Developing Open-access E-learning Materials for GIS Education Related to Terrain Analysis

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Abstract

Several projects have been conducted for enhancing GIS (Geographical information systems) education in Japanese universities. As a result, a basic core curriculum and teaching materials for university lectures were developed. However, comprehensive materials for exercises using GIS software have not been developed. Therefore, we launched a new project for developing and publishing materials for GIS exercises in 2015, entitled "Development of Open-access E-learning Material for GIS Education Based on the Existing Core Curriculum and the Body of Knowledge". In this project, materials explaining analytical methods using GIS were developed based on the basic core curriculum. These materials utilize free and opensource GIS software packages such as QGIS. This presentation focuses on materials related to terrain analysis. It is a core part of a section for raster data analysis, explaining how to use elevation data for various analyses such as the calculation of slope gradient and the creation of topographical profiles. In addition, we produced videos to explain equipment related to GIS and terrain analysis such as UAV (Unmanned Aerial Vehicle) and 3D printers. The materials will be published using the GitHub platform with a license that permits access by anybody.

Use of software

Materials for learning basic operations of GIS software are being produced. Students can learn mapping and spatial analysis using GIS. The materials are based on the GIS core curriculum and utilize free GIS software such as QGIS, GRASS GIS, and SAGA GIS. Part of our materials explains terrain analysis methods using GIS, in some sections such as raster data analysis and spatial interpolation.

#### List of major sections related to geomorphological research

- Raster data analysis
  - Visual analysis using DEM data (Altitude tints, Gradient slope, Slope direction, Hillshade, Topographic profile)
  - Calculating basically statistics
  - Filtering
  - Raster calculation
  - Watershed analysis
  - Cost path analysis

- Spatial interpolation
  - TIN（Triangulated Irregular Network）
  - IDW (Inverse Distance Weighted)
  - Spline interpolation
  - Kriging

