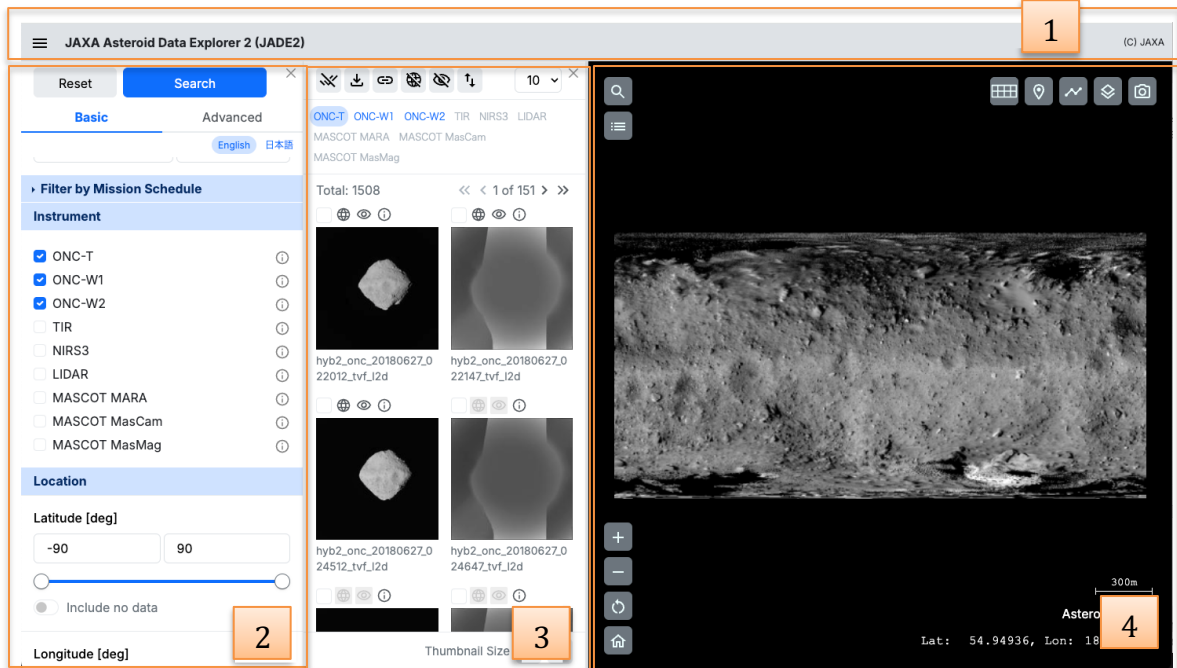


# JADE2 (JAXA Asteroid Data Explorer 2)

## User Manual

## 1. Windows of JADE2



### 1. Header

- Term of use of JADE2 and link to Hayabusa2 project and data archive websites are shown from the Menu button (left side of the header).

### 2. Search criteria widow

- Search criteria can be set in this window.

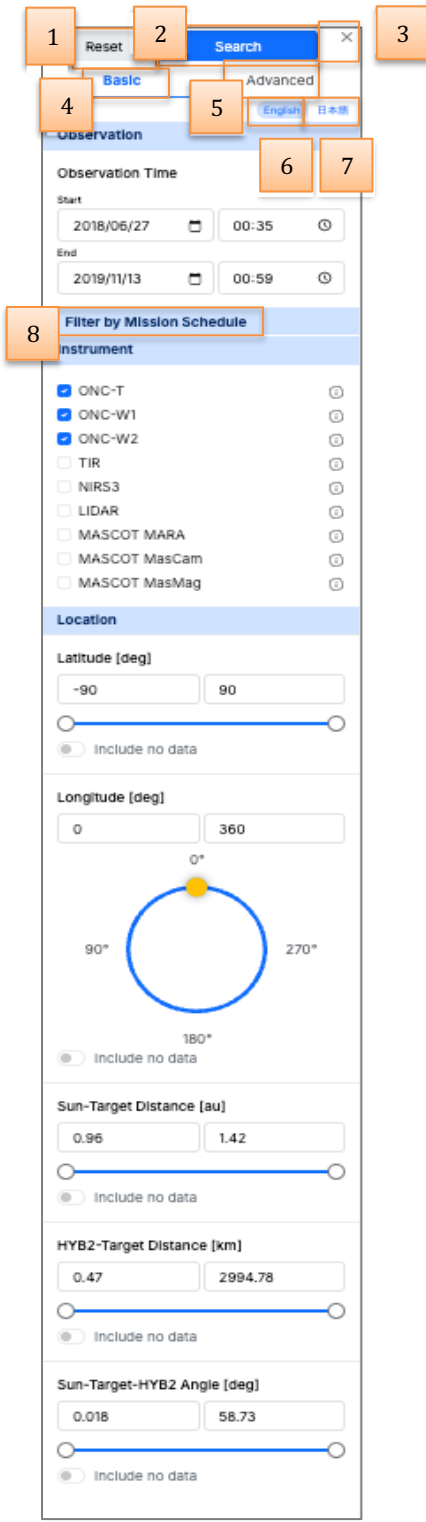
### 3. Search result window

- Found data by input search criteria are shown.

### 4. Basemap window

- Selected data can be displayed on the Ryugu basemap. Data can be also searched from the area of the map using polygons or longitude/latitude.

