of the most important industry in Bangladesh. Although Food and Agriculture Organization of United Nations (FAO) have researched the amount of rice production in Bangladesh so far, these data are unreliable, because unofficial figures have been supplied by governments through publications in foreign countries and FAO questionnaires.
Satellite remote sensing is effective to research the area of rice field. We can research it regularly and continuously with low cost. Especially, the microwave remote sensing has a large merit to be observable in spite of the weather. However, since the microwave image data is expensive, research institutions have been limited to observe continuously in developing countries. This study aims to establish the way to research the rice field using satellite images for free. At first, we are calculated the seasonal change of NDVI values in the area of the (BRRI Bangladesh Rice Research Institute), which idea is based that the harvest season of rice in Bangladesh can be reflected to the NDVI values. As a result, the NDVI values significantly dropped by 0.2-0.25 from November to December, which corresponds to the dry season, although the number of samples was small due to a lot of clouds. Since double cropping is common in Bangladesh, we have captured the one of the two. Based on the results of the test area, we deduced the area of the rice-planting field of Bangladesh. It should be noted that we exclude that of potatoes, sugar cane, and forest area.

Keywords: Remote Sensing, rice-planting, NDVI, Bangladesh

# Analysis of the flooded area in the Great East Japan Earthquake by MODIS thermal infrared data

*Takashi Nonaka[1], Yuki Uchida[1], Keishi Iwashita[1]

1.College of Industrial Technology, Nihon University

In the past several years, many previous studies have been conducted by the researches to analyze the backscattering differences of the synthetic aperture radar (SAR) data between pre- and post-event to estimate the flooded area. However, the data acquisitions were restricted only after the occurrence of the event in general. On the contrary, low-resolution optical sensor such as MODIS acquires images every day although the objects on the ground are visible only during clear days. The goal of this study was to monitor the flooded area continuously till the recovery phase, and determine to utilization of the optical Earth Observation (EO) satellite data.
The purpose of this study was to obtain the knowledge for estimating the wide flooded area from satellite thermal infrared data. We developed the methodology to estimate the flooded area using land surface temperature (LST) data, and evaluated the area by applying it to the case of the Great East Japan Earthquake. The test sites were Ishinomaki-shi, Sendai-shi of Miyagi Prefecture, and Souma-shi of Fukushima Prefecture. Firstly, the analysis of LST just after the earthquake was conducted both daytime and nighttime. Subsequently, we found that the LST of the flooded area at nighttime was higher than unflooded area. Secondly, we conducted the unsupervised classification in extracting the flooded area utilizing LST data of only after the earthquake. From the analysis of the threshold temperature, we revealed that it was different about 1 degree by the area. Finally, we evaluated the classification accuracy both qualitatively and quantitatively. By comparing the referenced data, the producer’s accuracy, user’s accuracy, and total accuracy were revealed for each site. The outcome of this study suggests that the observation of the temporal changes of the flooded area is possible by the continuous monitoring by the EO satellite data.

# Development of automatic aquatic macrophytes mapping system in Lake Shinji using Landsat-8 data

*Yuji Sakuno[1]

1.Hiroshima University

There is a serious problem for aquatic macrophytes expansion in the coastal region at Lake Shinji which is located in the Shimane-Prefecture after 2009. Grasp of the aquatic macrophytes distribution immediately by remote sensing is expected. Therefore the automatic calculation and mapping of aquatic macrophytes using Landsat-8/OLI data (32 scenes from April in 2013 to Nov. in 2015) with sensitive (12bit) and the high spatial resolution (30m) launched in February, 2013 was developed by this research. At first, the NDVI using a method by Sakuno et al. (2013) for the aquatic macrophytes extraction was calculated. The threshold value of NDVI to separate an aquatic macrophytes and non- aquatic macrophytes was set as 0. A median filter was used to eliminate noise of satellite images. Finally, the automatic mapping system was developed via NDVI from OLI data. The characteristic of aquatic macrophytes disributes in high density in the central southern part of Lake Shinji form September to November in particular.

