

HTT033-01

Room:202

Time:May 25 08:30-08:45

Shallow landslide assessment using two airborne laser scanner data measured before and after the rainstorm

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Shallow landslides damage the human life and activity, because they occur in many numbers simultaneously even though each one is small by rainstorms and earthquakes. However, previous methodology for analyzing shallow landslides were not effective for investigating a wide area with high resolution. Airborne laser scanner data are revolutionary for analyzing shallow landslides, but the data are obtained after the disaster usually.

I analyzed the topography of the shallow landslide in Hofu area, Yamaguchi prefecture where rainstorm occurred in 21th, July, 2009 used by airborne laser scanner data taken from Yamaguchi River and National highway office. The airborne laser data were obtained two times, one time is at 2005 before the rainstorm and the other time is at 2009 after the rainstorm. It is understood that the Hofu area is composed of granite, and most of the landslides are shallow landslide by the ground truthing and analyzing the airborne laser scanner data.

First, I paid attention to flow accumulation for assessment of shallow landslide. I calculated the flow accumulation from the airborne laser scanner data before the rainstorm, and the flow accumulation were compared with shallow landslide distribution. I can watch that most of the landslide had been generated near the area that flow accumulation is more than 1000 cells (1000 m²). This shows that the flow accumulation is very a critical factor of shallow landslide assessment by rainstorm.

Next, I calculated the difference of both airborne laser scanner data, and the difference shows the moving soil at the 2009 event. I assume that the moving soil around the shallow landslide is the weathering thickness in this area. I estimated the weathering thickness in wide area by analyzing the spatial relationship between the weathering thickness and various geomorphologic features.

Finally, the assessment of shallow landslide caused by spatial analysis between flow accumulation, weathering thickness, slope and shallow landslide distribution was constructed.

Keywords: shallow landslide, airborne laser scanner, flow accumulation, weathering thickness

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HTT033-02

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Factors affecting the formation of U-shaped valley form inferred from morphometric analysis using DEMs

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Glaciers filled some mountain valleys in the Quaternary period. Such glaciers left U-shaped valleys, whose form may vary according to environmental factors. We investigated how U-shaped valley form is related to environmental factors, the equilibrium line, and erosion rates. For six valleys in the United States and Switzerland, we made the longitudinal profiles and cross sections using DEMs. Then the elevation of past glacial surfaces was estimated from the cross sections and plotted along the longitudinal profile. The results indicate two to four periods of glacial advances in all valleys. For the valleys longer than 10,000 m such as Lauterbrunnen, the newest glacier deeply eroded the valley bottom.

We also conducted more detailed analysis of cross sections including the measurements of slope and curvature, and estimated erosion rates and equilibrium lines. This study will reveal the detailed topographic characteristics of typical U-shaped valleys and they will be used to estimate the past glacial distribution in other less typical U-shaped valleys.

Keywords: U-shaped valley, DEM, GIS

HTT033-03

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Analysis of Relationships between Morphology of Alluvial Fans and Geomorphic Properties of Source Areas

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Studies of alluvial fans and source basins are important to discuss geomorphic processes such as sediment transport and debris flow disasters in piedmont areas. Many researchers have discussed how properties of source areas such as slope, area, and lithology affect the morphology of alluvial fans. However, many of the previous studies were based on analogue data. Therefore, measurement of morphometric properties took large amount of time and efforts; the obtained results were not reproducible; and some parameters such as average slope of a basin were difficult to obtain. Furthermore, most previous studies analyzed fans only in a specific region.

This study obtains morphometric properties including area, average slope, and gradient of the main stream for both alluvial fans and source areas using GIS and DEMs, and analyzes relationships between the properties. Moreover, relationships between morphology of fans and lithological characteristics of source areas are analyzed using digitalized geological maps. In total 490 fans in the whole of Japan and 380 fans in the American South West were analyzed.

The inferred relationships between the morphometric properties show some differences depending on drainage basin area, pointing to different fan-forming processes in large and small basins. The relationships also differ between the American and Japanese fans, probably reflecting differences in sediment transporting processes (debris flow or fluvial flow) and climatic conditions. Analyses so far indicate no clear relationships between fan morphology and basin lithology, but more detailed analyses on this issue will be conducted.

