

MAPSIT: Making Data Accessible and Usable



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Planetary Advisory Committee, Aug 2020

Summary of Activities

- Decadal Survey PSDI White paper –now on arXiv: <https://arxiv.org/abs/2008.06171>
- Community meeting Oct. 14
- Keep moving forward PSDIs for missions, bodies

[Submitted on 14 Aug 2020]

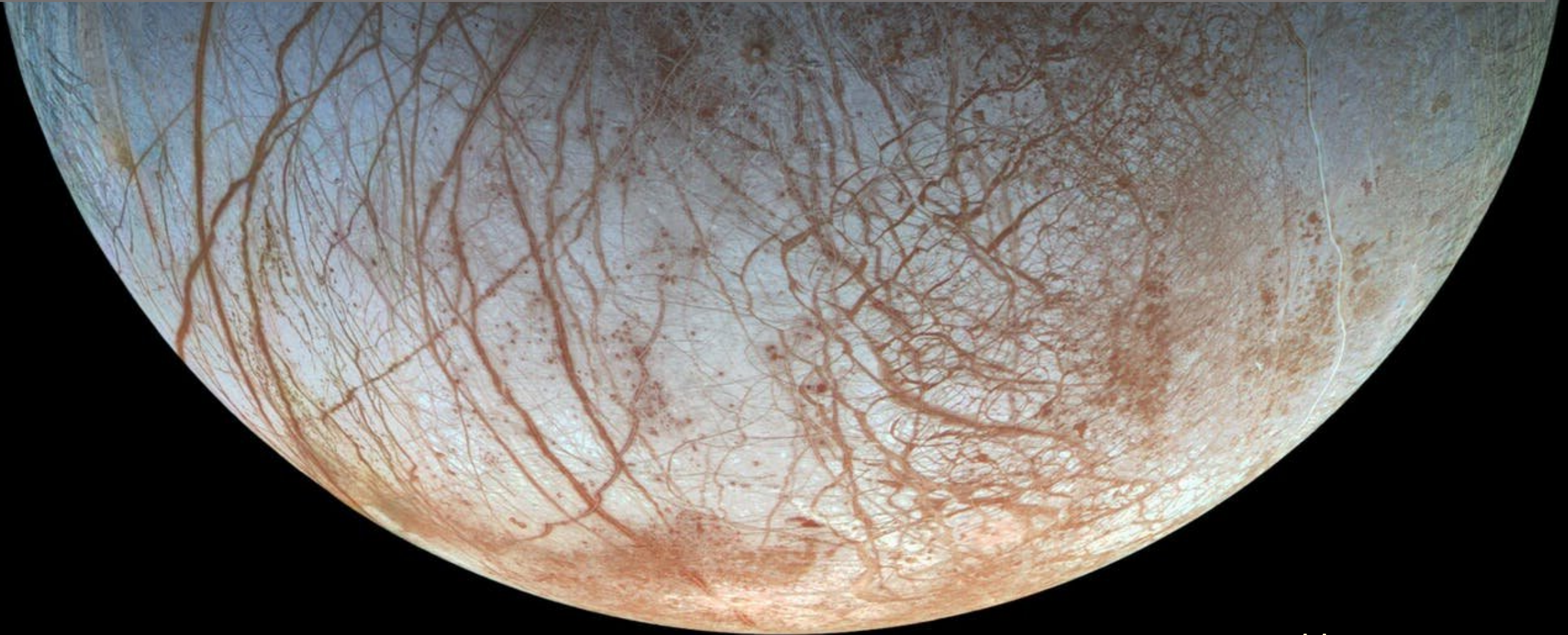
Maximizing the value of Solar System data through Planetary Spatial Data Infrastructures

