

Incision rate of the Oshika-gorge, Tottori-prefecture, estimated from Terrestrial in site Cosmogenic Nuclides dating

Miho Shinnoki¹, WATAKABE, Takuma², MATSUSHI, Yuki³, Hiroyukitsuzaki⁴, KODAMA, Yoshinori^{5*}

¹JA Bank Tottori, ²Graduate School of Regional Sciences, Tottori Univ., ³DPRI, Kyoto Univ., ⁴MALT, Univ. of Tokyo, ⁵Fac. Regional Sciences, Tottori Univ.

Incision rates of the Oshika-gorge, in Misasa, Tottori-prefecture were estimated from Terrestrial in site Cosmogenic Nuclides (TCN) dating of the strath terraces developed at a bend of the gorge (N35 22'18", E133 58'26"). The bedrock of the gorge consists of granite. At a surveying point, 7 terraces and present streambed were distinguished and we collected 8 samples of each surface site for TCN surface exposure dating. According to Kohl and Nishiizumi(1992), we extracted ¹⁰Be and ²⁶Al. Measurement of ¹⁰Be/⁹Be and ²⁶Al/²⁷Al ratios by accelerator mass spectrometry was undertaken at the Micro Analysis Laboratory, Tandem accelerator (MALT), the Univ. of Tokyo. Exposure ages of each terrace calculated from ¹⁰Be/⁹Be ratio and ²⁶Al/²⁷Al ratio gave close agreement with each other. Surface exposure ages of two strath terraces were calculated as No.1 strath terrace (relative height, 11.21m): 57.2±3.33 kyr and No.7 strath terrace (relative height, 1.64m): 10.4±0.80kyr. An incision rate of the Oshika-gorge at the surveying site for last 60kyr is 0.2 m/ kyr (0.2 mm/yr).

Keywords: incision rate, Oshika-gorge, strath terrace, TCN ages, dynamic equilibrium, Misasa, Tottori prefecture

Quantitative determination of erosion rates in humid region using depth profiles of in situ-produced Be-10 and Al-26

NAKAMURA, Atsunori^{1*}, YOKOYAMA, Yusuke¹, MIYAIRI, Yosuke¹, SHIROYA, Kazuyo², Hiroyuki Matsuzaki³, SUZUKI, Atsushi²

¹Atmosphere and Ocean Research Institute, University of Tokyo, ²National Institute of Advanced Industrial Science and Technology, ³Department of Nuclear Engineering and Management, The University of Tokyo

Quantitative determination of erosion rates is important across a diverse range of disciplines in geology, geomorphology, and biogeochemistry (Granger and Riebe, 2007). Yet rates of erosion have until recently been difficult to quantify over long timescale. Measurements of in-situ produced terrestrial cosmogenic nuclides (TCN) allow us to understand earth surface process quantitatively (Goss and Phillips, 2001). It has been successfully used to provide erosion rates of bedrock in arid regions where slow erosion process take place (e.g. Cockburn et al., 1999). On a global scale, environmental parameters such as mean annual precipitation have been used to explain erosion rate variability (Bierman and Caffee, 2002). However, the relationship between erosion rates and precipitation is still under debate due in part to scarcity of data from humid regions. In addition, erosion rates deduced from drainage basins, which is the only method to quantify erosion rates in humid regions, are strongly affected by basin slope (Riebe et al., 2000). Therefore, different approach to determine the erosion rates in humid regions is required to corroborate findings from arid regions. Here we present hilltop depth profiles of in situ-produced ¹⁰Be and ²⁶Al from Japan. Due to such sampling location, the contribution of basin slope should be minimized, allowing a direct comparison to studies of bedrock erosion rates in arid regions. When applying TCN-based erosion rates in mid latitude humid regions, where granitic saprolite is distributed, density uncertainties play an important role in determining erosion rate. The aims of this study are (1) to develop a model for TCN depth profiles, based on actually measured density in granitic saprolite, and (2) to assess the correlation of erosion rates and precipitation. These data indicate a link between earth surface process and climatic condition.

Keywords: cosmogenic nuclides, erosion rate, climate

Signatures of ESR signals observed in quartz of Kizu river sediments and of host rocks

NOSOHARA, Yoshihiko^{1*}, TOYODA, Shin², TAKADA, Masashi³, SHIMADA, Aiko⁴

¹Department of Applied Physics Okayama University of Science, ²Department of Applied Physics, Faculty of Science, Okayama University of Science, ³Department of History, Sociology and Geography, Faculty of Letters, Nara Women's University, ⁴JEOL RESONANCE Inc.

Paramagnetic lattice defects in quartz have recently been used as tracers to study the transportation of sediments on the surface of the earth especially on the origin of aeolian dust (e.g. Toyoda and Naruse, 2002), like isotopes have been used. Studies on aeolian dust utilizes only the E_1' center while impurity centers were shown to be other useful signatures in the studies of river sediments (Shimada, 2008).

