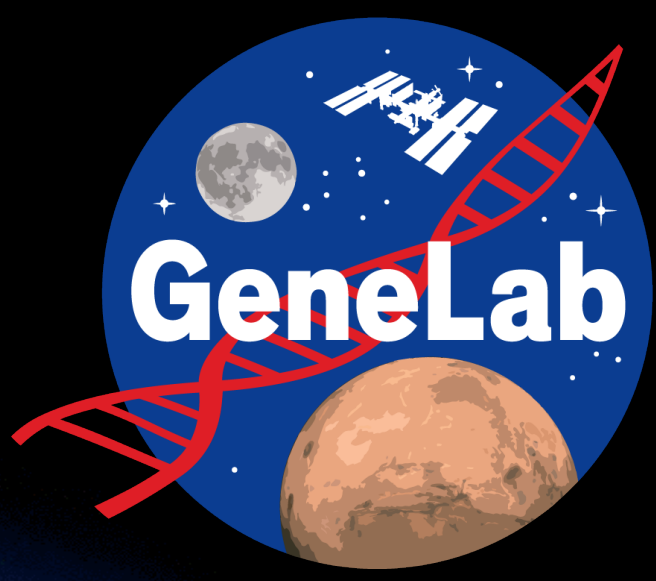
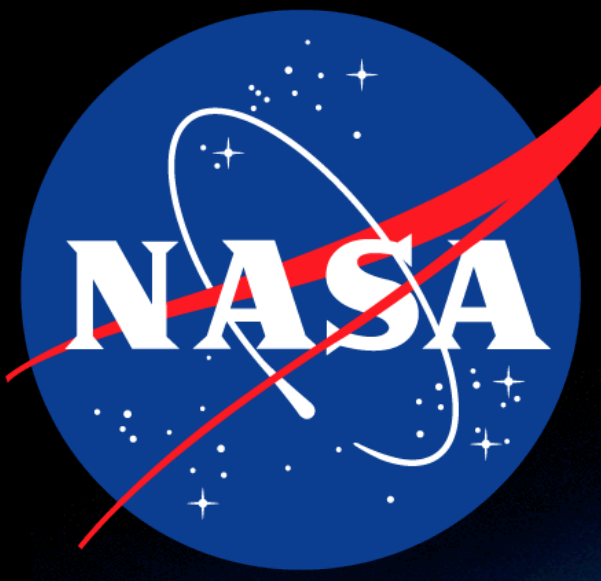




RadLab: A Comprehensive Database and Graphical and Programming Interfaces for Biologically Relevant Space Radiation Data

Kirill Grigorev¹, Ana Uriarte Acuna², Lauren M. Sanders³, Danielle K. Lopez², Ryan T. Scott², Samrawit G. Gebre³, Jack Miller^{2,4}, Livio Narici⁵, Sylvain V. Costes³

¹Blue Marble Space Institute of Science, Moffett Field, CA, USA; ²KBR, Moffett Field, CA, USA; ³Space Biosciences Division, NASA Ames Research Center, Moffett Field, CA, USA;

⁴Lawrence Berkeley National Laboratory, Berkeley, CA, USA; ⁵Department of Physics, University of Rome Tor Vergata, Rome, Italy

Overview

RadLab, a new component of the NASA Open Science Data Repository (OSDR), comprises a database of radiation measurements relevant to space biology and visual and programmatic interfaces for interrogation and retrieval of these data.

The attributes of data available through RadLab include spacecraft, types of radiation sensing instruments, locations within the spacecraft (e.g. ISS modules), associated celestial bodies, trajectories, and spacecraft coordinates. The application programming interface (API) implements a request syntax for retrieval of timestamped data filtered by various combinations of such attributes; the graphical user interface (GUI) extends this functionality with visualizations (spacecraft schematics, time series plots, geospatial visualizations) and provides easy means to iteratively refine search parameters, inspect the data on the fly, and download target data subsets.