Keywords: Alluvial fan, Drainage basin, Stream gradient, Basin area, Morphometric property, GIS

HTT033-04

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Study of slope-angle frequency distribution by LiDAR DEM as classification indices of slope angles

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A slope angle is considered to be one of the important evaluation indices in the study of the formation process of a slope. Particularly, various types of mass movement believed to have the greatest effect on the process of slope formation and slope angles are considered to have a close relationship with each other.

It has been pointed out that the frequency distribution of slope angles in widely spread mountain ranges indicates an almost normal distribution, and in mountainous areas such as the Japanese Alps where erosion is active, the slope angles are summarized to a mode of about 35 degrees, and in mountainous areas in Taiwan, the average slope is on the order of 35 degrees.

A certain regularity is thus recognized in the slope angles of mountainous areas, but there are few cases for studying in detail slope angles as quantitative judgment indices to be associated with such various mass movements affecting slope formation. This is due also to the fact that it has been difficult to obtain data of detailed quantitative slope angles reflecting the types of various scales of mass movement.

This time, because we have had an opportunity to create detailed slope classification maps using LiDAR DEM in several areas, a small experimental study on the relationship of slope frequency distribution characteristics, local mass movement and geological characteristics will be conducted in terms of a study range classified so as to reflect mass movement characteristics of the area.

The study regions are all in areas where erosion is very active, and areas where slopes mainly of rocks having a slope frequency distribution with a mode exceeding 40 degrees are widely distributed, and evaluation of characteristics such as mode, mean, median, and standard deviation of a frequency distribution will be attempted according to geological characteristics.

Keywords: slope angle, frequency distribution, mass movemnt, LIDAR DEM

HTT033-05

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Application of Google Mars, QGIS and ArcGIS for geomorphological research on Mars

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Geographical information systems (GIS) are necessary tools in planetary geomorphology. The use of GIS enables us to process systematically voluminous and diverse data sent by many spacecraft observing planets (Komatsu, 2008). In general, processing of these data includes exclusive software and complicated data conversion. It is difficult to analyze these data because special knowledge and time are required before data analysis. If these works are simplified, it would be vastly useful for planetary geomorphology. In recent years, the development of Google Mars (Google Inc.), and the Free and Open Source Software for Geospatial (FOSS4G) allow us to easily browse through Martin satellite images, and even to process the data. This study therefore introduces a new approach for geomorphological research on Mars using Google Mars, QuantumGIS (QGIS, which is one of the FOSS4G), and ArcGIS (ESRI). We also present results of a case study concerning Martian landslides.

This study investigated Shalbatana Vallis and Holden Crater. Martin valleys and crater wallslopes appear to be modified by numerous landslides. First, we conducted preliminary analysis, preparing landslide distribution maps using Google Mars. In Google Mars, we can display images including HRSC (special resolution –10 m), MOC (MDIM 2.1, spatial resolution is –230 m), HiRISE (special resolution up to –30 cm), THEMIS (infrared, spatial resolution –100 m), and MOLA-derived topography, some with 3D view. Overlaying these images on top of each other, we detected landslide bodies and scarps, and measured simple geomorphological characteristics, such as landslide length. Second, we saved the landslide maps as KMZ format, and imported the data to QGIS and ArcGIS. We then measured details of the landslides (e.g., area, relative height) based on the landslide maps, THEMIS and MOLA data. The analysis based on Google Mars was also verified by comparing it with the analysis based on QGIS and ArcGIS.

In conclusion, we correctly detected landslides in Shalbatana Vallis and Holden Crater, described in previous studies, using Google Mars. Their morphological characteristics were measured using QGIS and ArcGIS. We found that the analysis from Google Mars well corresponds to those from QGIS and ArcGIS (in the case of large-scale landslides). This indicates that we are able to conduct preliminary analysis of Martin landslides without complicated processing. We can then proceed to analyzing details of landslides using QGIS and ArcGIS. This method will be useful in future Martin geomorphology.

