HTT005-01   Room:202   Time:May 25 14:15-14:30

# Development of Seamless Digital Geological Map of Japan (1:200,000) Google Maps version -intuitive geological map-

Annie Yoshie Nonogaki (Masaka)[1]*, Yoshiharu Nishioka[1]

[1]Geological Survey of Japan, AIST

Seamless Digital Geological Map of Japan (http://riodb02.ibase.aist.go.jp/db084/index.html) is a digital geological map in scale of 1:200,000 published by Geological Survey of Japan (GSJ), National Institute of Advanced Industrial Science and Technology (AIST). It has a structurally and stratigraphically smooth geological boundary, and is based on a nationally-standardized legend based on the geological map of Japan 1:1,000,000 3rd edition (GSJ. 1992). It was developed by (1) creating nationally-standardized legend, (2) digitizing existing paper-based geological maps in vector format, (3) replacing each geological attributes by the nationally-standardized legend, (4) smoothing geological boundary of adjacent maps on GIS (Geographic Information System). It's been published on the Web since 2003, and users are able to select from among several user interfaces in accordance with the intended use and preference. Methods of data representation have been modified to suit the needs of the uses. Google Maps version is the latest and default user interface which uses Google Maps API (Application Programming Interface) and Google Earth API provided by Google, and it's been repeatedly improved with the help of comments by users. The major characteristics of the Google Maps version are intelligible operability and fast imaging speed.

Fast operation of Google Maps version is provided by "Image Pyramid" and "AJAX (Asynchronous JavaScript and XML)". The image pyramid, also known as "tile matrix set" in WMTS (Web Map Tile Service) standard defined by OGC, consists of a base image tile and a series of consecutively smaller sub-image tiles in lower resolution. As users zoom in or out on the map, different resolution level of image is displayed, and the image pixels of geological map are only loaded when a tile section comes into view. AJAX is a group of interrelated web development technique used for creating interactive web applications on client-side. It allows web pages to retrieve small amounts of data from the server, and update parts of a web page without reloading the entire page.

Google Maps version was developed with a goal of making and releasing geological maps in foolproof way. It is designed especially for end-users; therefore, users are able to change opacity of the geological map, zoom in or out, and search a specific location intuitively. Google Maps version doesn't require any plug-in unlike other user interface within our website, hence it is less reliance on user environment such as OS and browser. Development of Google Maps version serves as the foundations for future development of user-friendly digital geological map.
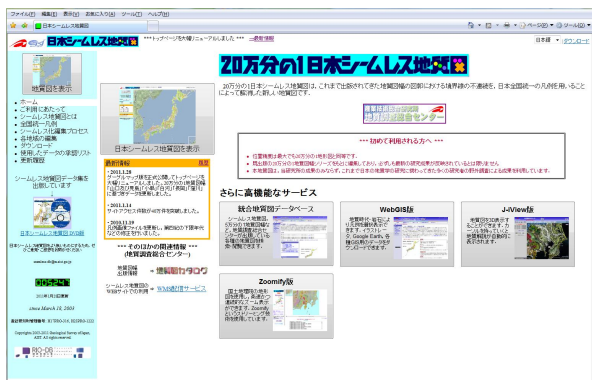
Keywords: GIS, Seamless, Geological Map, Google Maps API, AJAX, Image Pyramid

HTT005-02 Room:202 Time:May 25 14:30-14:45

Low-cost and User-friendly Field Survey Assisting System powered by Open Cafe System

Kazuhiko Nakamura[1]*, Rui Fukumoto[1], Shimon Sugiura[1], Hitoshi Saito[2], Kanae Nakayama[1], Yu Nakayama[1]

[1]NPO OpenConcierge, [2]Tokyo Metropolitan University

In traditional field survey in natural environment, the survey values are recorded in the paper such as field notes, and they are digitalized and analyzed indoors. The digitalization of this method is so complex that it is time-consuming. Then, the system into which digital data can be inputted directly in the field has developed recently. However, it is so expensive and the manner of operation is so complex that it doesn't become popular. In this study, we tried to develop low-cost and user-friendly Field Survey Assisting System (FSAS) in natural environmental field with open source software.

In this study, the positional information was treated as the main survey item by FSAS. So we used Free and Open Source Software for Geospatial (FOSS4G). Then, to improve usability of FOSS4G, we developed a package called Open Cafe System (OCS) and FSAS was powered by OCS. OCS has two features to improve the usability for users of FSAS. They are Web-GIS architecture and wrapping of FOSS4G with content management system (CMS). Web-GIS stimulate users without technical knowledge to use the system because users can use Web-GIS with just web browsers which they are familiar with. CMS manages web contents integratedly. In general, CMS makes it easy for users without technical knowledge to use the system. In OCS, users work with interface made by CMS, without struggling with FOSS4G.

