STUDY ON THE CREATION OF ULTRAVIOLET DISTRIBUTION MAP USING SATELLITE IMAGES

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ABSTRACT: In recent years, the destruction of the ozone layer is in progress globally such as the destruction of the ecosystem, an increase in cataracts and skin cancer effect is concerned, because it leads to the ground reaching the amount of increase in harmful ultraviolet (UV-B). Therefore, this study showed the difference in the amount of ultraviolet rays in daily living area such as park green space and sandy beaches, residential district. And this study researched the land cover situation targeted these points and the measurement of UV reflectance using a simple UV instrumentation of the land cover each. This study aims at creating a detailed ultraviolet estimation distribution map in Akashi city from the results of land-cover classification using satellite images and the ultraviolet reflectance of land cover each using remote sensing techniques. As the results, this study showed that the ultraviolet reflectance of the concrete and sand is high, meanwhile, the ultraviolet reflectance is lower, because vegetation such as grass have absorb more ultraviolet radiation. In addition, this study created an image by matching the result of land cover classification results and the ultraviolet reflectance of land cover each displays a warm land cover high UV reflectivity, and color coded by stages according to the ultraviolet reflectivity. Finally, this study created UV distribution map more precise than ultraviolet estimation distribution map of 20km square are provided by the Meteorological Agency.

1. INTRODUCTION

It has been pointed out in the "Montreal Protocol on Substances that Deplete the Ozone Layer" was adopted in 2002, the causal relationship between the harmful ultraviolet rays and reduction of the amount of ozone are being validated. And the Ministry of the Environment in Japan published "Health instruction manual about ultraviolet rays" in 2003, shows the UV protection for outdoor such as awnings stroller and wearing a hat, doing the warning against harmful ultraviolet radiation health damage such as cataracts and skin cancer is a concern[1)]. Japan Meteorological Agency has started to provide information ultraviolet predictive distribution diagram using UV index indicators from 2005.

However, ultraviolet prediction provided by Meteorological Agency is not sufficient accuracy, because the amount of ultraviolet light in other regions uniquely by observations weather and altitude, the ozone layer around the country from the data that has been collected by a fixed observation equipment of three places of Sapporo, Tsukuba Naha for the calculation. Figure 1 shows show the ultraviolet predicted distribution diagram of 20km mesh Meteorological Agency has to offer. Although there is a case study on information provided on the ground reaching amount of ultraviolet rays using 3km mesh satellite images that are available as existing research, this is the distribution on a regional scale[2)]. Therefore, in the case attention is paid to the urban space constantly changing by the movement of people, it is not sufficient accuracy in the information provided by the Japan Meteorological Agency and existing previous studies. Now, this study can say efforts on detailed information provided toward the ultraviolet prevention, is one of the important issues and urgent universal.

On the other hand, an actual urban space is made up of buildings and trees, the ground surface is covered with soil and asphalt, or turf, it is considered that a person actually bathed in UV amount depends on the configuration of trees and buildings, reflection also have an impact from the building in addition to the direct UV.

Therefore, the purpose of this study of which is to clarify the causal relationship between the spatial structure and realities on the ground reaching UV amount in daily living area, to create a ground reaching UV distribution diagram for environmental load reduction on the human body.

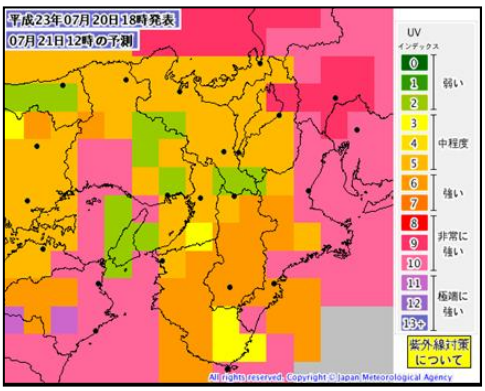


Fig.1. UV forecast distribution map

July 21, 2011 (meteorological institute)

2. Measurement of the UV reflectance of each land cover

2.1 UV measurement machinery

This study used the UV measurement machinery made in United States Ultra Violet Corporation. Figure 2 shows the surface of UV measurement machinery. This sensor name is Radiometer Sensor UVX-36 having wavelength range of interest is 365nm. This wavelength range of interest is UV-A. Then, Figure 3 shows observation method. UV sensor is attached to the upper and lower at a height of about 30cm from the ground surface, because it is desired to determine the amount of reflection from the ground surface and the amount of direct UV.

