Tools and Data From NASA Planetary Science Missions

Planetary Science Division

Dr. Robin Fergason
PSD Planetary Data Officer

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Disclaimers

• Presenting highlights of data and tools available.
  • Intended to give you a starting point for exploring ways to access, explore, and analyze planetary science data without significant technical or scientific expertise.
  • This is not meant to be an exhaustive list of all datasets and analysis tools available to the planetary science community.

• All information was gathered from publicly available information, and primarily on the dataset or tool website.
  • Descriptions of tools and/or datasets may not be exhaustive or complete; additional capabilities may exist. User is encouraged to further explore these examples.

• Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.
Planetary Data System (PDS)

- PDS is NASA’s long-term archive of digital data products returned from NASA’s planetary missions.
  - Atmospheres (ATM)
    - Non-imaging atmospheric data
  - Cartography and Imaging Sciences (IMG)
    - Digital image collections
  - Geosciences (GEO)
    - Related to the surface and interiors of terrestrial bodies
  - Planetary Plasma Interactions (PPI)
    - Related to the study of the interaction between the solar wind and planetary winds with planetary magnetospheres, ionospheres, and surfaces
  - Ring-Moon Systems (RMS)
    - Relevant to planetary systems, including planets, rings, and moons and the way they interact.
  - Small Bodies (SBN)
    - Relevant to asteroids, comets, and interplanetary dust
- Data available at: https://pds.nasa.gov/
Analyst’s Notebook – Landed Missions

- PDS Geosciences Node Analyst’s Notebook
- Tool for accessing the science data archives from NASA landed Mars and lunar missions
- Missions supported: Perseverance, Curiosity, InSight, Opportunity and Spirit, Phoenix, LCROSS, Apollo
- Features
  - Customizable searches for data, targets, and documentation
  - Interactive plot showing rover traverse over time
  - Information on samples collected for return to Earth
  - High-level view of the mission describe by the science and instrument teams
- Web-based service: https://an.rsl.wustl.edu/
QGIS – Free and Open-Source GIS

- Create, edit, visualize, analyze and publish geospatial data
  - Highly capable GIS software platform; relatively high learning curve
- Targets supported: Any target with geospatial data
  - Users import individual datasets and builds custom projects
- Features
  - Extensive analysis capabilities
    - Can write custom analysis functions and run those functions on data in QGIS
    - Vector and raster data analysis
  - Data analysis plug-ins are available (or can be written)
  - Data export function
  - Extensive training material
    - User guide, training manual, QGIS tutorials, books
- Website to download: https://www.qgis.org/en/site/forusers/download.html
  - Supported on Mac, Windows, Linux, Berkeley Software Distribution (BSD), and Apps for mobile and tablet

Illustrating a Mars shaded MOLA elevation plug-in; Image credit: https://www.giscourse.com/openplanetary-tile-loader-qgis-plugin/

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JMARS - Java Mission-planning and Analysis for Remote Sensing

- View and perform basic analytics of geospatial orbital data by importing multiple data layers

- Targets currently supported: Mercury, Venus, Moon, Mars, and Jupiter

- Features
  - Can save the state of an entire JMARS session to a file for later use
  - Adjust the opacity of datasets
  - Import custom datasets as data layers
  - Visually compare and plot data values
  - Impact Crater Analysis (in beta)
  - Data export function

- Website to download: https://jmars.asu.edu/
  - Supported on Mac, Windows, Linux, and Solaris

Image credit: https://jmars.asu.edu/tour-interface/overview

JMARS team has four posters during the Tuesday poster session
Solar System Treks

- View and perform basic analytics of geospatial orbital data by importing multiple data layers

- Targets supported:
  - Planets: Mercury, Venus, Mars
  - Moons: Europa, Ganymede, Icy Moons, Moon, Phobos, Titan
  - Asteroids: Bennu, Ceres, Ryugu, Vesta

- Features
  - Calculate distance, elevation, sun angles
  - 3D visualization
  - 3D printing
  - Can download products
  - Most map layers are available through a RESTful tile service

- Web-based service: [https://trek.nasa.gov/#](https://trek.nasa.gov/#)

Image credit: [https://trek.nasa.gov/europa/](https://trek.nasa.gov/europa/)
QuickMap

- View and perform basic analytics of geospatial orbital data by importing multiple data layers
- Targets supported: Mercury, Venus, Mars, Moon
- Features
  - Display lunar data from current and past missions
    - Arecibo, Clementine, Chandrayaan-1, GRAIL, Kaguya, Lunar Prospector, LRO
  - Provides metadata information for each image
    - Additional description about the image processing and image capture conditions
  - Draw polygons and select areas for plotting data
  - Enable 3D terrain
  - Data export function
- Web-based service: https://quickmap.lroc.asu.edu/
Small Body Mapping Tool (SBMT)

• Search, access, and analyze spacecraft data of small bodies

• Targets supported:
  • Asteroids
    • Main Belt: Ceres, Vesta, Lutetia, Ida, Mathilde, Gaspra, Steins
    • Near-Earth: Eros, Itokawa, Bennu, Ryugu, Toutatis
  • Comets
    • Hailey, Tempel 1, Wild 2, Hartley 2
  • Moons
    • Mars: Deimos, Phobos
    • Saturn: Dione, Epimetheus, Hyperion, Janus, Mimas, Pandora, Phoebe, Prometheus, Tethys

• Features
  • Allows users to visualize and manipulate small body shape models in three dimensions
  • Built-in analysis and mapping capabilities
  • Can save a previous session and reload
  • Data export function
  • Training videos and tutorials available

• Website to download: https://sbmt.jhuapl.edu/
  • Supported on Mac, Windows, and Linux

Image credit: Ernst et al., 2018, LPSC, Abs. 1043
Near-Earth Asteroids

- **The Daily Minor Planet** – Catalina Sky Survey
  - Examples of current Citizen Science efforts
  - Discussion Forum
  - Examples of what asteroids look like in survey images

- **International Search Collaboration (IASC)**
  - Provides high-quality astronomical data to citizen scientists around the world

- **PDS Small Bodies Node (SBN)**
  - NEO survey data
  - Catalina Sky Survey data
  - Survey data holding continues to grow

- **CATCH** – Comet Asteroid Telescopic Catalog Hunter
  - Search for an astronomical object with the CATCH tool
  - Features and functionality continue to be added

- **NEOWISE** – Space telescope to hunt for asteroids and comets
A virtual library for exploration and research of NASA's space rock collections
  • Apollo lunar collection
  • Antarctic meteorite collection

Features
  • View high-resolution 3D images of astromaterials
  • 3D images are produced using:
    • High-resolution precision photography
    • Structure-from-motion photogrammetry
    • Micro x-ray computed tomography
  • Extensive metadata of each sample
  • Data export function
    • High resolution 3D models of the rocks can be downloaded as .obj files

Web-based service:
https://ares.jsc.nasa.gov/astromaterials3d/
THANK YOU!