MAPSIT: A ROADMAP UPDATE

Jani Radebaugh*, Chair for MAPSIT Steering Committee

Planetary Science Advisory Committee, 9/24/19

*Justin Hagerty presenting

MAPSIT – Mapping and Planetary Spatial Infrastructure Team

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  - Website: http://www.lpi.usra.edu/mapsit

MAPSIT – MAPPING AND PLANETARY SPATIAL INFRASTRUCTURE TEAM

- The planetary community and NASA recognized the need for community discussion and input on how to help maximize scientific return from missions, and how to help users discover and use science ready data from missions

- This team (i.e., MAPSIT) is the result

- An Analysis/Assessment Group (AG) like *VEXAG* etc., but independent of location in Solar System
  - NASA HQ point of contact is Sarah Noble

KEY TERMS

- **Spatial Data** – Data with a locational/spatial component related to a common spatial reference (e.g., a coordinate system)
  - Digital terrain/elevation models
  - Map projected image mosaics
  - Geologic maps
- **Science-Ready Spatial Data Products**
  - Accurate, co-registered, interoperable, known error, reproducible

- **Foundational Data Products**
  - Orthoimages/controlled mosaics
- **Framework Data Products**
  - Mineralogy / element maps

MOTIVATION AND RATIONALE

- Spatial data contribute to the success of endeavors at NASA if they are correctly acquired, processed, discoverable, and usable
- Often, spatial data are not readily interpretable by users outside mission science teams or they are processed in ways that are non-standard and/or require exceptionally specialized knowledge
- MAPSIT is tasked with assisting the community in obtaining spatial data and making it accessible and usable to the planetary community, preferably in a science-ready format
- Findings related to these efforts have been made and are being reported in the form of the Mapping and Planetary Spatial Data Infrastructure Roadmap

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

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

THE MAPPING AND PLANETARY SPATIAL DATA INFRASTRUCTURE ROADMAP

- **Finding I: NASA and the MAPSIT community should work with missions to**
  - Ensure that instrument calibration plans are in place prior to launch and in flight
  - Encourage obtaining data of the highest possible quality, so that it can be placed spatially on the planet as accurately as possible
  - Ensure that derived products used by the team (e.g., high-level thematic maps, special mosaics, GIS layers, etc.) are delivered publicly as soon as possible during or after the mission.

THE MAPPING AND PLANETARY SPATIAL DATA INFRASTRUCTURE ROADMAP

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

THE MAPPING AND PLANETARY SPATIAL DATA INFRASTRUCTURE ROADMAP

- **Finding II: NASA and the MAPSIT community should work to**
  - Establish product formats that meet community needs for interoperability. Develop and maintain a community forum for selecting and maintaining data format standards
  - Encourage mission teams and research projects to incorporate their data into existing Planetary Spatial Data Infrastructures that are publicly available and can be used by others
  - Missions and data providers should be required to develop data user guides and other documentation and support materials for training the user community in the use of data they deliver

THE MAPPING AND PLANETARY SPATIAL DATA INFRASTRUCTURE ROADMAP

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

THE MAPPING AND PLANETARY SPATIAL DATA INFRASTRUCTURE ROADMAP

- **Finding III: NASA and the MAPSIT community should work to**
  - Ensure data are accessible via common methods (e.g., via online Web Map Services), rather than using single tools or proprietary formats
  - Make sure data services use a standard Application Programming Interface (API) or that can work well with a variety of interfaces
  - Duplication of effort in data delivery tools should be avoided where possible (communication)
  - Data transparency and access, such as the processing steps followed for the data products, must be made commonly available
  - Support improvements in the quality and abundance of metadata for spatial data products in order to improve data discoverability

THE MAPPING AND PLANETARY SPATIAL DATA INFRASTRUCTURE ROADMAP

- **Finding IV:** MAPSIT should coordinate with community representatives and groups, such as other NASA Assessment and Analysis Groups (AGs), to ensure that foundational data products are produced and that PSDIs are developed and maintained for each planetary body in the Solar System to best enable NASA exploration and mission goals.

