Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

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-

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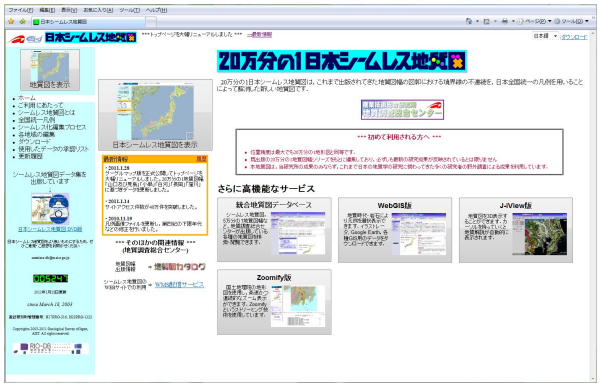
Seamless Digital Geological Map of Japan (http://riodb02.ibase.aist.go.jp/db084/index.html) is a digital geological map in scale of 1:200,000 published by Geological Survey of Japan (GSJ), National Institute of Advanced Industrial Science and Technology (AIST). It has a structurally and stratigraphically 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

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

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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.

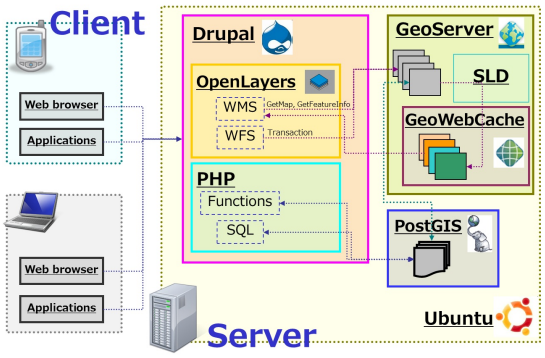
In this study, the positional information was treated as the main survey item by FSAS. So we used Free and Open Source Software for Geospatial (FOSS4G). Then, to improve usability of FOSS4G, we developed a package called Open Cafe System (OCS) and FSAS was powered by OCS. OCS has two features to improve 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

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

Extraction of caldera rims from gravity data using GIS

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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

Japan Geoscience Union Meeting 2011
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Flood Disaster Risk Management in Ratnapura, Sri Lanka based on GIS and Remote Sensing Techniques

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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

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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

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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

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

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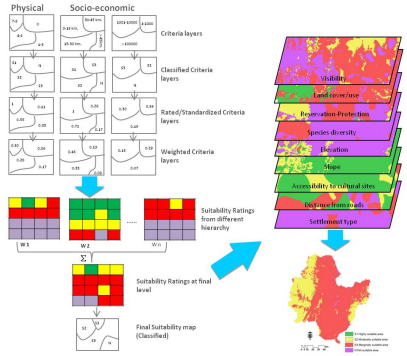
The present study aims to identify and prioritize the potential ecotourism sites using Geographic Information System (GIS) and Analytical Hierarchy Process (AHP) in Surat Thani Province, Thailand as a case study. The method used is the AHP which is integrated in ArcGIS. This study identifies the following 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

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Aggregation planning for access network based on population distribution

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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.

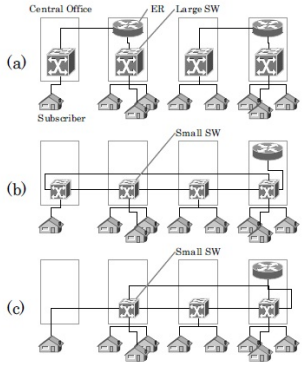
(c)node-integration

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.



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

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

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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.

Keywords: building model, digital city, facade, MMS, probability