Keywords: lake, monitoring, satellite

# Daily Change of the Earth Surface Temperature by Himawari-8/AHI

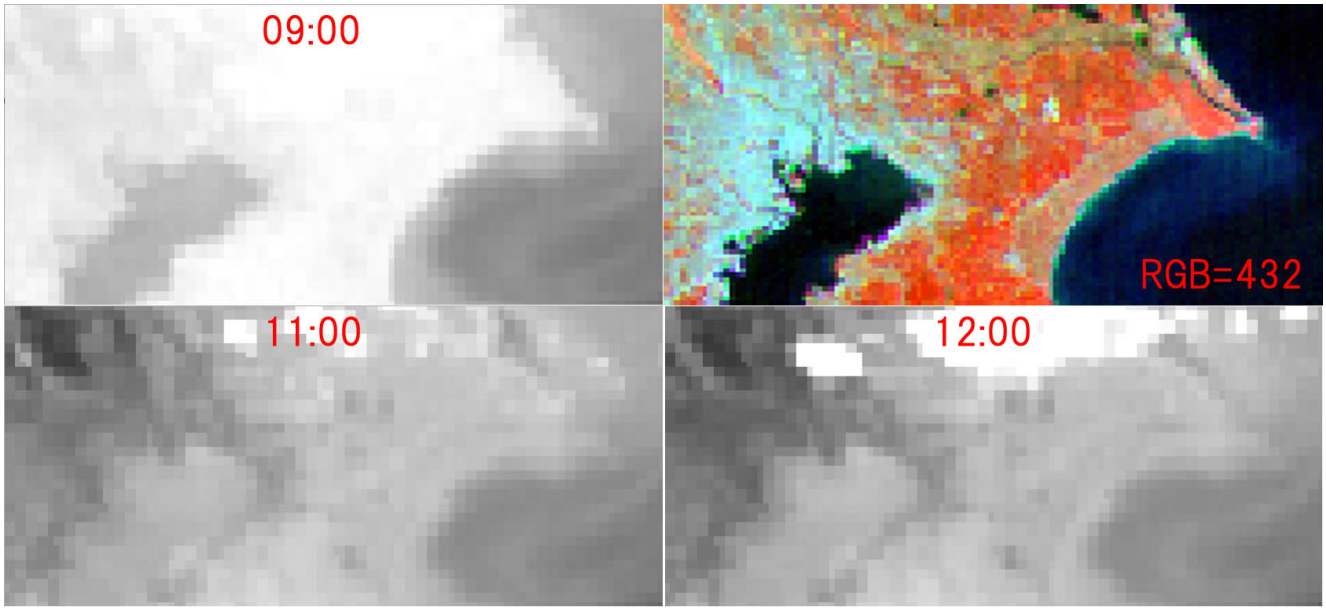
*Kenji Okuyama[1], Tomohito Asaka[1], Katsuteru Kudou[1], Toshiro Sugimura[1]

1.College of Industrial Technology, Nihon University

1. Introduction
The Japan Meteorological Agency(JMA) successfully launched Himawari-8 in October 2014 and start its operation in July 2015. JMA is operating Himawari-8 at around 140 degrees east covering the East Asia and Western Pacific regions. A new sensor system called the Advanced Himawari Imager (AHI) is scanning five areas: Full Disk(images of the whole Earth as seen from the satellite), the Japan Area, the Target Area and two Landmark Areas. In each 10-minute period, the AHI is able to scan not only the Full Disk once but also the Japan Area four times. Additionaly the number of bands has increased from 5 (VIS 1, IR 4) to 16 (VIS 3, NIR 3 and IR 10). Therefore AHI is observing the Earth surface temperature of Japan area at every 2.5 minutes continuously.
The purpose of this study is to analyse daily change of the Earth surface temperature observed by Himawari-8/AHI continuously. Land cover information is obtained from AHI visible and near infrared data observed at the same time. It was investigated that daily changes of the Earth surface temperature in artificial land cover (cities), natural land cover (forests and bare fields) and water area are different each other. It is known that the thermal environment of the urban is influenced by the landcover.
2. Data and Methods
AHI data observed in December 4th 0900 to 1500(JST), 2015 were used in this study. Band 14 is used for the analysis because the spectral range is similar to the one of Landsat/TM thermal band. Band 1 to 4, visible and near infrared bads, are used for land cover classification. Using dayly change of the brightness temperature by AHI band 14, curvilinear regression was caried out in each land cover points.
3. Results and Discussion
The following facts are found out.
* Standard errors at a city and a forest were small by a polynomial of the fourth degree.
* A standard error at a water area was small by a polynomial of the second degree.
* They are similar results at a farmland and a bare field by plynomials of the second to the fourth degree.
It could be confirmed that the daily change can be regressed by the second to the fource demensional polynomials. The results of this study should be useful for countermeasurement of urban heat island phenomenan.