## 2. About search window



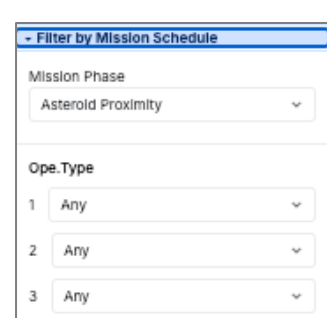
The screenshot shows a search window with the following elements:

- 1. Reset**: A button to return to default settings.
- 2. Search**: A button to search for data by clicking.
- 3. X(Close)**: A button to hide the search window.
- 4. Basic**: A tab for basic search criteria.
- 5. Advanced**: A tab for detailed search criteria.
- 6. English**: A language selection button.
- 7. 日本語**: A language selection button.
- 8. Filter by Mission Schedule**: A section for constraining data by mission schedule.

The 'Filter by Mission Schedule' section includes:

- Instrument**: A list of instruments with checkboxes and radio buttons.
  - ☒ ONC-T
  - ☒ ONC-W1
  - ☒ ONC-W2
  - ☐ TIR
  - ☐ NIRS3
  - ☐ LIDAR
  - ☐ MASCOT MARA
  - ☐ MASCOT MasCam
  - ☐ MASCOT MasMag
- Location**: Latitude and Longitude sliders with 'Include no data' options.
- Sun-Target Distance [au]**: A slider from 0.96 to 1.42 with 'Include no data' option.
- HYB2-Target Distance [km]**: A slider from 0.47 to 2994.78 with 'Include no data' option.
- Sun-Target-HYB2 Angle [deg]**: A slider from 0.018 to 58.73 with 'Include no data' option.

1. Reset
  - Return to the default setting.
2. Search
  - Search for data by clicking.
3. X(Close)
  - Hide the search window.
4. Basic
  - Search for data by basic criteria.
5. Advanced
  - Search for data by detailed criteria.
6. English
  - Change the display to English.
7. 日本語(Japanese)
  - Change the display to Japanese.
8. Filter by Mission Schedule
  - Constrain data by mission schedule as follows.



The 'Filter by Mission Schedule' window shows:

- Mission Phase**: Asteroid Proximity
- Ope.Type**: Three dropdown menus, all set to 'Any'.

### (a) Basic mode

Basic mode searches for data using common criteria through all instruments. To set criteria for each instrument, please use “Advance mode”.

Reset
Search
×

Basic
Advanced

English 日本語

Observation

Observation Time

Start

2018/06/27

00:35

End

2019/11/13

00:59

Filter by Mission Schedule

Instrument

☒ ONC-T

☒ ONC-W1

☒ ONC-W2

☐ TIR

☐ NIRS3

☐ LIDAR

☐ MASCOT MARA

☐ MASCOT MasCam

☐ MASCOT MasMag

Location

Latitude [deg]

-90

90

○

☐ Include no data

Longitude [deg]

0

360

0°

●

90°

180°

270°

☐ Include no data

Sun-Target Distance [au]

0.96

1.42

○

☐ Include no data

HYB2-Target Distance [km]

0.47

2994.78

○

☐ Include no data

Sun-Target-HYB2 Angle [deg]

0.018

58.73

○

☐ Include no data

No	Criteria	Format	Default setting (min/max)
1	Observation Time	Input Date and Time	2014/12/03 00:00   2019/11/19 23:59
2	Mission Phase	Selection	Any Commissioning EDVEGA Earth Swingby Transfer Approach Asteroid Proximity Return
3	Ope. Type1	Selection	Operation list based on the selected Mission Phase Example : Rovers
4	Ope. Type2	Selection	Operation list based on the selected Ope. Type 1 Example : MASCOT (>51m)
5	Ope. Type3	Selection	Operation list based on the selected Ope. Type 2 Example : Descent
6	Latitude	Slide	-90.00   90.00
7	Longitude	Circular slide	0.00   360.00
8	Instrument	Selection (multiple selection)	ONC-W1 ONC-W2 ONC-T TIR NIRS3 LIDAR MASCOT MARA MASCOT MASCam MASCOT MasMag
9	Sun-Target Distance [au]	Slide	0.96   1.42
10	HYB2-Target Distance [km]	Slide	0.47   2994.78
11	Sun-Target-HYB2 Angle [deg]	Slide	0.018   58.73

Filter by Mission Schedule

Mission Phase

Asteroid Proximity

Ope.Type

1 Any

2 Any

3 Any



Product level searched in the basic mode is as follows. To search for different product levels, please use “Advanced mode”.

Instrument	Default product level for “Basic mode”
ONC-T	L2d: data_iof
ONC-W1	L2d: data_iof
ONC-W2	L2d: data_iof
TIR	L2: Calibrated Brightness Temperature
NIRS3	L2C: data_calibrated
LIDAR	L2: data_derived
MASCOT MARA	L2B: data_calibrated
MASCOT Mas Cam	Data_calibrated
MASCOT MasMag	Data_sci_calibrated

## (b) About Advanced mode

Advanced mode can search for data using detailed criteria of each instrument. Contrast to “Basic mode”, criteria can be set for each instrument.

