

JAXA Virtual Planet

Operation Manual

(English Version)

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Contents

1. Introduction	1
2. How to Perform Operations	1
2.1. URL & Main Screen	1
2.2. Basic Operations	2
2.2.1 Switch Views	2
2.2.2 Layer List	3
2.2.3 Toolbox	4
2.2.4 Share.....	4
2.2.5 Others	4
2.3. Screen Operations	5
2.3.1. Moving Screens by Coordinates.....	6
2.4. Information Display	6
2.5. Scale Bar	6
2.5.1. Latitude & Longitude and Physical Quantity Display	7
2.5.2. Color Bar	7
2.6. Operations for Individual Functions.....	7
2.6.1. Distance Measurement.....	7
2.6.2. Area Measurement.....	7
2.6.3. Elevation Profile.....	7
2.6.4. Notes	7
2.6.5. Print.....	7
2.6.6. Custom Layer.....	8
2.6.7. Download	10
2.6.8. Subsolar /Sub-Earth Point	13
2.6.9. Search by Feature Name.....	13

1. Introduction

This document explains how to operate JAXA Virtual Planet.

2. How to Perform Operations

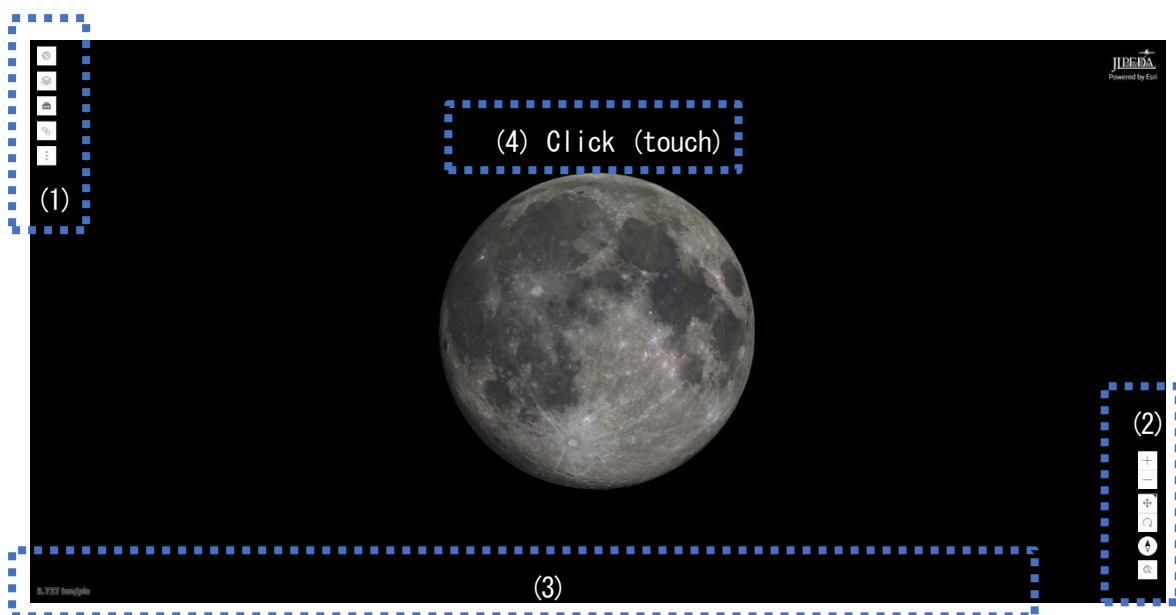
2.1. URL & Main Screen

JAXA Virtual Planet has two modes – an Easy version (high-operability system for the general public) and an Advanced version (system with sophisticated analytical functions for researchers). From mobile environments, only the functions of the Easy version are available. Both modes can switch between

Mode	Running environment	URL
Easy	Computer Mobile	https://vp.darts.isas.jaxa.jp/moon/
Advanced	Computer	https://vp.darts.isas.jaxa.jp/moon/?pro=1

Display language	URL
Japanese	https://vp.darts.isas.jaxa.jp/moon/?lang=ja
English	https://vp.darts.isas.jaxa.jp/moon/?lang=en

The main screen (top page) is shown below. The main screen is primarily comprised of areas (1) through (4). Explanations and the main functions allocated to each area are shown in the table.



