# The Need for a Planetary Spatial Data Clearinghouse

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As planetary missions become more diverse and mature, so does the data and the derived data created from those missions. This abstract focuses on planetary spatial data, which are inherently tied to locations on bodies in the solar system. It is information relative to specific places, and about those locations over time in a geographic and cartographic sense.

One of the aspects of a planetary spatial data infrastructure (PSDI) [1] is straightforward access to "science-ready" data. We lay out below how the concept of a planetary spatial data clearinghouse, similar to the National Geospatial Data Clearinghouse for Earth data, would put planetary sciences on a course to fully realize a PSDI.

**The problem of finding Planetary Spatial Data:** The Planetary Sciences community has a stable long-term archive in the form of the Planetary Data System (PDS). This archive is tasked with long-term storage, and serves as the cornerstone upon which a great deal of science and exploration have been accomplished over the decades. However, as the sophistication of science and exploration methods have increased over the years, users want more than just a static archive, they want more services than the PDS is currently able to provide.

Specifically in the realm of geospatial data, the planetary sciences community has a diversity of needs that it has tried to meet in various ways, by various actors, from various countries around the world. The wonderful thing is that they are not all trying to solve the exact same problem, but they are solving different problems or facets of problems that are all generally related to the concept of PSDI [1]. As a result, they are providing a vast array of valuable planetary spatial data.

The difficulty is when a researcher wishes to start a new endeavor, where do they start? Existing researchers have cobbled together knowledge of the complicated bazaar of planetary spatial data that exists, but even that knowledge is likely limited. New researchers or students could easily feel lost, and are in jeopardy of either spending time reproducing planetary spatial data that already exists or not using the best planetary spatial data they could, simply because they don't know that it exists.

Likewise, when space agencies begin large new projects, it is difficult for them to know what planetary spatial data is already available, and what they must fund to create.

**How do Earth scientists deal with this issue?** Earth scientists have very similar fundamental problems and issues regarding spatial data (Figure 1).

The Presidential Order that established the National Spatial Data Infrastructure of the United States [2] contained within it the concept of a National Geospatial Data Clearinghouse. And it is here that we may find a useful framework to think about in applying to our planetary problems.

The National Geospatial Data Clearinghouse does not, itself, primarily archive data. Instead, it acts as a central catalog of available data sets, through its https://www.geoplatform.gov portal, and those data sets are hosted elsewhere.

Providers of spatial data in earth sciences know that submission of their metadata to the National Geospatial Data Clearinghouse benefits their work (fulfilling the requirements of their funding bodies) and their colleagues. It makes their data searchable and findable, ultimately benefiting their field.

For more information about the National Geospatial Data Clearinghouse, the Federal Geographic Data Committee maintains an excellent concepts question and answer document at https://www.fgdc.gov/dataandservices/clearinghouse_qanda

**What would this look like for planetary sciences?** Laura et al. in [1] identify three foundational data themes for planetary sciences: geodetic coordinate systems, elevation, and orthoimages. Let's imagine a planetary spatial data clearinghouse which contains elevation and orthoimage data products for solar system objects. This clearinghouse would implement various database and web servers, but would be presented to a human user as a web site.

A researcher in need of spatial data comes to the clearinghouse looking for topography data and maps of Mars. When they search for topography, they would find the MOLA gridded data products, and may also find a merged HRSC/MOLA map. They might find regional terrain models created for landing sites, or even local terrain models created by researchers for their individual ROSES grants. When they search for orthoimages, they might find the USGS MDIM products, various USGS geologic maps, perhaps the excellent THEMIS mosaics hosted at ASU, or local mosaics and thematic maps that were created for published papers that are being hosted

by the journal or the author's university.

The point here is that some of this data would be hosted in formal PDS archives, some might be hosted by large projects like ASU's JMARS data holdings [3], JPL's various Trek holdings [4], or even on data repositories at universities and institutions, but the clearinghouse doesn't hold or maintain the data, it simply acts as a "table of contents" to facilitate search and discovery which points back to where the actual data are hosted. The PDS provides an important archive of geospatial data, but there is far more "science ready" planetary spatial data available than exists in the PDS alone. A planetary spatial data clearinghouse would catalog and allow discovery of more than just the spatial data hosted by the PDS.

