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Towards a Dynamic Spatio-Temporal Map and Information Library for the Planetary Sciences: Lessons learned from Earth-based approaches

Andrea Naß (1), Kristine Asch (2), Stephan van Gasselt (3), Jay Laura (4), Trent Hare (4), Jim Skinner (4), Angelo Pio Rossi (5), Sebastien Besse (6), Stéphane Erard (7), Thomas Roatsch (1), and Ralf Jaumann (1)

(1) DLR / Institut of Planetary Research, Planetary Geology, Berlin, Germany (andrea.nass@dlr.de), (2) BGR/ Geozentrum, Hannover, Germany, (3) National Chengchi University/ Department of Land Economics, Taipei, Taiwan, (4) USGS/ Astrogeology Science Center, Flagstraff, USA, (5) Jacobs University, Bremen, Germany, (6) Observatoire de Paris, Paris-Diderot, France, (7) ESA/ ESAC, Spain

The planetary science community refers to “mapping” in a different context with different aims and also meanings. One aim of planetary mapping is related to engineering topics, and might refer to the identification of landing sites. Another aim covers topics of fundamental research and is scientifically motivated. It might be related to the reconstruction of planetary history. Mapping can also refer to systematically observing a surface from orbital platforms and thus refer to the retrieval of physical information. Finally, mapping also refers to the process of information abstraction and compilation which is represented by the field of planetary cartography, i.e. the technical and artistic creation of map products.

Modern geographic and geological planetary maps are commonly developed from processed spaceborn raster and terrain-model data and photomosaics. Due to the lack of significant human activity on planetary surfaces other than the Earth’s, thematic variety and thus, thematic cartography, is rather limited.

Interpreted planetary maps differ considerably from Earth maps due to missing ground truth (except very local investigations in predominantly lunar and Mars exploration). With an expected increase of human activities on planetary surfaces in the future, more detailed information and advanced cartographic products might become popular and develop towards an indispensable tool for future exploration. Along with the availability of specific information, maps will also become more targeted and cover a wider range of topics.

However, to achieve higher degrees of specialization and variation, cartographic products require a consistent and extensive data basis accessible through an infrastructure. In order to develop such an infrastructure, formal coordination and organisation processes are required.

In the Earth sciences these topics have been growing organically and within individual state mapping campaigns (e.g. in the federal states of Germany and the US, the Italian regions), national approaches (e.g. the German 1:200,000 federal geology mapping project GÜK200 or the British 1:50,000 geology mapping project) and national infrastructures (e.g. AUSGIN, the Australian Geoscience Information network or the US National Geospatial Program) that were later re-shaped by using improved technical concepts. These approaches (might) differ from developments in the planetary sciences, and they present a great potential for a contribution as the planetary community can start thinking about structuring that sort of complexity to avoid similar problems and challenges right from the beginning.

Within this paper we discuss needs and requirements for an overarching Dynamic Spatio-Temporal Map and Information Library for the Planetary Sciences and highlight efforts implemented for Earth data and its benefits for planetary cartography. It concludes with a set of recommendations for implementing selected procedures and involvements of the community.

We present a summary of efforts in the planetary sciences to make higher-level spatial information, such as conventional maps and cartographic products, available to the community. We introduce existing standards (PDS, PSA, FGDC), as well as initiatives (like MAPSIT, PlanMap, VESPA) in the planetary sciences. This overview will result in a first concept for a Planetary Mapping Model that will be “inspired” by the INSPIRE framework, and based upon existing efforts in the planetary sciences.