

mart remote-sensing by super constellation with micro-satellites

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Micro-satellite with a weight of 50-100 kg has various merits compared to middle and large sized satellite, that is, 1) low cost fabrication compared to middle or large sized satellite, namely, few M EUR including BUS and mission payloads. The launch cost will be 1-2 M EUR as piggyback, 2) quick fabrication: about one or two years for flight model would be sufficient, enabling application of the latest technologies, 3) on-demand operation, taking detail information at a point of interest, and 4) the low cost and quick fabrication make us possible to launch not a small number of satellites, which is called as constellation flight.

The constellation realizes a frequent monitoring from the low earth orbit. If we inserted 48 satellites into proper orbits, we can watch any location in the world every 7-8 min, which could be dedicated efficiently to time-variable phenomena, such as flood, thunderstorm, forest fire and Tsunami. Another important aspect of micro-satellite is the advanced technology of payload sensors. LCTF (liquid crystal tunable filter) enables the super multi-color imaging at several hundreds of wavelengths without image distortion due to the unstable attitude of spacecraft. Bolometer array sensor make it possible to take image in mid-infrared band range around 10 um without cooling system, meaning light weight and less power consumption.

We would suggest the establishment of the Smart Remote-Sensing with super micro-satellite constellation, making use of advanced sensors, under collaboration among Asian countries in the near future.

Keywords: smart remote-sensing, super constellation, micro-satellite

Airborne LiDAR bathymetry survey in Japanese Pacific coast in 2012

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In 2012, Airborne lidar bathymetry survey in Japanese Pacific coast was planned and partially conducted at several selected sites.

The objective of this survey is to acquire detailed bathymetry data in Japanese Pacific coast which are important for Tsunami simulation as well as monitoring of coastal environment and ecosystem heavily damaged by the Great East Japan Earthquake occurred in March 2011.

An airborne lidar bathymetry system, Fugro LADS Mk. III, was brought to Japan for the first time in October 2012. Data acquisition flights over several coastal areas in Hokkaido, Tohoku, Mie, and Tokushima were conducted in November and December, 2012. Obtained data are currently being calibrated and evaluated.

In this presentation, the outline of the survey including instrument specifications, mapping areas, and the survey schedule as well as lidar data acquired in 2012 will be presented.

Keywords: Airborne LiDAR

Application and possibility to the disaster prevention of the water level sensor IC tags

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The visualization of the environmental information is important from the viewpoint of disaster prevention to keep the security of inhabitants. By using small and cheap sensor IC tags, if we located a water level sensor at many points, they were effective for monitoring of the rainfall flood and the swollen river, and official announcement of the refuge information. Ibaraki University department of engineering has attached a water level sensor in Hitachi City, Ibaraki prefecture from July, 2012. In addition, we build the real time rainfall flooding monitoring system experimentally and watch water level in the case of rain. Water level monitoring of the sea level of Pacific coastal of Tohoku area is possible by applying this system where we had damaged by earthquake disaster from the Great East Japan Earthquake.

Keywords: sensor IC tag, sensor network, water level sensor

Research on the accuracy control of DSM estimated from PALSAR-data

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Affected by global warming, it is estimated that the sea level is rising up to 59cm by the end of this century. For this reason, it is necessary to create especially the elevation data of lowlands along the sea. In this research, elevation data was created in accordance with two or more DSM creation methods. And, we examined the comparison method of DEM and DSM accuracy generated by each method and compared the accuracy in the same field of the DEM and DSM generated by GSI-10m, LP, ALOS/PRISIM, and ALOS/PALSAR. In addition, we examined the comparison method of PALSAR-data targeted the Marshall Islands.

Keywords: DEM, DSM, precision criterion

Generation of Vulnerability Assessment data about Water-related Disaster using ALOS/AVNIR-2 and PRISM

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According to the Fourth Assessment Report of the IPCC, due to the climate change, it is assumed that the flood damages such as typhoon will be increased at lowland area. In order to decrease storm and flood damages, it is important to unify the measures over land use, environmental plan, and traffic environment. In this research, we focused on the Hai Hau coast that is a downstream of Red-River, Vietnam. Around the Hai Hau coast, vast lowland areas are distributed. Therefore, in this research, we mapped the vulnerability assessment to the river flood for Hai Hau coast and its vicinity. Then, we mapped a salt farm, a shrimp farm and cultivated land using ALOS/AVNIR-2 and ALOS/PRISM in order to grasp the vulnerability assessment of the cultivated land received from overtopping waves of the coast. The result of this study, we generated the geographic information for water-related disaster, and considered the relation with present condition of land-use.