Area	[Explanation]	Functions
(1)	Area for basic operations buttons	Switch views, layer list, toolbox, share, help, etc.
(2)	Area for screen operations buttons.	Zoom in, zoom out, change perspective (bird' s eye), move screen according to coordinates, etc.
(3)	Area for displaying information unrelated to button operations Display area	Scale bar, color bar, coordinates, physical quantity, etc.
(4)	Map screen area	Layer popup

2.2. Basic Operations

This explains how to operate basic functions of the application. These operations are performed using the buttons positioned in area (1) of the main screen.

	Switch Views
	Layer list
	Toolbox
	Share
	Others

2.2.1 Switch Views

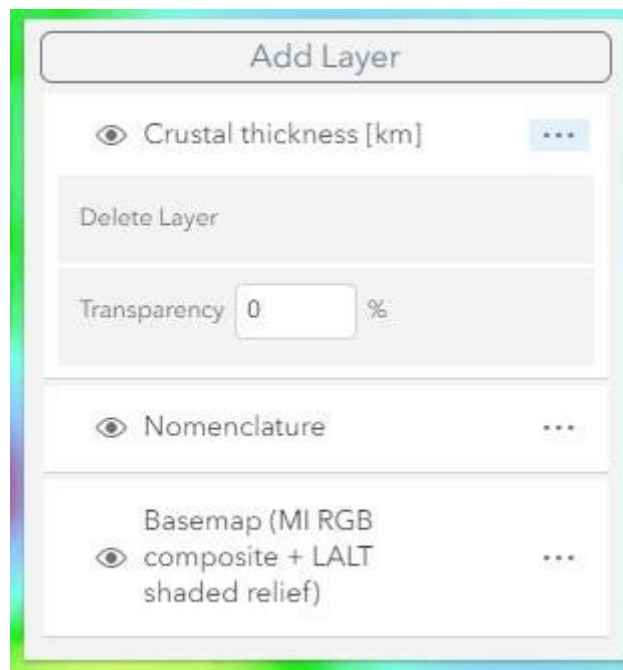
JAXA Virtual Planet has the following seven types of views. The initial view is type (1). Switch to another using the “Views” button. Views (1) through (4) are created upon launch of the application and stay resident in the memory, so the various operations performed on-screen will be remembered after switching to different views. Views (5) through (7) are generated and deleted as necessary due to memory limitations, so the information on these views will be re-initialized after switching views.

Screen	Coordinate system
(1) 3D globe	Geographic Coordinate System: GCS_MOON_2000
(2) Equidistant cylindrical 3D	Projected Coordinate System: Universal Transverse Mercator (UTM) projection SIMPLE_CYLINDRICAL_MOON
(3) North polar stereographic 3D	Projected Coordinate System: Universal Polar Stereographic (UPS) projection PolarStereographic_Moon
(4) South polar stereographic 3D	Projected Coordinate System: Universal Polar Stereographic (UPS) projection PolarStereographic_Moon

(5) Equidistant cylindrical 2D	Projected Coordinate System: Universal Transverse Mercator (UTM) projection SIMPLE_CYLINDRICAL_MOON
(6) North polar region 2D display	Projected Coordinate System: Universal Polar Stereographic (UPS) projection PolarStereographic_Moon
(7) South polar region 2D display	Projected Coordinate System: Universal Polar Stereographic (UPS) projection PolarStereographic_Moon

2.2.2 Layer List

Initially, only the base map is displayed. Users can add other layers as needed using the “Layer list” button. This shows how to perform layer operations.