The release of RadLab currently available to the public contains datasets provided by US and international collaborators and focuses on data recorded on the ISS. Investigators from multiple countries, including the US, Canada, Germany, Bulgaria, Hungary, Italy, Japan, Russia and the Czech Republic, have committed to provide data from their instruments in and beyond low Earth orbit; RadLab will soon expand to include past (e.g. Shuttle, Mir) and future (e.g. Artemis) data.

RadLab will provide a comprehensive, dynamic compendium of space radiation data, enabling the scientific community to perform analyses of data from multiple detectors and to determine the radiation environment of research missions and experiments.

The RadLab Working Group has been formed to foster collaborations among data contributors and users, to identify data sources, to develop standards for data harmonization, and to guide the development of the platform, with the goal to establish the use of RadLab in space radiation research and to advance our understanding of the space radiation environment in human habitats.

Acknowledgments

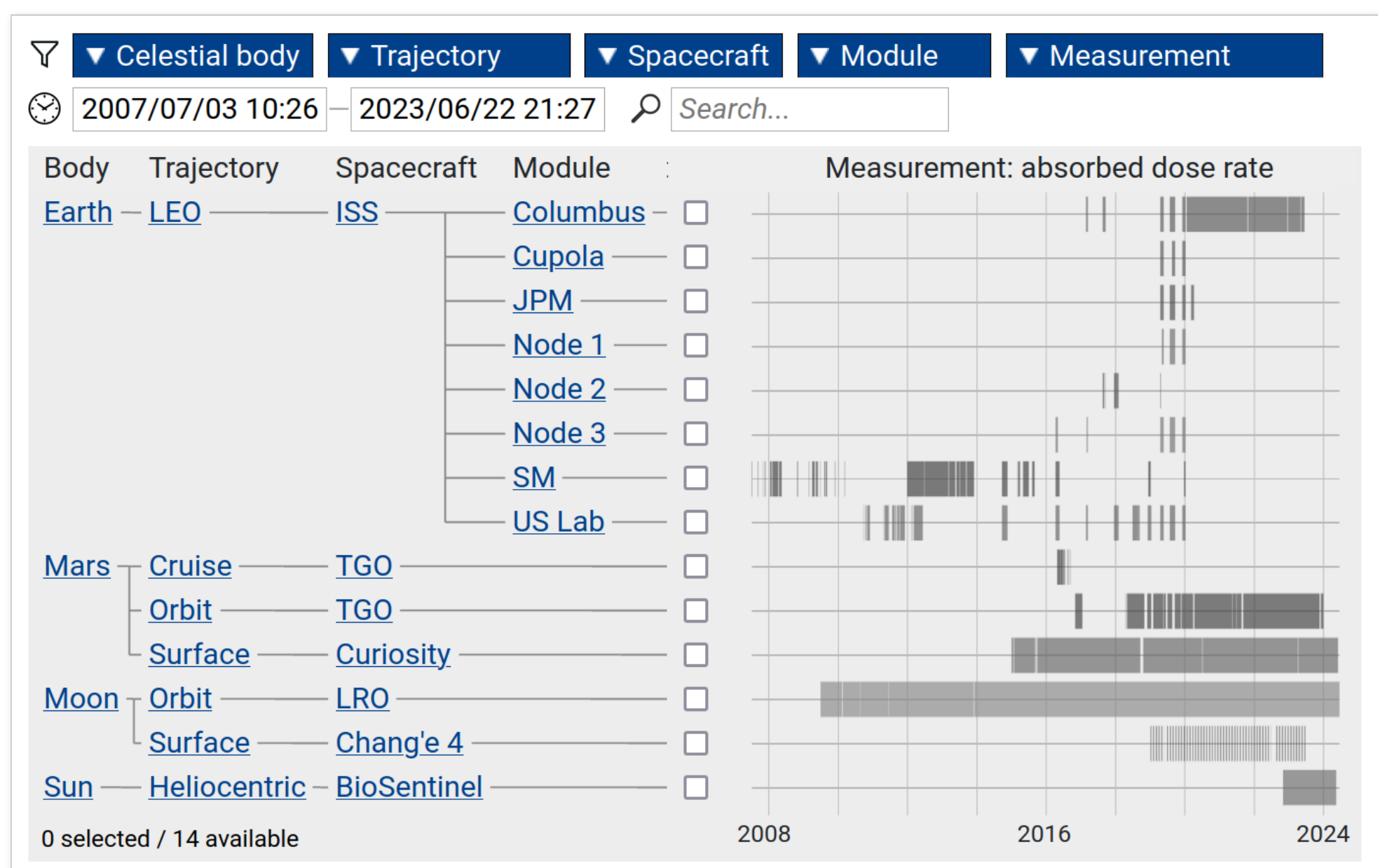
Support for this poster was provided by the NASA Space Biology Program, part of the NASA Biological and Physical Sciences Division and the NASA Human Research Program.

