Numerical modelling of tsunami-induced seawater intrusion and aquifer recovery process in the Niijima Island, Japan

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As reported after the 2004 Indian Ocean earthquake and the 2011 Great East Japan earthquake, the tsunami inundations can result in great damages to coastal aquifers by introducing massive saltwater into subsurface. The devastated salinization of groundwater resource can cause unexpected and strongly disturb local water supply. In order to secure water supply after tsunami events, assessment of tsunami-induced seawater intrusion to coastal aquifers is of great significance. In this paper, we presented a case study of the Niijima Island which is located in a tsunami-prone zone in Japan and is facing the risk of being attacked by a devastated tsunami within the next 30 years (Cabinet Office, 2011). A three-dimension (3-D) numerical model characterizing the groundwater system of the Niijima Island was developed using the FEFLOW code which can solve both density-dependent groundwater flow and saturated-unsaturated flow problems (Cabinet Office, 2011). Based on this model, we numerically simulated tsunami-induced seawater intrusion and aquifer recovery process on the Niijima Island. The effects of dispersivity and anisotropy ratio of hydraulic conductivity on modelling results were investigated. It was found that bedrock topography strongly influence the movement of the intruded saltwater plume. In order to evaluate the feasibility of utilizing the survived groundwater in the non-tsunami affected area, we modeled the aquifer with pumping behaviors in post-tsunami period. Since groundwater is currently the only freshwater source supporting the Niijima Island, this study can provide suggestions on tsunami disaster prevention and strategies of supplying freshwater for long-term recovery based on these numerical modelling results. This approach also has implications for the disaster preparedness regarding to tsunamis and tsunami-like events such as storm surges on other coastal areas.

Keywords: Numerical modelling, Tsunami, Groundwater

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Accuracy Analyses of High-Resolution Terrain Models Derived from UAV in River channels and High Mountains

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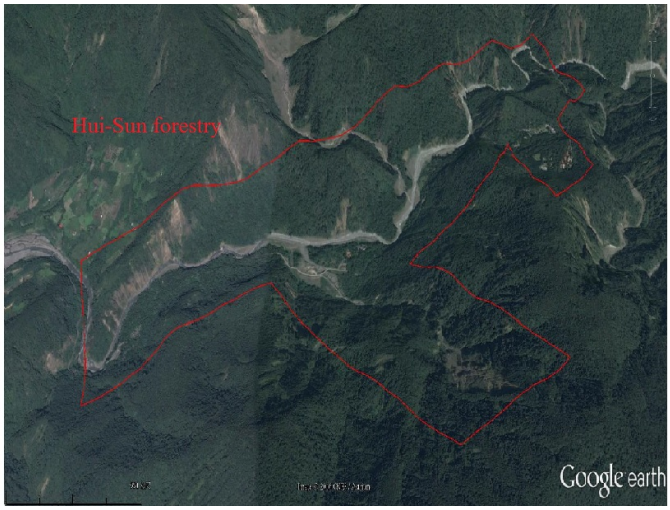
We use both fixed-wing and roto unmanned aerial vehicles (UAV) to obtain high-resolution terrain models over parts of Mao-Luo stream and Hui-Sun forestry areas(shown in the figure) , Nantou County, Taiwan, and the results are gorgeously evaluated by several ground check points with high accurate coordinates. The Mao-Luo stream and Hui-Sun forestry are river channel and high mountain topographies, respectively. In addition, Pix4Dmapper is used to generate 3D point clouds and Digital Surface Models (DSM) aided with high-accuracy control points covered by pre-made aerial targets. Couples of field UAV surveys are going to carry out by March. The purpose of the research is to analyze the feasibilities estimating accurate earthwork variations by UAV technique due to river channel sedimentation and high mountain landslides.