Reference:

Komatsu, G., 2008. Application of GIS to geomorphological research on Mars. *Journal of Geography* 117: 401-411 (in Japanese with English abstract).

Keywords: Geomorphological research on Mars,, Landslide, Google Mars, QuantumGIS, ArcGIS

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Contribution of Digital Japan Web system to municipalities' biosecurity measures against animal infectious diseases

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Digital Japan Web system by Geospatial Information Authority (GSI) of Japan is the system where map images are scrollable and scalable, and anyone can superimpose geospatial information on the images. In the system they are browsed as small-split tile for smooth scrolling. In taking measures against spreading of foot and mouth disease in 2010 and bird influenza in 2010-2011, GSI technically supported municipalities that use Digital Japan Web system to announce locations of disinfecting stations on the map images. As a result, in some cases of municipalities' publicity, the number of browsed tiled map images became much more than the number before the publicity. Many municipalities tended to deliver the locations in the list of land name and address or on the non-scalable scanned map image; however, it is thought that the system gave the efficient way of the publicity for municipalities to deliver the locations of disinfecting stations.

Keywords: Digital Japan, foot-and-mouth disease, influenza, disinfection, scroll, scale

HTT033-07

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Transition Process Analysis Using Polygon-based Land Use Data

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Land use transition reflects human activities with natural environment in a time period. Spatial data are very important to examine the land use transition process. Currently, most of the land use data are available in regular cell-based format. Geometry of land use is important attribute as land use category but the geometric characteristics in cell-based data is very difficult to capture as compared to polygon based data.

This study aims to analyze land use transition process using polygon-based land use data. Firstly, intersection of two land use data at specified time period is necessary that provides four types of polygon events (i.e., no change, change in land use, change in geometry, and change in both). Secondly, land use transition process is classified into 6 classes (i.e., stable, substitution, division-stable, division-change, expansion, and conversion) which are based on land use category and geometry. These classes represent polygon state. Additionally, we analyze relationships between polygon state and geometry of land use to explain the impact of transition process.

Central area in Tsukuba City is selected as a case study. The results indicate that during the land use transition process, polygon experienced changes in land use category and geometry has a tendency to be involved *expansion* in polygon state which can be considered as neighborhood effect. *Expansion* lowers the compactness of the geometry as compared to the other polygon states.

Keywords: polygon event, polygon state, transition process, land use

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Ontology of Land use categories -a case study of "public facility"

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The interoperability of spatial data plays significant roles for developments of convenience spatial data infrastructure. Nowadays, the interoperable spatial data have been promoted by establishment of data standard or provisions. Land use categories, however, have been still important subject in data interoperability, because there are not enough quantitative aspects. In addition, semantic interoperability is one of the biggest challenges in land use studies. In this study, the ontological analysis was conducted for "Public facility" in Japanese by experimental tests toward development of standardized land use classification. The reasons to employ "Public facility" are that its concept is diverse and complex compared to other same level category (i.e. Residence, Commercial facility). The people being tested are 50 students in University of Tsukuba. The contents of conducted experimental tests are following:

1. To categorize facilities to "Public facility", "Commercial facility", "Residence" or "others".
2. To write down facilities that can be categorized to "Public facility".

Test 1 can be expected to clarify the peripheral types of the facilities categorized to "Public facility" (i.e. not Prototype), and Test 2 may reveal its Prototypes.

Keywords: land use category, ontology, concept definition

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Spatial analysis on farmland abandonment and rural environment using grid-square data

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The author analyzed the relationships between farmland abandonment and physical and human environment of rural area based on grid square database of agricultural census. The database was composed from the rural statistics of agricultural census by the author. The author examined availability of the grid-square data in the analyses in which multiple statistics were used.