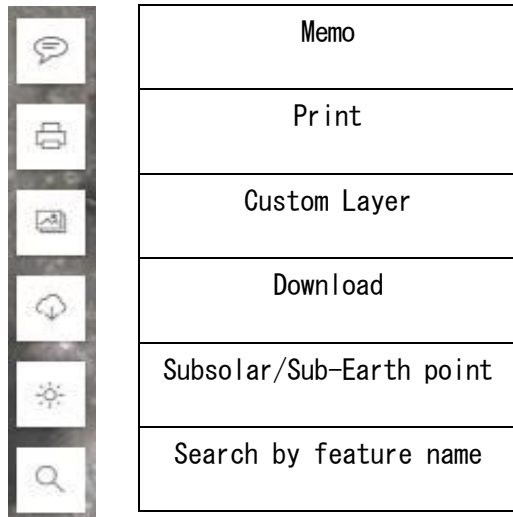


Part	Content
Add Layer	Selects a layer to add to the screen from the list of addable layers. Multiple layers can be selected and added at once.
(Drag)	Changes the displayed position. Layers can be dragged to change the relationships as to which are atop the others.
	Switches the display on and off.

Delete Layer	Deletes the corresponding layer. * The base map cannot be deleted.
Transparency	Configures the transparency level of layers. 0% is completely opaque, 100% is completely transparent.

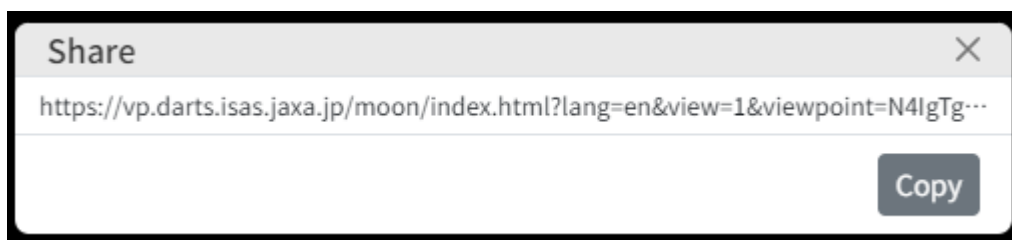
2.2.3 Toolbox

Displays a list of operable items from “Toolbox.” Refer to section 2.6 for details about each function.



2.2.4. Share

Click the “Share” button to display a URL that recreates the current screen in its current state. Display the URL in another computer or device, and the screen will display in the state that it was when the link was created.



2.2.5. Others

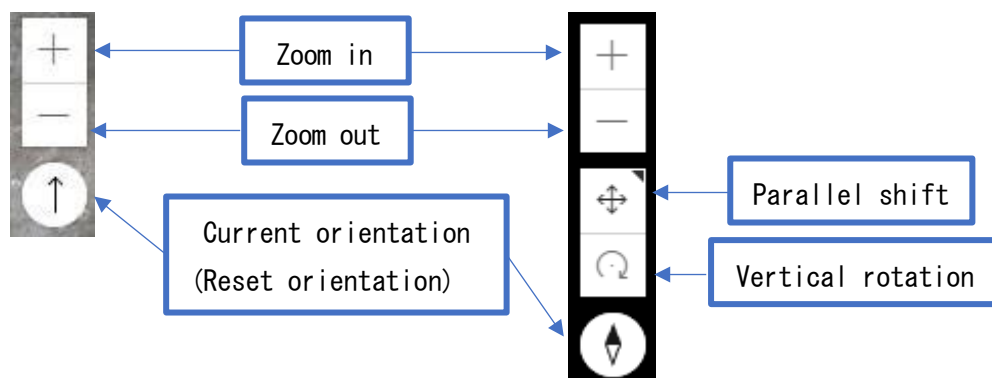
Click the “Help” button to display a separate tab with descriptions of operations, explanations about physical quantities, and other information. It is re-initialized when the “To Home” button is clicked. Use the “Switch Languages” and “Change Mode” to switch between Japanese and English language and between Easy and Advanced modes respectively.

	Help
	Home
EN	Switch Languages
Pro	Switch Modes

2.3. Screen Operations

Here we explain how to perform the operations for controlling map screens. These operations are performed using the buttons positioned in area (2) and also using area (4) of the main screen.