Keywords: Meteorological Satellite, Earth Observation, Earth Surface Temperature, Curvilinear Regression



# Environmental Monitoring Using Landsat-8 Data for Water Quality of Upper Mississippi River Basin and Hydrodynamic in the Louisiana Coastal Zone

*Yuki Uchida[1], Nonaka Takashi[2], Kenji Hasegawa[3], Keishi Iwashita[2]

1.Department of Civil Engineering College of Industrial Technorogy,Nihon University, 2.College of Industrial Technorogy,Nihon University, 3.KANSEI Company

For thousands of years the Mississippi River flowed freely in the heart of North America, draining 41% of the continental U.S. and parts of Canada. The Mississippi River is much cleaner today than it was 20 years ago, yet concerns remain over the status of water quality. Nutrient and herbicide problems should continue to be investigated and managed and salinity impacts addressed where diversions are operated. However, these concerns must be weighed against Louisiana’s ongoing problem of coastal land loss and the threatened acceleration of this loss with the recent Brown Marsh crisis.
The "dead zone" off the coast of Louisiana forms every year summer and is the second largest hypoxic zone in the world. Since 2000, as apart of the EPA sponsored Star Grant Research Program, several college based research organization in USA and Nihon University remote sensing research unit have contributed closely with the EPA Gulf Breeze Laboratory to develop a coupled hydrodynamic and biogeochemical model for the northern Gulf of Mexico hypoxia region. In this research, we are integrating satellite ocean color remote sensing imagery, hydrodynamic-water quality-sediment diagnosis modeling, and in situ measurements to assess and predict coastal ocean processes (such as nutrient-enhanced primary production) that regulate the development and size of hypoxic bottom waters in the region. The frequency, extent, and severity of coastal hypoxic events are increasing worldwide due to increasing eutrophication.
As a result, satellite-derived optical water mass classification procedures were well-combine with New Orleans land-use model and a model-derived stratification index to estimate the areal extent of coastal hypoxia in the northern Gulf of Mexico.

# Levee extraction method using the global DSM

*Ryojun Kawashima[1], Yuji Kuwahara[1], Hiroki Suzuki[1]

1.Ibaraki University

According to the IPCC Fifth Assessment Report, it is predicted that such as typhoons and heavy rain to increase in the future. Due to increase of typhoons and heavy rain, it considered the frequency of flooding will increase. We shall create a hazard map in order to suppress the flood. In areas where high-resolution DSM is not developed to be used SRTM and GDEM, but SRTM and GDEM have missing values. In this study, we propose a simple method of correcting the missing values. Using this method, it is possible to correct the missing values in a wide range of global.

Keywords: DSM, Levee, ALOS World 3D

# Estimation method of land cover change area for urbanized area by using coherence data of SAR

*Yuta Inoue[1], Daiki Sekine[1], Yuji Kuwahara[2]

1.Graduate School of Science and Engineering, Ibaraki University, 2.Department of Urban and Civil Engineering,Ibaraki University