The architecture of OCS is shown in Figure. OSC is composed by two main components: OCS server and OCS client. In OCS server, FOSS4G applications and Drupal (CMS) work on Ubuntu OS. Spatial data is stored by PostGIS (spatial extension of PostgreSQL). GeoServer works as GIS server which supports WMS (Web Map Service) and WFS (Web Feature Service). SLD (Styled Layer Descriptor) describes the appearance of map layers. GeoWebCache accelerates the processing by caching request. Drupal works as user interface and manages FOSS4G applications integratedly. PHP scripts controls database queries. WMS and WFS works on web pages with OpenLayers. In OCS client, users access the server with web browsers or specific applications. Client devices are laptops, smartphones, PDAs, and so on. They can get web pages made by CMS with web browsers, or can use the functions of OCS server easily with optimized applications.

The workflow of a field survey with FSAS consists of three steps. First, users make a format before the survey. The format has information of the survey such as title, date, item, note, area of the survey and base maps. Because users can freely customize survey items, FSAS can be used in various fields such as forests and rivers. Second, users input data on the survey. They just input the location on the GUI map and value of items into the format, because the format has information of the survey. All data is stored into the same table on the database. Each data has fields of belonging format, location, and value of items. Third, users export data after the survey. They can choose the export file type from CSV and KML. In this way, they can manage and use data for each survey in the unified way.

To examine the utility of FSAS in various fields, we did field surveys on water quality and tree position as an application study of FSAS. The study area is spring water in Hadano (Kanagawa, Japan) and street tree of Itabashi (Tokyo, Japan). Citizens in those places survey water quality or tree position with FSAS. They inputted the obtained data into FSAS with Android smartphones and iPhones. Participants could browse the results of the survey on site with the client devices.

We had a questionnaire after the survey to get the users' impression of FSAS. From the results of questionnaire, we thought that FSAS was easy for participants to use, nevertheless they did not have technical knowledge. The function of inputting data and browsing the result on site assisted them. It is suggested that FSAS has high usability in various natural environmental fields.
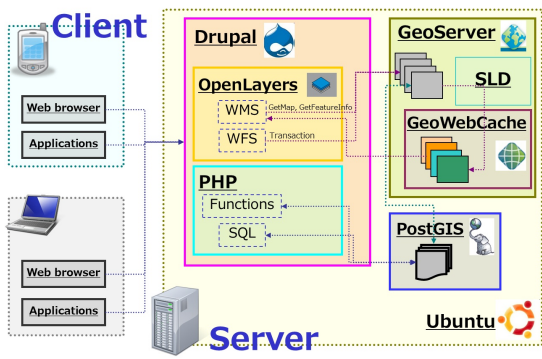
Keywords: field survey, digital data, GIS, FOSS4G, content management system, open cafe system

HTT005-03   Room:202   Time:May 25 14:45-15:00

Extraction of caldera rims from gravity data using GIS

OKY DICKY ARDIANSYAH PRIMA[1]*, Takeyoshi Yoshida[2]

[1]Iwate Prefectural University, [2]Inst.Min.Petr.Econ.Geol., Tohoku Univ

The Iwate-Miyagi Nairiku Earthquake caused a complex faulting along eastern foot and innumerable landslides on the southern flank of Mt. Kurikoma. The Neogene caldera structure around the mountain was considered to participate to these events (Nunohara et al., 2010). Assuming that calderas have regional depressions in the spatial distribution of gravity anomalies, Prima and Yoshida (2010) delineated caldera rims of Northeast Honshu by applying a hydrological analysis to the data. However, for some calderas, the interpretation of their rims may vary because preserved rim is not always obvious. Furthermore, the gravity anomalies contain noises that cause differences between the extracted and the estimated caldera rims. The amplitudes of the spectral distribution of gravity anomalies can be divided into three components: trends, signals and noises. The trend and signal components represent surface and subsurface structures below the seismic basement while the noise is considered as errors occurred in the generation of the data (Nozaki, 1997). In this study, a band pass filter was applied to the gravity anomalies to improve the extraction of caldera rims from the data. For gravity anomalies, this study used the data (Gravity CD-ROM of Japan, 2000) published by the Geological Survey of Japan. The gravity anomalies were corrected using 2.0, 2.3 and 2.67 g/cm^3 of assumed densities. In this study, gravity anomalies corrected using 2.67 g/cm^3 of assumed density was used for the analysis. Band pass filters with cut off wavelength ranging from 1 to 10 km were applied to the gravity anomalies. The lower cut off wavelength produces detailed edges of the extracted caldera rims while the higher produces rough edges. The calculations of band pass filtering and caldera rims extraction were conducted using GMT and ArcGIS. These calculations were automated to allow interactive observations for the changes of extracted caldera rims according to each cut off wavelength.

