

Visualisation and analysis of Mars data based on ArcOBJECTS

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Abstract

Geographic Information Systems (GIS) are powerful tools for integration of different planetary datasets, e.g. images, spectral data and digital terrain models which are typically given in different formats like vector and raster. We are currently involved in a project to import large volumes of data from the recent Mars missions into a planetary GIS database.

Before working in GIS with such datasets, it is necessary to prepare them for import. Using ArcOBJECTS, that is a collection of ArcGIS programming objects, and Visual Basic, we create ESRI shape files according to a suitable specification. Regular shape files are not sufficient, because often large numbers of attributes are available to individual data points in the original ASCII dataset. Here, the MOLA (Mars Orbiting Laser Altimeter) dataset is a typical example with over 33 attribute columns. These have to be imported using a .dbf database file. Once this is accomplished, it is possible to combine all these different datasets with raster information, such as HRSC (High Resolution Stereo Camera), or MOC (Mars Orbiter Camera) images, or MDIM 2.1 maps for joint analysis.

Subsequently, we have developed an improved method for analysis of volumes of large areal extent. ArcGIS Desktop provides a measurement with the “Area and Volume Statistics“ Module. It is possible to “calculate statistics above plane“ or “calculate statistics below plane“ for volume. This is not accurate enough for measuring, e.g. craters or valleys covering large areas, because the local top-surface may deviate from a planar surface. Furthermore it is not possible to specify a carefully selected area, but only the entire dataset. In our solution to the problem, we consider the resolution of the underlying digital terrain model, the slope of very large areas and the choice of a defined sub-area for accurate surface feature analysis of differential levels. We also implemented ArcOBJECTS to define our appropriate solution

We have applied our GIS tools for various geologic mapping and interpretation tasks, and for 2d and 3d visualisations and analysis. We will demonstrate the possibilities to import, measure and project large datasets in different formats with ESRI's object model for ArcGIS 9.X., presenting different examples.