THE MAPPING AND PLANETARY SPATIAL DATA INFRASTRUCTURE ROADMAP

- **Finding IV: NASA and the MAPSIT community should work to**
  - Determine the gaps that exist in creation of control networks and PSDIs for given bodies or disciplines according to the needs of upcoming missions and exploration timelines
  - If there are insufficient data to make necessary foundational products, identify what data are missing and how this can be addressed by future missions
  - Encourage the systematic creation of higher-order products maximize scientific return and efficiently facilitate research

THE MAPPING AND PLANETARY SPATIAL DATA INFRASTRUCTURE ROADMAP

- **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.

THE MAPPING AND PLANETARY SPATIAL DATA INFRASTRUCTURE ROADMAP

Finding V: NASA and the MAPSIT community should work to

- Look to other communities, especially those of Earth-based SDIs, for expertise and solutions that have worked
- Encourage innovative research into spatial data manipulation and processing
- Ensure key areas of expertise and institutional knowledge are developed and maintained through training, hiring initiatives, retention of spatial data experts, and recruiting the next generation of spatial data experts

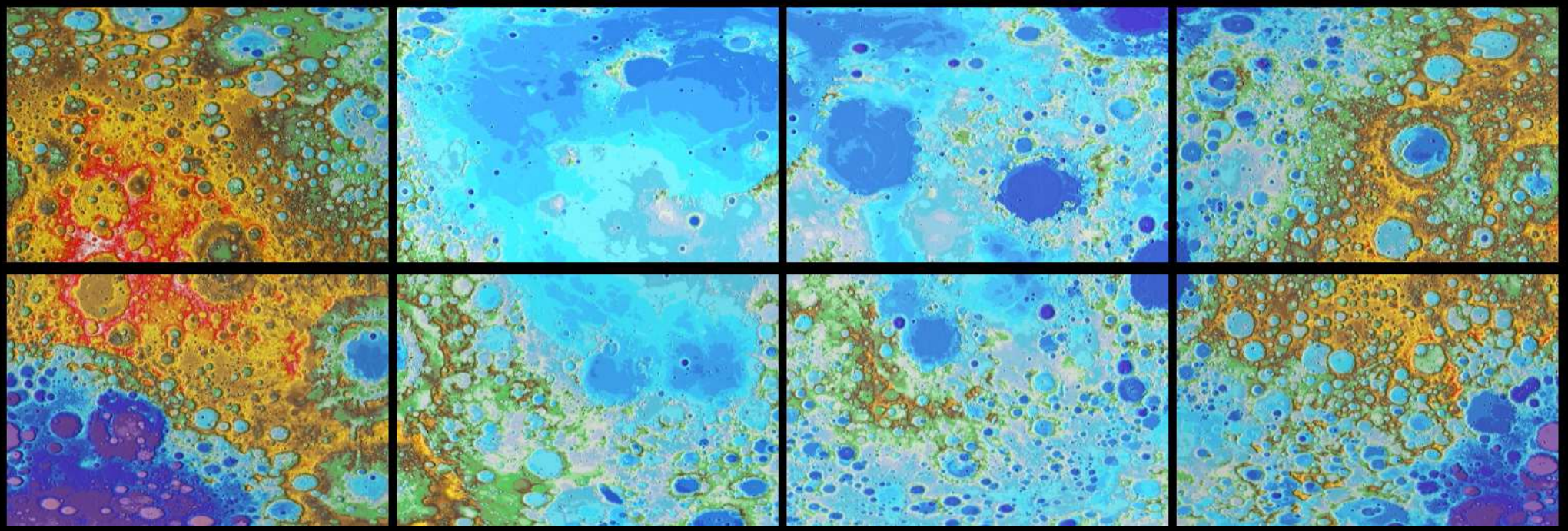
THE MAPPING AND PLANETARY SPATIAL DATA INFRASTRUCTURE ROADMAP

- The Roadmap is available for comment on the LPI website https://www.lpi.usra.edu/mapsit/

- Start talking with AGs regarding our best interpretations for your PSDI needs (i.e., SBAG)