Keywords: UAV, River Channels, High Mountains, DSM



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Vegetation historical background of the 3013 landslides in Izu Oshima Island

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2013 Typhoon Wipha triggered huge shallow landslides on the upper slope of Motomachi town and killed 39 people in Izu Oshima Island, south of Tokyo. We examined effect of historical vegetation change on the occurrence of the landslide. The landslide has occurred on a west facing slope which was covered by ca. 40 old evergreen broad-leaved forest dominated by *Ilex crenata* and *Eurya japonica* with five to six meters height. The forest has relatively smooth crown surface due to strong westerly wind in winter and storm perod. Many clumps of evergreen broad-leaved trees suggest that past fuelwood production has significantly affected the formation of the forest. The forest in Izu Oshima has provided fuel wood for salt production until 18th century when the salt production was prohibited due to destructive exploitation. Production and export of fuel wood to Tokyo has continued until 20 century and ceased in 1970th when fossil fuel.
Reconstruction of past vegetation surface by photogrammetry of aerial photographs taken in 1975 indicates that tree heights increased by about two times between 1975 and 2013 in many sites. The tree growth, however, did not directly lead increase in slope stability because invasion of tree root was strongly restricted by the underlying loess layers those are relatively hard. On the other hand, the growth of trees may have brought about decrease in slope stability, because biomass weight in the sliding block and oscillation by strong wind will be increased.

Keywords: shallow landslide, debris flow, forest

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A new index for risk evaluation of complex disaster due to typhoons

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This study aims at investigating a new index to evaluate complex disaster risk in coastal zones involving typhoons. Typhoons generate not only strong winds but also storm surges and high waves. Therefore, complex disasters attributable to typhoon forces can be expected to occur in coastal zones.
We proposed simultaneous excess duration (SED): the durations for which the wind speed, storm tide, and wave height simultaneously exceed their respective design values were calculated as an index of risk evaluation of a complex disaster due to typhoon. To verify the utility of SED, numerical simulations were conducted for intensified typhoons under both present-day and global warming climates in Ise Bay, Japan using an atmosphere-ocean-wave coupled model with a typhoon bogussing scheme.
Results showed that the middle part of Ise Bay is more dangerous from the standpoint of SED than the inner part of Ise Bay, which has been regarded as the most dangerous area from the standpoint of extreme values of storm tide. These results suggest that SED is important as an index of risk evaluation of complex disaster, and the risk of typhoon disaster should be evaluated not only from extreme values of storm tide but also from SED.
References:
T. Murakami, S. Shimokawa, J. Yoshino, and T. Yasuda, 2015, A new index for evaluation of risk of complex disaster due to typhoons, Nat. Hazards, 75, 29-44 (doi:10.1007/s11069-015-1824-5).

Keywords: Risk evaluation, Typhoon, Storm surge, High wave, Strong wind, Complex disaster

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Effect of the geological/geomorphological education through geopark for the establishment of mindset for disaster mitigation in Hakusan Tedorigawa national geopark, JAPAN

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The authors discussed the effects of the education through geopark on the establishment of the mindset of the local peoples about natural disasters.
Within the area of Hakusan Tedorigawa national geopark, occurrence of various natural disasters such as volcanic eruption, earthquake, landslide, flood, tsunami and flood tide are predicted. These disasters have its own territory. Because the local government provides the information on these disasters in one lot, local peoples have difficulties in understanding the disaster in their local area (Aoki and Hayashi, 2015a; JpGU).
On the other hand, the junior high-school students who learned the geological/geomorphological disasters within their own city through geopark education, they have “general” knowledge for the regional disasters rather than local people but don't know their “local” risk (Aoki and Hayashi, 2015b; APGN).
In this presentation, we try to understand "why" and "How" these students misunderstand the local hazard risk using the questionnaire research. At that time, we focused on the relationships between the "risk recognition" and "interest for geopark" of the students.

Keywords: mindset for disaster, geoprak, study

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The Creation of Standard Sign Templates for Evacuation Facilities and their Electronic Distribution System

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Japan is a country of frequent natural disasters, such as earthquakes, floods, landslides, volcanic eruptions, and so on. People sometimes are forced to take shelter at schools, hospitals, entertainment facilities, department stores, hotels, restaurants, underground malls, or multi-purpose properties. In the worst cases, victims have to stay at evacuation facilities for several weeks or more. Thus the evacuation facilities should be places that not only shelter victims, but also put them at ease and allow them to live their daily lives to as carefree an extent as possible.

In evacuation facilities, evacuees frequently face problems with “forgetting their position”, “displacement of spatial awareness”, and “route mistake”, and with suffering psychological depression by exposure to monotonous scenery.

