RECENT ENHANCEMENTS TO THE PDS GEOSCIENCES NODE'S ORBITAL DATA EXPLORER.

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Introduction: The Orbital Data Explorer (ODE: https://ode.rsl.wustl.edu) is a web-based search tool developed and maintained at NASA's Planetary Data System (PDS) Geosciences Node (https://pds-geosciences.wustl.edu). ODE provides search, display, and download functionality for PDS archives of orbital data products from planetary missions to Mars, Mercury, the Moon, and Venus [1].

Key Features: Key features of ODE include form- and map-based searching across multiple missions and instruments [1], product metadata and browse-product visualization, and a cart system with a high-speed download option using Aspera Connect [2]. ODE supports specialized granular query tools for subsetting science data at user specified spatial regions [3]. ODE generates product type coverage KMZ (zipped file of Keyhole Markup Language, KML) files and shapefiles for use with GIS tools. Additionally, a Representational State Transfer (REST) interface (https://oderest.rsl.wustl.edu, [4]) allows external users, scripts, and applications to access the ODE metadata and data products without using ODE web interfaces. Mars ODE provides a specialized tool for locating Mars Reconnaissance Orbiter (MRO) instruments' coordinated observations, including measurements coordinated with the NASA Phoenix landed mission [1].

New Features of ODE:

User Login. An optional user login was added to ODE in summer 2022. The free user accounts are shared with the PDS Geosciences Node's Analyst's Notebook website (https://an.rsl.wustl.edu) [5]. Logged in users are provided additional website capabilities.

Users have the option to bookmark product searches, map interface searches, product detail pages, and Mars ODE's MRO coordinated observation searches. Saved links can be accessed from the user's account area of ODE. No items saved by the user are shared or made public. The bookmarks are saved by category with a date time stamp, as well as with an optional user-entered description to help with later sorting and locating desired bookmarks. An example of bookmarked products and search results is shown in Fig. 1. For list maintenance, individual bookmarks can be removed or the entire list can be cleared later, as desired.

A history of viewed ODE product detail pages are cataloged for the user, as well. This can be helpful for quickly relocating PDS products for further review,

direct download, or addition to a cart order. Individual items or the entire history can be cleared at the user's preference.
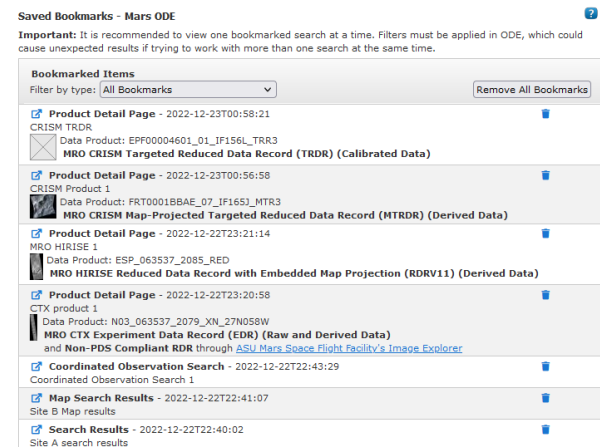

Fig. 1. An example of user's bookmarked PDS products, search result lists, map searches, and MRO coordinated observation searches from the Mars ODE.

To facilitate the reacquisition of past files that an ODE user may no longer maintain locally, a listing of past ODE cart orders is available to the user. The cart order history provides details including order date and time, PDS products ordered, and the total number of files. PDS products of past orders can be viewed, and individual, some, or all products of a past order can be added to the user's current cart request.

Faceted Search. The latest website enhancement has been the development of a faceted search feature for the product search page. To improve search efficiency and provide an interactive experience, this feature provides ODE users with rapid feedback on the results of their filter selections. As of January 2023, it is undergoing internal testing at the PDS Geosciences Node and will soon be available for public testing and comment.

The missions, instruments, processing levels, and product types of the product search page include the count of cataloged products matching the selected search filters. The product search form's date and angle filters display the product counts and minimum and maximum values, based on the matching products from the user's applied filters.

