

The Orbital Data Explorer at the PDS Geosciences Node: Capabilities and Recent Enhancements. June Wang¹ and Daniel M. Scholes¹, ¹McDonnell Center for the Space Sciences, Department of Earth, Environmental, and Planetary Sciences, Washington University in Saint Louis, 1 Brookings Drive, Campus Box 1169, St. Louis, Missouri, 63130, jwang39@wustl.edu.

Abstract: The Orbital Data Explorer (ODE), developed by NASA's Planetary Data System (PDS) Geosciences Node (pds-geosciences.wustl.edu), is a web-based system (ode.rsl.wustl.edu) for searching, visualizing, and retrieving PDS-archived orbital data from missions to Mars, Mercury, the Moon, and Venus [1]. ODE provides access to 37.6 million products totaling 2.57 petabytes of data, sourced from NASA's PDS, ESA's Planetary Science Archive (PSA), and JAXA data repositories. The catalog includes data from 17 planetary missions and over 70 instruments.

ODE supports both form-based and map-based searches across multiple missions and instruments, allowing filtering by observation type, location, time, angle, and unique identifier information. Faceted search functionality in ODE provides dynamically updated results as filters are applied. Users can browse metadata and preview products, manage selections through a cart system, and download data using a high-speed transfer option via Aspera Connect [2]. Specialized tools such as the Granular Data System (GDS) enable granular queries that subset science data in user-specified spatial regions. GDS supports data-point queries related to Mars Global Surveyor MOLA (Mars Orbiter Laser Altimeter), Lunar Reconnaissance Orbiter LOLA (Lunar Orbiter Laser Altimeter) and Diviner, as well as MESSENGER's MLA (Mercury Laser Altimeter) observations along orbits [3]. The ODE Representational State Transfer (REST) interface (oderest.rsl.wustl.edu) allows external users, scripts, and applications to access ODE's cataloged metadata and data products without using the ODE web interface. Additional capabilities include tools for locating Mars Reconnaissance Orbiter (MRO) coordinated observations and tools for generating KMZ and shapefile outputs for GIS analysis.

As the PDS transitions from the legacy PDS3 standard to the PDS4 information model, ODE has been updated to support evolving archive structures, expanded metadata, and growing data volumes. Recent development efforts focus on integrating newly released and migrated PDS4 data products while maintaining access to legacy PDS3 holdings. Catalog ingestion pipelines have been enhanced to support ongoing mission releases and improve metadata consistency. ODE has been updated to support crawling the PDS API for PDS Bundle contents and to use the API as a source of PDS4 labels for data processing and on-the-fly website presentation. These updates help prepare ODE for broader cloud-based archive transitions. PDS4 Logical Identifiers (LIDs) have been integrated into ODE's product search and map search interfaces. Users can filter products by full or partial LIDs, enabling efficient discovery of related products within the same bundle or collection. ODE's product detail pages now display associated bundle, collection, and product LID with direct links to their respective entries in the PDS4 Registry API (nasa-pds.github.io/pds-api/). These links support users who utilize the Registry API with their research or automated processing pipelines. In addition, ODE's product detail pages can be directly accessed via URLs containing the product LID.

ODE will continue to catalog and provide access to data releases from active missions and newly migrated PDS4 bundles. Ongoing development and user services ensure that ODE remains an interoperable access platform supporting the planetary science 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.