Keywords: Caldera rim, GIS, gravity anomaly, band pass filter

HTT005-04   Room:202   Time:May 25 15:00-15:15

Flood Disaster Risk Management in Ratnapura, Sri Lanka based on GIS and Remote Sensing Techniques

Pradeep Surantha Dassanayake[1]*

[1]SIS, University of Tsukuba

Introduction

Sri Lanka is prone to natural disasters commonly caused by floods, cyclones, landslides, droughts and coastal erosion for generations with increasing losses to life and property in the past few decades. Floods are more of a common occurrence in Sri Lanka than the other natural disasters. Flood has been one of the most costly disasters in terms of both property damage and human casualties in Sri Lanka.

As other less developed countries, Sri Lanka is in the initial stage of the adoption of geo-information for in disaster management although new world trends to Web GIS, real time warning system, satellite earth observation for rapid damage assessment, data standard and highly advanced Technologies that could be used for disaster management activities.

Motivation

For a number of reasons the most frequent choice should be protection from the flooding by means of physical control of the river, but there is also a need for a broader and comprehensive program for managing flood hazard in the study area. Flood protection has been helpful and must be continued. Side by side other preventive tools like effective planning for the growth of the city, creation of a computerized GIS database for the flood prone areas and a detail flood risk assessment mapping and zonation are required to minimize the harmful effects of flood hazard. Therefore, an attempt has been made to apply modern techniques like Geographical Information System and Remote Sensing for the assessment of flood hazard. The presence of risk assessment mapping will help the concerned authorities to formulate their development strategies according to the available risk to the area. Of course, the GIS and Remote sensing techniques can contribute to evaluate the environment and to minimize the risk of disaster.

Methodology

1. Evaluate the physical environment using remote sensing and GIS techniques (Terrain analysis, hydrological drainage analysis and other analysis).

2. Evaluate the social environment through the field work (interview the people, to know how they use their land, to know the governmental treatment like land use regulation or master plan).

3. Overlay the physical evaluation and social evaluation.

4. Design the optimal land use plan based on the both environmental analysis.

5. Share the optimal land use plan with people.

Keywords: Geographical Information System, Remote Sensing, Flood risk assessment, Vulnerability, Hazard mapping

HTT005-05　　　　　　　　　　　Room:202　　　　　　　　　　　Time:May 25 15:15-15:30

Hydrologic Response to Land use Change and its Impact on Coastal Ecosystem of Fiji

Ankita Dadhich[1]*, Kazuo Nadaoka[1]

[1]Tokyo Institute of Technology

Healthy coral reefs are a vital part of the coastal ecosystem and support a huge amount of sea life and fulfill a variety of human needs, like subsistence, fisheries, tourism and shoreline protection. These fragile coral reef ecosystems are rapidly deteriorating with intense anthropogenic perturbations in the river basins of northwest Viti Levu, Fiji, due to large terrigenous material run-off loads from the steeply-sloping watersheds. The cropland expansion has vastly altered the structure of natural watersheds and their ecosystems through accelerated conversion of forest land and marginal land to agriculture or urban area. Therefore, it is crucial to ascertain the temporal and spatial change pattern of coral cover and asses the environment factors, which directly/indirectly influence the reef ecosystem. This study focuses to find out intense and sustained environment pressures generated by anthropogenic activities and land use change on the coastal ecosystem using remote sensing and GIS. In this research benthic cover is analyzed temporally (1992-2007) and spatially to find out the impacts of terrestrial runoff from 14 adjoining agriculture dominated watersheds in the coastal area. To accomplish this task, an integrated modeling framework with land use change has been constructed to simulate the transport of runoff, sediment yield and nutrient pollution using ArcView interface based SWAT (Soil and Water Assessment Tool) model. The benthic cover change analysis using Landsat TM/ETM+ shows that coral cover reduced by 33.5% from 1992 to 2007 while the algae and seagrass cover increased by 139.3% and 70.6% respectively due to the fine sediments and nutrients carried by eroding sediments from the sugarcane fields. The land use change analysis indicates that maximum agriculture expansion is in small watersheds of the study area. Results reveals that during 1992-2007, forest land (27.04%) and shrubland/grassland (20.96%) was replaced by agriculture (46%) and barren land (2%) in small watershed (area 12.10 km2). Therefore, the hydrological response impact from these watersheds cannot be ignored as soil loss and nutrient loss are high, especially during the heavy rainfall event. In addition, Landsat data interpretations (1992-2007) for coral reef ecosystem also infer that there is an enormous increase in the degraded reef areas (59.39 %) around these coastal watersheds.