The present research aims to characterize sediments of Kizu river by analyzing ESR signals in quartz including the E_1' center and the impurity centers.

We collected twenty Kizu river sediment samples and granite samples which are possible sources of river sediments. The samples were sieved to 1000-500, 500-250, and 100-250 micrometers. Quartz grains were extracted from each fraction by chemical treatment and density separation. The quartz samples were heated at 400⁰C for 1 h to erase the inherited ESR signals before gamma ray irradiation. ESR measurements were performed at room temperature and at 81 K to observe E_1' and Ge, and Al and Ti centers, respectively.

The impurity centers were enhanced by gamma ray irradiation. The formation efficiencies of the signals at the origin were obtained, which probably correspond to impurity concentrations in quartz. The E_1' center was observed after heating the sample irradiated to 2.5kGy at 300⁰C for 15 min. The formation efficiencies of impurity centers and the intensity of the E_1' center were plotted against the geographical positions to find that there are several positive and negative correlations between those efficiencies and intensity.

If the sediment is a mixture of two sources, we will be able to find the mixture ratio by analyzing the sources and the sediment. We will perform further analysis to discuss the origins of the sediments with this basis.

Keywords: Kizu river, ESR, River sediments, quartz

Human impact on Bedforms of the Mid-Arakawa, Central Japan

MACHIDA, Takahisa^{1*}

¹Graduate School of Geo-environmental Science, Rissho University

I carried-out continuing observation of the changes in river-bed landforms in the alluvial-fan reaches of the mid-Arakawa. Destruction and reconstruction of a weir and a stepwork for irrigation induced the instability of sediments which resulted in the development of alternate bars and transverse bars with imbrication structures downstream. It is interpreted as response of fluvial system to human impacts.

Keywords: Human impact, River-bed form, Alluvial fan, Dynamic equilibrium, Fluvial system

A geomorphological project about the seismic barrier system around Lake Furenko

NANAYAMA, Futoshi^{1*}, WATANABE, Kazuaki¹, SHIGENO, Kiyoyuki², ISHIKAWA, Satoshi³, Shigeto Inokuma⁴, IKEDA, Yasuo⁵

¹AIST, ²Ibaraki University, ³Kyushu University, ⁴Nemuro City Museum of History and Nature, ⁵Hokkaido University of Education

There is an active barrier system around Lake Furenko in eastern Hokkaido. In general, the barrier system is a typical depositional system during transgression stage, however, many regions of Japan is a regression stage since 5000-6000 years ago. There are two major reasons about this issue. First, sea level is almost stable since 5500 years ago in this area. Second, this area has been affected by seismic activity of the Kuril subduction zone. The last unusual earthquake caused in the 17th centuries and this area has been subsided at a rate of 8.5mm/year. We want to clarify detail sedimentological and geomorphological process of the Furenko barrier system in the next three years.

Keywords: Lake Furen, seismic barrier system, unusual earthquake, transgressive stage, sea level change, eastern Hokkaido



Discovery of submerged karst topography in Nagura Bay, Ishigaki Island by broadband multibeam bathymetric survey

KAN, Hironobu^{1*}, Kensaku URATA², NAGAO, Masayuki³, Nobuyuki HORI⁴, Tomoya OHASHI¹, Yosuke NAKASHIMA⁵, GOTO, Kazuhisa⁶, YOKOYAMA, Yusuke⁷, SUZUKI, Atsushi³

¹Okayama University, ²Osaka University of Economics and Law, ³AIST, Geol. Survey of Japan, ⁴Nara University, ⁵Ariate National College of Technology, ⁶Chiba Institute of Technology, ⁷University of Tokyo, AORI

The existence of submerged exo-karst is pointed out by aerial photographs or topographic map of shallow seas (e.g., Hori 1996). However, most of these submerged karst identified by aerial exposure of high portion. There is no report on submarine topography of submerged karst area. The broadband multibeam survey was conducted in the central area of Nagura Bay, Ishigaki Island in the southern Ryukyu Islands. The sounding results are visualized at a lateral grid resolution of 1m. The observed submarine topography shows the development of various types of karst in extensive area.

The survey was carried out in August 2011 using a broadband multibeam sounding system R2Sonic 2022. This system is a shallow-water multibeam echo-sounder with selectable operating frequencies within the 200 to 400 kHz band and variable swath width from 10 to 160 degree. Within the acoustic sector, 256 receiver beams were formed using 1 degree across beamwidth x 1 degree along beamwidth. It may also rotate the swath sector either port or starboard side of the vessel. The main part of the sonar has a vertical resolution of 1.25cm. The system is operated with Hemisphere VS111 GPS Compass and Teledyne TSS Dynamic Motion Sensor DMS-10. The accuracy of VS111 GPS Compass is 0.6m in distance and 0.15 degree in direction when placing A30 and A20 antennas at 1m interval. The accuracy of DMS-10 Motion Sensor is 0.07 degree in roll and pitch, and 5cm in heave. The vertical accuracy of the system is around 5 to 10cm. The survey and data processing are carried out by the hydrographic survey software Hypack 2010. The visualization of the 3D bathymetry model is conducted by IVS 3D Fledermaus. In this research, we confirmed the observed submarine topography and the sedimentary features by SCUBA diving surveys.

