Terrain Representation Method using HSV Color Modeling

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Relief maps and topographic analysis derived from DEM are becoming more advanced because LIDAR or photogrammetry provide high resolution digital elevation models (DEMs). Typical relief map tools include ELSAMAP (Mukouyama and Sasaki, 2007) and red relief image map (Chiba and Suzuki, 2004). However, microtopographic features cannot be analyzed if positive and negative curvatures in ELSAMAP are excluded. Red relief image map does not include elevation information; therefore, it cannot convey the height of the features. This study aims to resolve these issues and create a new relief map that uses simple colorization to convey information about factors, such as elevation and slope, and identifies ridges and valleys from curvature calculations.

The open-source DEM from the Geospatial Information Authority of Japan, and the processing open-source programming language are used, and the development environment is integrated. The software reads out elevation data from DEM, and calculates elevation, slope, and curvature. After these factors are calculated, the program substitutes the magnitudes of elevation, slope and positive or negative curvature for the magnitudes of hue, saturation and value, which are the dimensions of the HSV color model.

The changes in elevation and slope of mountain areas can be easily understood from the terrain representations based on the HSV color model. As the elevation changes, the color on the relief map changes. As slope becomes steeper, the saturation increases. Mountain ridges appear light, and valleys appear dark.

However, this relief map cannot describe minute elevation changes of terrain with a gentle slope, such as a plain. Most gentle-slope terrains appear gray. Overlaying other maps, such as a contour map, over the HSV relief map is one way to overcome this problem. For this purpose, a new software program to create a rainbow elevation map from the same area of DEM is also examined. The rainbow elevation map includes color change per 1 m, and the colors change in a 360-m cycle. After the rainbow elevation map is created, the HSV relief map is overlaid on it. The effect of the rainbow elevation representation allows understanding the minute elevation changes in a plain. The elevation change of mountains is more dramatic compared with that of a plain; therefore, the microtopography of mountains is difficult to understand using the rainbow map. The color representation for understanding elevation, slope and micro topography of both mountains and plains in one map is a subject for future study.

Keywords: DEM, relief map, HSV color model

