高分解能衛星画像を用いた地上到達紫外線分布図の作成とその利用
The Utilization and Creating of UV distribution map using a high resolution satellite image

*石内 鉄平[1]
*Teppei Ishiuchi[1]

1. 明石工業高等専門学校
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, in this study, we 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. Additionally 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.

キーワード：衛星画像、紫外線、土地利用分類図
Keywords: satellite image, Ultraviolet, Land cover classification

インドネシア特有の新しい火災危険度指標の開発
A new fire risk indicator for Indonesia

*橋本 朝陽[1]、川俣 大志[1,2]、成瀬 延康[3]、高橋 幸弘[1,4]
*Hashimoto Asahi[1], Hiroshi Kawamata[1,2], Nobuyasu Naruse[3], Yukihiro Takahashi[1,4]

1. 北海道大学グローバルサイエンスキャンパス、2. 北海道大学高等教育推進機構、3. 滋賀医科大学、4. 北海道大学大学院理学研究院
1. Global Science Campus, Hokkaido University, 2. Institute for the Advancement of Higher Education, Hokkaido University, 3. Shiga University of Medical Science, 4. Graduate School of Science, Hokkaido University

Fires in dry season of Indonesia has become a serious problem. Most of Indonesian land is covered with peat moss, which occurs the expanding of fires due to the burning itself. Furumoto et al. showed that seasonal changes of soil water content in Indonesia estimated through the 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 fires will occur. Thus, the soil water content, reflecting the amount of precipitation in the area, can become the indication of the risk of fires. Our study aims to develop a new remote sensing index reflecting the fire risk using through the directional measurements of soil spectra. We have prepared the peat moss (in Canada, Sri Lanka and Indonesia) of several soil water contents measured (Field pro, WD-3). We obtained the reflectance spectra with 400-1050nm (light source: halogen lamp, spectroscope: self-made) from the respective peat moss. There are the features for obtained spectra, the reflectance difference between wet and dry in ultraviolet (infrared) is smaller (larger). The results indicate that a new fire risk indicator for the soil covered with peat can be favorable to use the ultraviolet wavelength range, such as a new deep blue band on Landsat 8. It can be essential to know precisely the surface water content of soil through the spectral measurements on the ground. The resulting satellite images calculated by our original index appears to reflect the risk of fires rather than well-known indices such as Normalized Difference Water Index and Normalized Difference Soil Index. In conclusion, we have developed a new fire risk indicator that highly reflects to the degrees of soil water content for peat soil. We will show the results of spectral measurements for several water contents of soil sampling in Indonesia.

キーワード：火災、泥炭土、インドネシア、衛星リモートセンシング、反射スペクトル
Keywords: Fire, Peat soil, Indonesia, Satellite remote sensing, Reflection spectrum

北極圏トナカイの周遊経路の年次変化に関するリモートセンシングによる研究

Research for annual travel-route changes of reindeer living around the Arctic Circle using satellite remote sensing

*鈴木 元太[1]、眼目 健翔[1]、田代 達也[1]、川俣 大志[1,2]、成瀬 延康[3]、高橋 幸弘[1,4]

*Genta Suzuki[1], Takeru Sakka[1], Tatsuya Tashiro[1], Hiroshi Kawamata[1,2], Nobuyasu Naruse[3], Yukihiro Takahashi[1,4]

1. 北海道大学グローバルサイエンスキャンパス、2. 北海道大学高等教育推進機構、3. 滋賀医科大学、4. 北海道大学大学院理学研究院
1. Global Science Campus, Hokkaido University, 2. Institute for the Advancement of Higher Education, Hokkaido University, 3. Shiga University of Medical Science, 4. Graduate School of Science, Hokkaido University