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Planetary spatial data returned by spacecraft, including images and higher-order products such as mosaics, controlled basemaps, and digital elevation models (DEMs), are of critical importance to NASA, its commercial partners and other space agencies. Planetary spatial data are an essential component of basic scientific research and sustained planetary exploration and operations. The Planetary Data System (PDS) is performing the essential job of archiving and serving these data, mostly in raw or calibrated form, with less support for higher-order, more ready-to-use products. However, many planetary spatial data remain not readily accessible to and/or usable by the general science user because particular skills and tools are necessary to process and interpret them from the raw initial state. There is a critical need for planetary spatial data to be more accessible and usable to researchers and stakeholders. A Planetary Spatial Data Infrastructure (PSDI) is a collection of data, tools, standards, policies, and the people that use and engage with them. A PSDI comprises an overarching

PSDI White Paper

- Spatial data contribute significantly to the success of NASA endeavors *if they are correctly acquired, accessible, and usable.*



Galileo Europa

PSDI White Paper

- Spatial data contribute significantly to the success of NASA endeavors *if they are correctly acquired, accessible, and usable*.
- Often, spatial data are *not readily interpretable* to users outside mission science teams or they are processed in ways that are *non-standard*.

What is a Planetary Spatial Data Infrastructure?

- A **plan** and a **structure** for obtaining and organizing data in a standardized way to make them **discoverable, accessible and usable**.
 - NOT just a collection of data
 - NOT just an application, like ArcGIS, a Trek, etc.
- A planetary SDI should be built around **USER** needs.
 - How should we obtain data so that it can give us the most information?
 - How should it be organized? What products are prioritized?
 - What technologies are needed for processing and use?

A Planetary Spatial Data Infrastructure - how?

- Assume a planet with mission/s past/future
- Committee of data gatherers, users, stakeholders
 - Agree upon ways to obtain/process data and create foundational data all can use
 - Agree how to keep/serve data long term
- Europa as case study

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Earth and Space Science

RESEARCH ARTICLE

10.1029/2018EA000411

Special Section:

Planetary Mapping: Methods,
Tools for Scientific Analysis and
Exploration

Framework for the Development of Planetary Spatial Data Infrastructures: A Europa Case Study

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See Laura et al. (2018) ESS doi:10.1029/2018EA000411 for a theoretical framework for a PSDI with Europa as an example

A Europa Planetary Spatial Data Infrastructure

- *Policy/Standards*

- Committee of OPAG, Europa Clipper, MAPSIT
- What products are needed from existing data, how do we collect and integrate new data, how to serve it, roles and responsibilities

- *People*

- *Enablers* = NASA
- *Suppliers* = anyone who has spatially enabled data products to contribute (old/new missions, outside of missions)
- *Developers* = maintain technical solutions like analysis tools, data services
- *Marketers* = NASA, missions, scientists
- *Users* = Anyone who uses the products

See Laura et al. (2018) ESS doi:10.1029/2018EA000411 for a theoretical framework for a PSDI with Europa as an example

A Europa Planetary Spatial Data Infrastructure

- *Data and Formats*

- Do an inventory to identify critical gaps and spatial efficacy
- All data that exists should be spatialized to existing orthomosaic base
- New data (to be obtained) must work spatially with previous

- *Access*

- Organizations and teams should be engaged as custodians
- So far: Raw on PDS, ASU RPIF V1,2 mosaics, USGS orthorectified via PDS annex
- **Develop an E-PSDI clearinghouse to make available spatially enabled data**

See Laura et al. (2018) ESS doi:10.1029/2018EA000411 for a theoretical framework for a PSDI with Europa as an example

A Europa Planetary Spatial Data Infrastructure

- *Policy and Standards*
- *People*
- *Data and Formats*
- *Access*

Summary of Activities

- Decadal Survey PSDI White paper
 - Based on the Roadmap, focused on data accessibility and usability
 - Published on arXiv
- Community meeting Wed. Oct 14, 11-4 MDT
 - PSDI plans and efforts
 - Data Ecosystem review in progress at NASA
 - Tools updates (ISIS, JMARS, Treks, LRO quickmap)
 - General discussion
- Execute the roadmap by **building PSDIs**
 - Start with Europa? Moon has some underway
 - Who should do these activities, how should they be funded? – NASA the steward, community can all help