Convex and concave topography consisted by closed contours is visualized in the surveyed area. The similar topography is not formed by accretion or sedimentation under the submarine environment such as coral reef formation. Because of the closed drainage, it is recognized as karst, the topography formed by groundwater flow. The following five karst types are recognized in the surveyed area. These types may reflect the difference of karstification process and stage. 1) doline karst, 2) compound doline (uvala) or mega-doline, 3) cockpit karst, 4) polygonal karst, 5) fluviokarst. SCUBA diving observations suggest the Holocene reef and reef sediments are accumulated on the submerged karst to form "cover karst" in Nagura Bay. The small-scale karst landform such as karren may buried in this covering process.

According to the aerial photographs, the shallow marginal area of Nagura Bay also consists of the submerged karst. We suggest that the Nagura Bay extent of 6 x 5 km is the largest submerged karst in Japan. The size is equivalent to Minami Daito Island in the Phillipine Sea and Hiraodai Plateau in northern Kyushu Island.

Keywords: submerged karst, coral reef, broadband multibeam echosounder, Ishigaki Island, Ryukyu Islands

A History of Mass Movement at Gangneung area, Eastern Coast of Korea, Since the Middle Holocene

PARK, Ji Hoon^{1*}

¹Dept. of Geography Education, Kongju National Univ., Korea

This study intends to reconstruct the history of mass-movement occurrence since the Middle Holocene in Gangneung area, east coast of Korea. For this purpose, the Sacheoncheon basin and the Yeongokcheon basin where large-scale landslides occurred particularly due to typhoon Rusa in 2002 were selected. Detailed field observation revealed that inorganic layers of hillslope origin and organic layers of former humic topsoil or swamp origin alternated in the deposits of the river terraces, floodplains and the present river beds along the uppermost stream. The upper surface of the organic layer indicates the date of colluvial event which is recorded by the overlying inorganic layer. Stratigraphic investigation of the deposits assisted by radiocarbon dating of organic layers enabled to point out the following results:

(1) On the uppermost valley bottom at Gireogigol (Loc. 1), mass movement occurred 2 times between 740yrB.P and 260yrB.P. and 2 times after 260yrB.P., while in Seokgugol (Loc. 2), the occurrence during recent 6,700 years was mass movement was about 10~20 times.

(2) On the backslope of river terraces as Loc. 3, mass movement occurred at least 1 time in the period between the formation of river terrace and about 2,000yrB.P. and at least 1 time after about 430yrB.P.

(3) On the backslope of floodplain as Loc. 4, mass movement occurred at least 1 time after around 2,800yrB.P.

(4) On the backslope of the present river bed as Loc. 5, mass movement occurred at least 1 time before A.D. 1869 and at least 3 times after the A.D. 1869.

From the above facts it is concluded that mass movements occurred several to scores of times after the Middle Holocene in the investigated area.

Keywords: Gangneung, Holocene, valley bottom, mass movement, river terrace, floodplain

Visualization of 3D crustal motions of Japan

KATO, Tadayoshi^{1*}, HARADA, Yasushi¹

¹School of Marine Science and Technology, Tokai University

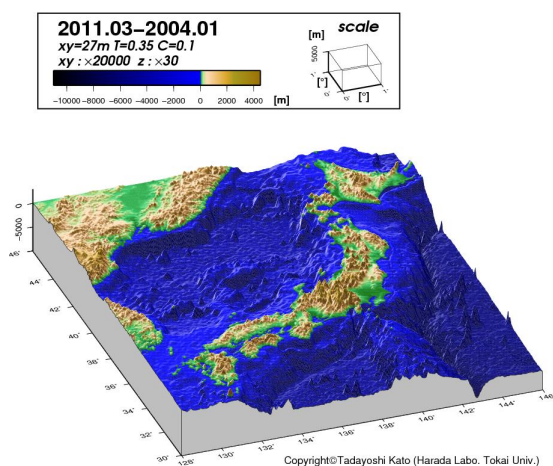
After 3.11 earthquake in Tohoku, Japanese people realize that they do not know much about crustal deformation in Japan continuously occurring and they do not know how to prepare for big earthquakes. One of the reasons of this problem is that crustal deformation is so slow that people can not understand how Japan is continuously deforming. The GPS observation is one method that can detect this kind of slow motions, and the Geographical Survey Institute of Japan(GSI) has about 1400 GPS stations over Japan to observe Japanese crustal deformations. If those deformations are easy to understand, people could prepare much better for big earthquakes in the near future.