Keywords: farmland abandonment, rural environment, agricultural census, grid square statistics

HTT033-10

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Analysis of the Economic Value of the Urban Residential Environment: A Case Study of Kobe

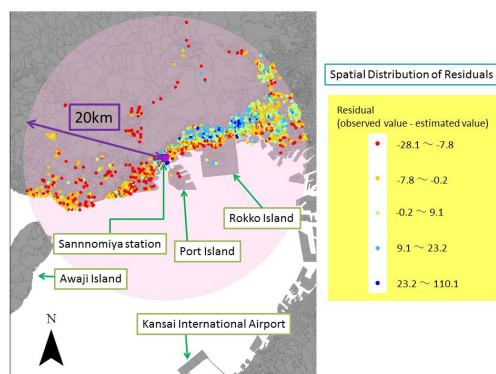
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In recent years, increasing attention has been paid to conserve and improve good living environments in Japan; for example, the Landscape Law was implemented in 2005. In this paper, we attempt to examine the economic value of the urban residential environment, taking into account the urban landscape and regional characteristics that are considered difficult for quantitative evaluation. To do so, we employ the hedonic approach that is based on the capitalization hypothesis that environmental benefits are capitalized into land rents. The variables of our particular interests are green visibility and regional brand, which have rarely been addressed in previous research.

The study area is Kobe, which was accredited as a design city by UNESCO in 2008. Depending on the available variables, different hedonic models were estimated for the Kobe central area (within 3,500 meters of Sannomiya station that is considered the city center), Kobe City, and Kobe broad area (within 20 kilometers of Sannomiya station). In the hedonic models, the dependent variable is the price of mansion per square meter and the independent variables are the residential characteristics including the two variables of interest: green visibility ratio and dummy of very affluent area (the latter is used as the proxy for regional brand). The data on the mansions are from the 2009 condominium data sets provided by the RITS Research Institute. We created the aforementioned two variables of interest by ourselves as follows. The green visibility ratio was calculated by the grid method, using eight photos taken for each mansion in the Kobe central area in August 2010. The dummy of very affluent area was created using the G-codes of Cameo Japan provided by GMAP Consulting. Besides the hedonic approach, we took a different approach (hereafter, the potential approach) to examine the presence of regional brand. In this approach, we examine the spatial distribution of the residuals (the differences between the actual and predicted values) of mansion prices based on the estimated regression model where the dependent variable is the price of mansion per square meter and the independent variables are those selected using the stepwise method from among the commonly used variables in hedonic analysis.

The results from the hedonic models indicate that green visibility ratio has a small and insignificant effect on the mansion price, but that very affluent area is significantly associated with higher mansion price. The results from the potential approach show that areas with clusters of mansions with high residual values overlap with areas that are considered to have regional brand, including Ashiya, Ashiyagawa, Mikage, Okamoto, Sannomiya, and Syukugawa in Hyogo Prefecture (Figure). Further, these areas correspond to the rankings of desired residential areas investigated by private research companies. Future work will entail the refinement of the methods to examine the value of regional brand and the applications of the methods to areas other than the Kobe area.



Keywords: hedonic analysis, residential environment, green visibility ratio, Kobe

HTT033-11

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Green Bases in Osaka as Sequential Landscape

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Cities have been recently greened with various places and greening techniques. For example, there are green buildings as green roofs and walls in a private land as well as green creations in public facilities in urban parks and streets. On the other hand, people are devoting their energies to conserve and preserve forests, groves of village shrines, old trees and time-honored trees. The age of abundant green is the present in the metropolitan area. Consideration to the landscape is one of the important subjects for urban design these days. Above all, it is essential to improve the green environment. Especially, it is important to conserve and use the existing green environment as well as simply increasing the green in the metropolitan area, where it is hard to have the wide green space.

Under the above-mentioned circumstance, the authors are trying to analyze a view of the green environment as the element of urban landscape in this study. The view of the green environment is analyzed as a sequential landscape, because people are viewing the green which movements in urban space. Osaka, prefecture, which is the case study area in this study, has mountains surrounding the Osaka Plain. Therefore, the urban area is spreading in the plain, and there are very few natural green there. The authors perceive a lot of green in Osaka because of such features. So, we can watch many types of planted green.