In this study, we propose the creation of standard sign templates for evacuation facilities and their electronic distribution system. The method of designing signs is based on cognitive psychology and has already been adopted in the sign system of a public parking garage building that has six floors (Takashima and Nakagawa, 2014). Figure below shows a schematic image of signs printed out and a distribution system on the Internet.

Keywords: sign system, evacuation facilities, electronic distribution system

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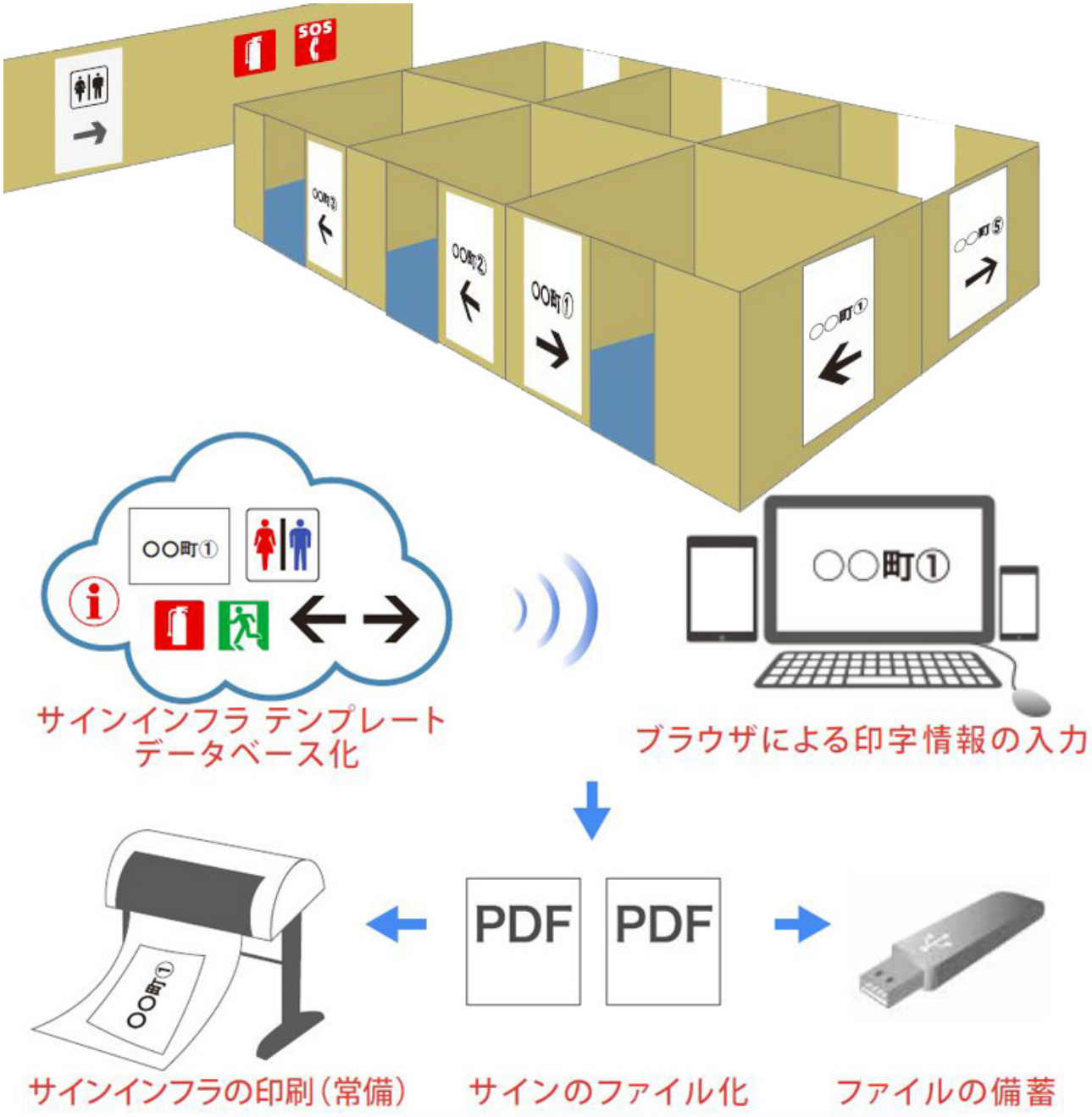

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