EPSC Abstracts
Vol. 12, EPSC2018-799, 2018
European Planetary Science Congress 2018

Data exploration in the ESA Planetary Science Archive – current status and future plans

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Abstract

The Planetary Science Archive (PSA – http://psa.esa.int/) is the PDS-compatible long-term archive of planetary mission data within the European Space Agency. As a cross-mission and cross-discipline archive, there are a wealth of possibilities for complex queries, but also a number of difficulties due to the diverse instruments involved. The current status and future plans to address this are discussed here.

1. The PSA

The PSA (1) contains data from a variety of Solar System missions, and supporting ground based observations. The earliest data are from ESA's first deep space mission, Giotto, whilst the archives are already being prepared for upcoming missions such as BepiColombo and JUICE. This includes orbiters, landers, descent probes, flyby spacecraft and, shortly, a rover. Combining the data from multiple missions, targets and instruments is key to truly exploit the data in the archive. However, the variety of instrument and mission types makes it difficult to find a unified way to present and search the catalogue.

1.1 The GUI

In early 2017 ESA released a new version of the PSA offering a flexible user interface for browsing and finding data products by target, instrument type etc. Responding to community and mission input, the user interface has been expanded to include additional functionality including filtering by wavelength range. Since a web interface has to find a balance between usability and flexibility, some advanced search functionality is only available through a query language.

A major recent improvement to the interface is in the display of browse products, essentially thumbnails that allow the user to visually identify interesting data. These can now be viewed in a gallery display. In the longer term, an enhanced geometric search will be available to query the data based on the location of the observations and other geometric parameters.

1.2 Machine interfaces

Whilst the web interface is useful for browsing and finding single products, data exploration requires more complex searches. The PSA currently offers two options for machine access to the meta-data and data themselves [2]. The Planetary Data Access Protocol (PDAP) uses a REST API to discover and retrieve available products and datasets. The query functionalities are, however, rather limited and make the service most suitable for retrieving and mirroring data. More recently an extension to the popular astronomical protocol TAP (Table Access Protocol) was defined for the purposes of planetary science [3]. EPN-TAP is supported by the PSA, although the full range of core data fields have not yet been populated. This offers more complex queries on meta-data and the resulting products can be directly downloaded using the PDAP file access mechanism.

2. Future developments

One of the key features that is missing from the PSA is a geometry-based search function. Currently the PDS labels delivered with each product describe the

geometric conditions associated with that measurement, but they are often used in different ways by different instrument teams delivering the data. To address this a new development will generate geometric information for relevant instrument directly using the mission SPICE kernels and instrument descriptions. Eventually this will be used in a map-based interface to allow geospatial searches on relevant products.

New missions (specifically ExoMars, BepiColombo and JUICE) will use the new PDS4 standard [ref] for archiving which also enables better linking of data products within the archive.

The ultimate data exploration system would allow all meta data (coming from all data labels) to be indexed and queried, to allow the user to perform detailed searches and retrieve only those data relevant. Although the PSA is currently far from this goal, steps have been taken in this direction by indexing selected parameters requested by several active missions.

3. Summary and Conclusion

The PSA offers a diverse range of data from in-situ and remote sensing instruments on a range of platforms. Ensuring long-term preservation of the data is the key goal of the PSA, but steps have been taken to enable more efficient data exploration. New functionality will be added in an incremental fashion and feedback from the user community is essential in shaping these developments.

References

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