In the analysis over a wide area, the green covered space was extracted with NDVI by using the remote sensing data. The present condition of green and variety were understood using the existing green covered space and the selection of 100 greens in Osaka. Then, the authors analyzed the green in relation to the green covered space, the green planning and the land use data in the city of Osaka, where we have the most familiar green.

In the analysis over a small area, the large-scale park is selected as a case study because of important for maintaining the green. A digital surface model was built with digital map data and LIDAR data, and then the greens in the park were tested by the visibility analysis from the streets. As a result, of this analysis, the green of the park can be seen on many streets around there. The greens in the park cannot be seen on the streets, actually because of viaducts, pedestrian bridges and street plantings on the streets.

The routes in the park, which are used by people, were selected from various networks. The greens in the park were understood by the visibility analysis. They also analyzed in detail from where and how people view the greens in the park by using images on the photo-sharing website. As the results of this study, it is understood that people come to the park to see the green like cherry blossoms, indicating the four seasons, and prefer the scene including the structure like the Osaka Castle with the attached green. The authors are going to propose the methods of green maintenance and application.

Keywords: green environment, green base, sequential landscape, geo-information technology

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Spatiotemporal Analysis of Landscape Transition in Aqua Metropolis Osaka

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As there were many canals and rivers in Osaka, it has been called the Aqua Metropolis. Many bridges were spanned over canals and rivers. Osaka had a landscape with a lot of atmosphere named the bridgescape "Happyaku-yabasi." Almost all canals were reclaimed during the high economic growth after World War 2 in Japan.

However, the development of a metropolis has been changed from expansion to maturity. According to this, the residents have begun to be interested in urban amenities. There are still two canals and three rivers in the central district of Osaka city. These are called the aquatic cloister. If a resident watches the aquatic cloister, one can imagine a part of the aqua metropolis. Many events after waterside are repeatedly done. So, the residents have started having an interest in watersides. In this study, the authors pay their attention to the historical transition of cityscape in the aqua metropolis Osaka.

This study has three purposes. First, the prospered time as the aqua metropolis is identified. Second, the historical transition is understood in Osaka. Third, the landscape in Osaka as the aqua metropolis is restored on computer graphics. In addition, the authors understand the historical transition of cityscape in the aqua metropolis Osaka visually.

Concretely, old topographical maps are located on the present urban space by using GIS. The topographical maps used in this study are eight sheets, the Genroku term, the early and late Meiji term, the Taisho term, the early, middle and late Showa term, and the present age. The authors traced over rivers drawn on the topographical map, and constructed the database of rivers. The database has a few information, which are the birth age and disappearance age of canals. Next, the changes of waterfront length are understood from database. A waterfront density is calculated by using waterfront length and total area of Osaka city. And the distribution of viewpoints inferred from pictures and old photographs is understood. Then, the important sites in the aqua metropolis Osaka are extracted from the distribution of pictures. And, the cityscape of the aqua metropolis Osaka is restored every time by using GIS and CAD/CG. The landscape transition is understood from the restored models. So, the restored model has the possibility of becoming the new historical data. Therefore, the models are saved as digital archives.

The authors discovered the following things. The change of the waterfront length has been visually understood from the database. Especially, many canals and rivers reclaimed between 1950 and 1970 in the central part of Osaka City. The reclaimed places were used as residential area or roads. The waterfront length is increased according to expansion of urban area. Moreover, the waterfront length is decreased after the third expansion of urban area because the reclamation of canals and rivers is advanced much. A waterfront density was high between Genroku era and the start of municipal administration in Osaka. In other words, the prosperous years as the aqua metropolis Osaka is between Genroku era and the start of municipal organization in Osaka. A distribution of pictures and old photographs have analyzed. As a result, the authors recognized "Osaka-Sango" as the important site of the aqua metropolis Osaka. Especially, Nakanoshima, the area around Tenma, the area around Kawaguchi, Yotsubashi and Matsushima are the most important site as the aqua metropolis Osaka. The landscape of Osaka was restored at the base in the Edo period. Each cityscape of site in the Edo period was restored. Simulating the landscape transition, the authors found a part of urban formation.