Keywords: climate change, satellite image, flood simulation, remote sensing

Field Survey of Coastal Vegetation using satellite image and surveying data at Funafuti Atoll, Tuvalu

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The objective of this study is to investigate land cover around the shoreline, and the geographical feature conditions of coastal vegetation growing on Funafuti Atoll, Tuvalu. In order to maintain the living environment of the South Pacific islands countries, sea-level rise is a serious problem. Thus, in this study, analyzed was the relation of land cover of shoreline area and hinterland by using aerial photograph (1984) and satellite image (2004). Then, geographical feature conditions of the coastal vegetation growing under natural condition were surveyed, and it was found that the coastal vegetation was growing in the altitude of about 2.2m.

Keywords: climate change, sea-level rise, coastal vegetation, land cover analysis, altitude

The changes in land use change and water research in the closed water area (Baiyangdian in China as an example)

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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, which 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 leads to decreased storage and dry up of Baiyangdian Lake.

The study area includes Baiyangdian Lake extending N38o40'-N39o05', E115o35'-E116o10'. Baiyangdian collects nine streams from Taihangshan Mountains and effluent stream flows into Bohai Bay. Swamp area includes 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 area 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.

Because Baiyangdian can maintain ecosystem services function, 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 decreased successively and wetland vegetated area increased first, and then have been decreased 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 and September in 2011. 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. Moreover, the observation months results are compared. The absorption rate of the nutrients in September is higher than it in April and June. Because reed biomass shows its maximum in August or September, nitrogen and phosphorus are absorbed by reed grass. We have conducted field survey of visibility of the lake water in September 2011. On the upstream side of the Baiyangdian, visibility is low because sewage from Baoding city and surrounding domestic area flows into Baiyangdian Lake.

In this time of the research, interannual variations of water area and wetland vegetation are clarified. Distribution of T-N, T-P, and NO₃-N are also clarified, and apparent relationship is recognized. With the progress of urbanization, the discharge of daily life water will be increased. Serious deterioration of water quality of Baiyangdian Lake is estimated. In the next stage of the study, we will plan the evaluation of the water cycle in the basin.

Study on the Secular Changes of Agricultural Structure in Xinjiang Using Satellite Remote Sensing

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Before Rural reform, Xinjiang had been an emphasis on food production, After rural reform, Under the policy of agricultural production of autonomous government of "actively develop a diversified management while maintaining the food production", Acreage of food crops has been decreasing by the increased production of cash crops, mainly cotton in recent years, food security has becoming an important issue in Xinjiang. In this study, we have analyzed the secular changes of agricultural structure in Xinjiang by using the local aspirations for each province, The Statistical Yearbooks for each year, and digitizing the printed materials. The result shows that the amount of food production has been increasing continuously, Acreage increasing is not observed from around 1960, It is on the decline since 1968. Acreage of food production in Xinjiang was 2347.80000ha in 1960, a percentage of the total acreage was 84.5%, including cotton. But in 2008, Acreage of food production becomes 1649.90000ha, percentage of total acreage was only 38.3%. From the spatial variation of food production in Xinjiang, it was confirmed that even in the amount of food production, or in the amount of food produced per unit area, in the 1990s it was mainly in the southern part of Xinjiang, and then in 2008, that the area of food production has expanded to almost area of Xinjiang; Period classification and spatial analysis hereinbefore was based on statistical data analysis. Here we extracted the area of winter wheat which is the main food crops in Xinjiang using SPOT / VEGETATION data, With analysis the secular changes of agricultural structure in Xinjiang, and then the analyzed results is confirmed by the statistical information.