QGIS
GRASS
SAGA GIS
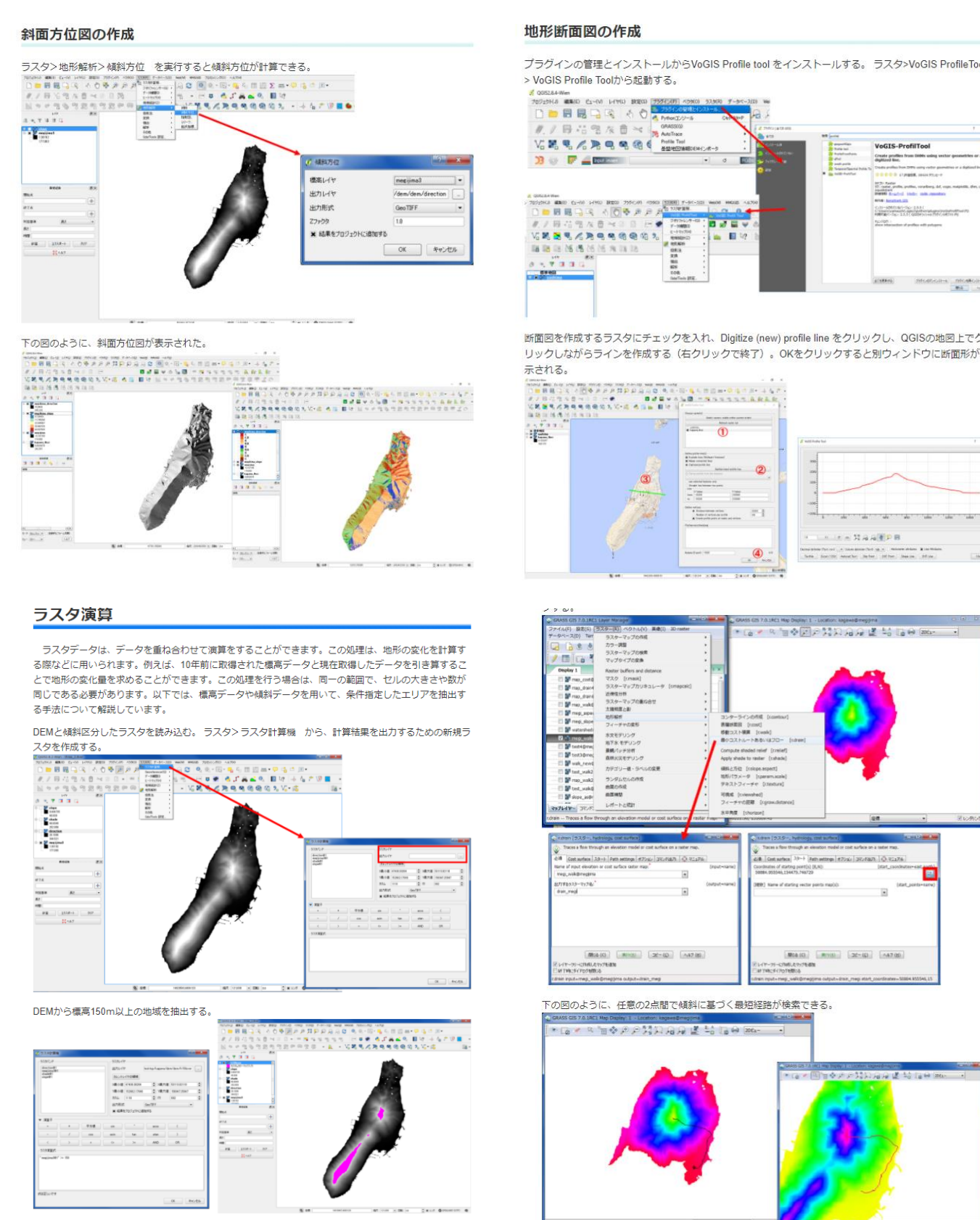
GIS-OER images

Examination of the materials : an GIS exercise

We used part of the developed materials in university classes and seminars for GIS beginners. The materials were improved after such trials.

Use of the materials at the University of Tokyo

Educational videos

Field surveys and outreach activity related to GIS sometimes require specific or expensive equipment. Therefore, videos introducing equipment with text guides were developed. We have provided videos of the use of UAV (Unmanned Aerial Vehicle) and 3D printer so far. In the UAV video, flight settings and operations are explained. In the 3D printer video, 3D model setting methods and printing operations using UP BOX+ are explained.

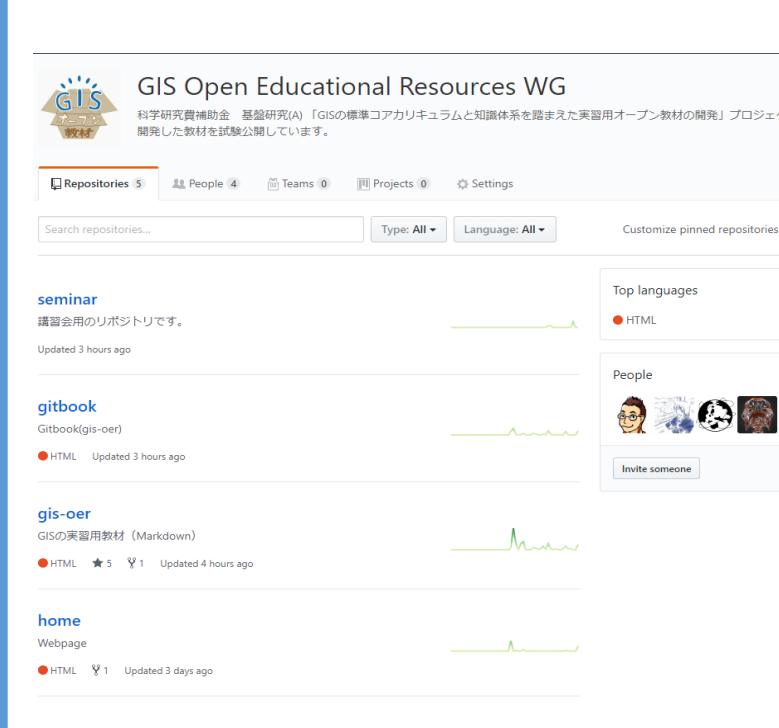UAV video images   3D printer video images

