VISUALIZATION OF THREE-DIMENSIONAL GEOLOGIC MODEL USING WEBGL

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ABSTRACT

A three-dimensional visualization system for geologic voxel model has been developed using WebGL. WebGL is a web technology that brings hardware-accelerated 3D graphics to the browser without installing additional software. The system allows users to visualize the voxel model by a simple mouse operation. It is possible to control rotating, zooming and panning of the model and visualize any geologic cross section by dynamical movement of cutting plane.

1. INTRODUCTION

Recently, needs for geological information have been increasing in various fields such as environmental assessment, urban planning, resource development, waste management and disaster mitigation. It is important to provide geological information as a three dimensional model for these fields. Nemoto *et al*. (2016) developed a web-based visualization system with an aim of sharing 3D geological model (Figure 1). The system allows users to visualize horizontal and vertical geologic cross sections in two dimensions. In this study, the function to visualize a voxel model and cross section in three dimensions.

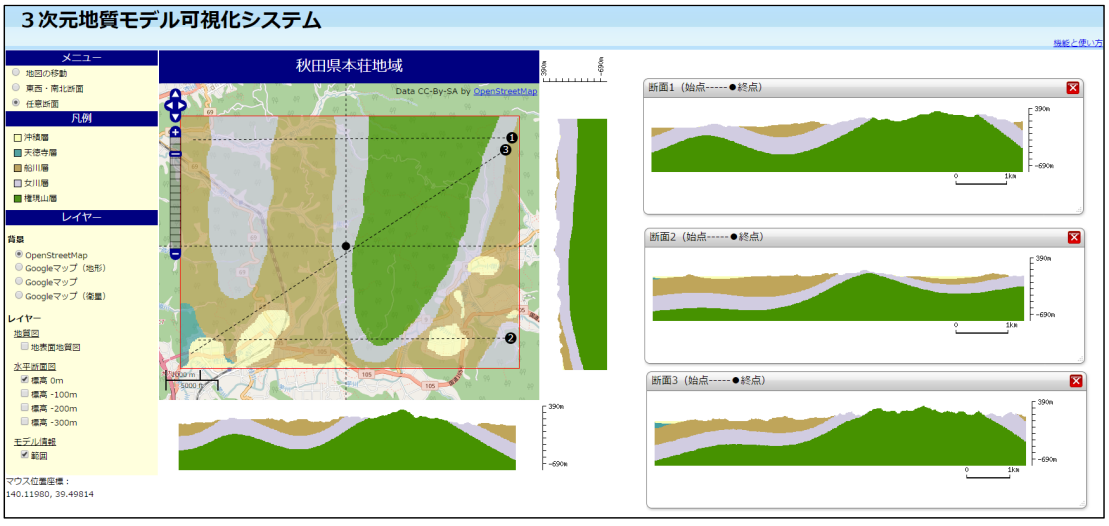

Figure 1. Visualization of horizontal and vertical cross sections.

2. THREE-DIMENSIONAL GEOLOGIC MODEL

The tree-dimensional geologic model consists of gridded boundary surfaces and the logical model of geologic structure. The logical model of geologic structure is table data that represents a logical relation between geologic units and boundary surfaces (Masumoto *et al*., 2004). If the logical model of geologic structure defines tree-dimensional space, we can define a function *g* which assigns a unique geologic unit to every point in the space.

The system handles a geologic voxel model. The voxel model is constructed by obtaining the geologic unit included in each voxel using the geologic function *g*. In this system, model data is managed in GRASS GIS 3D raster format (GRASS Development Team, 2018).

3. VISUALIZATION OF VOXEL MODEL

A visualization of geologic voxel model is implemented using WebGL. WebGL is a web technology that brings hardware-accelerated 3D graphics to the browser without installing additional software. Some JavaScript libraries have been developed to support WebGL. In this study, three.js is utilized to visualize voxel model.

Each voxel is created using THREE.EdgesGeometry object. As we have many objects, voxels are grouped into each geologic unit to speed up visualization process. Visualization of 87×65×70 voxel model is shown in Figure 2. Only one geologic unit can be displayed because of grouping (Figure 3).

Users can control rotating, zooming and panning of the model using mouse (Figure 4). It is possible to visualize any cross section by dynamically moving plane (Figure 5, 6). Moreover, a panel diagram is visualized by generation of some cross section (Figure 7).