The figure below illustrates the function of each button. The left side is for 2D, the right side is for 3D.



Screen operations assigned to mouse and screen touch actions are as follows.

Action	Functions
Drag	Directional movement (vertical rotation)* ¹
Double-click	Zoom in
Control + double-click	Zoom out

Scroll up	Zoom in
Scroll down	Zoom out
Right click + drag	2D rotation
Shift + Left click + drag	Zoom in on the range specified by dragging* ²
Arrow key	Move up, down, left, or right
N	With North on top
A	Rotation (counter-clockwise)* ³
D	Rotation (clockwise) * ³
+	Zoom in
-	Zoom out
Swipe Multi-swipe	Directional movement
Double-tap	Zoom in
Pinch in/out	Zoom in/out
Rotation using two fingers	Rotate

*1 Only directional movement is possible while in 2D views.

Switch between directional movement and vertical rotation with the  button while in 3D views.

*2 Only enabled while in 2D views.

*3 Rotation with the A/D keys is in the opposite direction while in 3D views.

2.3.1. Moving Screens by Coordinates

When screens are displayed, the latitude and longitude of the center of the current screen are configured by default. Enter any coordinates and click the “Apply” button to move to a screen positioned with the specified coordinates at the center. The display scale does not change when moving to the new screen.

A dialog box titled "Location" with a close button (X) in the top right corner. It contains two input fields: "Longitude" with the value "0" and "Latitude" with the value "0". Below these fields is a blue "Apply" button.

2.4. Information Display

Here we explain the information displayed in area (3) on the main screen.

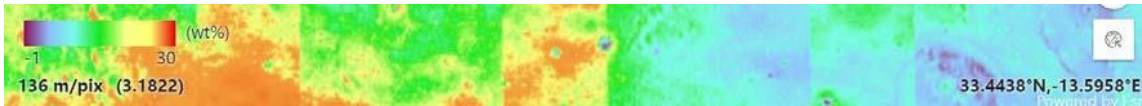
2.5. Scale Bar

Displayed at bottom-left of screen only while in 2D views. Resolution is displayed at the center of the screen instead of the scale bar while in 3D views.



2.5.1. Latitude & Longitude and Physical Quantity Display

When the mouse is clicked or stops at any spot on the screen for a specified length of time (0.5 sec), the latitude and longitude (bottom-right) and physical quantity (bottom-left, next to the scale bar) of that spot is displayed.



2.5.2. Color Bar

This is displayed when the uppermost layer displayed is either an image layer or “age division of sea.”

2.6. Operations for Individual Functions

Here we explain how to perform the operations for individual functions. These functions are performed from “Toolbox” in area (1) on the main screen.

2.6.1. Distance Measurement

Select “New measurement” then click two points on the map screen to measure the distance between the clicked points.

2.6.2. Area Measurement

Select “New measurement” then specify a polygonal shape by clicking the corresponding points on the map screen to measure the area of that polygonal shape.

2.6.3. Elevation Profile

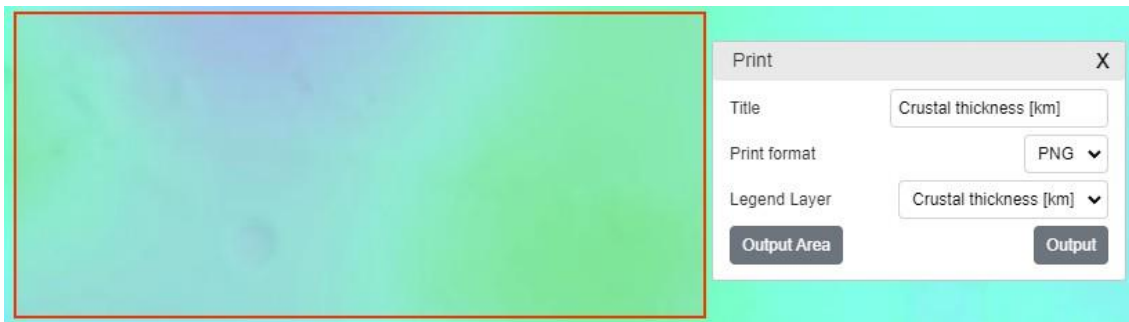
Select “New profile” then specify a segment on the map screen to measure a cross-section view of that segment. Measurement data can be downloaded in CSV format from .