URL | Contact

visualization.osdr.nasa.gov/radlab

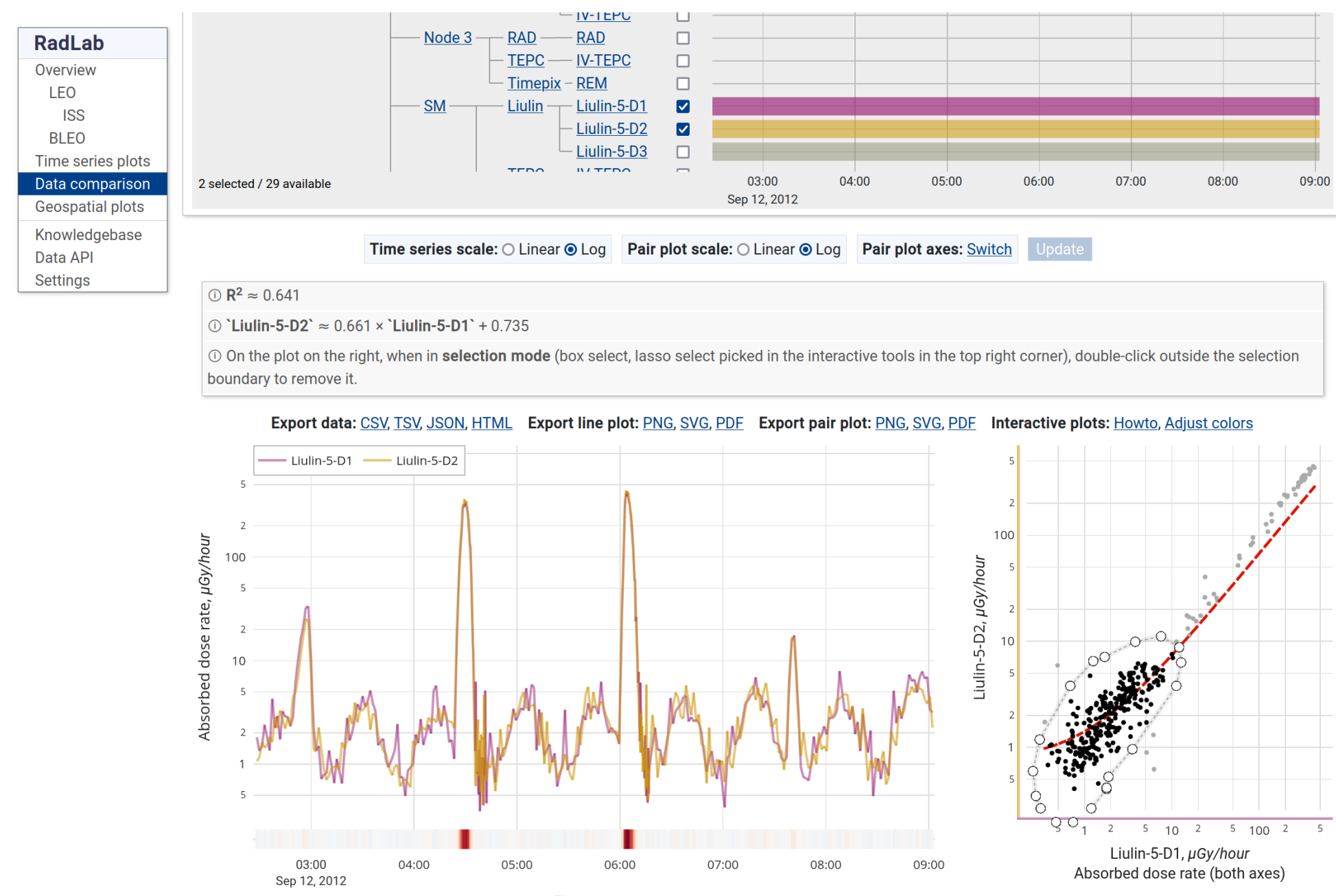
kirill.a.grigorev@nasa.gov

Graphical User Interface



The GUI provides means for interactive data selection based on meta-data: celestial body, trajectory, spacecraft, instrument type and name, measurement type.

Analytical visualizations



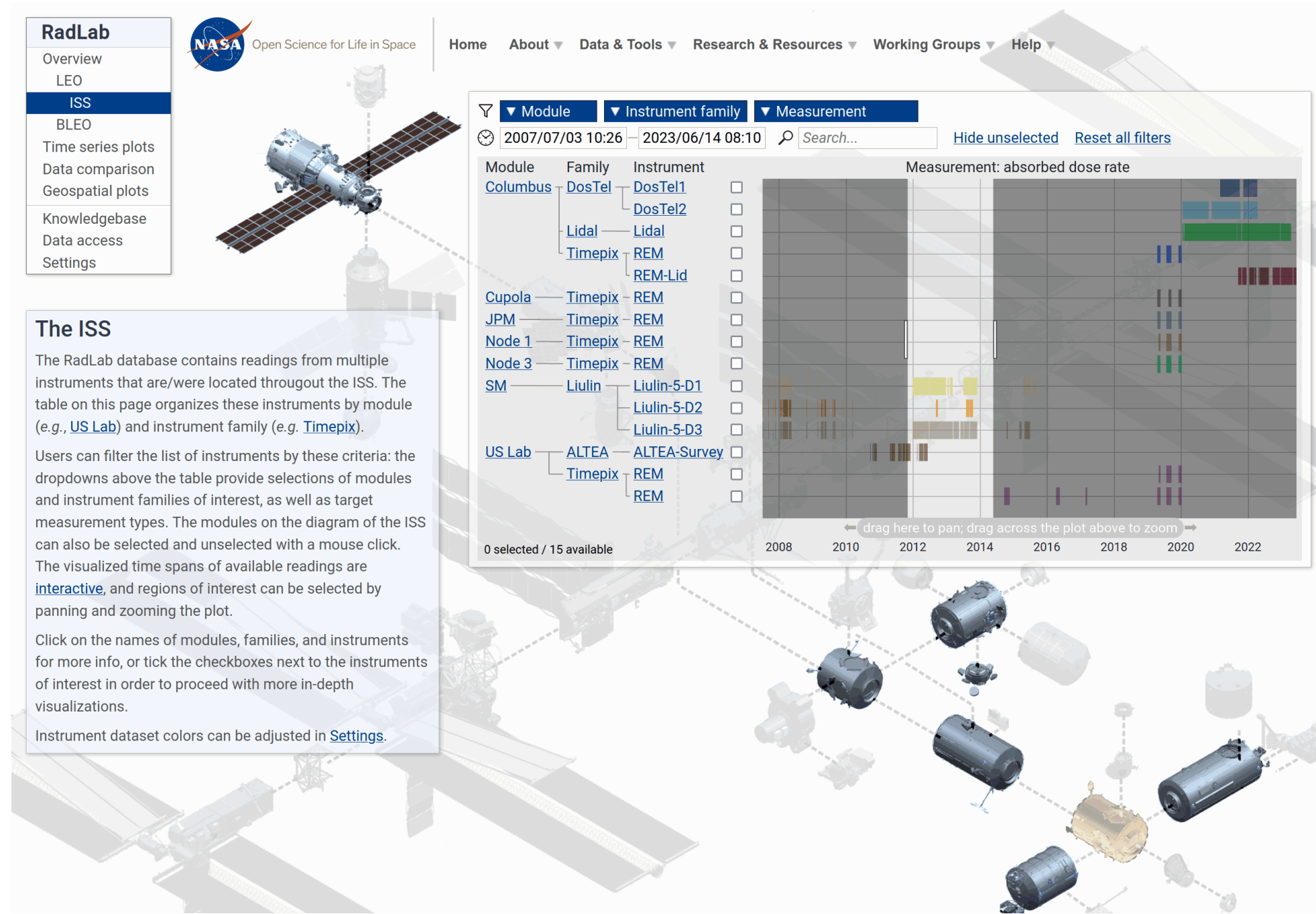
Query refinement, multi-instrument plots, and data export