Reminder of MAPSIT Roadmap

- <https://www.lpi.usra.edu/mapsit/roadmap/>
- Focuses on Planetary Spatial Data Infrastructure





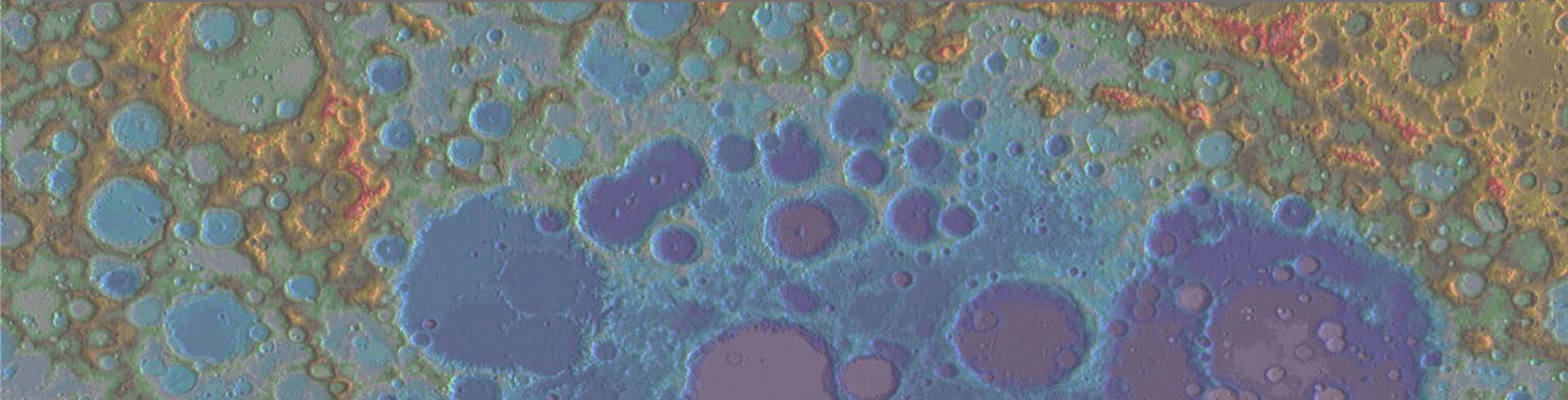
extras



- PSDIs require **FOUNDATIONAL DATA PRODUCTS** – provide basic positional information on which all other data can be placed. These are **controlled** and **registered** to the body.
- Not all bodies have these products made automatically by missions.
- This one: Lunar Reconnaissance Orbiter (LRO) WAC Color Shaded Relief Map of the Lunar far side, created from the Global Lunar Digital Terrain Model (100 m/pixel) and LOLA 30-m gridded DTM. (lroc.sese.asu.edu).

The Mapping and Planetary Spatial Data Infrastructure Roadmap

- Encourages the creation of initiatives to ensure that planetary spatial data are **correctly obtained and processed** and are **discoverable and usable** for a wide range of research and exploration purposes.