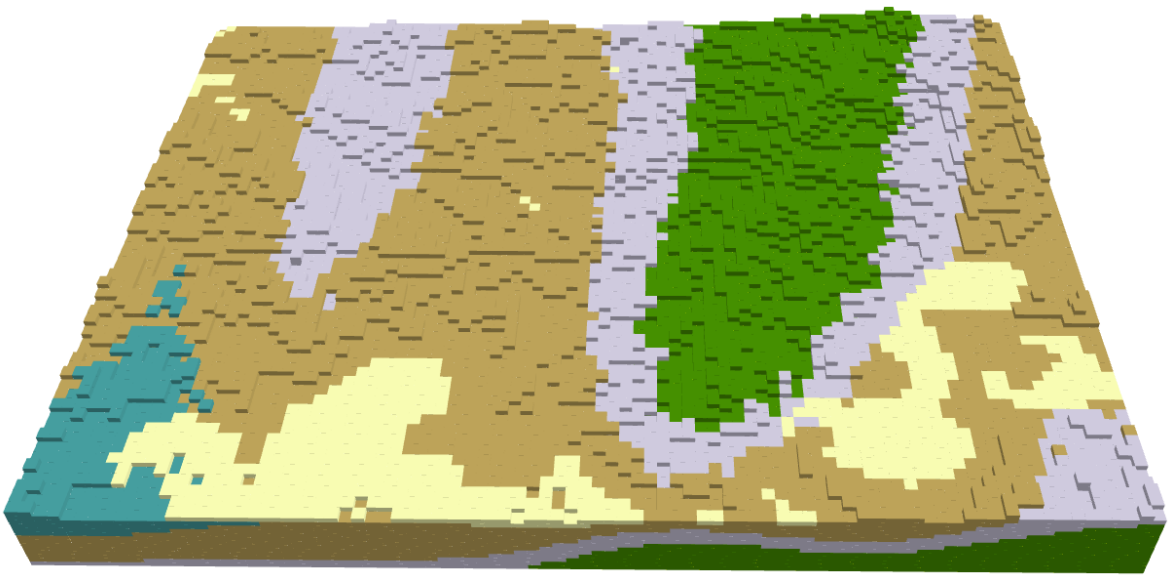

Figure 2. Visualization of voxel model using WebGL.

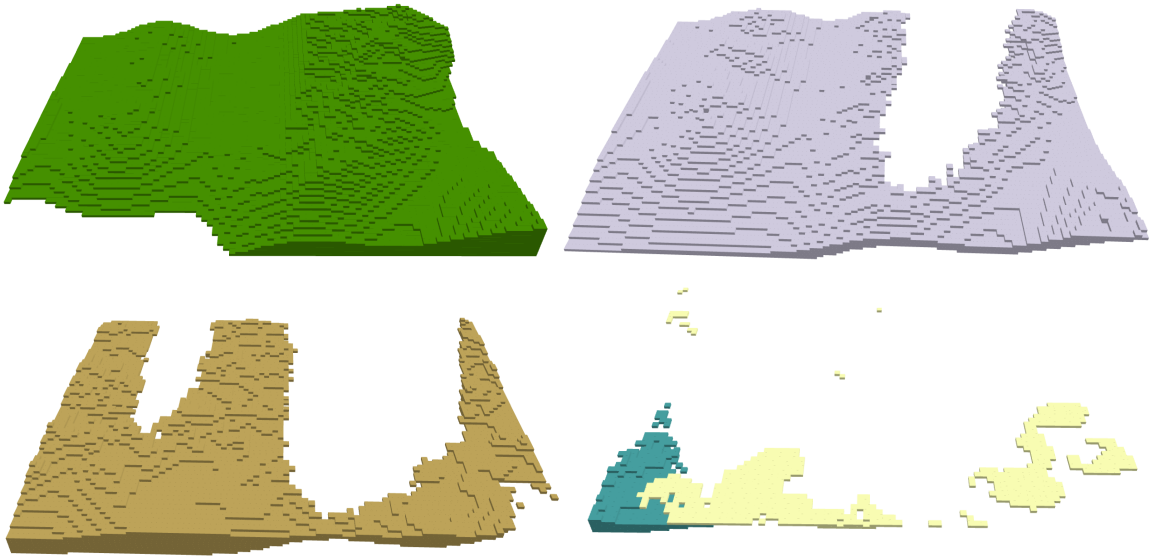

Figure 3. Visualization of each geologic unit.

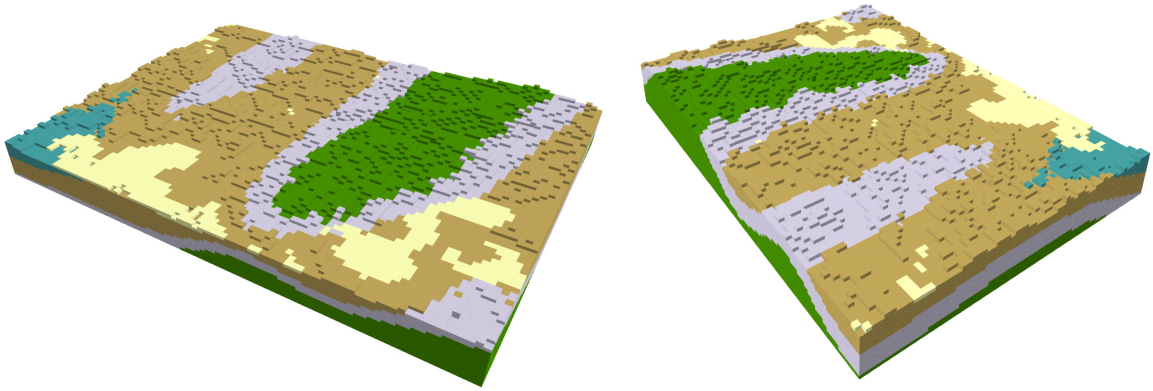

Figure 4. Rotating of the model.