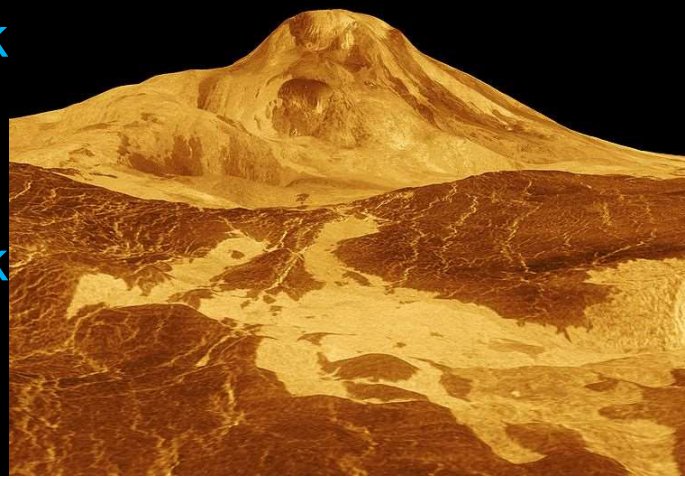
THE MAPPING AND PLANETARY SPATIAL DATA INFRASTRUCTURE ROADMAP

- Questions?
- Contacts: Jani Radebaugh (jani.radebuagh@byu.edu)



PLANETARY EXAMPLES

- Geodetic Coordinate Reference Frames
  - IAU defined lat/lon and ephemeris
  - Planetary is special: geodetic coordinate reference frames are iteratively defined as data improves. (laser altimetry (e.g. LOLA) for the Moon)
  - As a non spatial expert - these should just work
- Elevation Data
  - Mars DTM from MOLA, Magellan DEM
  - As a non spatial expert - these should just work
- Orthorectified Orthomosaics
  - Global Io Voyager/Galileo basemap
  - As a non spatial expert - these should just work



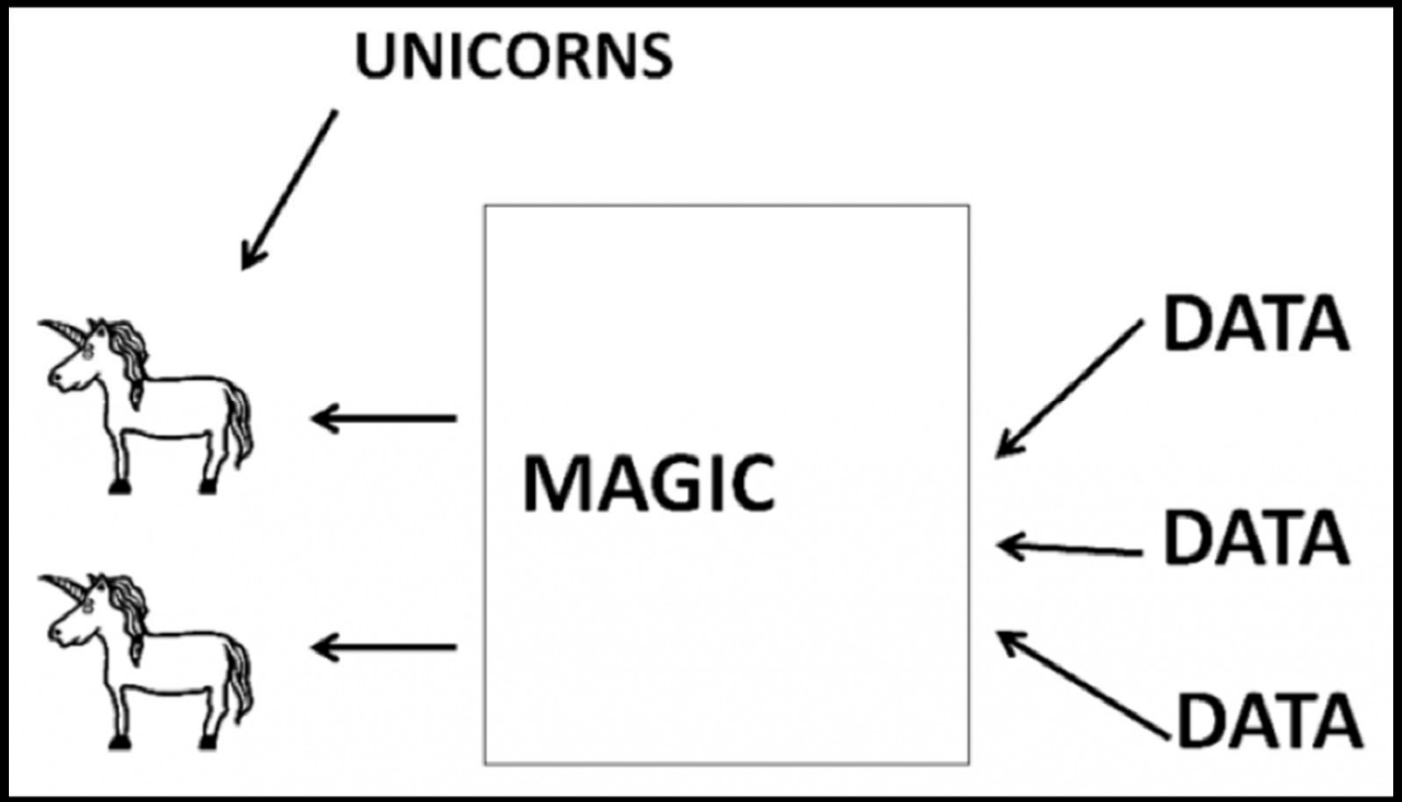
WHAT IS A PLANETARY SPATIAL DATA INFRASTRUCTURE?