However, time series plotting or vector arrow figures of the GPS data are sometimes not easy to understand the three dimensional deformation with time. In this study, we created 3D animation for Japanese crustal deformation using GPS data obtained by GSI, and make it easier for people to understand the Japanese crustal motions. The GSI already had created 3D animation of Japan for horizontal motion of only limited time and area, whereas we can make animations for three dimensional deformation of any given time and area if the GPS data are available. The newly created animations helped to understand the detailed crustal deformation in Japan.

We compared our results to a 100 years leveling data of Japan and the geological data for about two million years. In spite of time differences, a lot of similarities can be seen on the pattern of deformation of Japan, and amount of crustal motions were comparable between GPS data and leveling data.

By watching these animation, we hope people to understand how earth's crust is moving, and how Japan is deforming with earthquakes.

Keywords: GPS, Crustal motion, Visualization



Stereoscopic Topographic Map Synthesized from Digital Elevation Model

YOKOYAMA, Ryuzo^{1*}, SHIRASAWA, Michio¹, IMAIZUMI, Toshifumi²

¹Yokoyama Geo-Spatial Information Lab., ²Tohoku University

A new method for visualizing topographic maps in a 3-dimensional mode, called digital stereoscopic topographic map (DSTM), was developed. By referring to digital elevation model, parallax difference at each pixel of DSTM is adjusted to a specified scale and E-H ratio (ratio between elevation and horizontal distance). One of the advantages of DSTM includes the distribution of thematic characteristics versus elevation in one image. For example, by a stereoscopic slope map, to which the DSTM is applied to a slope map of ground surface, we can interpret ground surface distribution versus elevation simultaneously. DSTM can be printed as anaglyph images to look conveniently, but also directly adopted to regular electronic 3D display devices. The other advantages and applications of DSTM will be introduced by our colleagues in the succeeding oral and poster sessions.

Keywords: Digital elevation model, Topographical feature, Digital stereoscopic topographic map

Applying digital stereoscopic topographic maps to geomorphological and geological interpretation

IMAIZUMI, Toshifumi^{1*}, YOKOYAMA, Ryuzo², MIYAUCHI, Takahiro³, KAGOHARA, Kyoko⁴, SHIRASAWA, Michio²

¹Graduated School of Science, Tohoku University, ²Yokoyama Geo-Spatial Information Lab., ³Graduated School of Science, Chiba University, ⁴AIST

Thematic topographic maps have developed by the progress in analysis using digital elevation model (DEM) and have made clear representation possible. Such situation is supported by the supply of 250 m, 50 m and 10 m mesh DEM arranged by Geospatial Information Authority of Japan (GSI) and higher resolution 5 m, 2m and 0.5 m mesh DEM gained by laser profiler (LP) by private aerial survey companies. DEM-based analyses for topographic representation are various and product contour colored contour map, shaded map, relief map and their 3D map. Our digital stereoscopic topographic map (DSTM) is mainly composed of slope map and openness map, and they are three dimensionally represented by anaglyph image according to the analytical and display method by Yokoyama et al. (2012). These are characterized as follows.

(1) Digital stereoscopic slope map directly shows reliefs and geologic structures. Scarps, such as terrace scarps and fault scarps, are distinguished using high resolution DEM. Thus, we can classify topographic units and fault interpretation, putting results on maps and discussing or crosschecking results on screens by plural persons.

(2) Surfaces controlled by lithology and geologic structures are reflected by slopes more than reliefs. We can easily interpret structural topography among large scale geologic structure, just as if we view it in non-vegetated arid region.

(3) Digital stereoscopic openness map emphasizing valley and ridge lines clearly shows displacement reference topography, especially strike-slip fault topography compared to ordinal toposheets. High resolution LP-based openness map help us to interpret strike-slip offset streams. Besides, the openness map is effective to identify dissection, drainage pattern and catchments in hilly lands.

Keywords: Digital elevation model, Digital stereoscopic topographic map, Digital stereoscopic slope map, Digital stereoscopic openness map, Interpretation of geomorphology and geology

Spread topography in Japan

NAGATA, Hidehisa^{1*}

¹Fu Sui Do co. Ltd.

Spread which is defined that subsidence, rotation and disintegration of overlying hard strata due to flow of underlying soft ones, is a one of types of landslides. In Japan, a few cases including ones induced by earthquake were reported. Possible topography due to the spread in Japan is introduced preliminarily. The followings may be the cases: a) southern part of Okinawa Island, and eastern islands of the Katsuren Peninsula, b) Kuwana city, Mie Prefecture, c) Mino highland, Gifu Prefecture, d) Ichihasama River basin, southern foot of Kurikomayama mountain, Miyagi Prefecture, e) northern foot of Karibayama mountain, Hokkaido. These cases have the common geological structure that hard rocks like welded tuff (c, d), lava (e) and limestone (a) lie extensively and most flatly on the soft rocks such as mudstone and tuff, other than (b) that is perhaps triggered by earthquake. The spread topography as shown here is probably distributed everywhere in Japan. Although some cases are recognized as active faults topography, the recognition should be done carefully.