The objective of this study is to propose the estimation method of land cover change area that combining optical sensor data and coherence data, and to propose the application scope based on the estimated results of land cover change area caused of landslides and human activities.
Recently, due to the impact of the recent global warming, causing the unexpected torrential downpour and typhoon that increase the possibility of flood disaster and landslides. Therefore, it is very important to grasp the disaster situation immediately. In this situation, synthetic aperture radar (SAR) is not easily affected by weather and time than the optical sensor. It can grasp the disaster situation effectively. Currently, interferometric SAR (InSAR) has been applied to a crustal movement and landslides. InSAR is a surveying technology for measurement of crustal movement and generation of digital surface model by interfering with the SAR data observed in two periods. In this study, we focus on the coherence data that is one of the intermediate data of InSAR. Coherence data is the absolute value of the complex cross-correlation of the two SAR data, while coherence data is related to corresponding land cover changes. From these, we propose the estimation method of land cover change area combining optical sensor data and coherence data. The results of this study is as follows;
(1) The accuracy of the land-cover change region using the proposed method was about 60% to 80% when using a classification map, about 50% to 90% when using the land use. In addition, it was suggested that it is possible to capture the land cover changes involved in the agricultural cycle such as rice and sweet potatoes.
(2) It is available to apply in different purposes such as estimation of the damage area and selection of research candidate by devising the window size of coherence and parameters of the aggregation and sorting.
(3) The proposed method tended to estimate that land cover changes larger than the land cover changes obtained by visually reading, and there is a high possibility of being capture the change that cannot be read visually such as differences in water content.
(4) The estimation accuracy of the land cover changes area was largely affected by the resolution and the number of categories of land cover changes.
(5) It was difficult to estimate the land cover change on the growth of vegetation such as forests, shrub forests and rice.
(6) It was impossible to estimate the land cover changes in some area where data was missing such as the sea.

Keywords: Coherence, Land cover, Classification map

# Using Down-hole Electrical Resistivity Tomography for Detecting the Growing of Jet Grouting

*CHIHPING KUO[1], HSINCHANG LIU[2], NAIJUI YANG[1,3], YIXUAN LIN[1], HONGYI WANG[1], CHINWEI WU[1]

1.Department and Institute of Civil Engineering and Environmental Informatics, Minghsin University of Science and Technology , 2.Disaster Prevention and Water Environment Research Center, National Chiao Tung University, 3.Department of Civil and Water/soil conservation Engineering, Sinotech Engineering Services Co., Ltd.

Jumbo-jet Special Grouting, called JSG, is one method of ground improvement. For sites with soft soils, the JSG method is mostly effective and quick to provide soils reinforcement. It forms as a column, so that it can be serve as a pile. Arranged JSG piles also can be taken as a diaphragm wall. Traditional quality inspecting method for those underground construction often adopt taking cores in the edges of improved material and compress it. According to actual experience, the drilled core sometimes takes uncomplete samples or non-representative. It's also difficult to determine the outer edge of the grouted column by core-drilling. Therefore a subsurface geophysical method should be adopted herein. Electrical resistivity tomography method is widely used for detecting the interlayers, groundwater levels, or cavities in underground layers. Requiring long-length span for deeper detecting is an in-situ issue for earning straight and horizontal space to operate. Down-hole electrical resistivity tomography method is first proposed in this study in Taiwan. The result shows that this vertical arrangement can acquire more clear images due to be close and parallel to the grouted pile more than previously mentioned horizontal one. The form and growing of the grouting taken from this method can provide more credible parameter for future usage.

Keywords: JSG, Soft soils, Electrical resistivity tomography, subsurface geophysical method

# Multi Satellites Monitoring of Land Use/Cover Change and Its Driving Forces in Kashgar Region, China

*Ayisulitan Maimaitiaili[1], Akihiko Kondoh[1,2]

1.Graduate school of science, Chiba University, 2.Center for Environmental Remote Sensing