2.6.4. Notes

Draw shapes and saves them as notes. Notes are saved in the “Memo” layer.

2.6.5. Print

Output the selected area on the screen currently being displayed as either image files or PDFs. The displayed screen is captured as output, actual image data is not produced.



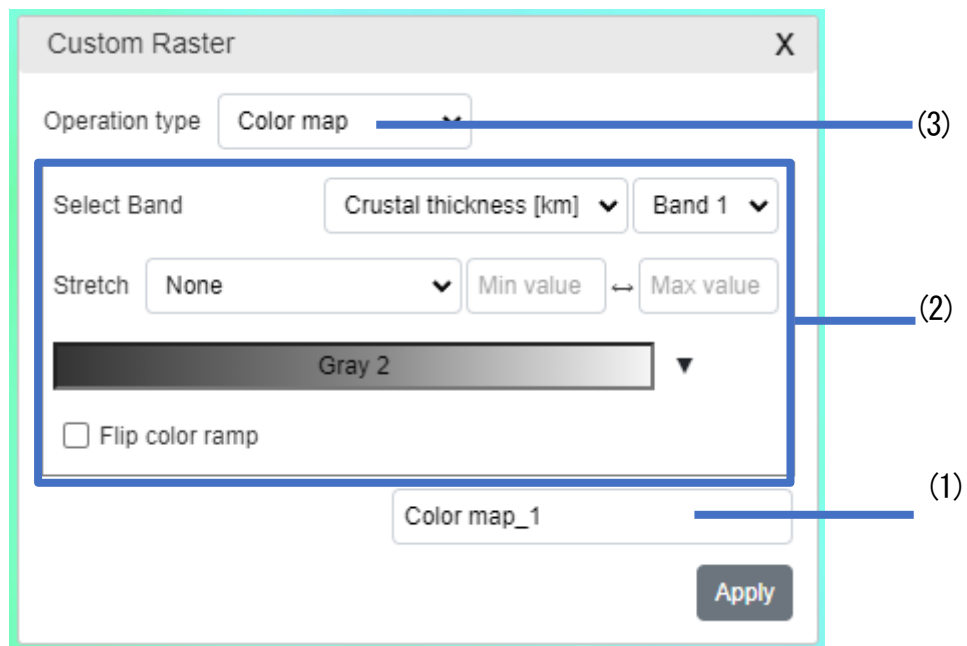
2.6.6. Custom Layer

The operation to define a function filter for image layers and generate layers with displays that differ from what was defined is called “Custom Layer”. Additional “Custom Layer” cannot be applied to existing Custom Layers, but color maps only of the results of ratio calculations can be applied.

The following three types of Custom Displays are supported.

Parameter	Definition
Color map	Converts the pixel values based on the color map to display a single-band raster in either a grayscale image or a gradation image. Stretch processing is performed as a preprocessing via either minimum/maximum or Histogram Equalization, and pixel values are converted to 0–255.
RGB composite	Three raster bands are integrated into one RGB raster.
Ratio calculation	Calculates a raster from a formula based on the raster bands.

Indicates how to perform operations. The Custom Display configuration screen is divided into parts (1) through (3). What each part contains is shown below.



Part	Content
(1)	Enter the layer name to output. If a chosen layer name is the same as an existing layer, the layer will be overwritten.
(2)	The advanced configuration screen is displayed according to the functions selected in (3).
(3)	Execute either color map, RGB composite, or ratio calculation, or choose from a list.

Indicates what is configured on each Custom Display.