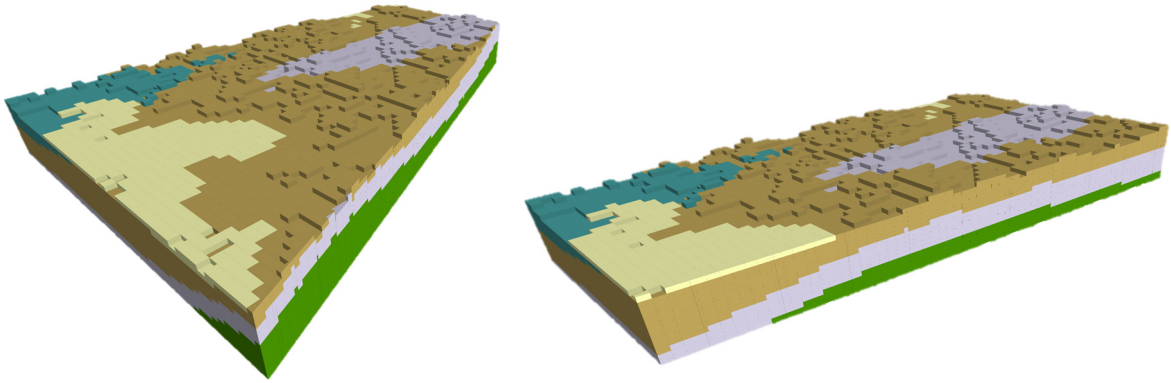

Figure 5. Visualization of vertical cross sections.

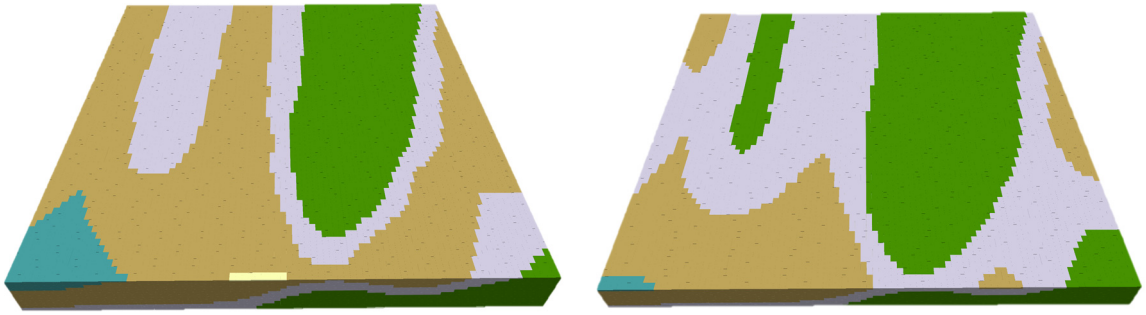

Figure 6. Visualization of horizontal cross sections.

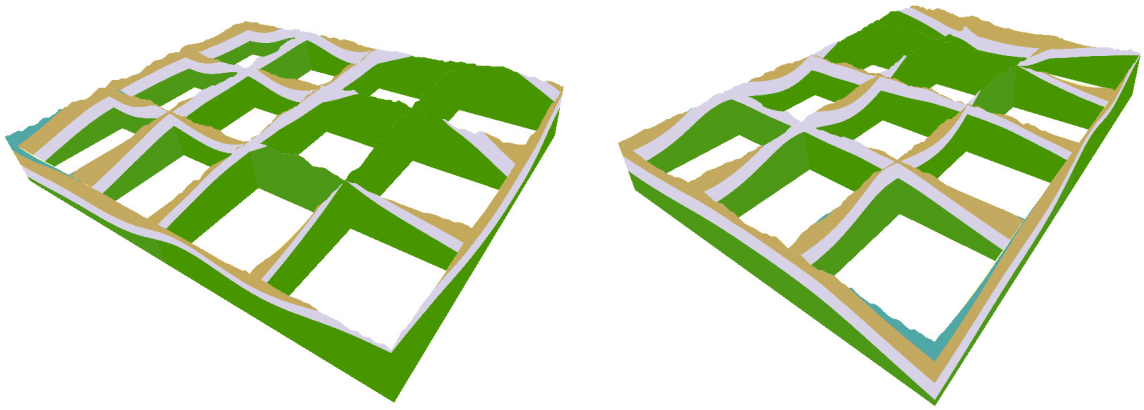

Figure 7. Visualization of the panel diagram.

4. CONCLUSIONS

A visualization of geologic voxel model was implemented using WebGL. It is possible to visualize the model dynamically by a simple mouse operation. The remaining problem are a development of visualization module for surface model and solid model.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

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