Application Programming Interface

Key	Type	Description	Unit	Value format	timestamp	instrument_id	absorbed_dose_rate	altitude	latitude	longitude
instrument_id	string	Note: case-sensitive A specific ID of an instrument, detector, or configuration; this is guaranteed to be unique in the database. E.g.: REM-Lid, the REM instrument affixed to the lid of Lida1 and included in the DORELI project; or Luluin-5-02, the second detector of the Luluin-5 instrument. Note: is always returned, even when not explicitly requested. The ID can be used to look up the specifics of the instrument and the dataset in the Knowledgebase.			2022-04-01T00:00:00	REM-Lid	0.9187814	416.851987	-8.324694	162.94325
timestamp	ISO-formatted string (or Unix timestamp)	Timestamp of recorded value(s). Note: case-sensitive if passed as an ISO-formatted string.			2022-04-01T00:00:00	DosTel2	2.368557	416.851987	-8.324694	162.94325
absorbed_dose_rate	number	Absorbed radiation dose rate	µGy/hour		2022-04-01T00:00:00	Lida1	1.99686266666667	416.851987	-8.324694	162.94325
dose_equivalent_rate	number	Dose equivalent rate	µSv/hour		2022-04-01T00:00:00	REM-Lid	2.2391858088147	416.851987	-8.324694	162.94325
flux	number	Particle flux	cm ⁻² s ⁻¹		2022-04-01T00:00:00	Lida1	2.6818824	415.176415	6.951546	173.790418
latitude	number	Latitude of a spacecraft at given timestamp, where available. This used the	deg		2022-04-01T00:00:00	DosTel2	2.88211030188679	415.176415	6.951546	173.790418