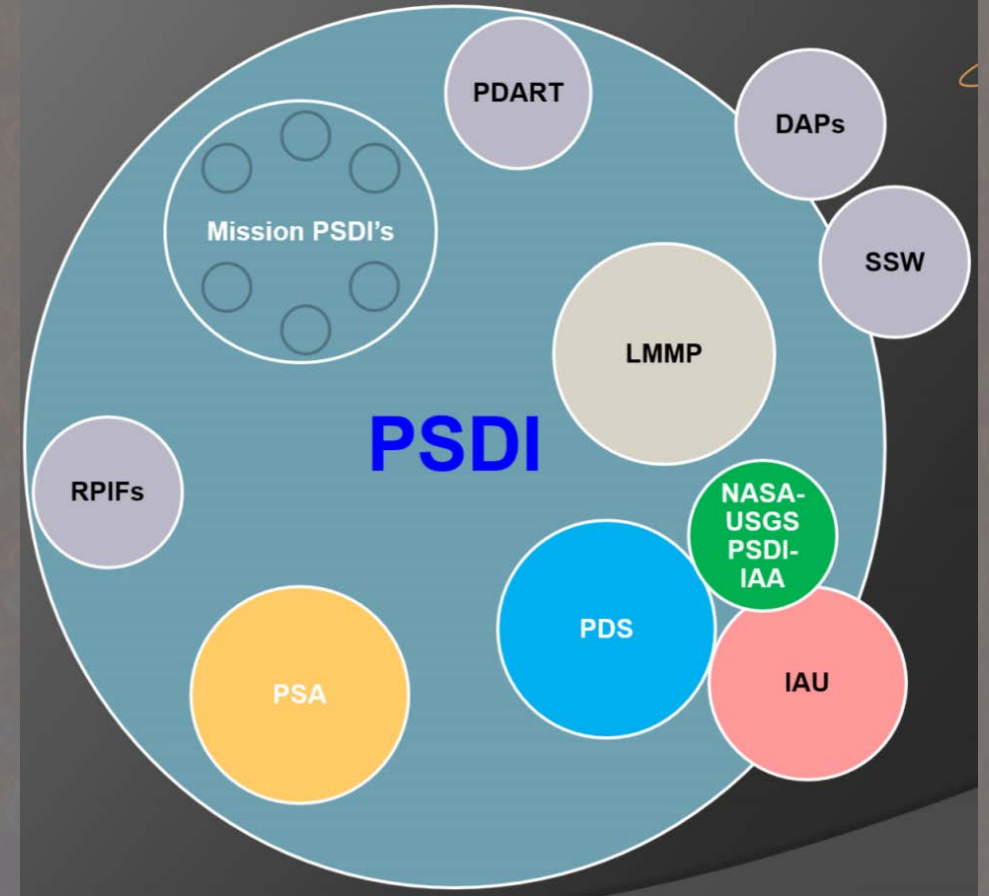


The Mapping and Planetary Spatial Data Infrastructure Roadmap 2019-2023 (SHORT summary)

- **Finding I:** High-quality data should be obtained and foundational data made – these are key to registering all data for a specific body.
- **Finding II:** Data that are ready-to-use and that conform to standards should be made – these broaden the reach of information.
- **Finding III:** Future efforts should ensure that data are easily discoverable, accessible, usable, and conform to evolving standards.
- **Finding IV:** PSDI(s) should be developed – this helps data reach beyond a single application or community.
- **Finding V:** Additional data tools, technologies and expertise should be developed following community priorities.

Doesn't NASA's PDS serve all data needs?

- The Planetary Data System (**PDS**) is tasked with long-term preservation of data
 - An element of the PSDI initiative
- Typically data stored within the **PDS archive** are **not spatially enabled** for immediate use by non-expert research scientists.
- Instead, adequate metadata are provided with the image data that **enable the user to create** spatially enabled products.
- **Significant expertise is required** to perform these operations and interpret the spatial correctness of the products.