The screenshot displays the 'Advanced' search mode interface. On the left, a 'Search Filter for each Instrument' panel lists instruments: ONC-T, ONC-W1, ONC-W2, TIR, NIRS3, LIDAR, MASCOT MARA, MASCOT MasCam, and MASCOT MasMag. ONC-T, ONC-W1, and ONC-W2 are selected with checkboxes. An arrow points from the 'ONC-T' checkbox to a detailed criteria panel on the right. This panel includes sections for 'Observation Time' (Start: 2018/06/27 00:35, End: 2019/11/13 00:59), 'Mission Phase', 'Asteroid Proximity', 'Ope.Type' (Any), 'Obs. Keyword', 'Calendar', 'Sun-Target Distance [au]' (0.96 to 1.42), 'HYB2-Target Distance [km]' (0.47 to 2994.78), 'Sun-Target-HYB2 Angle [deg]' (0.018 to 58.73), 'Product Level' (L2d: data\_jof), 'Camera Band', 'Resolution [m/pixel]', 'Latitude [deg]' (-90 to 90), 'Longitude [deg]' (0 to 360), 'Phase Angle [deg]', 'Slant Distance [m]', 'Compression', 'Stray Light Flag for ONC-T', 'Binning Pixel Size', 'Region-of-Interest Cutout', and 'Number of Subimages'. Annotations with arrows point to specific elements: 'Criteria are shown by clicking the arrow.' points to the arrow from the instrument list to the criteria panel; 'Select instruments to be searched for data.' points to the instrument checkboxes; 'Select criteria for data search.' points to the 'Sun-Target Distance' section; and 'Criteria can be canceled by removing [checkbox]' points to the 'Include no data' radio button.

Reset Search

Basic Advanced

Search Filter for each Instrument

- ☒ ONC-T
- ☒ ONC-W1
- ☒ ONC-W2
- ☐ TIR
- ☐ NIRS3
- ☐ LIDAR
- ☐ MASCOT MARA
- ☐ MASCOT MasCam
- ☐ MASCOT MasMag

Criteria are shown by clicking the arrow.

Criteria can be canceled by removing ☒.

Select instruments to be searched for data.

Select criteria for data search.

ONC-T

☒ Observation Time

Start: 2018/06/27 00:35

End: 2019/11/13 00:59

☒ Mission Phase

Asteroid Proximity

Ope.Type

1 Any

2 Any

3 Any

Obs. Keyword

Calendar

☒ Sun-Target Distance [au]

0.96 1.42

Include no data

☒ HYB2-Target Distance [km]

0.47 2994.78

Include no data

☒ Sun-Target-HYB2 Angle [deg]

0.018 58.73

Include no data

☒ Product Level

L2d: data\_jof

☐ Camera Band

☐ Resolution [m/pixel]

☒ Latitude [deg]

-90 90

Include no data

☒ Longitude [deg]

0 360

0°

90°

180°

270°

Include no data

☐ Phase Angle [deg]

☐ Slant Distance [m]