Keywords: Coral reefs, runoff, sediments, nutrients, remote sensing, SWAT

HTT005-06   Room:202   Time:May 25 15:30-15:45

Site Suitability Evaluation for Ecotourism using GIS & AHP: A Case Study of Surat Thani Province, Thailand

Khwanruthai Bunruamkaew[1]*

[1]University of Tsukuba

The present study aims to identify and prioritize the potential ecotourism sites using Geographic Information System (GIS) and Analytical Hierarchy Process (AHP) in Surat Thani Province, Thailand as a case study. The method used is the AHP which is integrated in ArcGIS. This study identifies the following criteria as indicators suitability within land ecosystem: landscape/naturalness, wildlife, topography, accessibility and community. The evaluating process for ecotourism site was conducted based on 9 chosen factors which are visibility, land cover/use, reservation/protection, species diversity, elevation, slope, proximity to cultural sites, distance from roads and settlement size. These factors were selected according to the professional opinions given. AHP was effectively used in order to calculate the detail of the factor and class weights. The methodology proposed was useful to identify ecotourism sites by linking criteria deemed important with actual resources of Surat Thani Province.
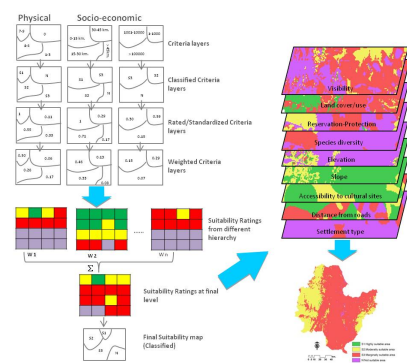
GIS-based model for multi-criteria land suitability evaluation for ecotourism

Keywords: Site Suitability Evaluation, AHP, GIS, Ecotourism, MCDM

HTT005-07   Room:202   Time:May 25 15:45-16:00

Aggregation planning for access network based on population distribution

Yu Nakayama[1]*

[1]NTT

In industrialised countries, population decline will occur in next decades. Japanese population is estimated to decline by 20% in next 30 years. Population decline tends to expand the inefficiency of infrastructure. Infrastructure plannings need to consider population distribution of the region.

Fiber to the home (FTTH) has been widely deployed for providing broadband access services in recent years. In Japan, FTTH occupies over 50% of broadband access service markets now. FTTH is expected to be deployed in rural areas with low subscriber density.

Access network planning has focused on urban areas. In urban areas, subscriber density is high because there are large population. In such areas, subscribers' lines are aggregated efficiently.

On the other hand, in rural areas, small population causes the inefficiency of aggregation. The same problem occurs when subscriber density declines along population decline in the decades to come. The inefficiency of aggregation increases deploying cost.

It is important to establish a planning method based on pupulation distribution. Subscribers' lines need to be aggregated efficiently anywhere. Especially, minimizing the deploying cost of the aggregation is important issue.

This study proposes the planning method which can minimize the aggregation cost by applying three types of aggregation depending on the subscriber density. The types of aggregation are as follows. They are shown in the figure.

(a)single aggregation
Single aggregation is existing aggregation type. Subscribers' lines are aggregated by large switches on every node. Each switch is connected to edge routers individually. This type is optimized for the areas with high subscriber density.

(b)cascade aggregation
Cascade aggregation is a proposed aggregation type. Subscribers' lines are aggregated by small switches on every node. Switches are mutually connected and compose ring networks. Each ring is connected to edge routers. This type is expected to improve the equipment efficiency in areas with low subscriber density.

(c)node-integration
Node-integration is the other proposed aggregation type. Subscribers' lines are not aggregated on nodes with insufficient number of lines. They are connected to another node and aggregated by any switch. Switches are connected to edge routers by single or cascade aggregation.

The planning method is based on a location-allocation model which is used to find mathematically the optimal location. It uses distribution of population and nodes and existing links as input layers. The number of subscribers' lines of each node is computed. Whether the node should be integrated and which size of switch should be applied are decided depending on the number of subscribers' lines. After that, it finds all combinations of the connections between small switches. For each combination, the optimal connections between switches and edge routers are found considering the existing links. Finally, it finds the optimal aggregation.

The proposed method was implemented into Quantum GIS (QGIS). QGIS is free and open source software for geospatial (FOSS4G). The method was implemented as the plugin of QGIS. It was written in Python. Shape files are read as input layers and. The calculation procedure is performed with QGIS API. Optimal solution is exported as shape files.

I did computer simulations in multiple scenarios. The scenarios have different population distributions. The simulation result shows that the proposed method can derive the optimal aggregation which can minimize the aggregation cost. It was suggested that the optimal aggregation differs from the population distribution. In urban areas whose population are large, the optimal aggregation is (a). On the other hand, the optimal aggregation is (c) in rural areas. Application of (b) and (c) in areas with low subscriber density reduces the deploying cost. (c) has more effect on cost reduction than (b). They are not suitable for urban areas because of inefficiency.