- A PSDI is a plan for how spatial data planning should occur and for organizing data in a standardized way so that data are discoverable, accessible and usable

- An ideal PSDI should serve a broad community whose members do not need to be experts in spatial concepts and who may not be concerned with the details of storing, finding, and using spatially enabled data (Laura et al. 2017).

WHAT IS A PLANETARY SPATIAL DATA INFRASTRUCTURE?

Users want the data to *just work*



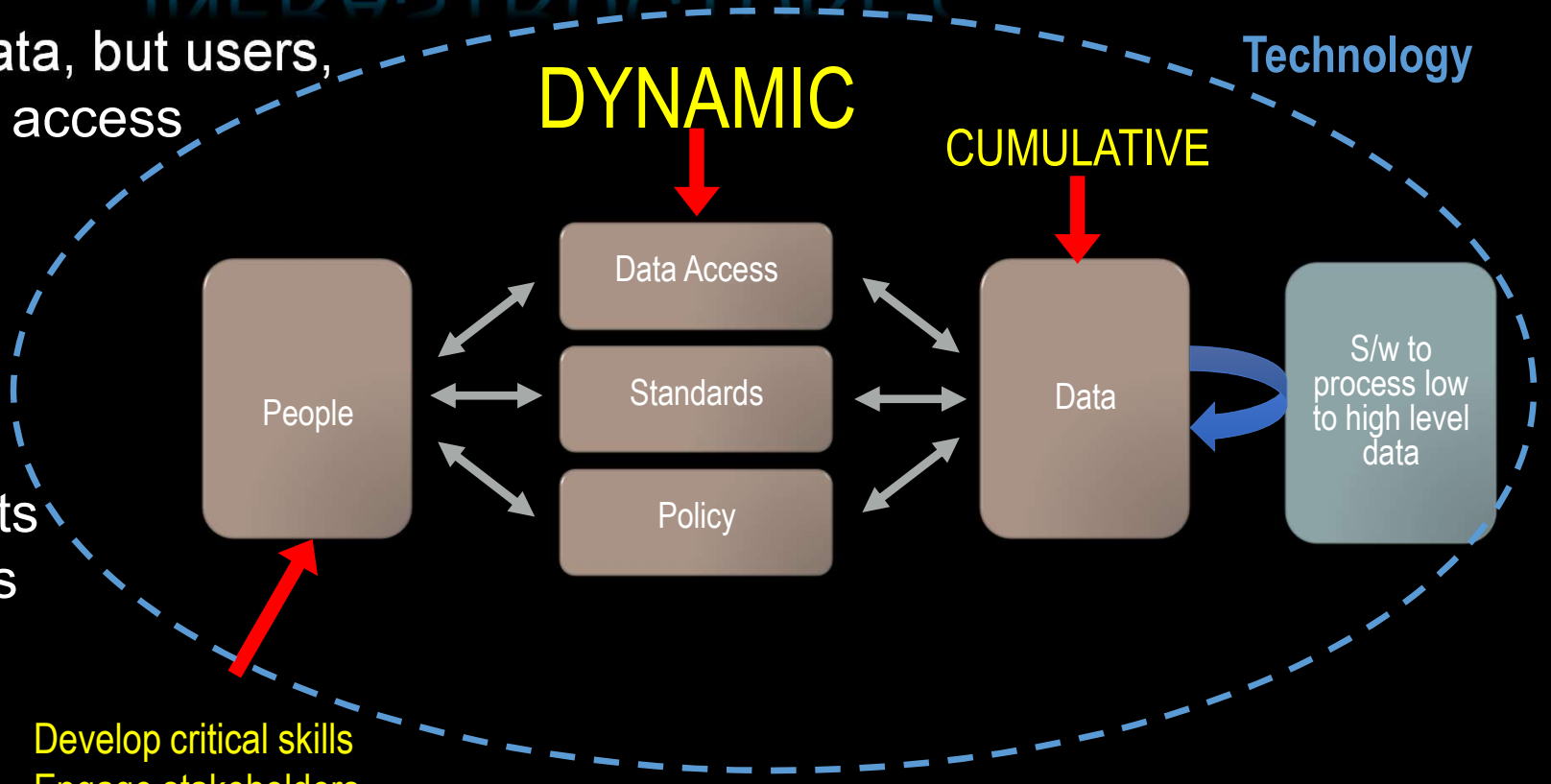
WHAT IS A PLANETARY SPATIAL DATA INFRASTRUCTURE?