The videos were embedded in the text-based materials with explanations. Such educational materials including field-based measurements have been limited in number. We are optimizing these materials based on the actual use during field courses and seminars.
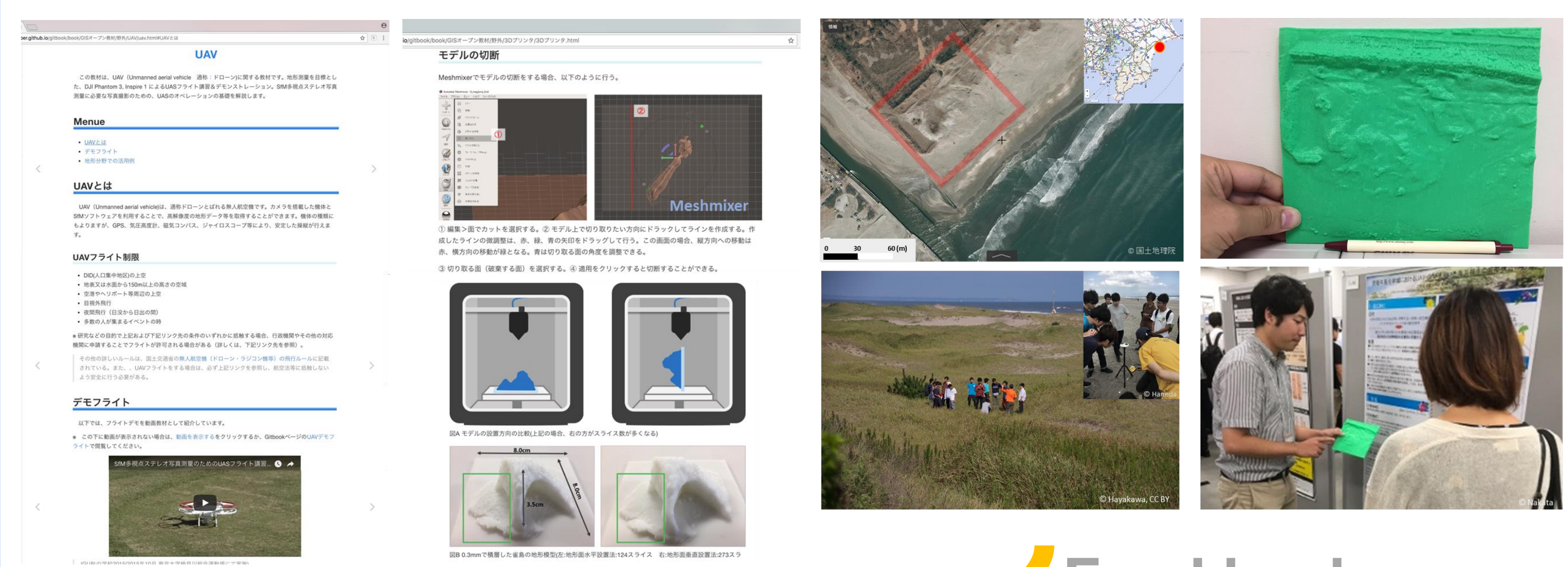
Feed back

Publishing in the GitHub platform

The materials are pre-released as GIS-OER (GIS Open Educational Resources) using the GitHub platform. GitHub is a WEB hosting service using Git, often known as a platform for open source software over the world. The materials were formatted as Markdown files, a light-weight markup language. The markdown files were converted to web pages with excellent browsability using the GitBook library and plugins. The materials are licensed under the creative commons license (CC BY-SA 4.0) . Anybody can download and edit the materials.
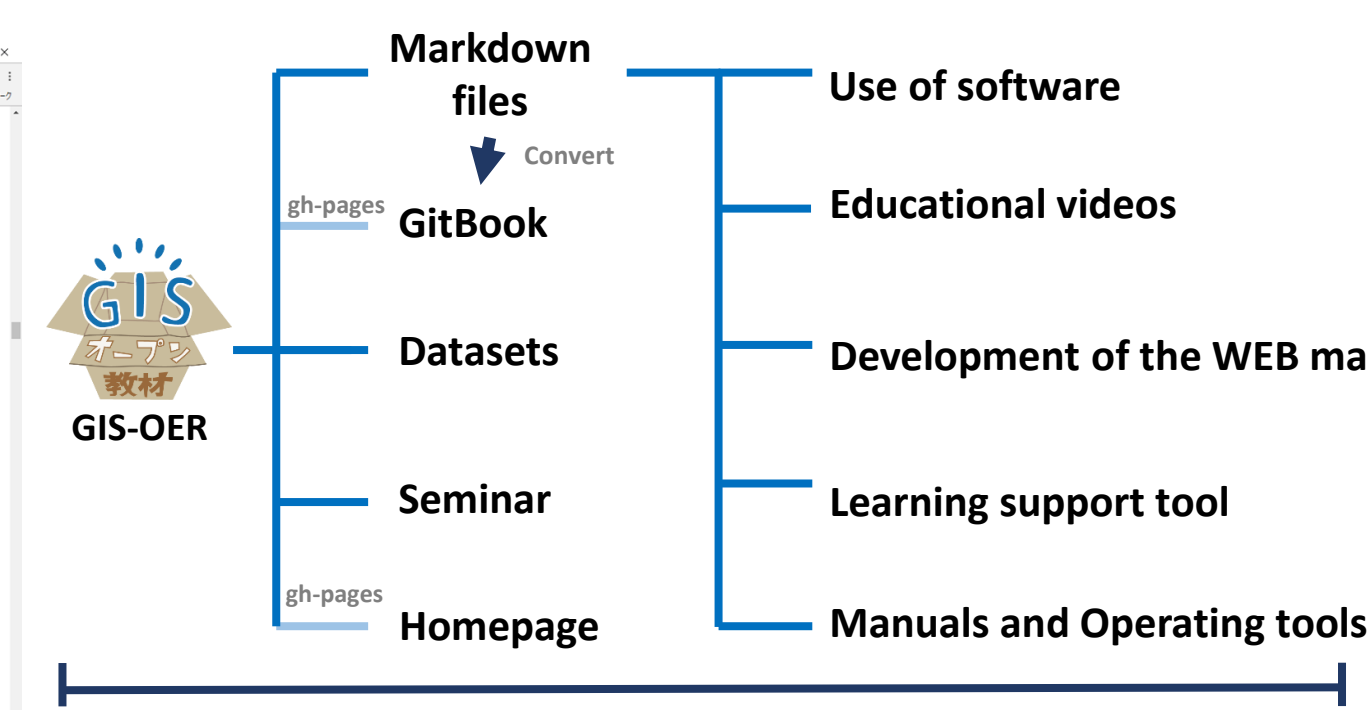

