

## Geological survey of tsunami deposits in Miyazaki Pre.

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The tsunami deposit has not been found yet in Miyazaki Pre.

Keywords: tsunami deposits, Hyuga Nada earthquake, Hiei earthquake, Nankai Trough massive earthquake

## Comparison of distribution of liquefaction in the Tone River lowland by using Google Earth images with the microtopograp

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The authors mapped the distribution of liquefaction in the Tone River lowland by the 2011 off the Pacific coast of Tohoku Earthquake on the basis of Google Earth images (taken on Mar. 29, 2011) interpretation. In addition, we drew microlandform classification map by using aerial photographs, the Rapid Survey Maps, and the Landform Classification Maps for Flood Control and compared both maps. A large number of the liquefied sites are located on the former river channels, their inner banks, old lakes had been reclaimed. By constars, a part of reclaimed lands and sand bar area are little liquefied.

Keywords: Google Earth, liquefaction, microtopography, land history, Tone River lowland, 2011 off the Pacific coast of Tohoku Earthquake

## Geomorphic condition of the liquefaction sites in the northern part of Miyagi prefecture during the Tohoku earthquake

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Mapping of liquefaction sites such as the occurrence of sand boiling and structural damage in the northern part of Miyagi Prefecture during the 2011 off the Pacific coast of Tohoku Earthquake were conducted based on the field survey and Google Earth images interpretation. The results of GIS analysis indicated that many liquefaction sites were located on the former river channel and natural levee (point-bar) along the Naruse River, Eai River, Hasama River and Kitakami River. However, liquefaction sites in the study area were more sparsely than the Tone River lowland. There were many ponds and marsh in the study area before 1930 as well as Tone River lowland. These ponds and marsh were buried by insufficient compaction deposit of dredged soils, and a large number of liquefaction occurred in these reclaimed land in the Tone River lowland. On the other hand, these ponds and marsh were drained off, and then transformed to the rice field in the study area. Thus, it seems that the artificial ground consist of loose sandy soils in the study area are less than the Tone River lowland.

Many sewage manholes were uplifted in the study area. These sites were located on flood plain (backmarsh) and natural levee. The amount of uplift displacement of a sewage manhole located on the clayey site was larger than the sandy sites. In particular, several sewage manholes located on the peaty site were uplifted more than 50 cm.

Keywords: liquefaction, sand boiling, uplift of sewage manhole, micro-topography, northern part of Miyagi prefecture, 2011 off the Pacific coast of Tohoku Earthquake

## Classification of natural hazards for Japanese events database

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In this study, we optimized the classification of natural hazards for building a database of such events. We defined five major categories of natural disasters: earthquake, volcano, storm and flood, heavy snowfall/hailstorm, and landslides. The major categories are divided into 25 subcategories. We are building a comprehensive database of events of natural hazards in Japan sourced from regional disaster management plans introduced by all local governments. These plans, spanning twenty centuries, use various terms that are now obsolete for describing historical natural hazards. We developed a table that compares the current classifications of natural hazards to the obsolete terms.

Keywords: Natural hazards, Classification of types, Natural hazard events, Database

## Methodology for flood risk assessment in Tokyo metropolitan area

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Flood is one of the most significant natural hazards in Japan. The Tokyo metropolitan area has been affected by several large flood disasters. Therefore, investigating potential flood risk in Tokyo metropolitan area is important for development of new adaptation strategy for future climate change, and socio-economic changes. We aim to develop a new method for evaluating flood risk in Tokyo Metropolitan area by considering effect of historical land use and land cover change, socio-economic change, and climatic change. Ministry of land, infrastructure, transport and tourism in Japan published Statistics of flood, which contains data for flood causes, number of damaged houses, area of wetted surface, and total amount of damage for each flood at small municipal level. Based on these flood data, we constructed a flood database system for Tokyo metropolitan area for the period from 1961 to 2008 by using ArcGIS software. By using these past flood data, we estimated damage by inundation inside a levee for each prefecture based on a statistical method. On the basis of estimated damage, we developed flood risk curves in the Tokyo metropolitan area, representing relationship between damage and exceedance probability of flood for the period 1976-2008 for each prefecture. Based on the flood risk curve, we attempted evaluate potential flood risk in the Tokyo metropolitan area and clarify the cause for regional difference of flood risk. By analyzing flood risk curves, we found out regional differences of flood risk. We identified high flood risk in Tokyo and Saitama prefecture. On the other hand, flood risk was relatively low in Ibaraki and Chiba prefecture. Prefecture with high (low) flood risk roughly corresponds to high (low) property. However, there are several exceptions. Although, property is relatively low in Saitama prefecture, flood risk is high. On the other hand, flood risk in Kanagawa prefecture is relatively low in spite of high property. In order to investigate possible factors that can explain these regional differences of flood risk in detail, we investigated spatial distribution pattern of property and ratio of damaged housing units in each prefecture. As a result, we found out that both property and ratio of damaged housing units are high in southeastern part of Saitama prefecture. We indicated that this spatial consistency between property and ratio of damaged housing units in Saitama prefecture seems to be a reason for high flood risk. On the contrary, high property area of Kanagawa prefecture is different from area with high ratio of damaged housing units. This spatial inconsistency between property and ratio of damaged housing units seems to cause relatively low flood risk. Consequently, we can point out that spatial consistency (inconsistency) between distribution patterns property and flood risk in each prefecture is also an important factor for explaining regional difference of flood risk between prefectures.

Keywords: Flood risk, Tokyo metropolitan area

## Optimal design of tree location for fluid flow power reduction

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To reduce the power of fluid passing through a tide-water control forest plays important role in the field of the tsunami hazard mitigation. Although there are some research concerning the effect of trees in terms of fluid resistance as represented by the coefficient of drag, those attempts have not yet led to an effective tree arrangement which should be defined by quantitative understanding of the flow field.

In this study, we develop a simulation system by combining an optimizer based on the genetic algorithm and the Lattice Boltzmann simulator working on a Graphics Processing Unit (GPU).

We performed two types of simulations:

- (1) Find the optimal arrangement of trees which minimize the integrated kinetic energy over the wake flow produced by trees.
- (2) Find the optimal arrangement of trees which maximize the integrated viscous dissipative energy over the wake flow produced by trees.

As a result, the first design concept leads to a trivial solution which places trees only on the edges of the simulation model. In contrast, the optimal arrangement of trees obtained from the 2nd design concept indicates about quintuple score as compared to the average of randomly placed tree arrangement, suggesting that we should consider the capability of flow control regulated by the tree arrangement.

The evolution process from the initial stage to the optimal tree arrangement, the consequence from the genetic algorithm, clearly derives a knowledge relating to the viscous dissipative energy involved in the vortex formation.

Keywords: tree, fluid, optimization, genetic algorithm, LBM, GPGPU