Involve not just data, but users, standards, policy, access

Data should just work!

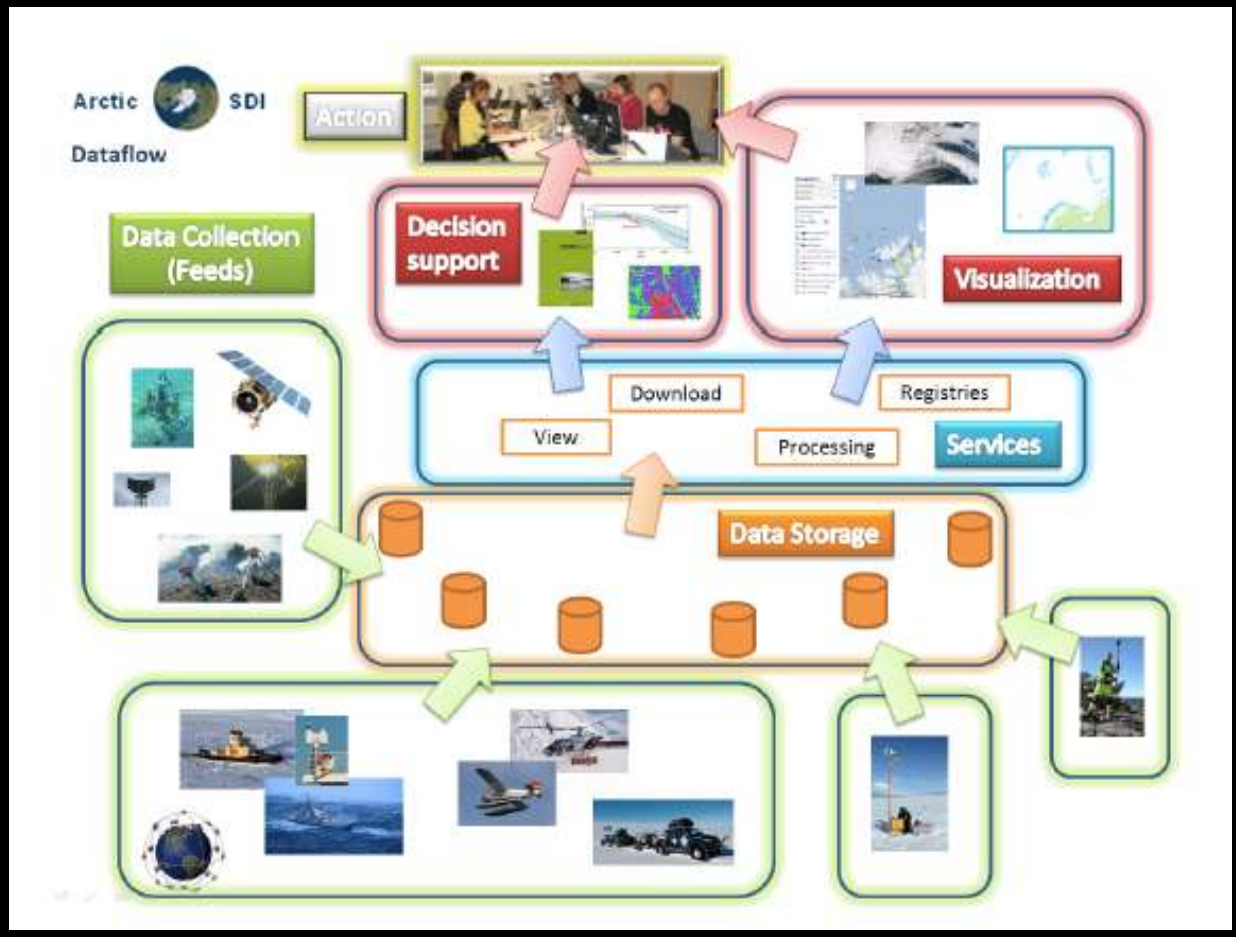
Involved are:

- Data products
- Technologies
- Standards
- People



EXAMPLE – ARCTIC SPATIAL DATA INFRASTRUCTURE

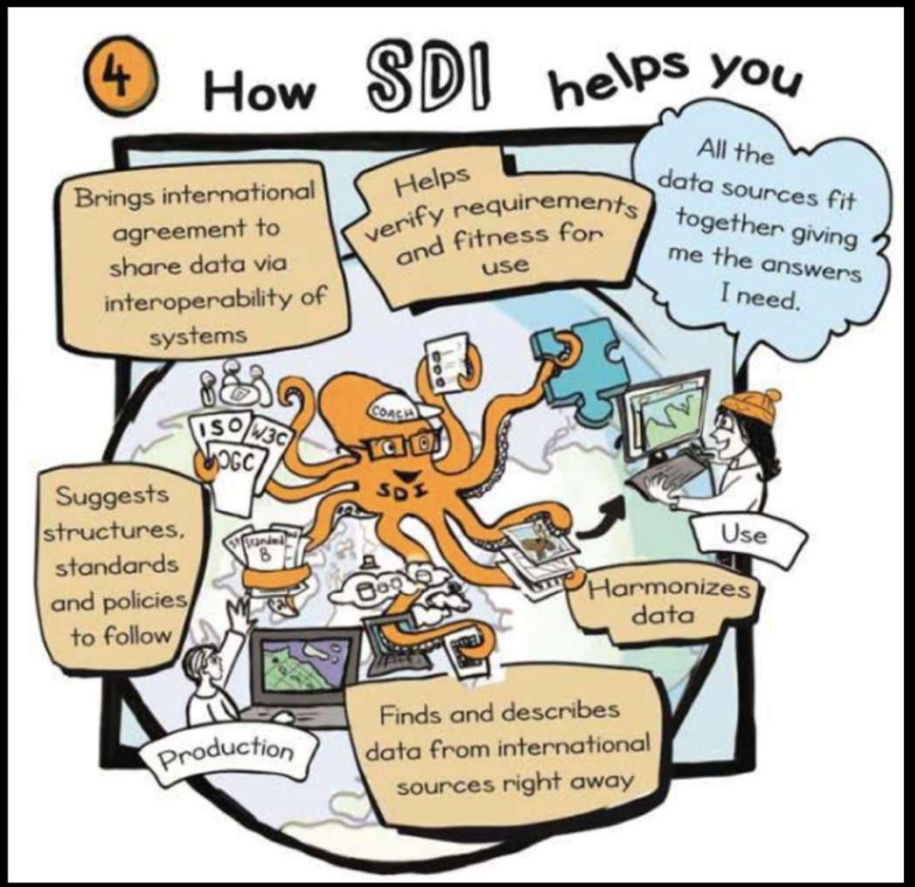
- Data from 12 different organizations – required heavy standardization
- Available in widely used geospatial formats
- Search enabled by tight data/information coupling
- Data available to all kinds of users



WHAT ABOUT EXISTING APPLICATIONS?

PSDIs are more like plans than data servers. Many times the controlled, foundational data need to be created and registered to the body, so that the overlying web-based or GIS-based applications can work.

Lots of Earth-based SDIs



DIFFERENCE FROM THE PDS

- PDS is tasked with long-term preservation of data
- Most frequently, data stored within the Planetary Data System (PDS) archive are not always spatially enabled for immediate use by non-expert research scientists.
- Instead, adequate metadata are provided along 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.