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Application of Google Mars, QGIS and ArcGIS for geomorphological research on Mars

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Geographical information systems (GIS) are necessary tools in planetary geomorphology. The use of GIS enables us to process systematically voluminous and diverse data sent by many spacecraft observing planets (Komatsu, 2008). In general, processing of these data includes exclusive software and complicated data conversion. It is difficult to analyze these data because special knowledge and time are required before data analysis. If these works are simplified, it would be vastly useful for planetary geomorphology. In recent years, the development of Google Mars (Google Inc.), and the Free and Open Source Software for Geospatial (FOSS4G) allow us to easily browse through Martin satellite images, and even to process the data. This study therefore introduces a new approach for geomorphological research on Mars using Google Mars, QuantumGIS (QGIS, which is one of the FOSS4G), and ArcGIS (ESRI). We also present results of a case study concerning Martian landslides.

This study investigated Shalbatana Vallis and Holden Crater. Martin valleys and crater wallslopes appear to be modified by numerous landslides. First, we conducted preliminary analysis, preparing landslide distribution maps using Google Mars. In Google Mars, we can display images including HRSC (special resolution –10 m), MOC (MDIM 2.1, spatial resolution is –230 m), HiRISE (special resolution up to –30 cm), THEMIS (infrared, spatial resolution –100 m), and MOLA-derived topography, some with 3D view. Overlaying these images on top of each other, we detected landslide bodies and scarps, and measured simple geomorphological characteristics, such as landslide length. Second, we saved the landslide maps as KMZ format, and imported the data to QGIS and ArcGIS. We then measured details of the landslides (e.g., area, relative height) based on the landslide maps, THEMIS and MOLA data. The analysis based on Google Mars was also verified by comparing it with the analysis based on QGIS and ArcGIS.

In conclusion, we correctly detected landslides in Shalbatana Vallis and Holden Crater, described in previous studies, using Google Mars. Their morphological characteristics were measured using QGIS and ArcGIS. We found that the analysis from Google Mars well corresponds to those from QGIS and ArcGIS (in the case of large-scale landslides). This indicates that we are able to conduct preliminary analysis of Martin landslides without complicated processing. We can then proceed to analyzing details of landslides using QGIS and ArcGIS. This method will be useful in future Martin geomorphology.

Reference:
Komatsu, G., 2008. Application of GIS to geomorphological research on Mars. Journal of Geography 117: 401-411 (in Japanese with English abstract).

Keywords: Geomorphological research on Mars,, Landslide, Google Mars, QuantumGIS, ArcGIS