(a)

Central Office   ER   Large SW

Subscriber

(b)

Small SW

(c)

Small SW
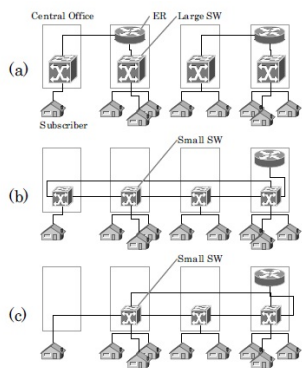
Keywords: access network, aggregation, location-allocation model, population decline

HTT005-08   Room:202   Time:May 25 16:00-16:15

Generating Method for Three-Dimensional Building Model with Mobile Mapping System Data

Takafumi Amano[1*], Shin Yoshikawa[2], Kimitaka Hirao[3]

[1]Graduate School of Eng., OIT, [2]Faculty of Eng., OIT, [3]Kansai Division, Pasco Corporation

In the field of landscape engineering, efficient and probable methods have been researched and developed to generate a digital city which is a city model made from three-dimensional computer graphics. The polygonal prism model, which is generated from the outline and the height of the building determined by the light detection and ranging (LIDAR) data or the number of the buildings stories, is mainly used to represent a building in surroundings. It is very easy to generate the polygonal prism model. However, this model cannot represent details of facades unless the texturing is applied.

In this study, the authors tried to generate a three-dimensional building model with details of facades by using the mobile mapping system (MMS) data as a point cloud. The data are acquired with three-dimensional laser scanners and GPS devices mounted on a vehicle.

The major information used in this study are the MMS data, the tracks of MMS and building outline data. The MMS data are point data. Each one has x, y and z coordinates and the GPS time with four decimal places by the second. The tracks of MMS are line data. Each one has a position of MMS (x, y and z coordinates) and the GPS time with one decimal place by the second. The generating process of three-dimensional building model, which proposed in this study, is as follows:
 (1) Creation of regression equation
Using the original MMS data (hereinafter referred to as P_{MMS}), the regression equation between the observation distance (x) and the interval of points (y) is derived through the least-squares method. This equation defines a threshold value. An equation $y<=0.1e^{0.165X}$ (Equation 1) is obtained from the mean values at three flat intersections in this study.
(2) Addition of observation distance
When a P_{MMS} is observed, the MMS vehicle position is estimated by the interpolation of GPS time and the observation distance of each P_{MMS} is obtained.
(3) Creation of lines
Lines are generated by connecting the P_{MMS} at the same GPS time.
(4) Removal of long links
The long line segments that do not satisfy Equation1 are excluded.
(5) Extraction of points from edges of objects
The points of the remaining line segments with the intersecting angles nearly 90 degrees are extracted as the points forming the edge of an object. The end points of lines are extracted as the points, too. It is now called P_{EDGE}.
(6) Input of outer line
It is required for the users to input the position of the outer wall lines referring on both P_{EDGE} and the building outline. The building outline is redefined based on the entered lines. The maximum height of P_{EDGE} around the entered line is temporarily assumed as the height of this building.
(7) Input of parapets lines
It is required for the users to input the line position of the parapet based on both P_{EDGE} and the building outline. The points are extracted again from P_{EDGE} around the end of the line. It is now called P_P.
(8) Presumption of parapet positions
After P_P are collected and sorted in an ascending order, P_P are divided into groups using Equation 1. The maximum and minimum values of the group are the top height and the bottom height of the parapet, respectively.
(9) Generation of surfaces
The surface models of buildings are generated from these data.

Based on the proposed method, the authors have succeeded in developing a system to generate semi-automatically rough three-dimensional computer graphics models of the building facade on GIS. However, the present model cannot be used for a bird's-eye view or a fly-through simulation used frequently in landscape simulation because it cannot reproduce the building roof. It should

be addressed to reproduce the roof in the near future.

HTT005-P01　　　　　　　　Room:Convention Hall　　　　　　　　Time:May 25 10:30-13:00

Considering spatial dependence in areal interpolation method based on eigenvector spatial filtering

Daisuke Murakami[1]*, Morito Tsutsumi[1]

[1]University of Tsukuba

Spatial data are often aggregated into spatial units. Because there exist many types of spatial units such as census units and grids, the difference in the spatial units among the spatial data often complicates the analyses. Transferring spatial data from one zonal system to another is useful for solving this problem. This process is called areal interpolation (e.g., Sadahiro 1999). We assume that areal interpolation is the conversion of spatial data from source units into target units.

Spatial dependence is a general property of spatial data, and it implies that data at nearby locations are similar whereas those separated widely are less similar. Thus, for accurate areal interpolation, it is quite natural to consider spatial dependence. However, there are no significant studies that have considered spatial dependence with respect to areal interpolation, except for Kyriakidis (2007), Gotway and Young (2007), and Mugglin et al. (1999). In addition, from the viewpoint of practical use, the methods proposed by these researchers are inferior to the conventional methods mentioned above. First, they are complex and difficult to implement. Second, their computational burden is large.