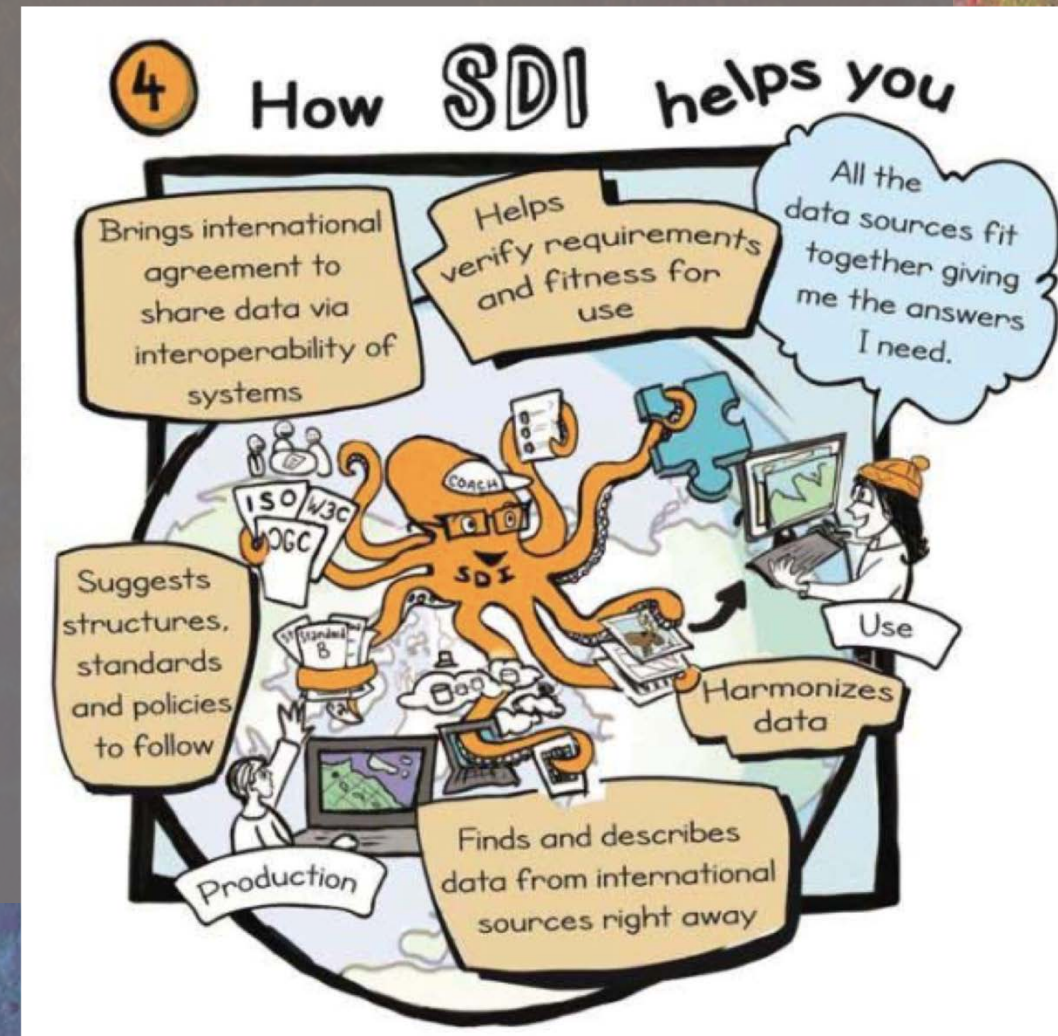
See Gaddis et al., 2017:

https://astropedia.astrogeology.usgs.gov/download/Docs/PlanetaryDataWorkshop/Presentations2017/Thursday/Humphreys/PDS_and_PSDI_Gaddis_6.15.17_v3.pdf

Don't we already have online applications?