The spatio-temporal changes of Land Use/Cover (LUCC) and its driving forces in Kashgar region, Xinjiang Province, China, are investigated by using satellite remote sensing and a geographical information system (GIS). Main goal of this paper is to quantify the drivers of LUCC. First, considering lack of the Land Cover (LC) map in whole study area, we produced LC map by using Landsat images. Land use information from Landsat data was collected using maximum likelihood classification method. Land use change was studied based on the change detection method of land use types. Second, because the snow provides a key water resources for stream flow, agricultural production and drinking water for sustaining large population in Kashgar region, snow cover are estimated by Spot Vegetation data. Normalized Difference Snow Index (NDSI) algorithm are applied to make snow cover map, which is used to screen the LUCC and climate change. The best agreement is found with threshold value of NDSI≥0.2 to generate multi-temporal snow cover and snowmelt maps. Third, driving forces are systematically identified by LC maps and statistical data such as climate and socio-economic data, regarding to i) the climate changes and ii) socioeconomic development that the spatial correlation among LUCC, snow cover change, climate and socioeconomic changes are quantified by using liner regression model and negative / positive trend analysis. Our results showed that water bodies, bare land and grass land have decreasing notably. By contrast, crop land and urban area have continually increasing significantly, which are dominated in study area. The area of snow/ice have fluctuated and has strong seasonal trends, total annual snow cover has two peaks in 2005 and 2009. With increasing population from 2,324,375 in 1984 to 4,228,200 in 2014 and crop land reclamation from 6031.4 $km^2$ in 1972 to 16549$km^2$ in 2014 at the study area. Water resources consumption increased with support to large population and irrigate whole crop land area, caused the water shortages that the surface water bodies decreased from 2531.43$km^2$ in the 1972s to 1067.05$km^2$ in the 2014. The grass land with an acreage larger than 6749$km^2$ in 1972 decreased to 922.6 $km^2$ in 2014. The transformations between water bodies, garss land and bare land are remarkbale. The results also suggested high linearity between the LUCC and socioeconomic changes that specific land cover change be cause of the fact that socioeconomic development. In the recent 42 years, average annual temperature have been increasing significantly, although, precipitation have increased but partly weaken effect of the rising temperature, in addition snow cover more sensitive to precipitation than temperature.The change of climate showed a nagitive relationship between snow cover with decreased and climate with increasing of the tempreature. Morover, the relationship between the LUCC and snow cover recorded higher linearity, because the temperature have increased, consequence influence on snow cover that provides melt water for study area which expanding crop land.

Keywords: LUCC, Driving forces, Snow Index, SPOT vegetation, Kashgar Region

# AMSR-E soil moisture evaluation over Shanxi Province of China and spatio-temporal characteristics of soil moisture distribution in East Asia

*mei sun[1], Akihiko Kondoh[2]

1.chiba university, 2.chiba university center for environmental remote sensing

Soil moisture is a crucial hydrological element that is closely connected to the earth's surface heat budget and climate change in semi-arid and arid regions. Recently, satellite remote sensing has been shown to be an effective way to determine soil moisture in large areas for long periods of time. AMSR-E soil moisture derived from passive microwave of time series data are available. In this study, one of the objective is to validate AMSR-E soil moisture using in situ soil moisture in Shanxi Province of China. The other is to clear the spatio-temporal distribution of soil moisture in East Asia. The results show that 64 of 108 in situ stations have good correspondences between AMSR-E soil moisture and in situ soil moisture. High correlation coefficients are confirmed during the following 3 conditions. 1) Sufficient density of in situ observations area. 2) Uniform land use type region and 3) relatively flat terrain area. AMSR-E soil moisture can be estimated more accurately over large regions according to these factors. In addition, characteristics of soil moisture distribution and variation are different depend on various environmental conditions in East Asia from 2003 to 2009. In Middle and lower Yangtze River plain, rainy season is suggested as a key factor that affects soil moisture changes. AMSR-E soil moisture can capture flood records at Bengbu near Huaihe River in 2003. In Sichuan basin, soil moisture obviously represents high value through a whole year due to flat terrain, and it is influenced by human activity when compared with farming calendar of paddy.

Keywords: AMSR-E, soil moisture, precipitation

# Land cover change mapping in some mining area of Mongolia

*Selenge Munkhbayar[1], Akihiko Kondoh[1]

1.Center for Environmental Remote sensing, Chiba University

Remote Sensing and GIS were used to monitor interactions and relationships between land use and land cover changes in the regional ecology area of Umnugobi province (South Gobi).This study aims at determining the land degradation conditions in 15 soums (administrative units) of the study area, Umnugobi province. Using GIS processing of data climate drivers (precipitation, air temperature) vegetation data and socio-economic drivers (livestock numbers, population figures, mining activities) were analyzed. We focused on developing a modeling approach for monitoring land degradation using GIS and Remote Sensing tools by integrating natural and socio-economic data. The Moderated Soil Adjusted Vegetation Index (MSAVI) from SPOT/VEGETATION was used to determine vegetation cover change for the period 2000 to 2013. Landsat data for the years 2000, 2010 and 2013 were analyzed to derive and classify “hot spot” areas of land degradation. GIS conditional functions were used for mapping and analyzing climate and socio-economic driving factors, both of which affect land degradation. Conditional functions such as MAP-Algebra from ArcGIS were developed using ground truth data and data from National Statistics. Our study documents that 60 percent of the study area is affected by land degradation caused by human and climate drivers.