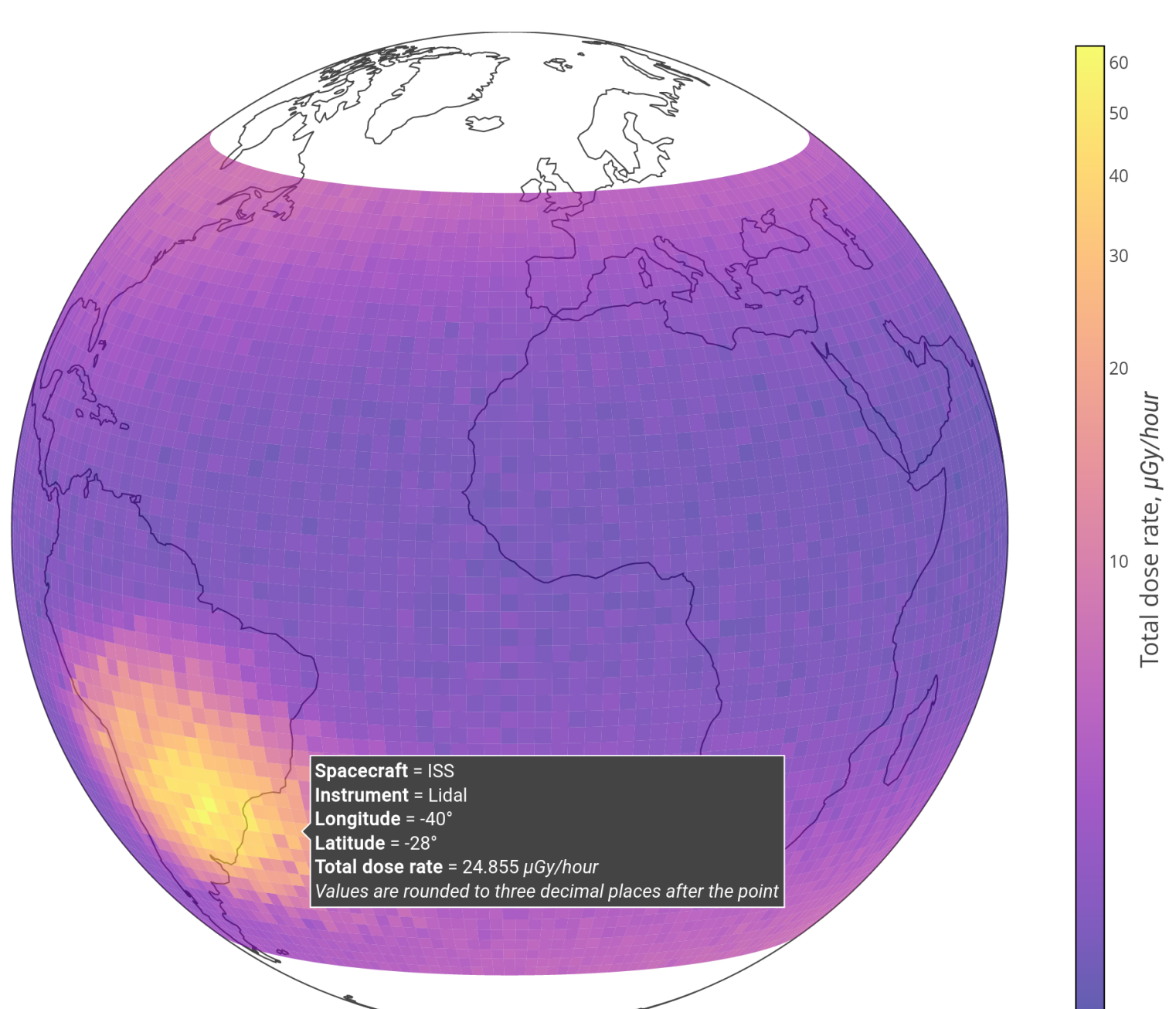
Extensive and easy-to-use API for programmatic analyses. Shown on left: documentation (partial screenshot), shown on right: example output. Supports multiple output formats.