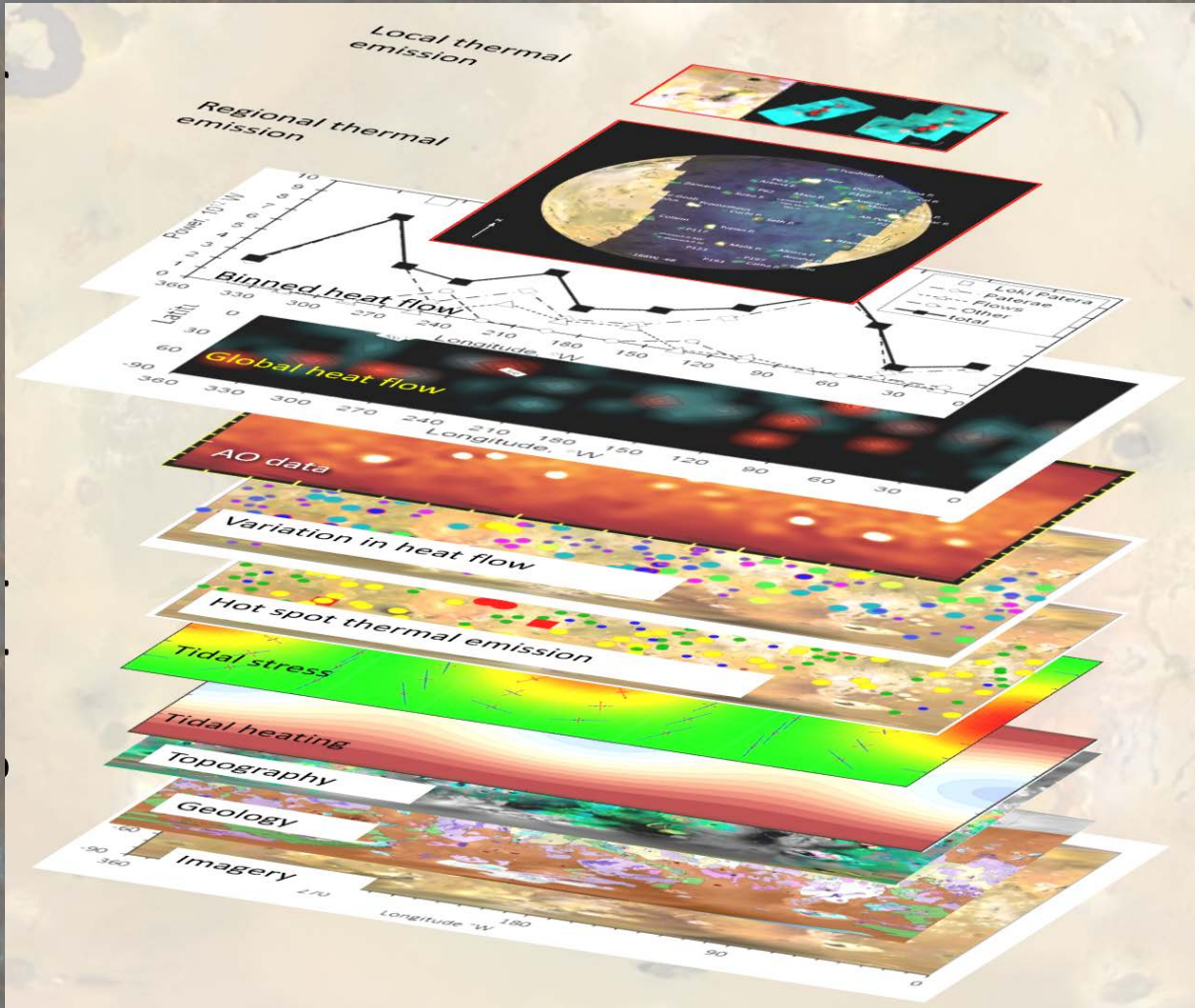
- PSDIs are **more dynamic** than most data servers and tools
- Often the controlled, foundational data need to be created and registered to the body, so that the popular web-based tools or GIS-based applications can work
 - *Anyone can contribute to this effort!*

Lots of Earth-based SDIs



Types of Integrated Data: Io example

Existing and proposed ASU Io database layers



- Foundational (base) data
 - Geodetic Coordinate Reference Frames - subject to refinement as knowledge improves
 - Elevation (Topographic) data
- Overlain data
 - Orthorectified orthomosaics
 - Spectral compositional maps
 - Geologic maps at various scales