☐ Compression

☐ Stray Light Flag for ONC-T

☐ Binning Pixel Size

☐ Region-of-Interest Cutout

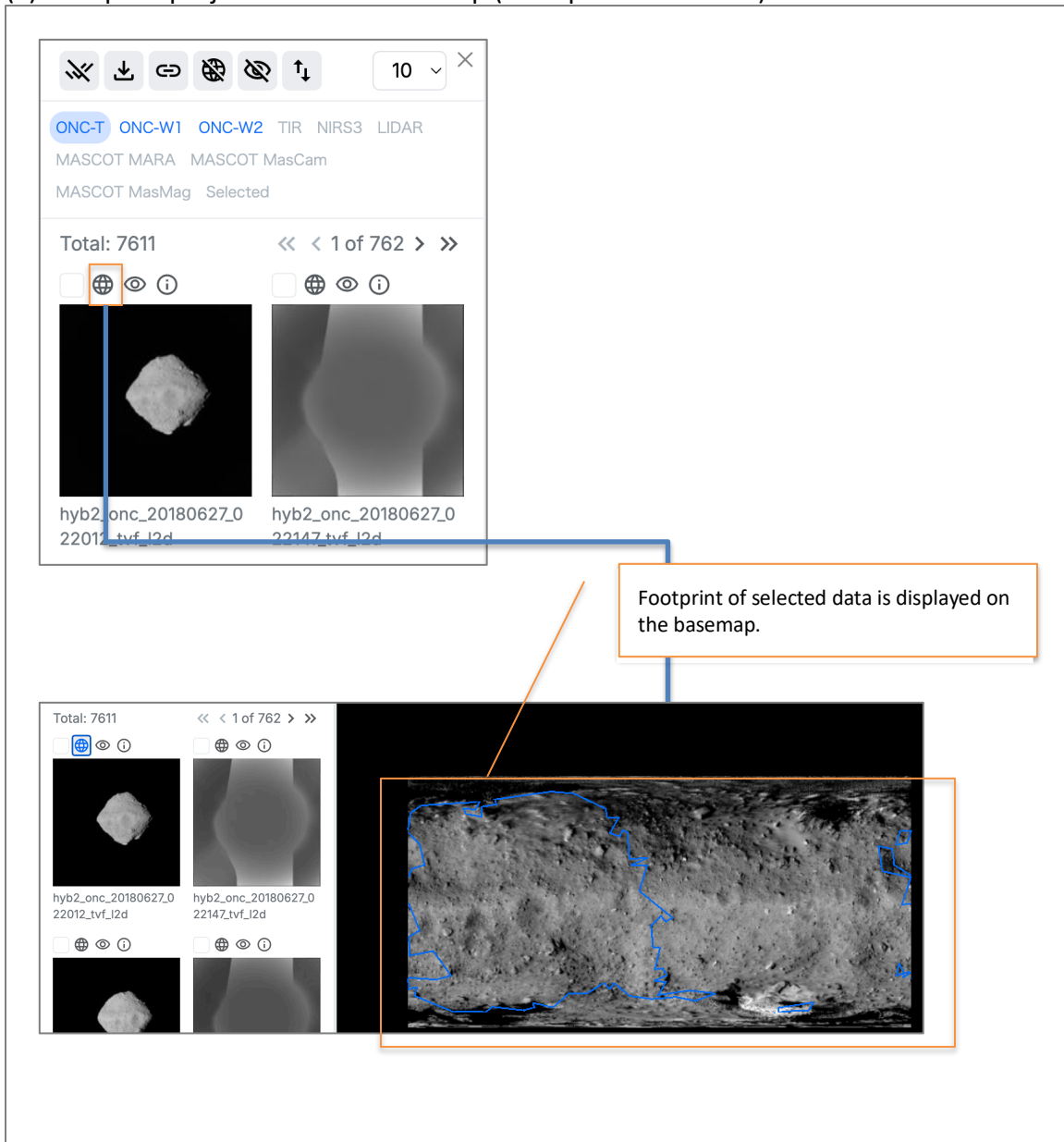
☐ Number of Subimages

### 3. Search result window

The screenshot shows a web-based search result window. At the top, there are eight numbered buttons (1-8) for global actions. Below them is a toolbar with icons for various functions. A filter bar (9) contains tabs for different data types: ONC-T, ONC-W1, ONC-W2, TIR, NIRS3, and LIDAR. Below the filter bar, there are instrument names: MASCOT MARA, MASCOT MasCam, and MASCOT MasMag. A 'Selected' button (10) is also present. A summary bar (11) shows 'Total: 435'. A pagination bar (12) shows '<< < 1 of 44 > >>'. The main area displays a grid of thumbnails (13-16) for different data points, each with a file name and a 'check box' (13). Below the thumbnails are buttons for 'Show footprint' (14), 'Show image' (15), 'Information' (16), 'Thumbnail' (17), 'File name' (18), 'Thumbnail size' (19), and 'Show graph' (20). A 'Thumbnail Size' control with minus and plus buttons is at the bottom right. A small graph window (20) is shown at the bottom left, displaying a plot of 'mascot\_mara\_ryugu\_science\_calibrated'.

1. Clear selected
  - Clear all checks of selected data.
2. Download
  - Download checked data.
3. Get permanent link
  - Generate URL link to reproduce current search results.
4. Clear footprint
  - Clear all footprints drawn on the basemap.
5. Clear all projected images
  - Clear all images projected on the basemap.
6. Change result order
  - Change order of search results.
7. Change number of displays
  - Change the number of displays of search results.
8. Close
  - Close the window of search result.
9. Instrument tabs
  - Shows search results of selected instrument.
  - Not selected for not-used instrument in data search.
10. Selected tub
  - Show all selected data by "check box" (button 13).
11. Total number
  - The number of searched data.
12. Page number
  - Current page of search result.
13. Check box
  - When checked, each data can be downloaded.
  - When checked, the data is shown in "selected tub".
14. Show footprint
  - Show footprint on the basemap.
  - If there is no data to represent position, this button cannot be checked.
15. Show image
  - When checked, the image is projected on the basemap (ONC, TIR).
  - For non-image data, this button cannot be checked.
  - If there is no data to represent position, this button cannot be checked.
16. Information
  - Show information.
17. Thumbnail
  - Show thumbnail.
18. File name
  - File name of data at database.
19. Thumbnail size
  - Change the size of each thumbnail.
20. Show graph
  - Show plot of the searched data (for non-image data).
  - For non-signal data, this button cannot be checked.

(a) Footprint projection of the basemap (Example of ONC data)



(b) Image projection of the basemap (Example of ONC data)

The interface displays a list of data sources at the top, including **ONC-T**, **ONC-W1**, **ONC-W2**, **TIR**, **NIRS3**, and **LIDAR**. Below this, **MASCOT MARA** and **MASCOT MasCam** are listed, with **MASCOT MasMag** selected. The total number of items is 7611, and the current view is 1 of 762. Two thumbnails are shown below the list, with the first one highlighted by an orange box. A blue line connects this box to a larger basemap view at the bottom right, which displays the projected image. A text box explains that the image of selected data is displayed on the basemap and that image projection can only be used for image data.

Image of selected data is displayed on the basemap.  
Image projection can be used only for image data.

(c) Graph plot (Example of NIRS3 data)

(i) Single point mode

The screenshot displays the JAXA Asteroid Explorer 2 (JADE) interface. At the top, there is a toolbar with icons for various functions. Below the toolbar, a list of data points is shown, including 'hyb2\_nirs3\_20180630T 06\_01\_cal' and 'hyb2\_nirs3\_20180630T 07\_01\_cal'. The main map view shows a grayscale image of an asteroid with a yellow dot indicating the selected point. A detailed graph plot of the NIRS3 Reflectance Spectrum is shown on the left, with the x-axis labeled 'Wavelength (microns)' and the y-axis labeled 'Reflectance'. The graph shows a blue curve representing the reflectance spectrum. Annotations explain the changes in the interface when a point is selected:

- In the case of L3 data, when projected area is clicked on the map, figure of reflection at the nearest observed point from the clicked point is shown.
- The observed point changes to blue circle.
- Polygon of the figure is changed to black.
- The observed point is marked in yellow.
- Polygon of the figure is changed to black.