They will restore more cityscape in the Edo period in the near future. Also, they have to investigate the charm and identity of Osaka. For that reason, they are required to verify a lot of historical facts.

Keywords: canals and rivers, Aqua Metropolis, landscape transition, historical environment

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Analysis of Alley Space in Kyoto

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The alleys in Japan are showing the formation and change of the city. And they are the symbol of history and culture which cities have. Kyoto has traced various changes from the ancient time as a historical city. And the alleys have accumulated local histories. Therefore, the alleys in the historical city have reached to the present reflecting people's activities of each age.

The streets on square grids are formed in the urban district of Kyoto. There are many alleys which can be passed through a block between the street. They are called "Ro-ji." The alley spaces in Kyoto have the features like the stone pavement and the townhouses called "machiya" and are in the spotlight. In this study, the authors paid their attention to alley spaces in Kyoto.

Presently, there are some problems in the alleys. One is that the efficiency of disaster prevention is low. It cannot be passed by the urgent vehicle like the fire engine because of the narrow width less than four meters. It is effective to widen the alleys to maintain the functions of disaster prevention. But it lose the special atmosphere in alley spaces. Therefore, it is important to improve the problems while maintaining this atmosphere. So, it is the purpose of this study to determine the atmosphere in alley spaces.

The control urban area where consists of four ward, Kamigyo, Nakagyo, Shimogyo, and Higashiyama Ward, is selected as a case study area. The authors used the data which are investigated by the city of Kyoto to extract the alleys in the case study area. The distribution of alleys is analyzed on GIS, and the crowded areas are found. Then, the spatial elements of alleys are extracted on the typical alley there.

Keywords: geo-information technology, Kyoto, alley space, typical alley

HTT033-14

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Analysis of Festival Space in Osaka

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The social infrastructure was serviced by the large-scale urban development, which accompanied the high economic growth in the 1960's. Convenient cities were built, but the historical environment has been lost. Therefore, a festival, which senses the history, attracts a people's attraction because people can see the past scenery through the festival in the modern space. So, this study deals with the festivals of shrines, which conspicuously reflect the local culture and history. The authors clarify the kind of festivals, which have been continued since the Edo period. The pictures, painted festivals, are selected from the collection of pictures. They tried to analyze the landscape of the present festival space.

In the analysis over a wide area, the typical festivals of each region are selected from festivals in Japan. And the characteristics of the festivals are identified to classify the season, and the purpose of the festival. As a result, they recognized that such festivals are a lot in the summer. Moreover, the summer festival in Osaka has been high appraised because it is retained the former culture. Therefore, they have decided to investigate the summer festival in Osaka.

Osaka was the trade center of Japan in the Edo period. Osaka was named as one of the big three cities, and was called the well-known Kitchen in the world. The present Osaka Prefecture is located in the three countries in the Edo period. The authors input lines of districts on GIS by using old maps.

The analysis used both the collection of pictures, which were published in the last part of the Edo period, and the geospatial information. The quantities of shrines and festivals, which were painted on the collection of pictures, were counted. And the position of the shrines and festivals were identified with geocoding. The area, which has a lot of festival and was painted on the collection of pictures, corresponds to Osaka city.

In the analysis over a small area, the Tenjin festival is selected from summer festivals because it has held around rivers and on roads among summer festivals in Osaka. The Tenjin festival is one of the big three festivals in Japan, one is crowded with galleries about 130 millions every year. It dates back to the tenth century. Along with time, the urban space has been changed, too. So the Tenjin festival has been influenced in both time and space. For example, it is pointed out that high-rise buildings are built in the city. The authors supposed those buildings were the obstruction to the view of the Tnjin festival. Therefore, they calculated visible area of the portable shrine in the Tenjin festival.

In conclusion, the authors identified the characteristics of the typical festivals in Japan with the analysis over a wide area. And the festivals in Osaka, which have been continued since the Edo period, were found out. They calculated visible area of the portable shrine in the Tenjin festival with the analysis over a small area. As a result, this study clarified that the view point field of the festival parade on roads are limited rather than on rivers. Furthermore, the high-rise buildings are obstacles to see the Tenjin festival. On the other hand, they can be valuable viewpoints, too. The landscape simulation with historical transition has to be executed by using the three-dimensional urban models in the near future.