In this study, we propose a new areal interpolation method that is an extension of the regression-based method suggested by Flowerdew and Green (1992) in order to consider spatial dependence. A distinct advantage of our method is that it can be implemented by using ordinary least squares (OLS), which is most frequently used as a parameter estimation technique for the regression model, and can be easily handled with light computational burden. However, it is well known that OLS by itself is not suitable when the residuals of the regression model are spatially dependent. Therefore, we employ the eigenvector spatial filtering technique (Tiefelsdorf and Griffith, 2007). More precisely, we incorporate the technique into the areal interpolation method by adding the eigenvector of the geographic connectivity matrix as an explanatory variable to the basic model of regression-based areal interpolation. Because the constructed model itself is essentially identical to the traditional linear regression model, no specific procedures are required to obtain OLS estimators. Thus, as compared to other areal interpolation methods that consider spatial dependence, the proposed method has the advantages that it can be easily implemented and is computationally efficient.

Finally, in order to examine the effectiveness of the proposed model, we apply it to the aging ratio data of 2007 North Kanto area, Japan. In this study, the conventional regression-based method and the proposed method are compared, where the former does not consider spatial dependence but the latter does. The methods are applied to the areal interpolation of the aging ratio whose source units are the municipalities in 2007, and the target units are the municipalities in 1995. The predictive error of the proposed method is 7.63 percentage points less than those of the regression-based method in terms of the average differential between the observed and predicted values. This indicates that it is important to consider spatial dependence in areal interpolation.

Keywords: areal interpolation, spatial dependence, eigenvector spatial filtering

# Visualizing income disparity in Japan with spatial statistic method

Kazuki Tamesue[1]*, Morito Tsutsumi[1]

[1]University of Tsukuba

With the collapse of the bubble economy in the early 1990s, economic disparities have arisen both among the people and among the different regions in Japan. Well known tools for analyzing income disparity are the coefficient of variation and the Gini coefficient, which are widely used such as in the reports of the government or standard economic textbooks, but they can only grasp the overall degree of income disparity. Advancements in spatial analysis have led to the development of strong tools to explicitly consider spatial dependence and heterogeneity; however, no significant research has been carried out using such tools for analyzing the economic disparity at the municipal level in Japan. The objective of this study is to visualize the dynamic change of the regional income disparities in Japan during the period known as the "lost decade." The data used in the study are annual data collected at the municipality level during 1998-2007. Exploratory spatial data analysis (ESDA) and local indicators of spatial association (LISA) have been used to classify municipalities into categories and to identify local spatial clustering and spatial outliers composing the income disparity in Japan, respectively.

We first classify each municipality into four clusters according to the Moran scatterplot: high per capita income municipalities with high per capita income neighbors (hot spot), high per capita income municipalities with low per capita income neighbors, low per capita income municipalities with high per capita income neighbors, and low per capita income municipalities with low per capita income neighbors (cool spot). The hot spots are concentrated along the center of Japan, also known as the Pacific Belt Zone, and the cool spots are located in the north and south west of Japan. The regional distribution of the clusters seems to be stable during the decade; however, unstableness of the clusters in Hokkaido prefecture are indicated. We also calculated the Euclidean distances between the Moran scatterplot for each region to extract municipalities with peculiar movement in the Moran scatterplot through the decade, and succeeded in detecting not only regions with dramatic cluster transition but also regions with peculiar behavior staying in the same cluster.

To identify influential observations and spatial outliers, analysis based on LISA has been carried out. Local Moran's I is efficient for identifying regions with similar and dissimilar values, thus it is a good indicator to spot strong spatial clusters, and local Geary's c is efficient for the quantification of income inequality between each region, thus can be used to indicate the degree of (dis)similarity. During the decade, the distribution of the municipalities' local Moran' I value had become simple except the regions in Tokyo, Nagoya and Osaka still have high values. This means that the strong spatial clusters only exist in the main metropolitan areas. A similar result is confirmed in the distribution of local Geary's c values, meaning that almost all municipalities do not differ compared to their neighbors, and the regions in Tokyo are identified to be strongly dissimilar to neighborhood regions.
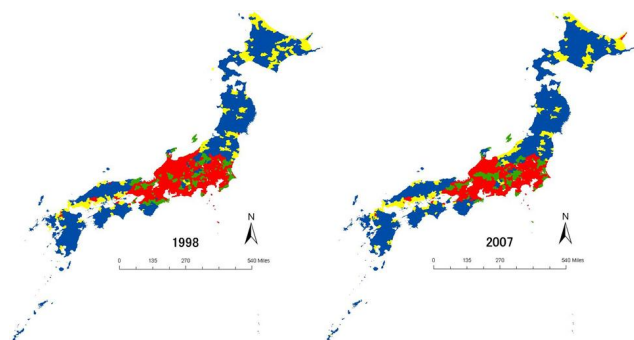
Distributions of the clusters