At “Multi point” mode, figure of mean reflections at each position is shown. Mean reflection is the averaged reflection of overlapped observation data.

To plot data of multiple points, please close the figure once.

Then, click another point on the map.

In “Multi Point” mode, multiple plots from the same observation data are also possible.

## (d) Download of data

The diagram illustrates the process of downloading data from a search results interface. The process involves selecting data, opening a download menu, and then downloading the data into a file explorer and two text files.

**Search Results Interface:** The interface shows a list of search results. The first result is selected, and the download menu appears. The download menu offers three options: "Download selected items (Selected: 2, Size: 8.17 MB)", "Download URL list of selected items (Selected: 2)", and "Download URL list of all search results".

**Download Menu:** The download menu is a dialog box that appears when the download button is clicked. It contains three options: "Download selected items (Selected: 2, Size: 8.17 MB)", "Download URL list of selected items (Selected: 2)", and "Download URL list of all search results".

**File Explorer:** The file explorer shows the downloaded files. The files are named "download\_list.txt", "hyb2\_onc\_20180627\_022012\_tvf\_l2d", "hyb2\_onc\_20180627\_022012\_tvf\_l2d.fit", "hyb2\_onc\_20180627\_022012\_tvf\_l2d.jpg", "hyb2\_onc\_20180627\_022012\_tvf\_l2d.xml", "hyb2\_onc\_20180627\_022147\_tvf\_l2d", "hyb2\_onc\_20180627\_022147\_tvf\_l2d.fit", "hyb2\_onc\_20180627\_022147\_tvf\_l2d.jpg", and "hyb2\_onc\_20180627\_022147\_tvf\_l2d.xml".

**Downloaded Files:** The downloaded files are listed in two text files. The first file, "url-link-list-selected\_20241213124151766.txt", contains the download links for the selected items. The second file, "url-link-list-all\_20241213124147983.txt", contains the download links for all search results.

**Downloaded Links:** The download links are listed in two text files. The first file, "url-link-list-selected\_20241213124151766.txt", contains the download links for the selected items. The second file, "url-link-list-all\_20241213124147983.txt", contains the download links for all search results.



### (e) Permanent link function

The diagram illustrates the process of generating and using a permanent link for search results in the JAXA Asteroid Data Explorer 2 (JADE2) interface.

**Top Panel (JADE2 Interface):** The interface shows search criteria under the "Basic" tab. The "Observation Time" is set from 2018/06/27 00:35 to 2019/11/13 00:59. The "Instrument" filter includes ONC-T, ONC-W1, ONC-W2, TIR, NIRS3, LIDAR, MASCOT MARA, MASCOT MasCam, and MASCOT MasMag. A "Share" button (represented by a link icon) is highlighted with an orange box. The search results show a total of 134 items, with a grid of four thumbnail images labeled "Noon".

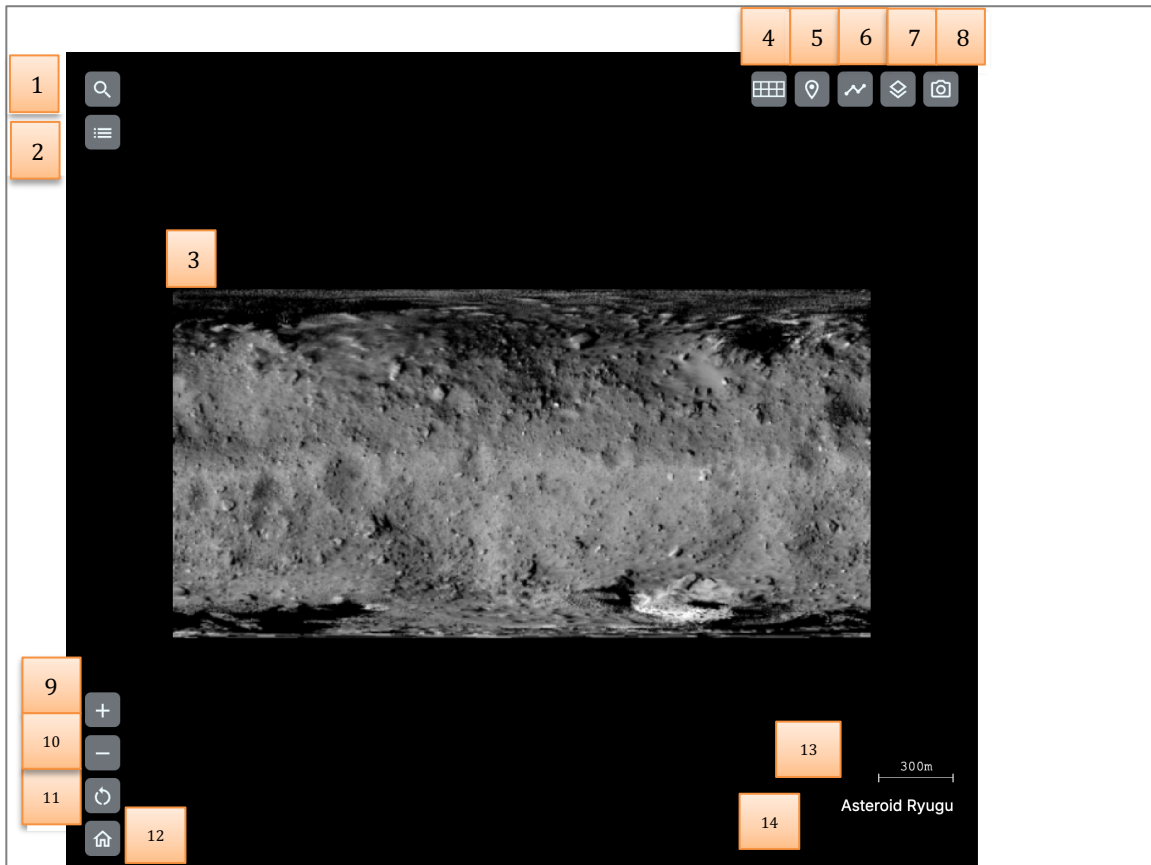
**Middle Panel (Permanent Link):** A "Permanent Link" dialog box displays the generated URL: `https://sl-ja-dev01.com/?search_key=d15831865d221a2ade0a8964aa7145215bde463e85f0f865b3d61c334a7b62b1`. A "Copy" button is visible.

