

UPDATES TO THE PDS GEOSCIENCES NODE'S ORBITAL DATA EXPLORER FOR IMPROVED DATA SEARCH AND DOWNLOAD. J. Wang, D. Scholes, R. E. Arvidson, S. Slavney, E. A. Guinness, L. E. Arvidson, F. Zhou, D. V. Politte, and S. J. VanBommel, McDonnell Center for the Space Sciences, Department of Earth and Planetary Sciences, Washington University in Saint Louis, 1 Brookings Drive, Campus Box 1169, St. Louis, Missouri, 63130, wang@wunder.wustl.edu.

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 PDS3 and PDS4 archives of orbital data products from planetary missions to Mars, the Earth's Moon, Mercury, and Venus [1,2,3]. A number of updates have been applied recently to the ODE interface to improve data search and download capability.

ODE Primary Features: ODE offers form- and map-based searches of cataloged planetary data across multiple missions and instruments [4]. Searches can be filtered by mission, instrument, processing level, observation type, location, time, observation angle, and PDS product identifier (ID).

ODE provides a detailed view of PDS metadata. Associated data files, metadata labels, format files, and documentation are accessible from the detail pages. Files can be downloaded directly or through the website's cart functionality.

ODE supports a specialized granular query tool for subsetting science data at specified regions [5]. This tool facilitates queries of orbital laser altimetry and thermal emission spectrometer instrument data including: MGS (Mars Global Surveyor) MOLA (Mars Orbiter Laser Altimeter) and LRO (Lunar Reconnaissance Orbiter) LOLA (Lunar Orbiter Laser Altimeter) and Diviner, as well as MESSENGER (Mercury Surface, Space Environment, Geochemistry and Ranging) MLA (Mercury Laser Altimeter). The granular query tool produces derived products in the form of ASCII or CSV tables, shapefiles, and binned images.

ODE provides a Mars Reconnaissance Orbiter (MRO) coordinated observation search tool. A coordinated observation is a planned observation involving multiple instruments at a given location and time. ODE tracks the coordinated observations from HiRISE (High-Resolution Imaging Science Experiment), CRISM (Compact Reconnaissance Imaging Spectrometer for Mars), MCS (Mars Climate Sounder), and CTX (Context Camera).

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/>, [6]) allows external users, scripts, and applications to access the ODE metadata and data products without using ODE web interfaces.

ODE provides a cart system for downloading many files at once. The cart ordering system retrieves data from multiple host PDS nodes and data nodes, if necessary, adds related files, and provides download information to the user. The ODE cart request download page provides a convenient and fast option with a single click link for users to download the entire user cart request using Aspera Connect, a web browser plug-in [7]. HTTP and FTP links are provided on the page for users who prefer to download the files through a client application, a different web browser plug-in, a local script, or directly through the web browser.

Data Inventory: ODE provides access to 25.2 million PDS products (1.6 petabytes of files) from more than 13 planetary missions and over 50 individual instruments. Available active missions include MRO, Odyssey, MEX (Mars Express), and LRO; completed available missions include MGS, Viking Orbiter, Clementine, Lunar Prospector, Lunar Orbiter, Chandrayaan-1, Magellan, GRAIL (Gravity Recovery and Interior Laboratory), and MESSENGER. ODE is continually updated for active missions as new and accumulating datasets are released by PDS. A detailed list of the current ODE holdings can be found at <https://wufs.wustl.edu/ode/odeholdings>.

Recent Updates: In addition to database and backend coding changes, a number of updates have been made to the ODE interface to improve data search and download functions.

Data search. Coverage query precision has been improved in the current version of ODE. Previously, only rectangle shapes were supported for product searches. The form-based and map-based search interfaces now include a freehand polygon area selection tool. This feature allows users to pan and zoom to regions over a standard base map and create a custom search area conforming to their specific location and shape of interest (e.g., Figure 1, right). Through the map-based search interface, immediate search result feedback can be viewed as the user alters the selection area.