Fig.2. Main body and Radiometer Sensor UVX-36 [3)]

Fig.3. Observation equipment

2.2 Selection of observation points and survey condition

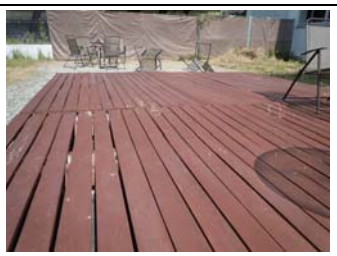
UV reflectance of each land cover is necessary in order to create a UV distribution map. And therefore this study was determined by the land cover UV reflectance using ultraviolet measuring device at multiple points. Observation points is sandy beach, grass, asphalt, concrete, wood deck and soil was surveyed during the day ultraviolet observation. Figure 4 shows survey view in the case of grass. And table 1 shows the landscape of each land cover.

Fig.4. Survey view in the grass

■Project summary

・Observation date: October 7, 2012
・Weather: fair weather
・Survey Time: 10:00-16:30
・Maximum temperature 25.5℃／minimum temperature 16.2℃
・Measure once every 30 minutes per one location
・Measure five times at one measurement time, it's average value is representative value

Table 1 the landscape of each land cover

sand	grass	asphalt
		
concrete	soil	wood deck
		

2.3 Results of the UV reflectance

Figure 5 shows the result of UV reflectance of each land cover. From the results shown in Fig.5, sand and concrete was obtained high reflectivity. On the other hand reflection of grass is low, this study found out that the reflectance of the grass withered in the same turf is low. The land cover of vegetable such as deck or grass can be seen that the large difference between land cover as soil and asphalt has occurred.

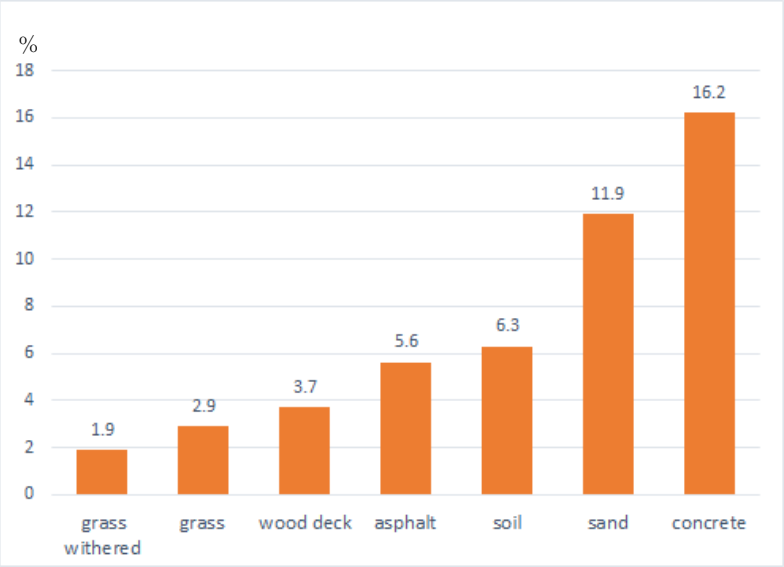


Fig.5. Result of UV reflectance of each land cover

3. Creating UV distribution map using satellite images

3.1 Study area and used data

In the case of doing land cover classification of satellite images, it is necessary to check the integrity of the state and local results after classification. Therefore, this study targeted Akashi city at Hyogo prefecture in Japan, because this area has our college, and that is advantageous geographical environment as we have to do the field survey. Akashi city is a commuter town of Osaka and Kobe, has a population of about 300,000 people. Therefore, it is positioned as one of the local city housing to some extent crowded.

In addition, this study with a satellite image is intended to create a distribution diagram of UV high definition. Therefore, it is necessary to select a high accuracy satellite image used. In this study, the region where Akashi, Hyogo Prefecture, to use satellite images of high resolution, the GeoEye-1. Table 2 shows the brief information of satellite images used. The institution of center of the figure 6 is Akashi National College of Technology.