Keywords: spread, landslides, active faults

Dissection process of hill around Mobara in Chiba pref.

MOKUDAI, Kuniyasu^{1*}

¹Pro Natura Foundation Japan

The dissected hills and valley is distributed around Mobara city in the southeastern part of Chiba Prefecture. The landform are affected the stratum and sea level change.

Keywords: Kazusa hill region, Kazusa Groups, valley

A study on the effectiveness of flood prevention projects in the Nakagawa basin, central Japan

MATSUZAWA, Takahiro^{1*}

¹Dep.Civil and Env. Eng.

The purpose of the present study is to verify the effectiveness of flood prevention projects for a certain river and to convey the information to citizens. To fulfill the objective, the past and current recorded data relating to the Nakagawa River were compared. Three past observation points of pre-projects and two current observation points after the projects were selected. Firstly, the latitude and longitude of these points were investigated by Google Earth. The location of the five points was then placed on the map by using GIS software. Secondly, change in the water level of every 12-h interval after a rainfall of the present river and the past river was examined and the rate of the change in water levels during and after rainfalls were also compared. These investigations revealed increasing of water levels of the past river during the rainfall and decreasing gradually after the rainfall, whereas decreasing of water levels of the present river even during the rainfall and also decreasing the level with noticeable fluctuation after the rainfall. It is considered that the flow discharges and water levels of the present river can be effectively controlled not only by natural way but also by flood prevention projects such as retarding reservoirs and drainage canals.

Keywords: Nakagawa river, GIS, flood prevention projects

Fluctuations of water level in the riverbed in 2011 in the upper reaches of the River Azusa, Central Japan

SHIMAZU, Hiroshi^{1*}

¹Rissho University

The upper reaches of the River Azusa, central Japan, is a braided river with gravel bed. Yearly mapping of the riverbed micro-landforms revealed that channel migrations and landform changes in the active riverbed occurs once every one or several years. To discuss the landform changes of the riverbed in the upper reaches of the River Azusa, photographs were taken at 10-minute or 30-minute intervals in the daylight between 3 July and 4 October using the GardenWatchCam made by Brinno Inc. The camera was set on the slope which can overlook the riverbed. Channel migration occurred before camera setting. It was probably caused by the 10 May and/or 22 June floods. After camera setting three flood events were observed on 4 July, 23 August and 20 September. On 4 July in the Baiu rainy season and on 20 September by a typhoon, water level of the main channel rose 0.5meters and 0.7 meters, respectively. During these events no landform change but slight lateral erosion occurred. Although the daily rainfall on 20 September was much larger than that on 4 July, the maximum depths of the main channel of the two flood events were the same. This shows that heavy rain event after the Baiu rainy season does not cause the extreme rise of the water level and that major landform change occurs only in the Baiu rainy season.

Keywords: riverbed, landform change, water level, River Azusa, Kamikochi

Upper limits of tsunami going upstream along the rivers in southern Miyagi and northern Fukushima Prefectures.

SAIJO, KIYOSHI^{1*}

¹Miyagi University of Education

Upper limits of tsunami going upstream along the river channels in coastal areas of southern Miyagi and northern Fukushima Prefectures, at the time of the 2011 off the Pacific coast of Tohoku Earthquake, were determined on the basis of the field observation. The results suggest that some factors such as river channel inclination, geomorphic settings, and landuse control the distances of tsunami going upstream.

Keywords: The 2011 off the Pacific coast of Tohoku Earthquake, Tsunami, River, Miyagi Prefecture, Fukushima Prefecture

Detection of linearments in the southern part of Iwaki City using a LiDAR data

IWAHASHI, Junko^{1*}, SEKIGUCHI Tatsuo¹, ONO Yasushi¹, TAKAHASHI Noriyo¹

¹GSI of Japan

We detected the linearments in the 826 km² area of the southern part of Iwaki City, in the region where Yunodake Fault and Idosawa Fault are located, using digital images created from a 2-m LiDAR DEM. The linearments were traced on a computer screen by fully-zoomable images, which are frequently 1:10,000 scaled images. We digitized all linearments except for artificial features, and saved the data as a shape file. The linearments are arranged in four groups: 1) earthquake surface faults caused by the earthquake in April 11th 2011 (M 7.2) and traces which is assumed to be the extension of the fault 2) other fault traces 3) linearments caused by landslides 4) structural geomorphology. We also created a summit level contour map from the LiDAR DEM, and compared with the known faults which include the earthquake surface faults.

