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A Community Roadmap for NASA Planetary Spatial Data Infrastructure

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Abstract

Planetary spatial data returned by spacecraft are of critical importance to NASA and other space agencies [1]. However, much of this data remains inaccessible to the general science user because it is difficult to find, process and interpret. MAPSIT, the Mapping and Planetary Spatial Infrastructure Team, is a NASA community assessment group, similar to other AGs, with the mandate to create a roadmap for developing Planetary Spatial Data Infrastructures (PSDIs) for all bodies of NASA interest in the Solar System. We will present the first Roadmap, which is a 5-year plan, in its near final form in late 2019.

1. Introduction

Spatial data, such as remote sensing imagery, are obtained by flyby, orbiting, or landed spacecraft and are used to make higher-order products including mosaics, basemaps, and Digital Elevation Models (DEMs). Often these spatial data are not processed in ways that are standard or interpretable to users outside the mission science teams, nor are the higher-order products available to the general scientific user, especially over the long-term. NASA and the planetary community have recognized the need for a strategy for making planetary spatial data accessible and useable to the community. We discuss the MAPSIT Roadmap for Planetary Spatial Data Infrastructure (PSDI).

2. Rationale and Definitions

The intent of the MAPSIT PSDI Roadmap is to offer guidance on how to make planetary spatial data accessible and useable and to encourage best practices in acquiring new data and development of products and tools. Planetary Spatial Data Infrastructures (PSDIs) are frameworks to support Solar System spatio-temporal data discovery, access, and use. Foundational data products support PSDIs and include global topographic mosaics and other spatial products that are based on the best-available data and that are accurately scaled and registered to defined common coordinate frame [2] associated with a given planetary surface. These products, along with their quantitative assessment of spatial efficacy, serve as a base to which additional products can be geodetically controlled, e.g. via photogrammetric, radargrammetric, or altimetric solutions [1, 3]. They can be used in any planetary delivery service to support accurate and effective decision-making for science, engineering, and management to achieve NASA goals.

A coherent plan for obtaining and using planetary spatial data is necessary to fully realize the potential of the data and to fulfill NASA's science and exploration goals. The roadmap findings are aimed at enabling seamless discovery, access, and use of spatial data for all users, developing interfaces that exploit current technologies, and evolving capabilities in pursuit of these goals.

3. Current Availability of Spatial Data

MAPSIT recognizes that there are numerous efforts within the NASA planetary science community that focus on planetary spatial data and delivery services. The PDS (Planetary Data System; https://pds.nasa.gov/) has a specific NASA charter to

archive and deliver mission data, but their services focus on medium-to-long-term preservation (an engineering focus) and are not necessarily focused on delivery of the most usable, often highly derived, products (a user focus) [4]. The typical planetary data user, who often is not an expert in spatial data manipulation, may not able to easily access or use archived planetary data. Furthermore, there is no requirement placed on NASA missions to accurately register their spatial data onto the target planetary body's surface, an often laborious and complex process that leads to the necessary quantified, accurate knowledge of the location and scale of objects within spatial data, and that allows for the proper use and comparison with other data. Such highly usable data products often do not exist for many planetary bodies, or were created with now outdated standards, coordinate frames, and techniques.

4. Roadmap Findings

The following major findings are the main points of emphasis in the 2019 MAPSIT PSDI Roadmap. Supporting details are not included in the abstract for space reasons.

Finding I: NASA missions should be encouraged to obtain high-quality data that can be incorporated into existing spatial foundational data products, or create new ones for previously unseen territory, and thus maximize the value of the NASA science return.

Finding II: NASA-funded projects, including missions and Research and Analysis (R&A) projects, that obtain or create spatial data should be encouraged to deliver data in formats that are easily usable and that con-form to standards agreed upon by the community.

Finding III: Existing and new planetary spatial data should be easily discoverable and accessible, and data access tools must evolve with the technology.

Finding IV: MAPSIT should coordinate with community representatives and groups, such as NASA Assessment Groups, to ensure that foundational data products are produced and that Planetary Spatial Data Infrastructures (PSDIs) are developed and maintained for each planetary body in the Solar System to best enable NASA science and exploration goals.

Finding V: NASA and the planetary community should support the development of tools, technologies and expertise to ensure planetary spatial data are properly acquired, processed and available for effective use to the fullest extent, now and into the future.

4.1 Roadmap Rollout

The Roadmap is planned to be presented to NASA in a completed form in July of 2019. However, we plan to solicit further input and comments from the international planetary community and incorporate that into the document. Further, it is intended for the roadmap to be a living document and to change with the needs of the community.

5. Conclusions

The ultimate goal of the MAPSIT PSDI Roadmap is to enable seamless discovery, access, and use of spatially-enabled data for all users, to help develop interfaces that exploit current technologies and evolving capabilities in pursuit of this goal, and to support NASA in its science and exploration goals. These tasks also topic of current discussions outside US, e.g. within the European Planetary Community [5]. These tasks collectively support a broad community effort to develop tools, data products, and services that support a range of community members to use current technologies for data storage, processing, and visualization, and to deliver spatial products that "just work" for users.

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