Table 2. Image brief of the used satellite image

Location	Akashi city (in Japan)
Date	March 2010
Image type	GeoEye-1
Spatial resolution	0.41m pan-sharpened images
File format	GeoTIFF (11bit/pixel/band)

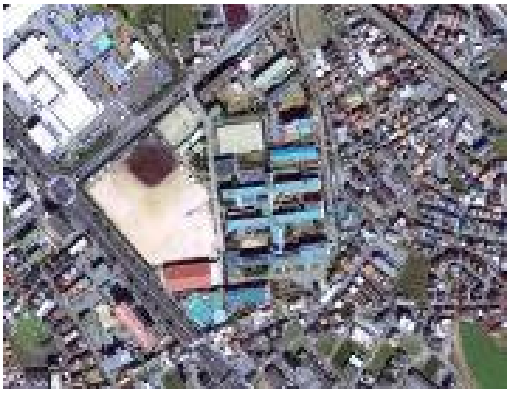


Fig.6. Geoeye-1 image of study area

3.2 Land cover classification using satellite images

In order to create a distribution diagram ultraviolet, this study followed by land-cover classification in urban space using satellite images. Land cover classification is a supervised classification using training data. The training data is a land cover obtained ultraviolet reflectance of each land cover. Figure 7 shows result of Land cover classification using satellite images.

■Legend■
White - Buildings
Green - Vegetation
Blue - Water
Gray – Concrete
Brown - Soil
Ocher - Sand

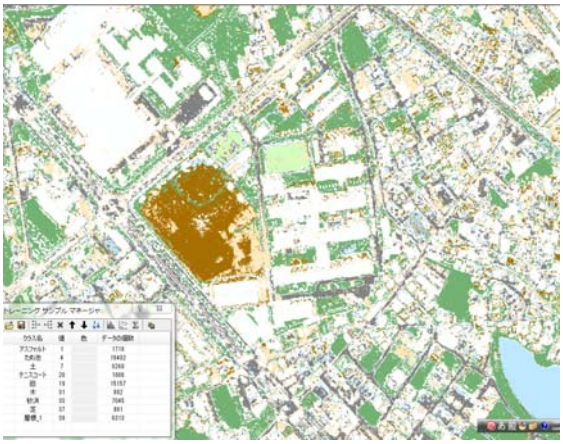


Fig.7. Result of Land cover classification

3.3 Creating UV distribution map

This study created a distribution diagram ultraviolet exceeding UV map in Figure 1 of 20km mesh. Land cover is understood from Figure 7, UV reflectance of each land cover has been grasped from Figure 5. By using these values, Figure 8 is shown distribution diagram of the ultraviolet reflectance of each land cover. In particular, place of concrete residing in the city and the coast covered with sand that the color is red in Figure 8, reflection of ultraviolet rays is high is shown.

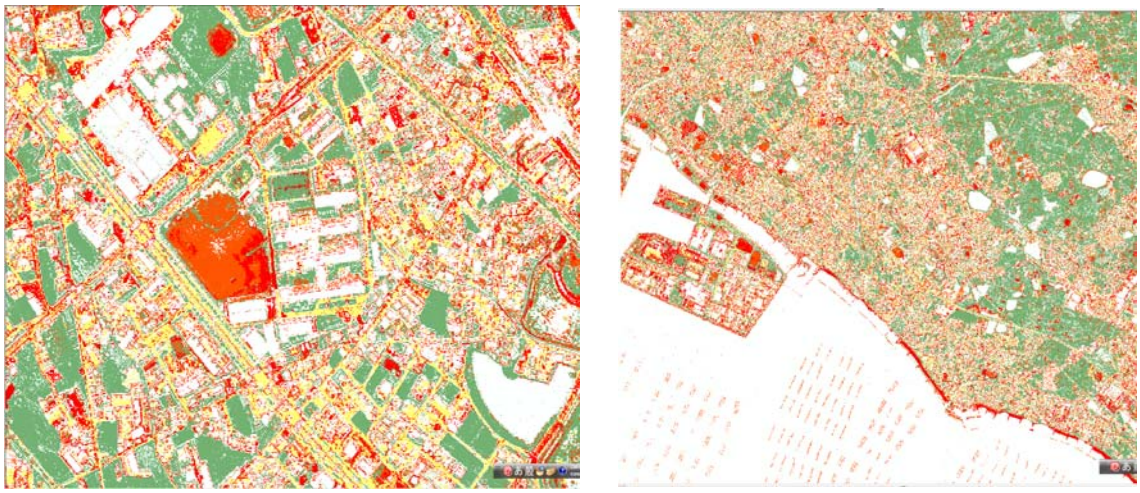


Fig.8. UV distribution map in Akashi city

4. Conclusion

The present study created a detailed ultraviolet distribution map of the city by using the satellite image. However, ultraviolet light distribution diagram prepared in this study is only focused on land cover, it is not able to consider shade created by buildings or trees. It is expected to address the creation of a detailed UV distribution map from considering height such as the buildings or trees in the future.

References

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