Keywords: Xinjiang, Remote sensing, Agricultural Structure, Period classification, Spatial analysis

Spatio-temporal Variations of AMSR-E Soil Moisture in Semi-arid Region,China -A Case Study in Shanxi Province-

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Soil moisture plays an important role in earth's water cycle. Soil moisture variations can help us to know earth surface changes and so on, especially in semi-arid regions. AMSR-E(Advanced Microwave Scanning Radiometer of EOS) is a sensor which provides timely, long-term informations on land hydrology. In this study, we use ground-based soil moisture data to validate AMSR-E(Koike Ver5.31) soil moisture data in ShanXi Province in China. We analyze the spatio-temporal variations of soil moisture in this areas. The validation results show that the quality of AMSR-E soil moisture estimation is good. Timing of precipitation event will correspond to AMSR-E soil moisture variation very well.

Keywords: soil moisture, validation, AMSR-E,, ShanXi Province

Creating the vegetation and land-cover classification map by video camera onboard helicopter

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1. Method

Fukushima Daiichi nuclear disaster brought about wide area radioactive contamination in March, 2011. The deposition of radioactive material emitted from the plants differ by tree species and geographical feature. Therefore, to grasp vegetation and geographical feature is important for making countermeasure against radiation contamination.

Target area is Yamakiya-district, Kawamata-town, Fukushima-Pref., one of planned evacuation area. We measured the distribution of air dose rate by walking mountain slopes with gamma ray spectrometer with GPS. High spatial resolution visible images were taken by the video camera installed on helicopter. Vegetation and land-cover classification map based on the captured video camera images were superimpose on the map of dose rate, and examining the relationship between air dose rate and the vegetation or land-cover.

2. Results

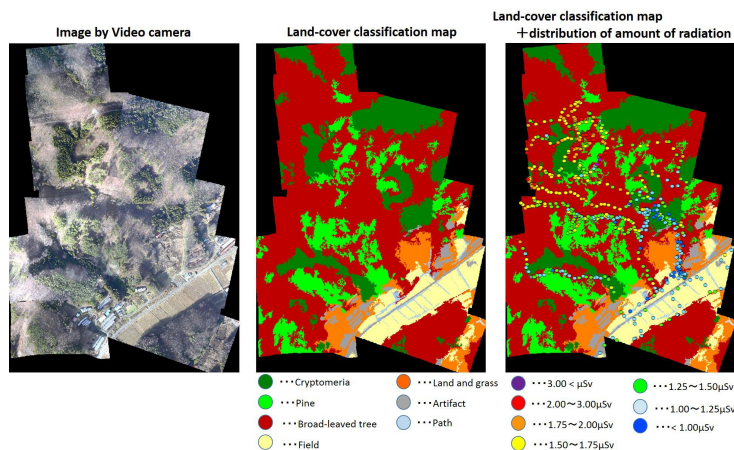
We create the vegetation and land-cover classification map using "eCognition8.8" software. Element of classification is "Broad-leaved tree", "Cryptomeria", "Pine", "Field", "Land and grass", "Artifact", "Path".

The result is as follows. We can read out what the air dose rate is high level around the evergreen needle-leaved tree.

3. Remarks

We were able to create the accurate vegetation and land-cover map and analyze the relationship between air dose rate and the vegetation and land-cover at low cost remote sensing. To tackle with radioactive contamination, we have to apply vegetation-land cover map with the result of field survey.

Keywords: Nuclear Disaster, Proximal Remote Sensing, Fukushima, Yamakiya, Video Camera, object-based image analysis



Creating the vegetation and land-cover classification map by hyperspectral camera on-board helicopter

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1.Introduction

Disaster of Fukushima Daiichi nuclear plant brought about wide area radioactive contamination in March, 2011. The deposition of radioactive material emitted from the plants differ by tree species and geographical feature. Therefore, to grasp vegetation and geographical feature is important for making countermeasure against radiation contamination.

In the previous paper, we used video camera installed on the helicopter. We used hyperspectral camera for the second experiment, and the image was used to make vegetation-land cover map in Yamakiya district, one of planed evacuation area in Fukushima.

2.Method

Hyperspectral camera used is "NH-7" made by EBA JAPAN CO.,LTD. The specification is as follows: Image resolution:1.3M pixels, Capture rate:7sec(1.3M pixels), Wavelength range:350nm-1100nm, Wavelength sampling interval:5nm, Digitization:10bits, Weight:750g. We mounted NH-7 in helicopter by using the special antivibration device.