Low Earth Orbit | The ISS



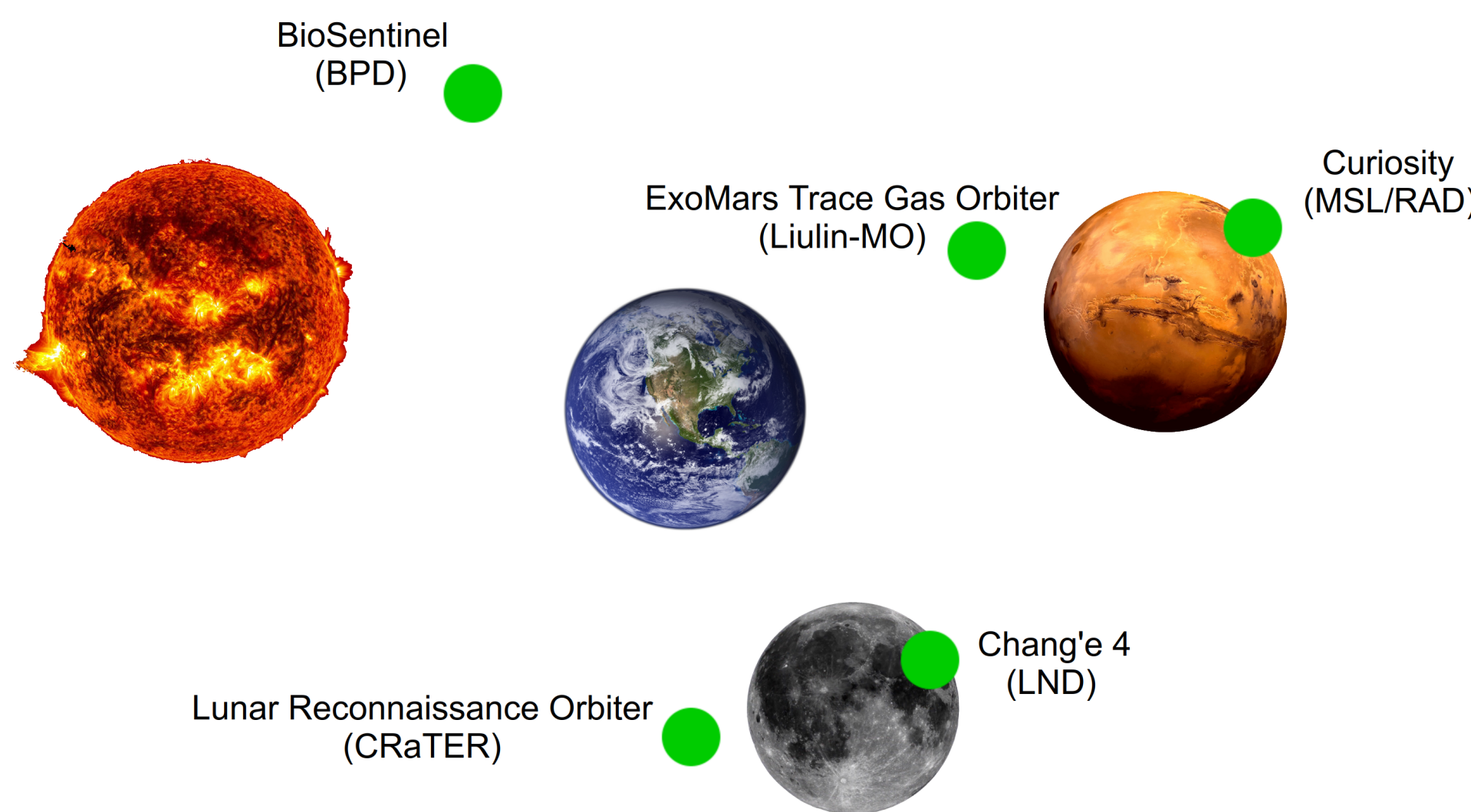
The GUI includes special visual functionality for ISS-based instruments

