EPSC Abstracts
Vol. 5, EPSC2010-862, 2010
European Planetary Science Congress 2010

Innovations in Planetary Mapping – From Digital Storage to Map Preparation

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In the context of ongoing and new missions to Mercury, the Moon, Mars, Venus, and Outer-Solar System objects and with the return of unprecedented high resolution image data and derived information, new data analysis techniques and requirements are put forward. Remotely sensed image data forms the crucial data basis for work conducted in the fields of planetary geology and geomorphology whose results are often presented and communicated through thematic, i.e. geological and geomorphological, maps. Modern mapping techniques and generalisation (abstraction) during mapping conduct lead to new map data and allow to derive information that become important for subsequent scientific and engineering investigations. Mapping in planetary geology today is usually carried out using geographic information system environments (GIS) which allow to ingest and manage huge amounts of data at different scales and which are utilized and arranged for mapping. Though the mapping process in general has become more convenient and more efficient by using modern GIS environments, the connection to a spatial database management environment additionally allows sharing and exploring data within the research community and across different projects. Furthermore, the database management system (DBMS) allows to store and query data efficiently and helps to maintain data integrity and provides mechanisms for the control topological constraints. In order to employ such a DBMS within a GIS environment a data model depicting the real-world relationships has to be set up which can cope with a variety of requirements concerning metric, thematic and topologic boundary constraints. Such a model is currently under development, which allows preparing, describing (on the meta-information layer), managing and archiving digital map results. With the help of such a database schema the mapper is able to utilise a predefined (but still extendable and customisable) GIS-based mapping environment for his/her specific needs. The conceptual model is designed in a stepwise manner and consists of different modules, of which each copes with specific mapping-related tasks and which can be combined and integrated into a common database model. One module handles the implementation of standards for digital map symbols which were developed by the Federal Geographic Data Committee (FGDC). By using such standards, mapping results follow international guidelines targeted on the cartographically correct representation of objects. A second module component deals with a detailed and standardised description of the digital mapping results. This description is based upon traditional map legends and includes all the essential information needed to reconstruct surface characteristics. Other modules handle technical issues, such as the embedding of descriptions for vector-based symbols, or are focused on the geoscientific value, such as the implementation of planet-specific assignments of stratigraphic units within their chronologic context. An important baseline requirement for the mapping model was its independency of GI- system architecture and platform. To manage this we use free and open formats for the database model as well as for the implementation of individual modules. The GIS based mapping process is significantly improved for the planetary mapper as there is no need to deal with technical and cartographic issues, and the focus can be put on the actual mapping, interpretation and analysis work. Furthermore the implementation facilitates the efficient storage of spatial data and reduces data redundancy, which has become a crucial issue in the context of massif data return.

Acknowledgements:
This work is supported by FP-6 Europlanet and the Helmholtz Alliance "Planetary Evolution and Life".