

## Learning of relationships between landforms and natural disasters

This is a supplementary material of the poster presentation below.

The poster, explaining the details of this study, is available on the “EGU2020: Sharing Geoscience Online” from 4 to 8 May 2020.

Report on science classes and a workshop for teen students to learn geography and geology using Minecraft (EGU2020-12516)

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### What is “landform”?

Landforms are forms of undulations of the earth's surface. They are the results of the movement of constituent materials and will continue to change. In other words, the landform represents how the land was formed.

There are many different types of landforms, each of which has its own name. If you know the type of landform, you can understand what kind of disaster-prone land is.

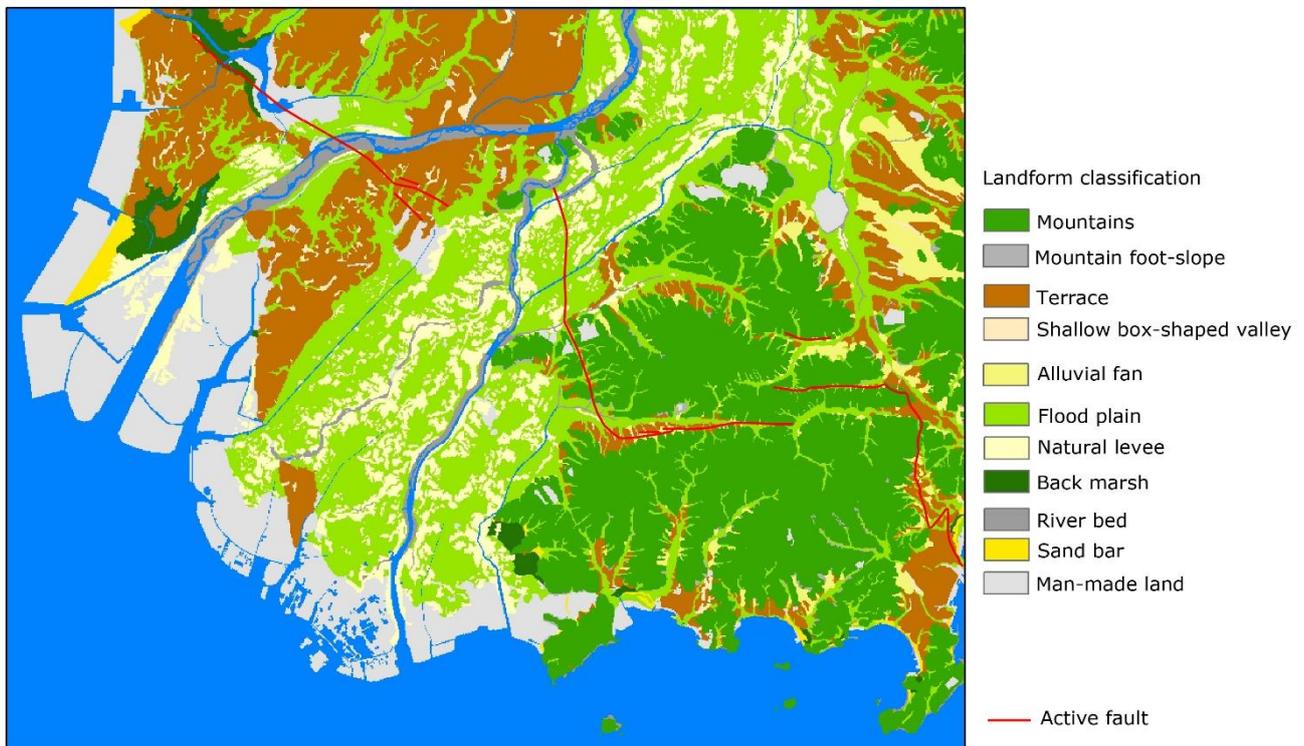


Fig.1 Landform classification of the region of the Workshop 2



Fig.2 Screen-shot of the Minecraft world. The actual landform elements in plains, such as natural levees, are slight elevations. In the game the height differences are exaggerated.

The followings are landform types in the region of the enclosed Minecraft world and the risk of their natural hazards.

Please learn, and let's build a home, buildings, or towns where you want them on the Minecraft world!

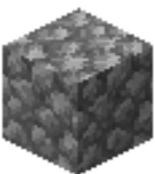
**Please email or send to the twitter (@GSI\_Research) your screenshot and the reason why you built it there!**



### Mountains

**Overview of this terrain** Land consisting of ridges and valleys, or relatively steep slopes. In rainy areas such as Japan, the surface is weathered and turned into soil, which is covered by forests.