Keywords: income disparity, Moran scatterplot, local Moran statistic, local Geary statistic

HTT005-P03   Room:Convention Hall   Time:May 25 10:30-13:00

Evaluation of pan-sharpened image for human settlements mapping: A Case of South East Asia Cities

Koko Lwin[1]*, Yuji Murayama[1]

[1]Division of Spatial Information Science, [2]Geoenvironmental Sciences, [3]University of Tsukuba

Mapping the human settlements is essential for urban planning, disaster management and emergency preparedness and other humanitarian assistances. Effective disaster preparedness requires quantitative spatial distribution patterns of population in order to position emergency response centers and prepare food and shelter in the event of disaster. Mapping the human settlements from remote sensing data is cost effective and timely manners which is suitable for disaster management. This study reports the evaluation of human settlements mapping result using pan-sharpened image in order to improve the spatial and spectral properties of original low resolution remote sensing data.

Keywords: Pan-sharpened image, human settlements, South East Asia cities

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Sustainability of Agriculture Land Use in Eastern Bhutan

Loday Phuntsho[1]*, Takashi Oguchi[2]

[1]GPSS, GSFS, The University of Tokyo, [2]CSIS, GSFS, The University of Tokyo

Abstract

In Bhutan about 70% of the population live in rural areas based on agriculture farming and related activities. The eastern region occupies a major agriculture share. However, in recent years, the sector has been facing challenges in the form of land degradation, instability in productivity, crop damage, and issues of fallow land, leading to decline in agricultural land use. These challenges were implicated as a result of climate variability, especially fluctuations in temperature and erratic precipitation patterns although no detailed study exists. Against this backdrop this research measures the influence of climate variability on agricultural land use by analyzing- land use change (LUC) in eastern Bhutan from 1994 to 2005 in relation to biophysical and socio-economic factors [LUC = f (biophysical and socio-economic factors)], using GIS and the SPSS programs.

Given the importance of agricultural sectors, the sustainable utilization of limited arable land will play a critical role in sustaining rural livelihood and food security. The sustainability of agriculture is viewed mainly in terms of the capacity of an agricultural system to adapt and deal with stresses and to carry itself on. This study gives insights into the importance of addressing agricultural sustainability issues in a holistic manner, and finally provides some inputs towards developing strategies to deal environmental impact and changes.

Keywords: Agriculture land use, Climate variability, Eastern Bhutan, GIS, Sustainability

HTT005-P05　　　　　　　　Room:Convention Hall　　　　　　　　Time:May 25 10:30-13:00

DEM-based morphomoetric analysis of drainage basins in Mt. Danxia, Guangdong Province, China

wen zhang[1]*, Takashi Oguchi[2], Yuichi S. Hayakawa[2]

[1]Univ. Tokyo, [2]CSIS,Univ. Tokyo

Mt. Danxia is where the special term "Danxia landform" was coined. The landform is characterized by red-colored sandstones and steep cliffs, often providing a beautiful scenery. In recent years, the landform has been receiving international attention, and some of them were designated as the UNESCO World Natural Heritage. However, morphometric studies of Danxia landforms have been limited. Geomorphological characteristics of drainage basins in the Mt. Danxia area provide a key to understand the evolution of the unique landscape. Morphometric properties related to basin geometry (area, relief, relief ratio, slope, and hypsometry) of subwatersheds in the study area were quantitatively examined using the ASTER GDEM. We found high spatial variations in their morphometric properties throughout the whole basin. Some possible effects of tectonics and lithology on the basin geometry are inferred. Basin geometry of the subwatersheds can also be related to their relative position within the whole basin, i.e., upstream or downstream along the main stream, perhaps reflecting the geomorphological evolution of the whole basin. The hypsometric curves of the subwatersheds with concave and convex shapes may indicate the differing stages of the subwatersheds, some of which seem to have already reached the equilibrium (mature) stage.