Keywords: collection of pictures, festival space, landscape transition, visibility analysis

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Distribution of temporal geospatial information using Cyber Japan Web System

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Temporal geospatial information dataset of Tsukuba City was constructed. Temporal range is about 10 years from 2000 to 2009; the area is 15 square kilometers along Tsukuba Express railroad. Data contents are transportation (road and railroad), land use, topography (Digital Elevation Model), buildings and drainage. The authors proposed two types of temporal data specification, one is occurrence and disappearance type data such as road, buildings and so on, another is coverage type data such as land use and DEM. This dataset is not only image data described for background map but also analytical data such as polygon type or mesh tape.

The authors also developed the system which extracts optional time serial geospatial data from temporal geospatial information dataset, and portraits image data such as topographical map published by GSI. As the users select optional time, the system constructs GIS data to select all objects which exist in selected time, and describes topographical maps. And the authors developed the system which distributes the described olden topographical maps for base map using Cyber Japan Web System. The users can distribute various contents data which overlay olden topographical maps.

Keywords: temporal geospatial information, Cyber Japan Web System, Tsukuba City

HTT033-16

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Development of Web-GIS in Order to Accumulate Regional Knowledge

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The Science Council of Japan's 2008 "Towards the Accumulation and Utilization of 'Regional Knowledge'" places heavy importance on locally inherent regional knowledge, and considers systemic reforms targeting the accumulation, organization, utilization, and release of this regional knowledge, together with technological development, and the establishment of a system for operating the above, to be essential. "Regional knowledge" is information, knowledge, and wisdom that combines "specialized knowledge", highly specialized data resulting from scientific knowledge, with "experiential knowledge", which is a product of the experiences of the people living in an area. It permeates the daily lives of people living in a region. It is now possible for people to easily exchange information with others anytime, anywhere, and with anyone, through the use of information systems. Effectively used, information systems can make it possible to share regional knowledge even more efficiently.

Against this backdrop, the importance of information systems which can share regional knowledge, which is "implicit knowledge", the domain of local residents, left un-visualized, not having been conveyed to others, in the form of "formal knowledge", which can be stored, organized, utilized, and publicized, will continue to grow. The objective of this study is the development of an information sharing GIS, specially tailored to the efficient accumulation of regional knowledge within regions on the city, town, and village spatial scale.

The information sharing GIS of this study is a geographical information system which integrates a Web-GIS, an SNS (Social Networking System), and a Wiki into a single system. These three Web applications have the following features.

- Web-GIS: This makes it possible to geographically understand positional information, manage massive amounts of position based data, as well as display analysis results involving environmental variables.

- SNS: These are suited for the sharing of information between users connected by some commonality. Because users can be individually identified, SNS can be used in the creation of environments which are close to the real world.

- Wiki: With wikis, it is possible for multiple users to modify and update the same Web page. Users cooperate together to create and refine content, improving it over time.

Integrating the three Web applications described above makes it possible for SNS to be used to narrow down the user base to target users, for Web-GIS to be used to visualize actual target regions, and for wikis to be used to share information specific to individual locations, creating a synergistic effect capitalizing on each of their strengths. Our study is unique in that it regards the development of an information sharing GIS which integrates these three Web applications.

The information sharing GIS which is the topic of this study uses a design which ameliorates the following three constraints such as time constraints, spatial constraints and continuous operation related constraints, making it possible to design systems in accordance with target cases. This shows the utility of the system designed during the course of this study.

Future study issues faced by this unique and useful information sharing GIS will be addressed by selecting several target cases, putting the GIS in normal operation, and then having users perform an evaluation. These evaluation results will be then used in the further development of the system. Specific target cases include regional communities and school education.

Keywords: Local Knowledge, Information Sharing GIS, Web-GIS, SNS, Wiki