There are nomads who hunt wild reindeer for a living in the Arctic Circle around Siberia. Recently, the reindeer has been changing the travel-route, having an animal behavior going along the conventional route for pasture. Thus, the livelihood of nomads who hunt them has been menaced. To solve this problem, Tatsuzawa investigated the travel-route of some groups of wild reindeer by installing GPS transmitter on them. Almost all travel-route of reindeer groups, however, remain unclear, because the area of Arctic Circle is large. Previous works reported that the reason of changing the travel-route must be a global warming, forest fire, thunder, and flood, however they only discuss their circumstances. The purpose of this study is to research for annual travel-route changes of reindeer living around the Arctic Circle using satellite remote sensing. At first, we supposed that an annual change of summer-growing pasture affects the changes of reindeer travel-route. we have analyzed images of Landsat7,8(Resolution;30m) using typical vegetation index of NDVI (Normalized Difference Vegetation Index) to compare with travel-route taken with GPS transmitter. Our results show that reindeer travels in vast field when the value of NDVI is higher in the north area(~100km), away from staying in summer, on the basis of data obtained in July and August 2010-2012.The changes of NDVI can be related to the amount of snow in winter near Siberia. Landsat series has a temporal resolution of 16 days, however, errors can be occurred by the image calculation due to the amount of moisture in the air, spices of the vegetation, etc. Thus, we have also analyzed annual changes of NDVI using MODIS satellite images, which the temporal resolution is one day.

キーワード：北極圏、トナカイ、リモートセンシング
Keywords: Arctic Circle, reindeer, satellite remote sensing

Sentinel-2A MSIデータを用いた作物分類の評価
Assessing crop classification from Sentinel-2A MSI data

*薗部 礼[1]
*Rei Sonobe[1]

1. 静岡大学
1. Shizuoka University

Crop classification maps are useful for managing agricultural fields, which are developed and managed through a variety of social actions or policies. Furthermore, they can hugely impact biogeochemical and hydrologic cycles, climate, ecosystem functions, the economy and human health.

The Sentinel-2A satellite was launched on 23 June 2015 and provides the opportunity for crop type identifications. It carries the MultiSpectral Instrument (MSI), which has 13 spectral bands ranging from 433 nm to 2190 nm including three visible bands, three red edge, two near-infrared (NIR) and two short wave infrared (SWIR) bands except for the three atmospheric bands (i.e. Band 1, Band 9 and Band 10). Especially, the SWIR bands have a great potential for evaluating photosynthetic capacity (e.g. maximal carboxylation rate, Vcmax) and that may lead to an improvement in crop type identification.

In this study, six clop types (i.e. beans, beet, grass, maize, potato and winter wheat) were identifies using MSI data acquired on August 11, 2016, except the atmospheric bands. Accurate classification may be possible with currently existing supervised learning models. A comparison among the kernel-based extreme learning machine (KELM), the multi-layer perceptron and the random forests was performed and the hyperparameters of them were tuned using Bayesian optimization, which is a framework used to optimize hyperparameters of noisy, expansive black-box functions and it defines a principled approach to modelling uncertainty.

As the results, it was found that KELM performed better, achieving an overall accuracy of 90.3 %.

キーワード：Kernel-based extreme learning machine、ハイパーパラメータ
Keywords: Kernel-based extreme learning machine, hyperparameters

A UAV-based approach to estimate the uncertainty in GNSS locations over a broad-spatial scale

*永作 俊[1]、島崎 彦人[1]
*Shun Nagasaku[1], Hiroto Shimazaki[1]

1. 独立行政法人国立高等専門学校機構 木更津工業高等専門学校
1. National Institute of Technology, Kisarazu College

Location data obtained by GNSS-based telemetry has been widely used for estimating the movement patterns, home range size, and resource selection of free-ranging animals. Although the GNSS-based telemetry has advantages over conventional VHF radio telemetry in terms of positional accuracy and precision, it is still important to define the confidence interval of the estimation by accounting for the uncertainty in location data. Since the uncertainty in GNSS locations is mainly induced from GNSS signal interruption by rugged terrain and off-terrain objects such as buildings and tree canopies, Canopy Openness (CO) has been commonly used as the first-order approximation of the GNSS signal interruption probability (GNSS-SIP). However, applicability of the CO is limited in specific locations where hemispherical images were taken for estimating CO. To evaluate the uncertainty in GNSS locations for free-ranging animals, an alternative method must be employed.

This study examined the potential of a UAV-based approach to estimate the degree of uncertainty in GNSS locations over a broad-spatial scale. A set of high-spatial-resolution aerial images acquired from the UAV platform was used to derive a Digital Surface Model (DSM) and a quasi-DSM. The DSM represents bare ground surface and includes all objects on it, while quasi-DSM is identical to the DSM except for tree canopies. Morphometric Protection Index (MPI) was derived from the DSM. Elevation Mask (EM) was then derived from the DSM and quasi-DSM to be used in GSILIB software for predicting the values of Geometrical Dilution of Precision (GDOP) and number of satellites (NSAT).