Keywords: Danxia landforms, Morphomety, Hypsometry, DEM

Geospatial analysis on topography and archaeological sites in Kayseri, Turkey: A preliminary result

Yuichi S. Hayakawa[1*], Ryoichi Kontani[2], Hiroshi Sudo[3], Yuji Yamaguchi[4], Fikri Kulakoglu[5]

[1]The University of Tokyo, [2]Notre Dame Seishin University, [3]Okayama Orient Museum, [4]Doshisha University, [5]Ankara University

Landform is a fundamental factor that affects cultural activities of human beings, and such effects on the artificial remains such as road position and settlement distribution can more strongly be reflected in ancient periods than in the modern periods. Here we investigate the spatial relationships between archaeological settlements (B.C. 3000-1000) and landforms in Kayseri region in central Anatolia Highland, Turkey. The data of landforms were acquired by both the field measurement and remote sensing techniques: The field topographic measurement comprise the use of LRF (Laser Range Finder) and DGPS (Differential Global Positioning System), which enables on-site quick (10^1-10^2 minutes for a 10^4-10^6 m^2 area) acquisition of detailed topographic data with a submeter-order accuracy. Some of these detailed topographic data suggest the existence of buried buildings and walls, which had never been identifiable by existing low-resolution topographic datasets. Satellite imagery data are also used to obtain the broad-scale topographic data in the area. A DEM produced from ALOS PRISM imagery data is used to identify characteristic landforms around the archaeological sites. Using these materials we discuss the historical, temporal changes in the archaeological site locations in relation to the landforms.

Keywords: LRF, DGPS, DEM, ALOS PRISM, geoarchaeology

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Establishment of interoperability Web-GIS in water environments by Mobile-phone-based Database for Water Quality

Rui Fukumoto[1*], Kazuhiko Nakamura[2], Yu Nakayama[2], Syuntaro Okauchi[3], Kazana Kikuchi[4], Takuya Shirahige[4], Taichi Furuhashi[5], Kouichi Sayama[6], Futaba Kazama[7]

[1]WingBase Inc., [2]OpenConcierge, [3]Kyorits Chemical Check Lab., Corp., [4]Hitechs Inc., [5]CSIS The University of Tokyo, [6]Water and Greenery Research Association, [7]University of Yamanashi

1. Background and study objective

Long Term Ecological Research Network (LTER) [1] is widely watched as a view of environmental monitoring in global scale. In particular, LTER is able to capture a slow change in environmental issues as a precondition to make continued monitoring in Long term. On the other hand, they need to be huge costs so that we try to observe, analysis and transmission of information in many observation site. The key point of continued monitoring in Long term is how to assume including cost between citizens, ministry, industrials and academy. It is desirable that citizens investigates familiar water environments, organize results obtained, sort out the problems involved and makes it to practice activity. [2]One of the trials is Nationwide simultaneous survey of familiar water environments. [3]Citizen 's group has problems which are cumbersome management of the data, their activity can be closed and ill-attended in young person.One of the solution against these problems is Web-GIS(WG) facilitating citizen 's activity. There are varied databases for water environments in internet. Bur derelict sites are not negligible except in the case of sites managed by ministry. Another problem are difficult operation and less well-known. We address the challenge to develop by Water-Voice (WV) [4] which is the application can be registration and reference investigation results on investigate site.It 'll cost huge to develop functions as WV each WG for water environments.The purpose of research is validating the availability by development of interoperability of holding contents between WV to WG in existence within OGC interoperability technology. [5]

2. Methods

We adopted Open cafe system [6] which is FOSS4G package and can use XML in data passing in internet.Target WG are WV covers Tama-river basin and Yamanashi-water-net(YAN) [7] covers all area in Yamanashi prefecture.We adopted iPhone-OS and web browser which are Internet Explorer, Fire Fox and Google chrome for client applications.

3. Results and discussion

The system architecture can be developing interoperability in different WG in the figure.All user have to do is access WV server by client application with location information and to be automatically selected registration destination and reference destination, we call Contents and to be confirmed current basin by polygon data of basin.This system can be interoperate between WV to YAN can define the attribute for the consistency different WG 's items of data by preparation Contents map table in WV server and equip the PHP function which are can be permitted registration to database and reference database from outside server request in YAN server. Using Web Process Service, it can be used for various analyses by make data which are Web Coverage Service distribution in Raster Ring, aggregate input data which are based on interpretation of Contents Map in Contents Ring and define region by polygon data which are Web Feature Service distribution in Vector Ring.

Our conclusions are following.

1. It can be shared new function to be equipped in different WG and cut cost down.

2. It can be used for various analyses from shared databases.

3. It can be registration and reference data under field survey not required expert knowledge to user.

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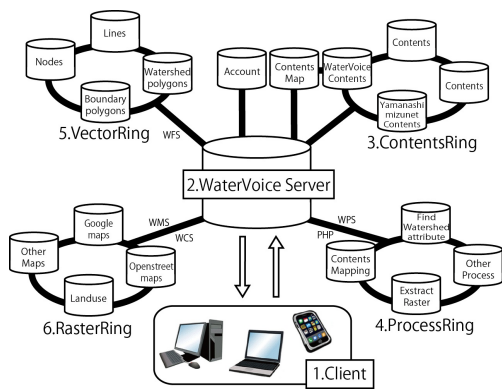
Keywords: mobile-phone, water quality database, web-GIS, interoperability, FOSS4G, water environment