Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HTT08-P01 会場:コンベンションホール 時間:5 月 26 日 18:15-19:30

Urban Geological Mapping in Tekirdag Region (NW of Turkey) by Integrated Geophysical methods for Disaster Mitigation

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Urban geological mapping issue is a key to assist management of land-use, new developed areas, assessment of urban geological hazards. This study has been performed in the frame of an national project, which is a complimentary project of the cooperative project between Turkey and Japan (JICA&JST), named as Earthquake and Tsunami Disaster Mitigation in the Marmara Region and Disaster Education. Integrated geophysical methods can have an important role to yield subsurface information in urban areas provided that geophysical methods are capable of dealing with challenges related to these scenarios. With this principal aim, the results from several geophysical methods (microgravity, magnetic) is evaluated to characterize lithological changes, to image fault zones and to delineate basin geometry in the urban areas. The process uses the combination of passive and active techniques as complementary data: magnetotelluric method (MT), microtremor H/V analysis and ambient noise array measurements to overcome the limitations of traditional geophysical methodology. This study is focused on Tekirdag and its surrounding region (NW of Turkey) where some uncertainties in subsurface knowledge (maps of bedrock depth and the isopach maps of thickness of quaternary sediments) need to be resolved to carry out the urban geological mapping. The subsurface structure can be estimated using integrated methods. (1) Acoustic impedance contrast between Eocene sediments and Metamorphic or Paleozoic bedrock is detected through microtremor H/V analysis that provides the soil resonance frequency. The predominant frequencies in the region range from 0.5 Hz to 8 Hz in Tekirdag city. The results of H/V technique is a fast scanner of the geometry of basement. (2) Ambient noise array measurements constrain the bedrock depth using the measurements of 1D-shear-wave velocity of soft soil. (3) Finally, the microgravity data analysis contribute mapping basin geometry and bedrock depth. The Eocene basin- Paleocene basement boundary is constrained between surface and 400m depth, approximately. The integrated geophysical measurements presented is an optimized and fast tool to refine geological mapping by adding 2D information to traditional geological data and improving the knowledge of subsoil structure in Tekirdag and its surroundings. The preliminary results will be presented.

キーワード: Geophysical Methods, Microtremor, Microgravity, Magnetic, NW Turkey
Keywords: Geophysical Methods, Microtremor, Microgravity, Magnetic, NW Turkey

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Ground surface deformation of small mud volcano by repeated measurements of terrestrial laser scanning (Murono, Japan)

Ground surface deformation of small mud volcano by repeated measurements of terrestrial laser scanning (Murono, Japan)

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We perform terrestrial laser scanning to detect changes in surface morphology of a mud volcano in Murono, Niigata Prefecture, north-central Japan. The study site underwent significant deformation by the strong earthquakes in 2011, and the surface deformation has continued in the following years. The point cloud datasets at different scan times were registered by minimizing the closest point distance of the point clouds at stable ground features, and centimeter-order deformations in the central domain of the mud volcano were detected. The spatial pattern of the deformation, together with some geophysical measurement data, will be used for analysis of physical mechanics of the mud volcano.
Keywords: mud volcano, TLS, point cloud, DEM

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アクセス困難な海食崖における高解像度かつ高頻度な地形変化計測手法
High-resolution spatio-temporal topographic survey in hardly accessible sea cliff

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The present study applied Structure from Motion (SfM) photogrammetry measurement with small Unmanned Aerial Vehicle (UAV) to quantify inaccesible coastal cliff geometry. Specifically, 1) the authors have experimented multiple UAV-SfM photogrammetry on a peninsular-rock surrounded on three sides by the sea; and 2) topographic change volume and rate are calculated using the difference between 3D topographic data. A case site is located in the center part of the Taitosaki in the east of Chiba prefecture, Japan. The peninsular-rock named Suzumejima has circular shape with a diameter of 50 m and a height of 30 m. Aerial photography using the small UAV was conducted twice on 24 June and 31 October 2014. The photos were taken from various elevations and angles to cover all slopes including vertical and partially overhang cliffs. The photos were processed using the SfM photogrammetry software and the 3D point clouds and textured models were derived. Point densities are about 1,700 points/m^2 in the case of June and about 1,000 points/m^2 in October respectively. Each point of the 3D cloud has x, y, z coordinates as well as colour (RGB) enabling further qualitative analysis. Extracted profiles which are derived from 3D point cloud show the vertical cliff, wave-cut bench and sea cave including ceiling portion clearly. To detect the temporal change of the island quantitatively, firstly the 3D model was subdivided into four segments: a flat area such as the wave-cut bench and floor portion of the sea cave; b vertical cliff on the east side; c slopes on the south and west sides; d ceiling portion of the sea cave. Secondly target slope was formed on the top face by rotating the 3D model adequately for each segment. Lastly the target area was clipped appropriately and topographic change was evaluated by comparing raster data of two periods. At the beach area (segment a) on the west side of the island the difference between the geo-referenced 3D rasters is up tp 110 cm and total erosion volume is 26 m^3. At the floor portion of the sea cave (segment a), the maximum erosion depth is 230 cm and total volume of the topographic change is 146 m^3. At the segment b small erosion is recognized at the base of the cliff which depth is up to 130 cm and volume is only 12 m^3. At the segment c relatively small topographic changes are recognized at some parts of the slope and that total volume is only 9 m^3. At the segment d large collapses were occurred on the ceiling portion of the sea cave which total volume is 64 m^3. Average erosion rate of the cliff, i.e. segments b, c and d, is about 4.5 cm/4 months. According to the previous study using topographic maps with a scale of 1/1,000 in 1960 and 1966, erosion rate of the Taitosaki sea cliff is about 1 m/year on average. The erosional rate estimated from the present study is rather small in comparison with the previous one. However as the target period of the present study is very short, the continuous monitoring in the future will make it possible to evaluate the erosion rate of the sea cliff more accurately including seasonal and/or annual variations.

キーワード: 無人航空機, SfM, 写真測量, 海食崖
Keywords: UAV, SfM, photogrammetry, sea cliff