Keywords: Iwaki, Yunodake Fault, Idosawa Fault, LiDAR, linearment, summit level map

The difference land process of the radioactive material by the soil erosion from various land use divisions

YODA, Hiroki^{1*}, ONDA, Yuichi¹

¹Graduate School of Life and Environmental Sciences

The Fukushima Daiichi power plant accident has released large amount of radioactive materials to the atmosphere. Since then we are being monitoring the radioactive material distribution by soil erosion in different land use types (moderate slope tabako field, steep hill slope, grass land, grazing land and young cedar forest stand) in Yamakiya-Kawamata town, Fukushima prefecture., Stainless plat was used to construct runoff plot per land use type. At each erosion event, eroded materials were collected in the outlets of each plot and the radioactive materials contents were determined using gamma-ray spectrometer. Within the observation period (July 17 to September 4, 2011), results indicates that large volume of outflow ($717 \text{ m}^3 \text{ ha}^{-1}$) was recorded from grass land use type. Moderate slope of tabako field had shown the highest values in sediment load (920 kg ha^{-1}) and inventories of both ^{137}Cs (1.0 kBq m^{-2}) and ^{134}Cs (1.2 kBq m^{-2}). The differences of sediment load and radioactive materials among the land-use types might be partly because of the difference in slope and land cover types. For example, the smallest amount of outflows in both sediment and radioactivity were obtained from young cedar forest stand where the canopy, undergrowth and tick litter layer on the forest floor prevent the mobilization of radionuclide coded soil materials which ends lowest outflow amount.

Keywords: Cesium-137, Cesium-134, Radionuclides, Soil Erosion, Gamma-ray Spectrometer, Canopy

Development of a Grid-based Landscape Evolution Models and Application to Actual Topography

INOUE, Shin^{1*}, TANAKA, Yasushi²

¹Dia Consultants Co.,Ltd, ²Department of Geography, Komazawa University

We developed a simple and widely useable Landscape Evolution Models (LEMs) to investigate Japanese actual topography and we examined influence of differences of coefficients of a river and sea erosion. As a result, this LEMs suggests that channels are meandered when the drainage index is large and it is consistent with previous research. However, this model implies that the formation age and elevation of paleo-shoreline shift by the area and it is not consistent with previous insights. In order to consider whether it actually occurs or not, we must investigate actual topography and geology. The LEMs is a tool to visualize the idea about landscape evolution based on many topographical researches. Application of LEMs to actual topography means verifying the idea. Therefore, developing LEMs and applying it to actual topography and examining these results is very important for us to understand "landscape evolution process" more deeply.

This study was carried out as commissioned research from the Nuclear Waste Management Organization of Japan (NUMO).

Keywords: LEMs, DEM, GTL, sea level change, landform development, marine terrace

Volume loss due to the catastrophic sector-collapse causing the Okinajima debris avalanche of Bandai volcano, Japan

YOSHIDA, Hidetsugu^{1*}

¹Kanto Gakuin Univ.

This research discusses the volumetric magnitude of the catastrophic sector-collapse of Bandai volcano occurred in the late Pleistocene. The collapse produced the huge-scale rockslide-debris avalanche deposits named as the Okinajima debris avalanche. The collapse had occurred at the southwestern part of the volcano, and the Okinajima debris avalanche went down into the Inawashiro and Aizu basins and deposited there. Along with the conspicuous hummocky landforms observed, we can recognize the horseshow caldera on the southwestern sector of volcanic edifice. Some previous researches indicate that the collapse volume (or depositional volume) reaches more than 4 cubic kilometer (km^3). In regard to the catastrophic collapse volume at the Bandai volcano, the author has once examined another event occurred in 1888 A.D., the smaller one. By focusing on the size-distance distribution pattern of debris avalanche hummocks, Yoshida (2012) evaluated the appropriateness for the volume estimation of the 1888 collapse (ca. 0.49 km^3) by Yonechi et al. (1988) and Yonechi and Chiba (1989). Based on this result, it is made a fresh review of the collapse volume of the Okinajima event. The investigation offers new insights as follows;

1) Collapse volume is not likely to exceed beyond ca. 3.2 km^3 , calculated from the dimensions of the volcanic body and the source area (scar).

2) Scar size is approximately five times larger than that of the 1888 collapse, which amounts to the collapse volume of the Okinajima event of ca. 2.5 km^3 at a maximum, referred to ca. 0.5 km^3 of the 1888 event. The Okinajima's value is comparable to that observed at Mt. St. Helens in 1980 A.D.

3) According to the empirical relationship shown by the author's previous results and the distribution pattern of the Okinajima's hummocks, the loss volume by collapse is expected as ca. $1.8\text{-}1.9 \text{ km}^3$. This is kept within the error (Yoshida et al., 2012) from the above mentioned observed value ($< 2.5 \text{ km}^3$).

Keywords: catastrophic sector-collapse, volume, hummocky landforms, Okinajima debris avalanche, Bandai volcano

Preparation of the digital stereoscopic topographic maps of Japan using 10m DEMs

SHIRASAWA, Michio^{1*}, YOKOYAMA, Ryuzo¹

¹Yokoyama Geo-Spatial Information Lab.