**Bottom Panel (Browser):** A web browser window shows the URL entered into the address bar: `https://sl-ja-dev01.com/?search_key=d15831865d221a2ade0a8964aa7145215bde463e85f0f865b3d61c334a7b62b1`. The JADE2 interface is loaded, showing the same search criteria and results as the top panel.

**Annotations:**

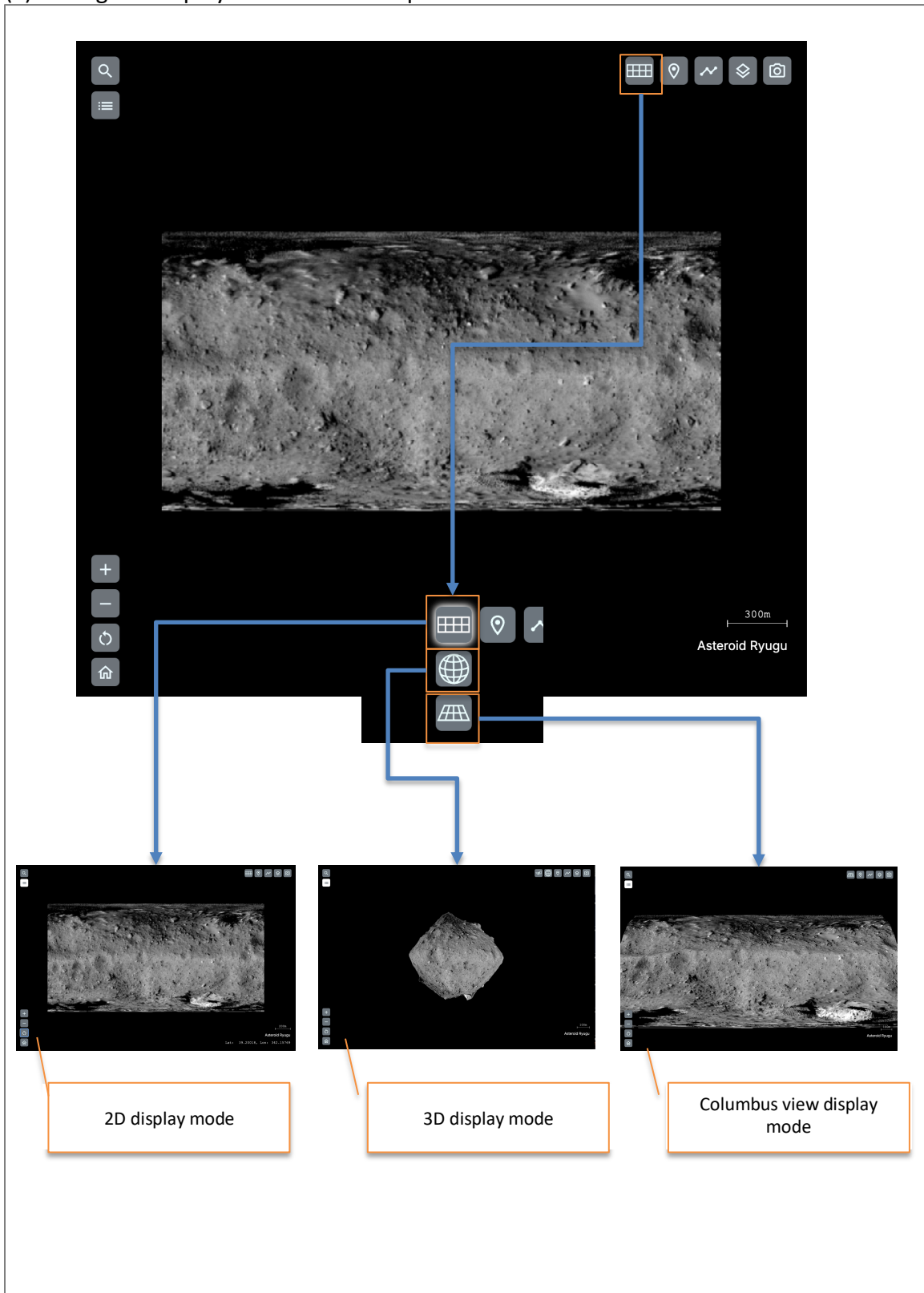
- An orange box highlights the "Share" button in the top panel, with a callout stating: "URL link of search result using the current criteria is generated."
- An orange box highlights the URL in the browser's address bar, with a callout stating: "We can reproduce current search condition using the generated URL link."

