Enhancement of lunar topographic data with statistical voting algorithm

Kohei Utsumiya[1], *Chikatoshi Honda[1]

1.The University of Aizu

In addition to terrestrial planets, grabens and ridges that are typical topographic features on the moon indicate stress activity of the lunar surface. The grabens, which show negative channel-like reliefs result from tensile stress in lunar subsurface. On the other hand, the ridges, which show positive riliefs, result from compressive stress in the lunar subsurface. Especially, grabens and ridges have been supposed to be indicators of thermal evolution of the moon, because these feature result from expansion and constriction of the moon.
In order to find grabens and ridges by visual inspection, images taken by exploration camera are usable. However, some of ridge have gentle slope and some of graben have shallow channel-like relief, so it is difficult to identify these degraded features by visual inspection. In addition to degraded features, visibility of these topographic features is affected by spatial resolution and sun-lighting condition. Therefore, we use the Digital Terrain Model (DTM) of the moon for production of enhanced topographic data. The DTM provides elevation data of the lunar surface and is not generally affected by sun-lighting condition. However, it is difficult to identify small grabens and ridges with DTM data. In previous research with a similar purpose, roughness parameter (Root Mean Square Slope, here after RMS) with DTM data was utilized to identify several topographic features such as craters, ridges, and lava flows. The RMS with DTM data depends on a parameter set of calculation window size and data sampling step size. Appropriate parameter combination of these two parameters was needed to adjust to every scale of topographic features. In this study, on the basis of topographic data, we developed new calculation algorithm based on statistics named as “statistical voting algorithm”. In this algorithm, we calculated an average and standard deviation in calculation window and it vote to each pixel which has a significant difference comparing with the average value. Continuously, we do same procedure along with moving calculation window. We expect that this algorithm is good at identifying small degraded or small-scale topographic feature.
As a result, and an availability of the statistical voting algorithm with DTM data to enhance the contrast of DTM data at the topographic features was confirmed. The appropriate parameter of this algorithm is window size 640 pixels in both case of grabens and ridges. This algorithm is useful to identify not only normal topographic features but also small and indistinct ones. However, small target superposed on large topographic feature could not be identified by visual inspection with our statistical voting algorithm data.

Keywords: Topographic feature, Digital Terrain Model, Statistical voting algorithm