It is important to note that such a clearinghouse site must be managed to adapt and change. Its value would lie in the fact that there are human beings knowledgeable about solar system geospatial data that seek out published data in order to populate such a clearinghouse, and keep current on the field. Additionally, data providers could make their meta-data available via standards like the the OGC Catalog Services for the Web [5]. The growth and viability of such a clearinghouse requires both a managed search for data, and the ability for data providers to share the existence of their geospatial data.

A planetary spatial data clearinghouse as described above would be a valuable tool enabling planetary science research, and an important piece of realizing a planetary spatial data infrastructure.

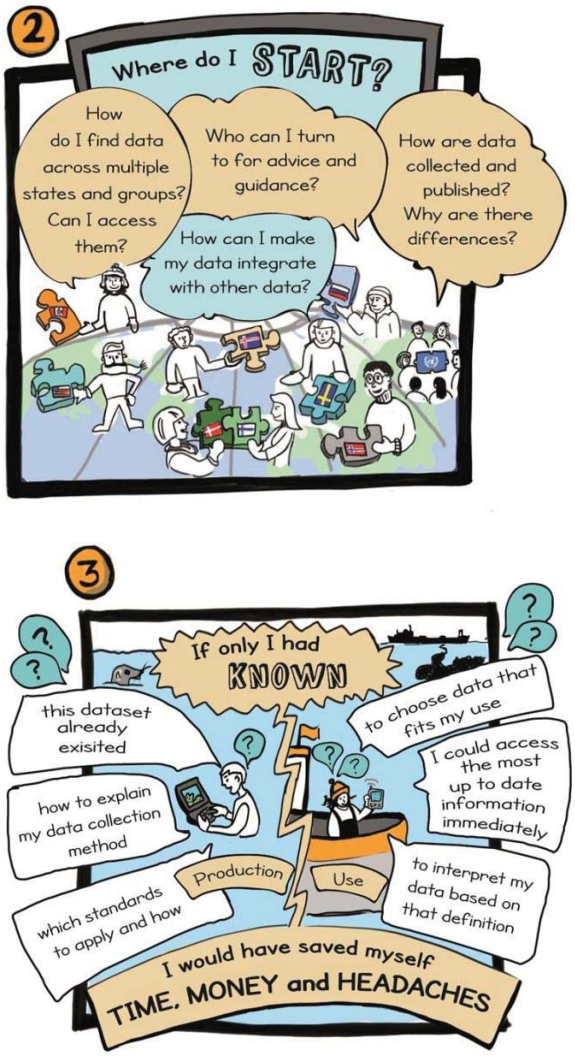


Figure 1: These cartoons are from the Arctic Spatial Data Infrastructure document [6] and are available under the Open Government License – Canada.

**References:** **[1]** J. R. Laura et al. "Towards a Planetary Spatial Data Infrastructure". In: *ISPRS International Journal of Geo-Information* 6.6 (2017), p. 181. DOI: 10.3390/ijgi6060181. **[2]** *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*. Exec. Order no. 12906, 59 Fed. Reg. 71 (April 11, 1994). 1994. **[3]** S. Dickenshied et al. "JMARS - Remote Sensing Visualization and Analysis for All Planetary Bodies". In: *LPI Contributions* 1986, 7126 (June 2017), p. 7126. **[4]** E. Law and B. Day. "Public Outreach with NASA Lunar and Planetary Mapping and Modeling". In: *European Planetary Science Congress* 11, EPSC2017-98 (Sept. 2017), EPSC2017–98. **[5]** T. M. Hare, L. R. Gaddis, and M. B. Bailen. "OGC Catalogue Services for Planetary Portals". In: *Lunar and Planetary Science Conference*. Vol. 46. Lunar and Planetary Inst. Technical Report. Mar. 2015, p. 2476. **[6]** Arctic SDI Board. *Spatial Data Infrastructure (SDI) Manual for the Arctic*. 1st ed. Sept. 2016. URL: https://arctic-sdi.org/wp-content/uploads/2017/04/SDI-Manual-for-the-Arctic-EDITED2_PS.pdf.