#### 4. About base map window



1. Show / hide of the search criteria window
2. Show / hide of search result window
3. Basemap
4. Change of display mode
  - 2D, 3D, and Columbus view can be selected.
5. Search for data with area defined by longitude / latitude
  - Constrain longitude and latitude to search for data.
6. Search for data using polygon on the map
  - On the map, drawing a polygon, data can be searched for based on the polygon.
7. Selection of layer
  - Insert of grid on the map and change types of the basemap.
8. Capture of map
9. Zoom up
10. Zoom down
11. Refresh
  - Clear all objects drawn on the map.
12. Home size and position
  - Set the base map to the default position and size.
13. Scale bar
  - Scale bar at the center of the map.
14. Name of asteroid

(a) Change of display mode of basemap



(b) Searching with a polygon on the basemap

The figure consists of three screenshots of the JAXA Asteroid Data Explorer 2 (JADE2) interface, illustrating the process of searching for data using a polygon on the basemap.

**Top Screenshot:** The interface shows the "Basic" tab with filters for Observation Time (Start: 2018/06/27, End: 2019/11/13) and Instrument (ONC-T, ONC-W1, ONC-W2, TIR, NIRS3, LIDAR, MASOCOT MARA, MASOCOT MasCam, MASOCOT MasMag). The "Location" filter is set to Latitude [deg] from -90 to 90. The "Total" count is 7611. A blue arrow points from the "Search" button to the "Polygon" tool icon in the top right corner of the basemap.

**Middle Screenshot:** The "Polygon" tool is active, and a yellow line is drawn on the basemap. A text box explains: "Polygon lines can be drawn on the basemap, which can be used for searching." Another text box explains: "When data are already searched, this polygon can constrain area of the searched data." The "Total" count is now 3412.

**Bottom Screenshot:** The polygon is completed (enclosed). A text box explains: "When we draw a polygon, edge is added by clicking the base map. Then, by double clicking, the polygon is enclosed. After that data is searched for." The "Total" count is now 1135. The basemap shows the asteroid Ryugu with the polygon drawn on its surface.

### (c) Constraint of area by bounding box

The screenshot shows the JAXA Asteroid Data Explorer 2 (JADE2) interface. The left sidebar contains filters for Observation Time, Instrument, and Location. The main panel displays a basemap of Asteroid Ryugu with a blue bounding box indicating the constrained area. The 'Area Select' dialog is shown, allowing users to define the bounding box by setting latitude and longitude values.

**Area Select Dialog:**

- BoundingBox:**
  - Max Latitude
  - Min Longitude
  - Max Longitude
  - Min Latitude
- FeatureCollection:**
- Buttons:** Save, Clear

By setting latitude and longitude, a polygon is shown on the basemap. When data are already searched for, further constraint of the searched data is possible using the input latitude and longitude.

The final screenshot shows the JADE2 interface with the bounding box constraint applied, resulting in a yellow box on the basemap and a total of 7412 data points.

# (d) Searching from feature collection

The process involves the following steps:

- Initial Search:** The JAXA Asteroid Data Explorer 2 (JADE2) interface shows search filters for Observation Time (2018/06/27 to 2019/11/13) and Instrument (ONC-T, ONC-W1, ONC-W2, TIR, NIR3, LIDAR, MASCOT MARA, MASCOT MasCam, MASCOT MasMag). The initial search results show 7611 items.
- Area Selection:** The 'Area Select' dialog box is shown with the 'FeatureCollection' tab selected. The bounding box is defined by the following coordinates:
  - Max Latitude: 22012.1v1J2d
  - Min Longitude: 24512.1v1J2d
  - Max Longitude: 24647.1v1J2d
  - Min Latitude: 24512.1v1J2d
- Final Search Results:** The search results are updated to 3486 items. The 'Area Select' dialog box is shown with the 'FeatureCollection' tab selected, where the 'Type' is set to 'Crater' and the 'Feature' is set to 'Brabo'. The final search results show 3486 items, with a specific feature labeled 'Brabo' highlighted on the asteroid's surface map.

Polygons of features such as crater can be represented on the basemap. When data are already searched for, further constraint of the searched data is possible using the input feature.

## (e) Display of additional layers

The figure consists of three screenshots of the JAXA Asteroid Data Explorer 2 (JADE2) web application, illustrating the process of displaying additional layers on an asteroid map.