**Natural hazard risk** There is a risk of collapse, debris flow, and landslides due to heavy rainfall and earthquakes.



### Mountain foot-slope

**Overview of this terrain** This land is located in the lower part of a mountain or cliff/terraced cliff with a slope slower than the mountain. It is formed when sediment is deposited by landslides and mudslides.

**Natural hazard risk** There is a risk of collapse, debris flow, and landslides due to heavy rainfall and earthquakes.



**Terrace**

**Overview of this terrain** The land is flat and elevated above the surrounding area. It is formed when the surrounding area is left behind due to erosion.

**Natural hazard risk** There is little risk of river flooding, but be careful when the elevation is small with the river. Beware of landslides near the edge slope. The ground is good and the risk of earthquake shaking and liquefaction is small.



**Shallow box-shaped valley**

**Overview of this terrain** The land is located in a terrace, fan or sand dune and is slightly lower than the surrounding area. It can be formed by small-scale runoff action or by the accumulation of sand and gravel on the periphery, which makes it relatively low.

**Natural hazard risk** Rainwater tends to collect temporarily during heavy rainfall, which can lead to flooding. The ground may be softer than the surrounding area, and there is a risk of liquefaction, especially in the vicinity of sandbars and dunes.



**Alluvial fan**

**Overview of this terrain** A gentle slope that fans out from the exit of the valley at the foot of the mountain. It is formed by the accumulation of sediment carried by flooding from the valley.

**Natural hazard risk** There is a risk of inundation from water coming out of the mountains and debris/mud flows near the outlet of the valley. The ground is relatively good, so it is hard to shake in an earthquake. There is a risk of liquefaction in the downstream areas.



### Flood plain

**Overview of this terrain** Low, flat land with small undulations. It is formed when sand and mud carried by a flood are deposited around a river, or when the sea floor has dried up in the past.

**Natural hazard risk** Beware of river flooding. The ground is softer the closer to the coast that it is slightly more prone to shaking in an earthquake. There is a risk of liquefaction. Beware of high tides in coastal areas.



### Natural levee

**Overview of this terrain** A narrow strip of land along a river that is 0.5 to several meters higher than its surroundings. It is formed when sediment is deposited in a flooded area of a river.

**Natural hazard risk** The land is relatively safe from flooding, but it can be flooded in a major flood. There is a risk of liquefaction at the margins.



### Back marsh

**Overview of this terrain** The land is primarily in a flood plain, slightly lower than the surrounding area. It is formed by the accumulation of mud contained in the floodwater with little sand or gravel from the flood.

**Natural hazard risk** The land has been flooded for longer than its surroundings by river flooding and is poorly drained. The ground is extremely soft, so it is prone to large shaking during an earthquake. There is a significant risk of liquefaction. Beware of high tides in coastal areas.



### River bed

**Overview of this terrain** River bed,

**Natural hazard risk** Areas that are flooded by rising rivers and high waves. Riverbeds are at great risk of liquefaction.



### Sand bar

**Overview of this terrain** Mainly along the shore of present and former times, with land slightly higher than the surrounding area. It is formed by the deposition of sand and gravel washed up by waves.

**Natural hazard risk** This land often escapes inundation in a normal flood. The margins are prone to liquefaction by strong earthquakes.



### Man-made land

**Overview of this terrain** The lower ones along the coast is reclaimed land and is used for rice paddies. Flat, relatively high land along the coast is landfill, often used for factories and port facilities. There are also flatlands, cuts and fills, that have been cleared and leveled in the mountains and other areas.

**Natural hazard risk** Reclaimed lands are generally lower than the sea or lake level, so they are easy for flood water to stay in during a flood. Be careful of storm surges in coastal areas. Steep cliffs are at risk of collapsing due to heavy rain or earthquakes. Common risks for all man-made terrain is that the ground is soft and easily shaken by an earthquake. There is a risk of liquefaction.



### Active fault

**Overview** Fractures that shift during an earthquake are called "faults". Among faults, active faults are those that have repeatedly been active for hundreds of thousands of years or more and are expected to continue to be active in the future.

**Natural hazard risk** Active faults move at intervals of about 1,000 to tens of thousands of years.

Although less frequent, if you live near an active fault, you will suffer significant damage in the event of an earthquake.

Sentences "Overview of this terrain" and "Natural hazard risk" were edited by referring to the explanations of attribute information in the Vector tiles (natural landforms) of the GSI maps.

<https://maps.gsi.go.jp> (Web map, in Japanese)