The degree of conformity of the MPI to CO was confirmed by a simple linear regression model, and the CO was successfully estimated from MPI over a broad spatial range. However, because the MPI was calculated based on the DSM, the following problems remained unsolved: (1) the CO predicted from MPI represents only the CO at top of the terrain or off-terrain objects; and (2) it cannot consider the effect of GNSS signal transmission through an object or gaps among objects. In contrast, the GDOP and NSAT, which were derived from the DSM and quasi-DSM via the EM, were found to be capable of more properly estimating the positioning accuracy and precision. This might be attributed to the fact that the GDOP and NSAT were predicted taking into account the GNSS satellites constellation and the effect of GNSS signal transmission through an tree canopy and gaps among canopies. In conclusion, the UAV-based approach would be a promising method to estimate the degree of uncertainty in GNSS locations over a broad-spatial scale.

キーワード：GDOP、NSAT、Elevation Mask、Canopy Openness、Morphometric Protection Index
Keywords: GDOP, NSAT, Elevation Mask, Canopy Openness, Morphometric Protection Index

低価格既製UAVの技術動向
The latest trend of low-priced UAV

*齋藤 修[1]
*Osamu Saitou[1]

1. 茨城大学
1. Ibaraki University

The visualization of the environmental information is important from the viewpoint of disaster prevention to keep the security of inhabitants.Videos taken from the airplane conveyed the horror of the recent great disaster which attacked the various places in kyusyu Japan, the Kumamoto Earthquake of 2016. Numerous engineers and researchers were shocked by the images. Moreover, many real-time movies and images of this disaster exist. Especially in the past several years, other disasters caused by extreme weather because of our changing climate, such as heavy typhoons, rain cataracts, flurries, and tornadoes, also cause widespread destruction. When these disasters or earthquakes occur, rapid situational assessment is crucially important, but it is difficult because transportation systems including roads and railways often shut down under those circumstances. Therefore, a monitoring system that provides information immediately when a disaster occurs is required. When a disaster occurs, monitoring from an uncrewed aerial vehicles (UAV) or satellite is effective.

キーワード：UAV、マルチコプタ、防災
Keywords: UAV, multicopter, disaster prevention

複数衛星の時系列観測データによるバングラデシュの長期間海岸線変化検出
Long-term Change Detection of the Coastal Zone in Bangladesh Using Multiple Satellite Data

*はりぷ あいふまる[1]、郭 栄珠[2]、近藤 昭彦[3]
*HALIPU AYIHUMAIER[1], Youngjoo Kwak[2], Akihiko Kondoh[3]

1. 千葉大学融合理工学府、2. 水災害・リスクマネジメント国際センター、3. 千葉大学環境リモートセンシング研究センター
1. Graduate School of Science and Engineering, Chiba University, 2. International Centre for Water Hazard and Risk Management, 3. Center for Environmental Remote Sensing,Chiba University

　バングラデシュ人民共和国の約80%はガンジス川、ブラマプトラ川、メグナ川から形成された沖積低地からなる平坦地の平野である。また，モンスーン地域であるバングラデシュは，雨季と乾季の差が明瞭であり、雨季には水位の上昇にともない洪水が頻発し，大量の土砂を下流に供給する。一方で，河口の沿岸部では，侵食と堆積のプロセスが活発で，数年という短い期間に大きく沿岸部の形状が変化する。さらに近年では，サイクロンの大型化，来襲頻度の変化により，高潮・強風被害が拡大し，海岸線の変化，海岸堤防の決壊による農地への塩水の浸入も発生している。長期間を渡った海岸線の変化を把握することは，堆積・侵食プロセスの把握だけでなく，近年の極端気象の影響を見る上でも重要な課題である。本研究の目的は、1993年から2016年までの海岸線変化を抽出し，その時系列変化と水文事象との関係を明らかにすることである。