The weather condition was windy at the flight day, however, we took the satisfactory hyperspectral images. It is because NH-7 has the advantages of "Freely configurable measurement time and Sensitivity adjustment function". We make the hyperspectral images around Yamakiya elementary school.

3.Results

We analyzed the hyperspectral data by using "ENVI" image processing software. The classification is accurate in every element by comparing the image by video camera and field investigation.

4.Vision

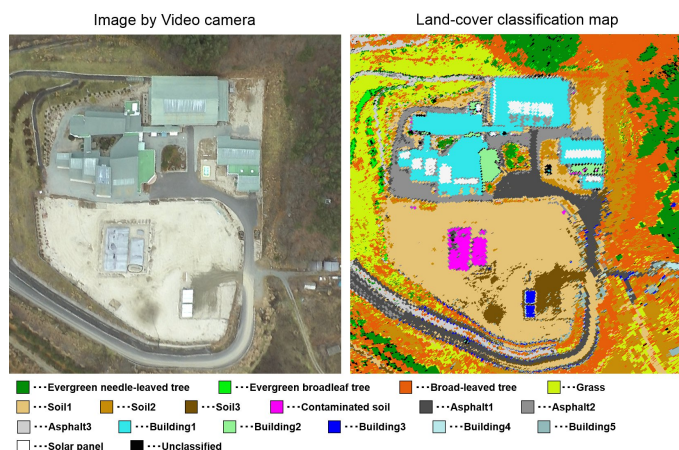
We brought out what the vegetation and land-cover classification map based on hyperspectral data is available for understanding the situation of land utilization accurately and promptly.

In the future, we will create the method of analyzing in more broad area and short time by using the knowledge leaned in this time and try to create the vegetation and land-cover classification map in whole of Yamakiya area.

And we have the plan to capture without the influence of employment of airplane material because NH-7 is able to mount in UAV.

We will utilize the vegetation and land-cover classification map to make the efficient plan of decontamination.

Keywords: Hyperspectral Camera, Spectral imaging, Proximal Remote Sensing, Nuclear Disaster, Fukushima, Yamakiya



Validation observation for the derivation of lower tropospheric ozone by remote sensing

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The lower tropospheric ozone is a major photochemical oxidant affecting human health and vegetation. In recent years, the long-range transport of the tropospheric ozone from the Asian Continent affects air quality in Japan and other wide areas. Remote sensing from a satellite is effective to observe such extensive/transboundary air pollution. However, it has been quite difficult to measure the lower tropospheric ozone from the satellite.

We have proposed that it can be evaluated with simultaneous measurement of solar backscattering spectra in the ultraviolet(UV) and visible(Vis) regions. Because the atmospheric Rayleigh scattering cross-section is much larger in UV than that in Vis, lower tropospheric light path length of the solar scattered radiation observed from space is significantly different in these two wavelength regions. This difference in the light path changes ozone column amount along it in the lower troposphere, and enables us to evaluate the lower tropospheric ozone amount.

We carried out aircraft experiments to validate this method over Tsukuba on 10th and 13rd September 2012. UV and Vis backscatter spectra were measured with two Maya2000pro (Ocean Optics) spectrometers at two altitudes 2500 ft (760 m) and 25000 ft (7600 m). Simultaneously, ozone profile was measured with ozone monitors on-board the aircraft, with ozonesonde launched near Tsukuba, and the tropospheric ozone lidar. Because aerosol scattering may significantly affect the evaluation of the lower tropospheric ozone amount, in situ aerosol observation with the CRDS, PSAP, and PASS instruments and the lidar observation were carried out in the Meteorological Research Institute. From the aircraft, we observed solar scattered radiation from zenith, nadir and 20 degree oblique directions in ultraviolet(300 ~ 380nm wavelength) and visible(400 ~ 700nm wavelength) spectral range. Because the surface reflected light greatly contribute to the scattered light from nadir, especially in the visible spectral range, for accurately estimation of the ozone amount, it is particularly important to understand the surface reflection spectrum. In this experiment, ground reflection spectra at different surface conditions such as rice paddy, forest, urban areas and so on were measured at a low altitude of 2500ft (760m). Similar aircraft observation was also carried out in January, 2013. Results of these observations will be presented at this session.

Keywords: remote sensing