Keywords: socio-economic change,, mineral resources, land degradation monitoring, grassland degradation

# A new forest map of South America using MODIS data 2013

*ALIFU ZILAITIGU[1]

1.Center for environmental remote sensing Chiba university

Forests cover approximately 4 billion hectare (ha) of the earth, not only to provide a place and resource of habitat to life on Earth, but also play a major role in global environmental conservation through such as CO2 absorption and evapotranspiration action. In recent years, anthropogenic CO2 emissions, the reduction and deterioration of forests due to deforestation is happening. This loss of biodiversity is serious environmental problem. In order to solve these problems, it is necessary to capture the forest change on a global scale and to create a forest maps using remote sensing as one of the means. The study area is South America (63 °S, 60 °W from longitude 90 °W from latitude 14 °S). The land surface area is about 1.7 billion ha in 2008 and the population are about 385 million people. Amazon is the largest tropical rainforest at continental scale, and has about 21 percent of the world's forests. The proportion of forest in the continent at the time in 2005 is reported about 50% -47%. The objective of the study is forest mapping of S.A. with six forest types; evergreen needleleaved forest, evergreen broadleaved forest, deciduous needleleaved forest, deciduous broadleaved forest, mixed forest and open forest. MODIS 500m (2013) data and PALSAR global mosaic data were used for the classification. Original MODIS data were converted into indexes like NDVI, GRVI and LSWI, and predictor variables were produced. To create training data, high resolution images in Google Earth and the data that was used for the global mapping of 2008 year were used as reference. Mapping was done by the supervised classification method using decision trees. After creating a forest map, validation was done by random sampling method for each class.

Keywords: MODIS, South America , forest map

# Elucidation of reindeer travel-route by satellite remote sensing

*Hinako Telengut[1], Haruki Takanashi[1], Takeru Sakka[1], Tatsuya Tashiro[1], Itsuki Kida[1], Kyohya Watanabe[1], Fiolenta Marpaung[1], Takahiro Yoshii[1], Yuka Ogino[1], Masataka Imai[1,3], Nobuyasu Naruse[1,2], Yukihiro Takahashi[1,3]

1.Global Science Campus, Hokkaido University, 2.Institute for the Advancement of Higher Education, Hokkaido University, 3.Graduate School of Science, Hokkaido University

There are nomads who hunt reindeers for a living in the Arctic Circle of Siberia. The trade of the meat and the fur has become one of the most important industries. Recently, the reindeer, which has an animal behavior going along the conventional route for pasture, has been changing the travel-route. Thus, the livelihood of nomads who lives by hunting them has been menaced. The reason of changing the travel-route must be a global warming resulting from the vegetation change of the pasture. To track the travel-route, some reindeers were installed GPS devices in Sakha Republic in Russia. Almost all positions of reindeer groups, however, remain unclear, because Siberia is a vast field.
The aim of this study is to elucidate changes of wild reindeer travel-route in Siberia by satellite remote sensing; 1) through the seasonal change of vegetation of the pasture, and 2) through the direct survey of reindeer groups by satellite image analyses. The study area was selected around Lena River and Olenyok valley in Sakha Republic, Russia. This work focused on 1).
First, investigated the effects of climate change on vegetation around Lena River where the travel-route of wild reindeer was observed. Although there is a report that the annual difference of vegetation in Siberia discussed using MODIS data, we use Landsat 7,8 images to discuss the travel-route in higher special resolutions. We have calculated the normalized difference vegetation index (NDVI) from satellite images of the corresponding area of 2010-2015. From the result, only in 2010 and 2015, the period that NDVI value becomes a peak, had clearly shifted by about one month. It is reported that El Niño occurred during these years, leading to abnormal summer weather in the region. This result supports that the change of the wild reindeer travel-route frequently occurs due to the change in activation timing.