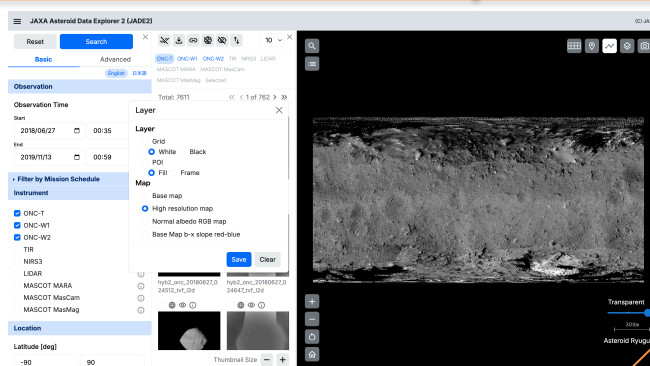
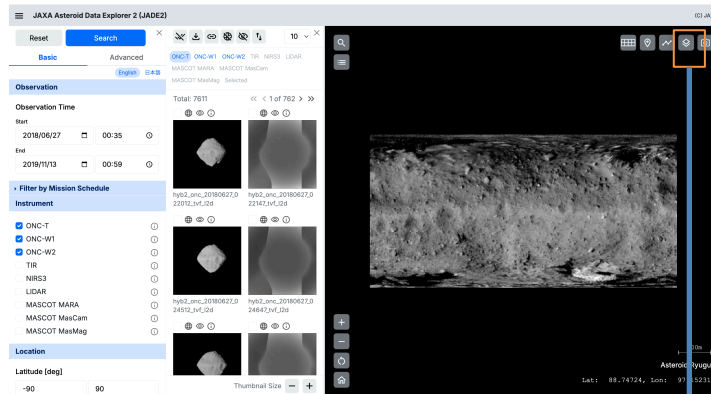
**Top Screenshot:** The interface shows the 'Basic' tab with filters for Observation Time (Start: 2018/06/27 00:35, End: 2019/11/13 00:59) and Instrument (ONC-T, ONC-W1, ONC-W2, TIR, NIRS3, LIDAR, MASOCOT MARA, MASOCOT MasCam, MASOCOT MasMag). The main map displays a grayscale image of Asteroid Ryugu with a 300m scale bar and coordinates (Lat: 88.74724, Lon: 97.15231). A blue arrow points from the 'Layer' button in the top right corner to the middle screenshot.

**Middle Screenshot:** The 'Layer' panel is open, showing options for 'Grid' (White, Black, POI, Fill, Frame) and 'Map' (Base map, High resolution map, Normal albedo RGB map, Base Map b-x slope red-blue). The main map now displays a grid overlay on the grayscale image of Asteroid Ryugu.

**Bottom Screenshot:** The 'Layer' panel is open, showing the 'Grid' options. The main map displays the grayscale image of Asteroid Ryugu with a grid overlay. A yellow line and several green circles (Points of Interest, POI) are overlaid on the map, indicating specific locations of interest.

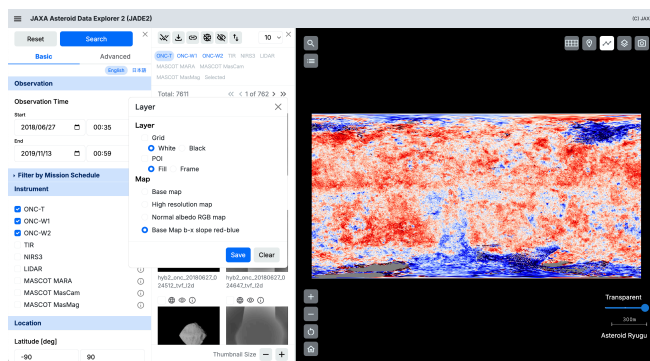
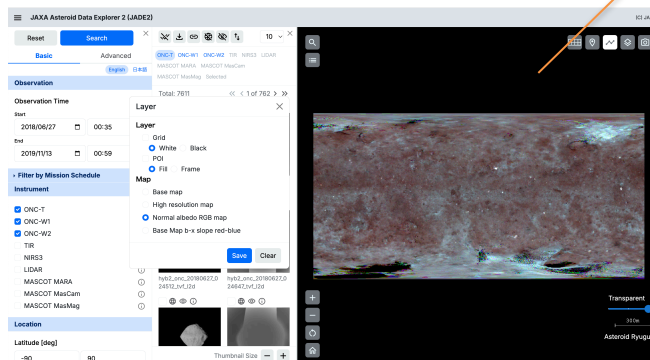
Grid and points of interest (POI) can be added on the basemap.





On the basemap, the additional maps shown below can be added.

- High resolution map
- Normal albedo RGB map
- Base Map b-x slope red-blue
- Base map (Default)





# (f) Display of Hayabusa2 orbit

The figure consists of four screenshots of the JAXA Asteroid Data Explorer 2 (JADEX2) interface, illustrating the steps to display the Hayabusa2 orbit around the asteroid Ryugu.

**Screenshot 1:** The main interface shows the 'Basic' tab. The 'Observation Time' section displays the start and end dates (2018/06/27 to 2018/07/13). The 'Instrument' section lists various instruments, including ONC-T, ONC-W1, ONC-W2, TR, NIRS3, LIDAR, MASCOAT MARA, MASCOAT MaxCam, and MASCOAT MesMag. The 'Location' section shows the latitude and longitude of the observation point. The main view displays a 3D model of the asteroid Ryugu.

**Screenshot 2:** The same interface is shown, but with a small icon of Hayabusa2 appearing next to the view icon in the top right corner.

**Screenshot 3:** The 'Spacecraft Orbits' panel is open, showing the 'Observation Time' and 'Filter by Mission Schedule' sections. The 'Mission Phase' is set to 'Asteroid Proximity'. The 'Opn. Type' is set to 'Any'. The 'Play' button is highlighted.

**Screenshot 4:** The 'Spacecraft Orbits' panel is closed, and the main view displays the orbit of Hayabusa2 around Ryugu. The orbit is shown as a red line, and the asteroid Ryugu is shown as a small grey sphere.

In 3D view mode, the icon of Hayabusa2 appears next to the view icon.

Setting mission information (e.g., date) and clicking play button, Hayabusa2 and its orbit appear around Ryugu.