By using 10m mesh DEM of GSI, we have developed four kinds of digital stereoscopic topographic map (DSTM), i.e., slope map, positive openness map, negative openness map and shaded relief map of elevation, for the total land areas of Japanese territory, with the scales of 1/500,000 and 1/200,000. The application of those maps are under investigation by our colleagues, and some results will be introduces in the oral and poster sessions in this conference.

Keywords: Digital elevation model, Stereoscopic topographic map

Simultaneous reading of small-meso scale topography in NE Japan outer arc, using digital stereoscopic topographic map

MIYAUCHI, Takahiro^{1*}, IMAIZUMI, Toshifumi², SHIRASAWA, Michio³

¹Graduated School of Science, Chiba University, ²Graduated School of Science, Tohoku University, ³Yokoyama Geo-Spatial Information Laboratory

Geomorphological reading is the most important and fundamental working in topographic process study. Recently, many kinds of tools, demonstrated by highly precise topographic maps, relief maps and high resolution air-photos and satellite images, are developed for improvements in the readings. But in any case, it seems to be difficult to simultaneously read topography in several scales and describe the results as a map. Digital stereoscopic topographic maps (DSTM) by Yokoyama et al. (2012) makes it possible and is newest effective tool from professional and educational viewpoints .

We demonstrated the effect of using DSTM in small-meso scale terrestrial topography reading in the northern Northeast Japan arc. Obtained results are as follows.

(1) Small scale topography of < 10 km in size and < 100 m in height: Early Pleistocene marine terrace sequences are seamlessly observed and their situation can be recognized. New active structures can be identified by unusual drainage patterns and incision degrees.

(2) Meso scale topography of 10-100 km in size and 100-1000 m in height: More than C-class active faults in activity are clearly identified by continuous shades representing fault scarps. Fault line valleys and scarps by differential erosion and low-relief erosion surface are clearly detected besides.

(3) Coastal, volcanic, tectonic and structural topography can be simultaneously read in regional scale of 1:200,000. Based on this excellent fruit, We presented the synthesized geomorphological map, considering internal and external process.

The above results indicate that DSTM is useful for analytic geomorphological study and the complication of regionally described topography. Further practical applications are desirable in interdisciplinary fields around geomorphological science.

Keywords: Geomorphological reading, small-meso scale geomorphology, digital stereoscopic topographic map, regionally described topography, northern Northeast Japan arc

Interpretation of geologic structures and structural landforms using a digital stereoscopic topographic map

KANISAWA, Satoshi^{1*}, IMAIZUMI, Toshifumi¹, SHIRASAWA, Michio²

¹Tohoku University, ²Yokoyama Geo-Spatial Information Lab.

Structural landforms depend on the differences of resistance of rock weathering and denudation. Especially, these reliefs are well preserved in the mountainous areas because of denudation processes to the areas reflected in the geologic structures such as fault and fold of the strata and zonal structure of plutons. As an example, we present the good correspondences between the results of geological observation and the reliefs of inner structure of zoned plutons, faulting, and folding in the Kitakami Mountains. In this study, the correspondences are demonstrated by 10m mesh DEM-derived digital stereoscopic topographic maps. These topographic maps can show the vertical information of the height of topography, therefore the differences of slope or relief are stereoscopically and clearly expressed as shaded information with the height of topography.

The 10m mesh DEM-derived digital stereoscopic topographic map is a good and effective tool to decipher the geologic structures from the structural landforms, and furthermore make possible to multiple and inter-disciplinary discussions. The new knowledge and interpretations can be expected and achieved from the use of this map.

Keywords: Digital stereoscopic topographic map, Kitakami Mountains, Geologic structures, Structural landforms

Identification of tectonic landform using digital stereoscopic topographic map and satellite image data

KOSAKA, Hideki^{1*}, KAGOHARA, Kyoko², MIWA, atsushi³, IMAIZUMI, Toshifumi⁴, SHIRASAWA, Michio⁵

¹Kankyo Chishitsu Co.,Ltd, ²AIST, ³Oyo Co., ⁴Tohoku Univ., ⁵Yokoyama Geo-Spatial Information Lab

In order to delineate the geomorphic features in and around the active fault zone, the Kitakami Lowland and Itoigawa-Shizuoka tectonic line, digital stereoscopic topographic map and satellite image data were combined. The main image involved in this study was (1) digital stereoscopic slope map (DSSM) and (2) ALOS image. The DSSM shows geomorphic line and surface of fluvial terraces, so it shows the distribution of the old terraces and the development of the erosional scarps around the fault zone. 3D display of the scarps and surfaces suggest that geomorphic features change in dip and strike direction of the active fault zone. The detailed image (1/50,000) shows fault scarp across erosional scarps.

