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Conceptualizing an Open Map Repository as Part of a Planetary Research Data Infrastructure

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Introduction: In the field of planetary remote sensing, terabytes of data from extraterrestrial planetary bodies are made available to the scientific community today. With the development of new missions, the volume and variety of these data continue to grow.

This development has been largely facilitated through developments leading to higher integrated technology allowing to build compact and efficiently performing platforms and instrumentation. A likely other reason might be an increasing international competitive pressure which motivated new developments in sensor technology and mission designs. Along with the increase of raw data volume, the volume of derived research data continues to grow in parallel, albeit at a slower rate.

While mission data, i.e. primary research data (PRD), as derived from instruments, are commonly well maintained within archives such as the *Planetary Data System* (PDS) and *Planetary Science Archive* (PSA), derived research data, i.e., secondary research data (SRD) might not always share the same fate. For an more user and object-oriented usage of mission data first efforts came up in the last years [1-3]. Scientific studies, resulting in further derived data do not often receive the same attention.

In order to accomplish efficient *research data management* (RDM) for both kind of RD and to provide tools across research domains it is important to develop appropriate and effective structures. In that context, *research data infrastructures* (RDI) have the primary goal of collecting existing data under uniform guidelines and to make data accessible in defined ways. RDI initiatives supports the establishment of research management practices, including adopted metadata standards, research lifecycle and associated infrastructures. E.g. *The European Open Science Cloud* (EOSC) as RDI undertaking, "aims to federate existing and future RDI - across disciplines - under a single umbrella, and provides (open) services for the European researcher community." [4] They are targeted to provide faster and more efficient data access in order to pool resources and avoid

duplication where redundancy is technically not needed.

A large volume of RD that are derived in the field of planetary research carry an explicit spatial component through an absolute reference, or through relative location information, as inherent characteristics, which can thus be described as spatial data and spatial RD. These spatial (research) data serve as fundamental basis for further cartographic products and maps.

Maps, as one example of SRD, have been an essential part of planetary research since the beginning of observation and they have been constantly refined and improved since then. Planetary maps range from image maps to topographic reference maps, to geologic and to landing-site maps. Their variety, however, is naturally limited due to the lack of anthropogenic overprint and lithologic diversity.

In order to re-integrate these maps into the research-data life cycle [5] and to make them not only available for a sustainable reuse, but also to improve the associated information, further efforts are necessary which are outlined in the following sections.

Aims: The overarching goal here is to develop a practical concept, and to address requirements to enable open, transparent and sustainable access to planetary maps as part of the open planetary spatial research data family. Therefore, approved and established environments serve as blueprint for our concept for an Open Planetary Map repository.

We here refer to *maps* as conventional cartographic visualization products which contain a classical map layout composed of the main map contents (the topics), map frame, map grid information related to at least one cartographic reference system, map scale information, map title and map legend, as well as other map-related metadata information [6, 7]. These maps can be provided in different formats on various media.

Method and Results: In order to assess the current situation and to find a strategy to close the planetary research-data cycle, we first need to analyze the main elements along its current research path. We here 1. identify how the current situation, including users (actors) and data flows, is constituted and how main processes are characterized. In step 2., additional as well as potentially alternative roles and data paths, respectively, are identified and further developed through user and system requirements. Finally, based on the assessment of the current situation and a requirement analysis, potential solutions are highlighted in step 3. that build upon existing Earth-based Infrastructure developments, especially the INSPIRE framework [8] or demonstrate which additional developments are required.

Especially the adaption of spatial research infrastructure developments shows how the planetary community could benefit from an adaption of existing infrastructure environments in order to

Summary: The aim of this study is to characterize the relationships between different interest groups (stakeholders) and products as well as processes, and to discuss how processes could potentially be optimized and streamlined in order to re-insert planetary maps (and research information) into a healthy and sustainable research cycle. Developments like this could build a thematic bridge to Earth-based RD repositories [9-11] in order to push the reuse of planetary maps forward. One way of realizing an approach targeted at improving the re-use of research data in the planetary sciences is by merging the existing alternatives and to integrate the structural benefits from the INSPIRE (or any other SDI) domain. The creation of an Open Map Repository as part of a Planetary Research Data Infrastructure is described in detail in [12], in particular with respect to the communication and participation, coordination and the technical implementation.

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