Digital terrain analyses of the Nōbi Plain using the Fundamental Geospatial Data

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Geomorphological maps are drawing of ranges showing homogeneous landforms. They have been used for estimation of high vulnerability areas of flood or landslide, suitable areas of infrastructure development. In addition, they have also been used for estimation of soils and ground shaking for earthquake, because they are good indicator of rock erosion resistance and ground conditions under the same climate / geological structures. Iwahashi and Pike (2007) and Iwahashi et al. (2018) provided global terrain classification data using the three geometric signatures, i.e., slope gradient, surface texture, local convexity, calculated from 1 km and 280 m resolution DEM (Digital Elevation Model). They were generally appropriate to distinguish mountains, hills, terraces and fans, and plains; however, they couldn't classify shallow highlands on plains like the natural levees.

In order to understand topographies of plains from DEMs, it is conceivable to use a higher resolution DEM such as LiDAR. However, artificial modification due to farming and urbanization is intense in plains, and artificial steep slopes due to embankment are also reflected in DEMs. Therefore, it is difficult to grasp the natural topography (topography before artificial modification) using DEMs. However, the plains are habitat and population are concentrated in plain. So in the area where the existing geomorphological map does not exist, accurate classification of the spatial distribution of the micro topography is required in order to grasp the disaster vulnerability and the appropriateness of land development. In this presentation, we investigated the geometric signatures calculated from DEM and its expressive ability for the Nōbi Plain, a representative urbanized alluvial plain in Japan.

We interpolated 10 m to 90 m DEMs from the Fundamental Geospatial Data (GSI), and calculated HAND (Height Above Nearest Drainage; Rennó et al. 2008) in addition to slope gradient, surface texture, and local convexity. The reason why we choose HAND is that we need a first order derivative of elevations which does not emphasize artificial modifications, and it is a hydrological parameter including the upstream information.

The outline of the result was as follows. The image of the surface texture expresses the edge of the delta, but it has the effect of excessively amplifying the noises in the area where artificial modification in the delta has progressed. The image of the local convexiy represents the settling area of the plain near the Yoro fault, but the overall depiction of the shallow highlands in the plain is unclear. On the other hand, HAND is superior in detection of gentle alluvial fans and delta even in urban areas with many artificial unevenness, and it is clarified that HAND is promising as a parameter of terrain classification of alluvial plains.

References

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