ODE's map-based search interface has also been updated to provide a clearer organization of product

coverage layers. The product coverage layers are now grouped by missions, instruments, and PDS4 standard processing level (e.g., Figure 1, left panel), which is similar to the form-based product search page. The product coverage layers are listed by their named grouping types rather than only product type abbreviations. This allows users to more easily locate and interact with layers of interest.

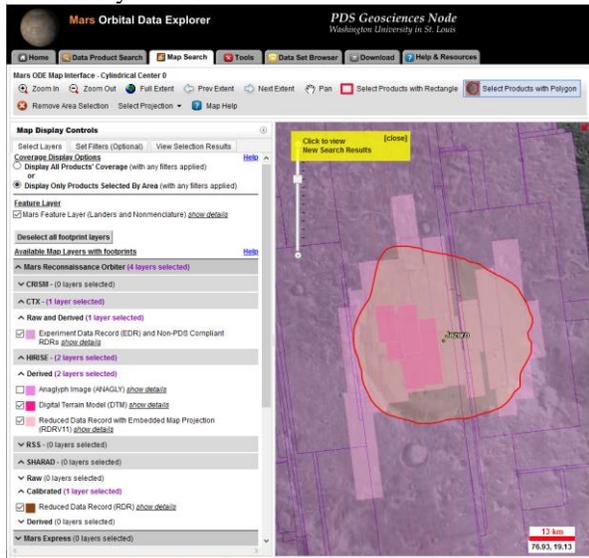


Figure 1. Improved Mars ODE map-based search, Left: products coverage map layers grouped by missions, instruments, and PDS4 standard processing levels. Right: free-hand polygon selection of multi-instrument MRO data at Jezero Crater.

The Mars ODE's MRO coordinated observation search has a new filtering option. A user can now enter a PDS product ID (including wildcard characters) to find any coordinated observations that include the specified product ID. This can be helpful for confirming if a PDS product of interest was part of a coordinated observation and to locate related observations. Specifically, other products of a coordinated observation can be located if the product ID of a single coordinated observation is known.

Data download. The ODE cart process has been enhanced to better support users with large ODE cart requests. Typically, ODE cart requests are limited to 50GB of PDS product files per cart order. This limit exists to ensure each cart request can be fulfilled in a timely manner. Users always have the option to create multiple consecutive cart requests. When a user completes the cart checkout process to request PDS products, the ODE cart system acquires, organizes, and packages the PDS product files for user download. Any files that are not archived at the PDS Geosciences Node are automatically acquired by ODE from their remote data archive locations.

In cooperation with the LROC Data Node, a process has been implemented to transfer files to the PDS Geosciences Node using Aspera high-speed data transfer technology [7]. This process uses a combination of scheduled scripts and ODE web services to coordinate the transfer of the files using the software. The implementation of this system has significantly improved the speed of acquiring LROC data files for ODE cart requests, resulting in faster cart order fulfillment. For example, the transfer of a 504 MB LROC CDR image from the LROC Data Node is completed in approximately 60 seconds, versus 10 minutes via HTTP, a 10x improvement.

To support users who wish to request more than 50 GB of PDS products or prefer to directly download desired files, ODE provides additional download options under the "Advanced user options" located on the first ODE cart checkout page. Through advanced download options, users can download a list of all the direct HTTP and FTP paths to the PDS product files in their cart. This supports users who wish to utilize their own third-party download tools, such as Wget and curl, or simply wish to include data product acquisition as part of their own coded script. Wget and curl examples are also provided to assist users.

Future Work: Newly released data from ongoing missions will continue to be added to ODE. ODE's catalog of PDS archives will be updated to reflect changes as archives are migrated from the PDS3 to PDS4 standard. Website interface capabilities will continue to be improved. Feedback from the community is valued and always encouraged; comments from users can help identify useful future improvements and feature additions.

Contact Information: The PDS Geosciences Node welcomes questions and comments for additional ODE functions from the user community. If you have any questions or comments please send emails to ode@wunder.wustl.edu or post on the Geosciences Node forum <https://geoweb.rsl.wustl.edu/community/>.

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