Keywords: Remote Sensing, Reindeer, Siberia, Penguin

# Influence on climate change caused by aerosol released from forest fires in Sumatra Island

*Kosei Sawada[1], Akari Taura[1], Shoji Kawarabayashi[1], Nana Iwadate[1], Takahiro Yoshii[1], Fiolenta Marpaung[1], Kensuke Watanabe[1,3], Nobuyasu Naruse[1,2], Yukihiro Takahashi[1,3]

1.Global Science Campus, Hokkaido University, 2.Institute for the Advancement of Higher Education, Hokkaido University, 3.Graduate School of Science, Hokkaido University

Aerosols in the atmosphere, by blocking the sunlight, can have a direct influence on the climate (direct effect). When the number of aerosols increases in the atmosphere, the size of cloud particles can be reduced because the water content in the atmosphere is finite: aerosols can be a core of clouds. The finite amount of moisture leads to the large lifetime of clouds and the increase of cloud density, allowing increasing the reflection efficiency of the sunlight. This effect called as indirect effect. Both of the effects work to cool the Earth. On the other hand, the aerosol, the specific fine particles such as black carbon, absorbs sunlight. Thus, There is a large significance to quantitatively clarify the influence of aerosols on the climate, since it depends on the sources and the types.

This study aims to clarify the influence of aerosols on the climate, which the aerosol released from forest fires in Sumatra Island. MODIS and Landsat8 satellite data were used.

In the previous work, there is a report that quantitative estimation of the influence of aerosols on the climate was performed. The aerosols were released by the Kilauea volcano in Hawaii Island. They showed that the size of cloud particles with increasing aerosol decreases (indirect effect). The present study was also as the same manner.

Keywords: Aerosol, Cloud core, Remore sensing

# Estimation of snow water equivalent by satellite images in Hokkaido

*Yuki Sato[1], Mei Noguchi[1], Taiga Tsue[1], Hiroyasu Asian[1], Yui Kobayashi[1], Takeya Kanbara[1], Takahiro Yoshii[1], Kensuke Watanabe[1,3], Masataka Imai[1,3], Nobuyasu Naruse[1,2], Yukihiro Takahashi[1,3]

1.Global Science Campus, Hokkaido University, 2.Institute for the Advancement of Higher Education, Hokkaido University, 3.Graduate School of Science, Hokkaido University

In Hokkaido, there are 119 AMeDAS points that can observe the amount of snowfall. Many of those are located around urban areas. The number of AMeDAS points is not enough to observe the amount of snowfall in Hokkaido Main Island 77984km$^2$. Remote sensing is one of the best means to measure it. Satellite images in microwave range have been used to know it so far, although there is a large error in the case of wet snow. In addition, as long as synthetic aperture radar (SAR) is used, the spatial resolution is not high satellite images in microwave range. On the other hand, satellite images in the range of visible and inferred have been not suitable for observing the snow depth, although the presence of the covered snow can be measured. If almost all of optical satellite images, having high spatial resolutions, were used for two-dimensional mappings of the amount of snowfall, we will have a great advantage for applying to the drone in the near future.
This study aims to estimate the snow water equivalent through the amount of snowmelt in Hokkaido using satellite images in the range of visible and inferred, as the first step of area estimation of the amount of snowfall.
First, we have researched the correlation between the river inflow to Chubetsu Dam in Northern Hokkaido and the seasonal change of the average brightness of Landsat-8 images. We found that the both have a strong correlation. The river's basin was calculated from topographic maps and Digital Elevation Model (DEM). The area of basin is 230.5km$^2$, which is ~3.5% error compared to the officially announced at 238.9km$^2$. Since clouds and vegetation in the area make the amount of snowfall unclear, we discussed the influence.

Keywords: Remote Sensing, snow water equivalent

# The Creation of Ultraviolet Distribution Map using Satellite images and Digital Terrain Model

*Teppei Ishiuchi[1], Haruka Nakazawa[1], Ismail Arai[1]

1.National Institute of Technology, Akashi College

Recently, there has been a growing interest in environmental issues in the world. Japan Meteorological Agency publish the UV forecast distribution map. However, it cannot show clearly the situation of ultraviolet amount at local areas. Therefore, this study proposed the method of creating localized ultraviolet distribution map using a high resolution satellite image and digital terrain model. This ultraviolet distribution map is in consideration of the state of the land cover and the shade by trees. In addition, questionnaire survey was conducted about the interest in ultraviolet and Evaluation of ultraviolet distribution map created in this study. As a result, it was indicated that ultraviolet distribution map is effective in promoting of ultraviolet protect.

Keywords: Ultraviolet, Satellite image, Digital terrain model