The faceted search update includes a results summary box that provides a running total and filter summary when using the product search page. The total filtered or unfiltered product count is displayed, based

on whether search filters have been set on the page. The list of applied filters is displayed, similar to a commerce website. The filters can be removed by clicking each filter's displayed text. See Fig. 2 for an example of the results summary box. If data sets are selected, they are included in the list of applied filters, along with their matching product count for quick reference. The summary box floats on the right side of the screen as the page is scrolled vertically. Once the user is satisfied with the previewed results, they may proceed to view the product search results in a table or on the map. When returning to the search page, the last query's filters are automatically populated, allowing the user to adjust the previous search criteria.
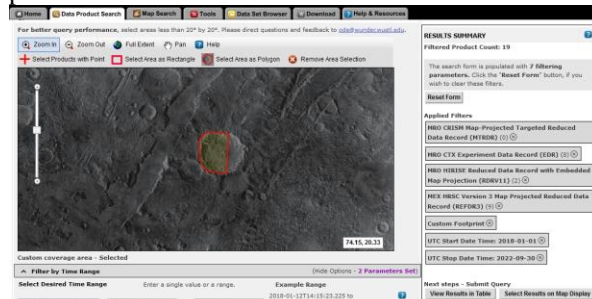

Fig. 2. Mars ODE's product search page with a custom search location set, and the faceted search results summary box to the right side of the page, displaying filtered product count summary, selected data sets, and additional applied filters.

Data Inventory Updates. ODE provides access to 36.8 million products in the PDS, ESA's Planetary Science Archive (PSA), and JAXA data repositories (1.99 petabytes of files) from more than 16 planetary missions and almost 70 instruments. ODE is continuously updated with newly released data from active missions, including NASA's Lunar Reconnaissance Orbiter (LRO), MRO, Mars Odyssey, and ESA's Mars Express and ExoMars Trace Gas Orbiter (TGO).

New PDS4 additions to the ODE catalog include ExoMars TGO ACS (Atmospheric Chemistry Suite) raw data, new derived LRO Diviner regional cumulative and seasonal polar cumulative products, new derived MRO SHARAD surface clutter simulations bundle, Odyssey GRS improved DND (Derived Neutron Data) data bundle, and LRO LEND raw, calibrated, and derived data released in PDS4 format since September 2022.

The PDS nodes and numerous mission instrument teams are working to convert archived and active mission data to the PDS4 standard. ODE is cataloging the converted data sets as they become available. If the previous PDS3 labels are maintained in the archive, they will still be available through ODE. PDS4-converted

data that have been updated in ODE over the last year include MESSENGER Radio Science raw data and MDIS data, as well as GRAIL Gravity Model data sets.

Future Work: The Geosciences Node plans to release the faceted search capability on the ODE website after public beta testing and associated updates are complete. Additional faceted search options will be added as and when possible. We plan to explore a filtering option for the product search form to select mission, instrument, processing level, and product type based on taxonomy attributes.

Newly released data from ongoing missions will continue to be added to ODE, including from LRO, MEX, MRO, Odyssey, and ExoMars TGO missions. Highly derived PDS4 bundles of orbital data for Mars, Mercury, Venus, and the Moon will be added to ODE as they become available. ODE's catalog of PDS archives will be updated to reflect changes to previously released archives that are being converted from PDS3 to PDS4 format. PDS4-migrated Magellan data are planned to be updated in the Venus ODE. Beginning in spring 2023, newly released LRO data will only be delivered to the PDS in PDS4 format, which will be cataloged in ODE.

With multiple upcoming missions to Venus, we plan to add ESA's Venus Express data to the Venus ODE, which are PDS3-format archives.

Contact Information: The PDS Geosciences Node welcomes questions and comments for additional ODE functions from the user community. This feedback helps identify useful future improvements and feature additions for the website. If you have any questions or comments, please email ode@wunder.wustl.edu or post on the Geosciences Node forum at https://geoweb.rsl.wustl.edu/community

References: [1] Wang, J. et al. (2015), 46th LPS, Abstract #1560. [2] Scholes D. et al. (2018), 49th LPS, Abstract #1235. [3] Wang, J. et al. (2011), 42nd LPS, Abstract #1896. [4] Bennett, K. et al. (2014), 45th LPS, Abstract #1026. [5] Stein, T.C. et al. (2010), 41st LPS, Abstract #1414.