　解析には複数の衛星データ（主にJERS-1SARデータとALOS PALSARデータ）を用いて，地理情報システム(GIS)上で海岸線のトレースを行った。また，ガンジス河口の地形変化と降水量およびガンジス川の水位との相関関係を分析した。その結果、ガンジス河口では侵食とともに、堆積も生じていることが1993年から2016年までの衛星画像から判読できた。ガンジス川の河道の両岸では侵食傾向を示したが、川の中央部では中州が形成され堆積傾向を示した。河道では侵食と堆積がともに活発で、短い時間で砂州の消滅や出現、河道の変化が見られた。対象期間で河口付近の海岸では侵食もしくは堆積傾向が続いていた。

　今後の課題としてサイクロンのような突発的なハザードによってどの程度地形変化が（現在も）進行するのか、最近のALOSPALSAR-2とLANDSAT-8のデータも含めて引き続き検討を行う予定である。さらに、現在のガンジス河口域における周期的な地形変化は将来気候変動による海岸災害の予測にも重要な要素であるため、社会経済的要因も考慮した統合的な影響評価・分析が最も重要な課題の一つである

リモートセンシングを用いた森林に於ける樹木の被覆面積の推定
Evaluation of Covered Area with Tree in Forest using Satellite Remote Sensing

*伊藤 亜珠希[1]、吹田 智紀[1]、岸 里名子[1]、鎌田 航毅[1]、村橋 究理基[2]、川瀬 陽平[3]、Lahrita Lucy[3]、川俣 大志[1,4]、成瀬 延康[5]、高橋 幸弘[1,2]
*Azuki Ito[1], Tomoki Fukita[1], Rinako Kiski[1], Koki Kamada[1], Kuriki Murahashi[2], Yohei Kawase[3], Lucy Lahrita[3], Hiroshi Kawamata[1,4], Nobuyasu Naruse[5], Yukihiro Takahashi[1,2]

1. 北海道大学グローバルサイエンスキャンパス、2. 北海道大学大学院理学研究院、3. 北海道大学大学院農学研究院、4. 北海道大学高等教育推進機構、5. 滋賀医科大学
1. Global Science Campus, Hokkaido University, 2. Graduate School of Science, Hokkaido University, 3. Graduate School of Agriculture, Hokkaido University, 4. Institute for the Advancement of Higher Education, Hokkaido University, 5. Shiga University of Medical Science

Forest occupies important position for global environment. Especially, trees in forest play major role for fixing carbon dioxide, leading to deceleration of global warming. In our knowledge, the covered area with tree in forest is evaluated by the cost- and time- consuming method such as aircrafts, high resolution satellite images, and field survey. Alternative inexpensive method covering the wide area is issue of interest. Here, we propose the method which combines the new index R described below with low-resolution Landsat 7 remote sensing, applying to branches of trees on mountainous areas covered with snow because it's easy there to distinguish between vegetation and non-vegetation. Figure displays two new index R= (band1(4)-band5)/(band1(4) +band5) and normalized difference vegetation index (NDVI) in varying the ratio of branches to snow in a pixel. As to the reflectance spectra of branch, Beech (that is a deciduous broad-leaved tree and widely distributes in Japan) is adopted as the model species. Both slopes of our new indexes Rs have more steep than conventional index, NDVI, which means the formers are more sensitive than the latter.
Following these results, we would examine other indexes using other wavebands. Our final goal of this study is to establish the most effective index to estimate quantity of trees by satellite remote sensing. The detail will be shown in the presentation.

