RECENT ADDITIONS TO THE ORBITAL DATA EXPLORER OF THE PDS GEOSCIENCES NODE. J. Wang[1], D. Scholes[1], R. E. Arvidson[1], E. A. Guinness[1], and F. Zhou[1], [1]Department of Earth and Planetary Sciences, McDonnell Center for the Space 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 PDS archives of orbital data products from planetary missions to Mars, the Earth's Moon, Mercury, 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 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 Additions to the ODE:

Data Inventory. A great deal of new lunar data will be produced as NASA (and private enterprises and other national space programs) embark on an array of new missions. The new data sets will be ingested into the lunar ODE as they are made available. Note that new lunar related datasets have been added into the lunar ODE since 2021. One large addition is the SELENE (KAGUYA) data from JAXA, including data from the Alpha Ray Detector, Gamma Ray Spectrometer, High-Definition Television, Laser Altimeter (LALT), Lunar Magnetometer, Lunar Radar Sounder (LRS), Multiband Imager (MI), Terrain Camera, Plasma Energy Angle and Composition Experiment, as well as Upper-Atmosphere and Plasma Imager. Figure 1 is an example of a multi-instrument search of SELENE LALT time series topographic data (turquoise lines), LRS Subsurface SAR data (green lines), and MI Near-Infrared images (blue rectangles) at Schrodinger Crater near the South Pole.

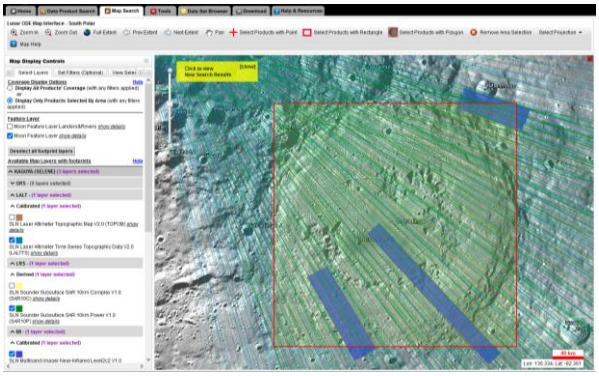

Fig. 1. Multiple-instrument search of SELENE data at Schrodinger Crater. The basemap is LRO (Lunar Reconnaissance Orbiter) LROC WAC (Wide Angle Camera) mosaic in south polar stereographic projection.

In addition to lunar data, ODE now hosts data for Mars, Mercury and Venus. Datasets from instruments NOMAD (Nadir and Occultation for MArs Discovery) and CaSSIS (Colour and Stereo Surface Imaging System) of the ESA's (European Space Agency's) TGO (Trace Gas Orbiter) mission were added during the spring of 2021. An example of a cross-mission instrument search of CaSSIS data with others in ODE map-based search interface is shown in Fig. 2.

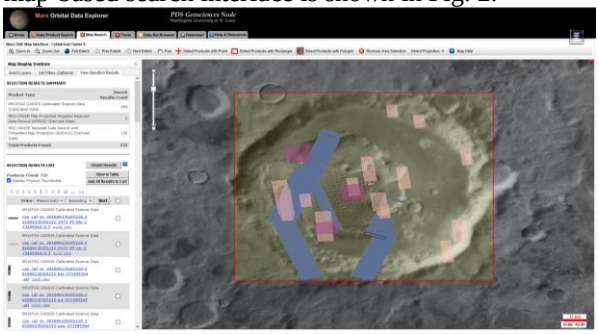

Fig. 2. A cross-mission instrument search of TGO CaSSIS (blue polygons), MRO CRISM (purple polygons) and MRO HIRISE (pink polygons) data at Mars Rabe Crater, which contains large sand dunes.

The ExoMars 2016 TGO data are currently undergoing a general bulk reprocessing by the instrument teams. The reprocessing will create new version 3.0 products that will replace those already in the ESA's PSA (Planetary Science Archive) and cover all data from the start of the mission for all the instruments. The ODE catalog will be updated to use the newer version products, as they become available.

ODE provides access to 30.5 million PDS products (1.67 petabytes of files) from more than 15 planetary missions and over 64 individual instruments. ODE is continually updated for active missions such as MRO, Odyssey, ESA's MEX (Mars Express) and TGO, and LRO (Lunar Reconnaissance Orbiter) when new and accumulating datasets are released by PDS. ODE also maintains datasets from completed missions including MGS (Mars Global Surveyor), Viking Orbiter, Clementine, Lunar Prospector (LP), Lunar Orbiter, Chandrayaan-1, Magellan, GRAIL (Gravity Recovery and Interior Laboratory), and MESSENGER. As PDS3 archives are migrated to PDS4 format, they are updated in ODE to catalog the archive updates. To this point, LP and MESSENGER archives are examples of PDS4 archive migration updates in ODE. LRO is migrating its existing archives to PDS4 this fiscal year (i.e., by September 30, 2022). MRO and Mars Odyssey missions plan to convert their data processing pipelines to PDS4. LRO, MRO, and Odyssey missions will be delivering data acquired after October 1, 2022 in PDS4 format, and at such time when the user community has migrated their analysis tools to work with PDS4 archives. ODE will host both PDS3 and PDS4 data for these missions, until they are all migrated to PDS4. Derived data from individual data providers are regularly added to ODE as they become available. A detailed list of the current ODE holdings can be found at https://ode.rsl.wustl.edu/odeholdings/.

Help Documentation Improvements. The online ODE help documentation has been upgraded to include a responsive layout to better fit user screens, simple navigation, and improved help search capability. Missions, instruments, and product types sections have been improved to add additional reference links and include DOIs (Digital Object Identifiers). New sections were added for SELENE and TGO to introduce the instruments and datasets newly added to ODE.

Web Interface. The ODE map interface includes an improved product detail listing. Once a location search is made through the map interface as a point, rectangle, or custom polygon, a result list of PDS products intersecting or within the selection area are displayed. The user can move the browser mouse over the result list to highlight the individual product footprints on the map. The ability to click a "quick view" was added to the result list, so the user can review and hide a full product's details without opening a new browser instance or leaving the map interface. The previous ability to open the product details to a new browser or browser tab has been maintained.

Future Work: Newly released data from ongoing missions will continue to be added to ODE. Highly derived PDS4 bundles will be added to ODE, as they become available. ODE's catalog of PDS archives will be updated to reflect changes as previously released archives are migrated from PDS3 to the PDS4 standard. Additional international space agency datasets that are PDS compliant will be added to ODE, as they are identified to complement currently cataloged archives.

The website interface will continue to be updated to improve data search and download capability. A user login capability will be added to ODE. This optional feature will allow users to save searches, bookmark PDS products and provide the ability to review previous cart requests.

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 an email to ode@wunder.wustl.edu or post on the Geosciences Node forum https://geoweb.rsl.wustl.edu/community/.

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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.