GitHub of the GIS-OER
https://github.com/gis-oer

GIS-OER WEB site
http://gis-oer.csis.u-tokyo.ac.jp/
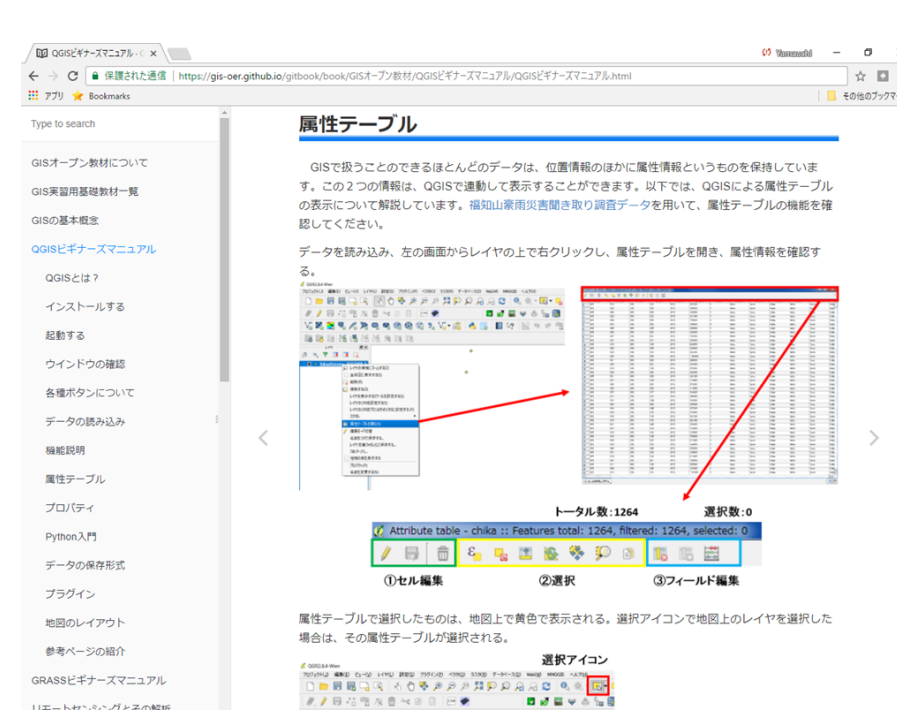
GitBook style of the materials
https://gis-oer.github.io/gitbook/book/

GitHub
The materials constitution of GIS-OER

Future work

- The materials will be open to the public after sufficient amount of trials in university lecture classes and seminars.

- More advanced materials such as WEB GIS (Map tiles) and 3D terrain analysis will be developed with supports by the other open projects related to learning materials.

- These materials are provided only in Japanese at this moment. We will develop an English version by translating a part of the materials related to terrain analysis.

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