キーワード：リモートセンシング、ブナ、森林、被覆面積
Keywords: Remote sensing, Beech, Forest, Covered Area
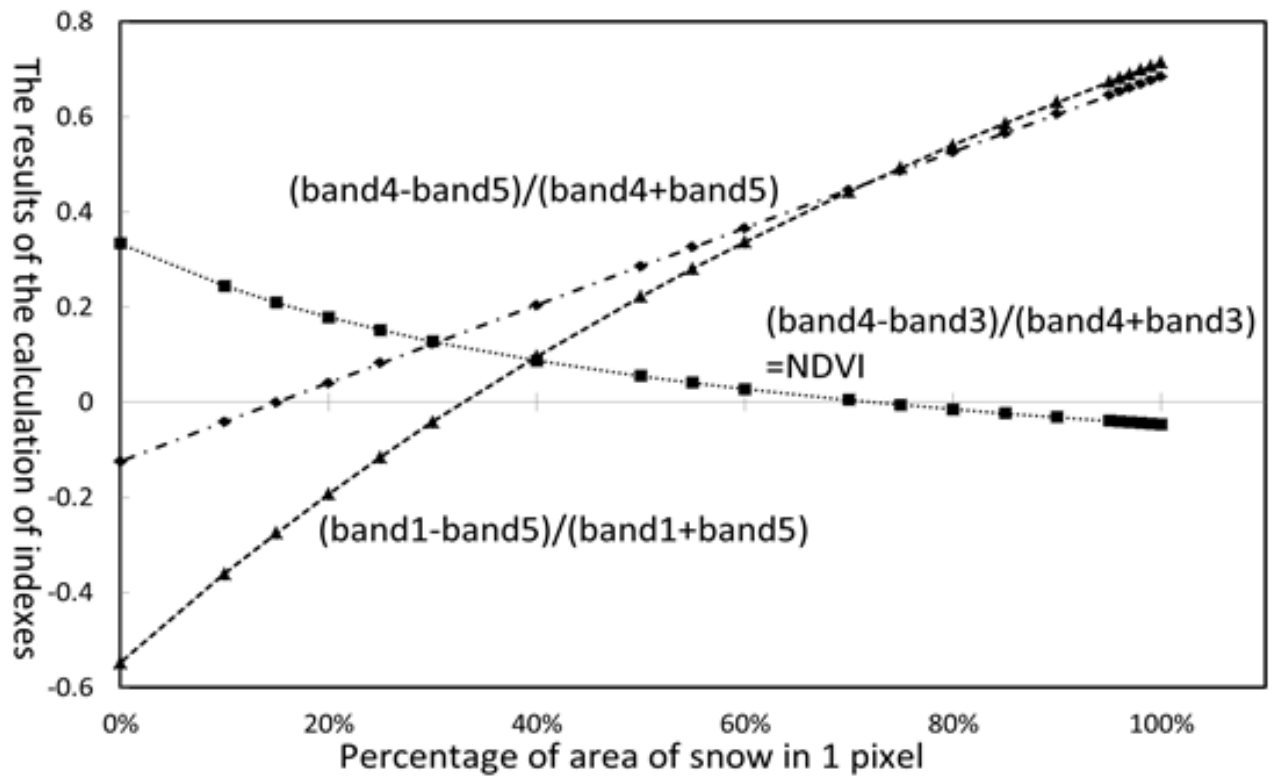
Seeking the distribution of cryoconites using satellite images

*山家 大知[1]、安本 有唯[1]、川俣 大志[1,2]

*Daichi Yamaga[1], Ally YASUMOTO[1], Hiroshi Kawamata[1,2]

1. 北海道大学グローバルサイエンスキャンパス、2. 北海道大学高等教育推進機構
1. Global Science Campus, Hokkaido University, 2. Institute for the Advancement of Higher Education, Hokkaido University

Cryoconites, which are small dark objects on glacier are formed by cyanobacteria tangling with minerals, melts the glacier faster because of its high absorption of sun light. These cryoconites were researched only by field survey which was valuable, low frequency and could only be researched in small ranges. Also there were some remote sensing researches about darkening and regression on the glaciers. However cryoconites have had difficulties in distinguishing with clouds, sands, shadows and other dark things on the glacier. Here, according to the different luminance's between the glacier and the cryoconite, we propose a new method with using multispectral bands of Landsat8 (resolution 30m), band2 (450-515nm, B2) and band5 (850-880nm, B5) to distinguish those two by making a new formula" (B5-B2)/(B5+B2)" (R). At the range of B2, the cryoconite's reflectance is about 10 %; otherwise the glacier has high percentage. In the range of B5, the cryoconite's one is about 20%; in contrast the glacier's almost half. The satellite images we use in 2016 July 30th, are analyzed since the cryoconite appeared widely and well in the period of 2016 late July to the beginning of August. We were successful in removing the shadow on this image by comparing R and RGB image. If a pixel in R is brighter than the other images, the place of the pixel should contain cryoconite or sand. We used the satellite image from 2016 July 30th. This is because the cryoconites appeared well in the period of 2016 late July to the beginning of August.
The calculated index(R), in their spectra from previous studies, applied that both of the cryoconites and the sands take a positive value while the glacier take a negative value in the pixel.
The criterion will be shown in the presentation.

キーワード：クリオコナイト、リモートセンシング、氷河
Keywords: cryoconite, remote sensing, glacier