Keywords: Kitakami Lowland, Itoigawa-Shizuoka tectonic line, digital stereoscopic slope map, scarp, active fault

Interpretation of large-scale landslide slopes in Tohoku District by stereoscopic topographic maps

HIGAKI, Daisuke^{1*}, Ryuzo Yokoyama², Michio Shirasawa²

¹Hirosaki University, ²Yokoyama Geo-Spatial Information Lab., ³Yokoyama Geo-Spatial Information Lab.

Interpretation of large-scale landslide slopes in Tohoku District by stereoscopic topographic maps

Keywords: Landslide slopes, Disaster management, Stereoscopic topographic map

Comparison of tectonic geomorphology using digital stereoscopic topographic map

KAGOHARA, Kyoko^{1*}, IMAIZUMI, Toshifumi², MIYAUCHI, Takahiro³, SHIRASAWA, Michio⁴

¹AIST, ²Graduated School of Science, Tohoku University, ³Graduated School of Science, Chiba University, ⁴Yokoyama Geo-Spatial Information Laboratory

Accumulation of digital-elevation data and development of visualize technique for them has enabled to multi-scale geomorphic readings based on geomorphic feature which is different from aerial photograph and satellite images. We present examples on tectonic geomorphology readings of Median Tectonic Line, Adera Fault, Inazani Faults and Senya Fault, using four kind of digital stereoscopic topographic maps (DSTM) by Yokoyama et al. (2012). We focus on differences in distinguishability among their maps. Shaded-relief map shows topographic roughness as shade. Digital stereoscopic slope map (DSSM) shows finer variations in surface structure. Positive values of topographic openness are high for convex forms, whereas negative values are high for concave forms, so digital stereoscopic positive openness map (DSPOM) and digital stereoscopic negative openness map (DSNOM) emphasize ridges and valleys. Fault scarp and terrace scarp are identified clearly from DSSM. Stream-offset and col along strike-slip fault well represent in DSNOM. By using DSSM, DSPOM and DSNOM, we can identify more various topographic patterns clearly than that from shaded-relief map. We hope that the digital stereoscopic topographic maps can be not only researcher's tool but also useful materials for education and disaster prevention.

Keywords: tectonic geomorphology, strike-slip fault, dip-slip fault, digital stereoscopic topographic map

Digital stereoscopic slope map derived 5m and 2m mesh, in the Sendai plain and the Iwaki region

NAKAJIMA, Hidetoshi^{1*}, IMAIZUMI, Toshifumi², MIYAUCHI, Takahiro³, KAGOHARA, Kyoko⁴, MIWA, atsushi⁵, SHIRASAWA, Michio⁶

¹Geospatial Information Authority of Japan, ²Graduated School of Science, Tohoku University, ³Graduated School of Science, Chiba University, ⁴AIST, ⁵OYO Co., ⁶Yokoyama Geo-Spatial Information Lab

We interpreted fault topography by using detail digital stereoscopic slope map (Yokoyama et al., 2012) derived 5m mesh data and 2m mesh data in the Sendai plain and Iwaki region, respectively. Obtains results are as follows.

1) New tectonic slope continue northeast to southwest in direction, parallel to the Nagamachi-Rifu fault zone, in northwest part of downtown in Sendai.

2) Surface fault caused by the 2011 earthquake in Iwaki region, clearly interpreted by using digital stereoscopic slope map derived 2m mesh DEM data. The fault trace accompanied with scarp of maximum 2m in height, penetrate through the river bottom and slope of hillside.

Keywords: 5m & 2m mesh DEM, Digital stereoscopic slope map, Nagamachi-rifu active fault zone, 2011 earthquake fault in Iwaki

Software development of Viewer for Stereoscopic Topographic Map

SASAKI, Tatsuya^{1*}, YOSHIKANE, Masanori¹, SHIMOYAMA, Nao¹, SHIRASAWA, Michio², YOKOYAMA, Ryuzo², IMAIZUMI, Toshifumi³

¹OYO corporation, Database Business Department, ²Yokoyama Geo-Spatial Information Lab., ³Graduated School of Science, Tohoku University

This paper shows the new software development of stereoscopic topographic map browser. Anaglyphic raster data of stereoscopic topographic map of Japan's land area generated from 10m-mesh DEM by the Geospatial Information Authority of Japan were used in this development.

This viewer was developed based on GIS engine MAGIS (developed by OYO Corp.). MAGIS is a general-purpose GIS engine which has been widely used in Japanese local governments as a business support system in public domain management.

The new viewer provides seamless and fast mapping, as well as smooth zooming of stereoscopic topographic map data of Japan's whole land area. This usability can benefit a wide range of map users with its user-friendly interface.

The parallax of stereoscopic topographic map data has been pre-optimized for this viewer. The new browser will be released to all the map users.

Keywords: Digital stereoscopic topographic map, GIS, Software Developmnt