Geospatial visualizations



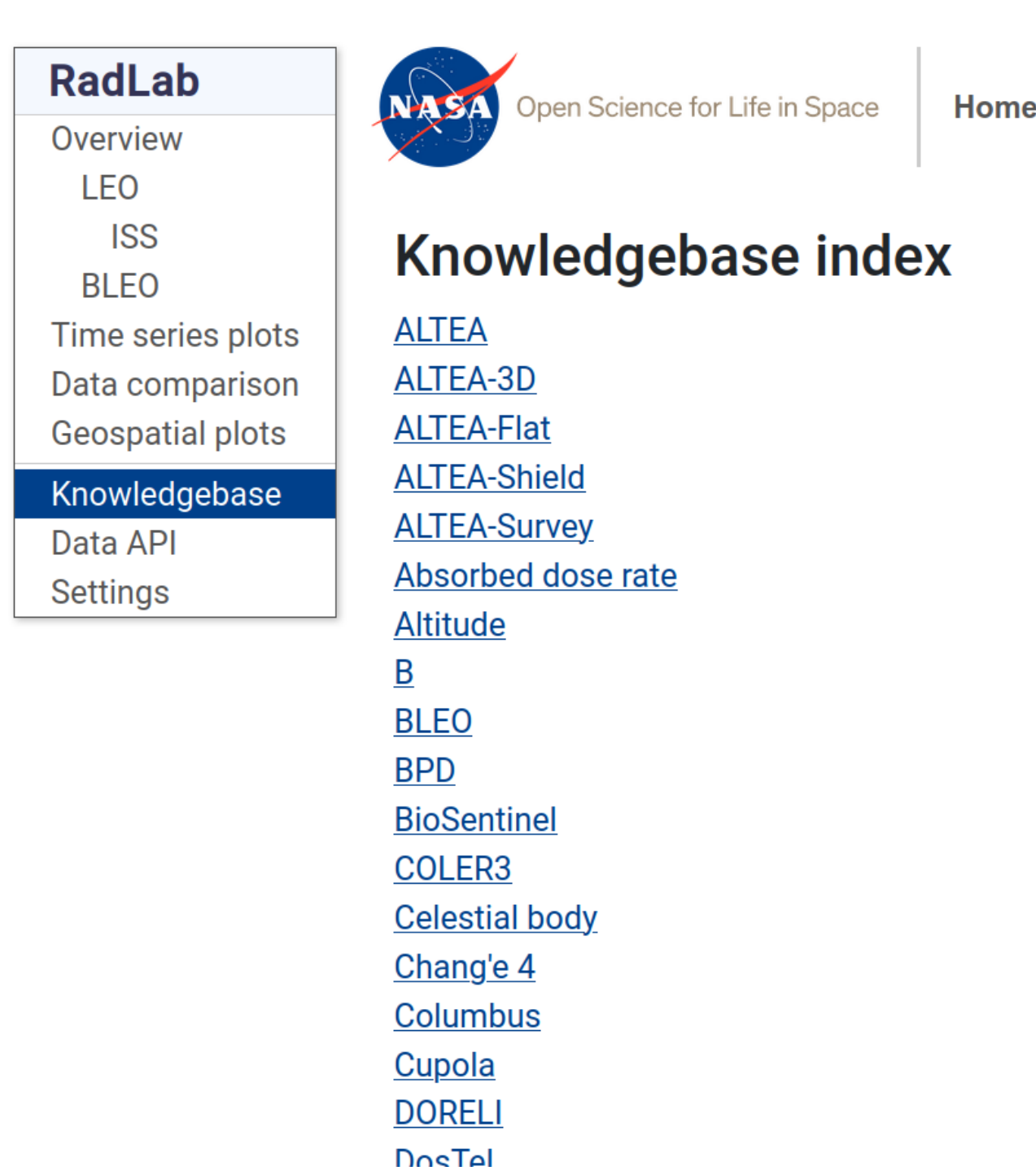
Coordinates associated with each timestamp (ISS: currently; BLEO: proposed)

Beyond Low Earth Orbit



Multiple BLEO instruments are also currently available

Knowledgebase



An interconnected, wiki-like resource for instrument information

RadLab Working Group | Roadmap

The RadLab Working Group (the RLWG) consists of radiation experts, principal investigators responsible for specific instruments; and researchers interested in using the data and expanding the scope of its applications.

Goals of the RLWG include, but are not limited to:

- acquisition and integration of radiation telemetry datasets
- development of standards for data normalization and for increasing its FAIRness (Findability, Accessibility, Interoperability, and Reusability)
- standardization and harmonization of metadata, both rigid (coordinates, types, etc) and free-form (comprehensive radiation Knowledgebase)
- application of the data in multiple scientific domains (radiation research, space biology)
- identification of additional use cases and development of appropriate methodologies and standards.