Screen	Content
Color map	(1) Select band: Select from a list of image layers. The list for the band of the selected layer is displayed. Choose from that list. (2) Specify the stretch processing to perform on the output. Select either “Minimum/maximum” or “Histogram Equalization,” or this can also be left unspecified. If left unspecified, the minimum/maximum pixel values for the layer will be converted to 0–255. For “Minimum/maximum,” the specified pixel values are converted to a range of 0–255. Values outside the specified range are set to “No Data” value (–9,999). For Histogram Equalization, the minimum/maximum pixel values for the layer are converted into a range of 0–255 after

	processing the Histogram Equalization. (3) Select the color map to apply from the list of color maps. Grayscale is specified as the default. [Reverse and use]: Reserves the selected color map and applies it.
RGB composite	(1) Select band: Select the bands allocated to each RGB color from an image layer list and a list of bands of the selected layer. (2) Configure minimum and maximum values if you wish to limit the output range for each band. Values outside of the specified range will be replaced by the minimum and maximum values. * MI Reflectance, MI FeO Abundance, and MI TiO₂ Abundance Only these three layers are enabled.
Ratio calculation	Allocate bands specified in band selection to variable names (a, b, c). Enter the arithmetic expression to execute in the text box at the bottom of the screen. https://pro.arcgis.com/en/pro-app/latest/help/analysis/raster-functions/calculator-function.htm When you wish to apply index or logarithm calculations to bands and pass them on to the calculation formula, select functions from the lists to the right of the band names. * MI Reflectance, MI FeO Abundance, and MI TiO₂ Abundance Only these three layers are enabled.

2.6.7. Download

Indicates the operation of downloading the data of the selected field for the selected layer.



Item	Content
Select Layer	Selects the layer to download from among the layers added to the layer list.
Format	Selects the format of the output. Selectable formats differ by layer type. Image layer: GeoTiff SP/LRS layer: Shapefile/csv list
Resolution	Choose original, half, quarter, or eighth resolution. Only enabled when image layers are being downloaded.
Output Area	Specify the output area in rectangular shape. Click “Output Area” to switch to rectangular entry mode, where the desired rectangle can be entered on the screen.
Output	Downloads a file. The screen will display “Loading” to indicate standby status while downloading, and a download link will appear at the bottom of the screen when finished. * SP/LRS layer has 2,000 downloadable data items

2.6.7.1. SP Data Output Format

Data fields output as Shapefile and CSV files are as follows. -

Shapefile format

Field name	[Explanation]	Remarks
FID	Shape unique	
Shape	Shape unique	
Revo_num	Revolution number	REVOLUTION_NUMBER in Lbl file
Strip_num	Strip number within revolution	REVOLUTION_NUMBER in Lbl file
Scene_num	Scene number in strip	REVOLUTION_NUMBER in Lbl file
Serial_num	Same Scene_num/Strip_num/ Serial number in Revo_num	
Spc_url	Data URL	
Lbl_url	LBL URL	
Thumbnail	URL of thumbnail image	

- CSV format (SP_ref.csv)

Field name	[Explanation]	Remarks
Revo_num	Revolution number	REVOLUTION_NUMBER in Lbl file
Strip_num	Strip number within revolution	REVOLUTION_NUMBER in Lbl file
Scene_num	Scene number in strip	REVOLUTION_NUMBER in Lbl file
Serial_num	Same Scene_num/Strip_num/ Serial number in Revo_num	
Spc_url	Data URL	
Lbl_url	LBL URL	
Thumbnail	URL of thumbnail image	

Longitude	Longitude	
Latitude	Latitude	
Ref5126	Center wavelength 512.6 (diffuse) reflectance value Spectral value	296 fields
...		
Ref25879	Center wavelength 258.79 (diffuse) reflectance value Spectral value	

– CSV format (SP_rad.csv)

Field name	[Explanation]	Remarks
Revo_num	Revolution number	REVOLUTION_NUMBER in Lbl file
Strip_num	Strip number within revolution	REVOLUTION_NUMBER in Lbl file
Scene_num	Scene number in strip	REVOLUTION_NUMBER in Lbl file
Serial_num	Same Scene_num/Strip_num/Serial number in Revo_num	
Spc_url	Data URL	
Lbl_url	LBL URL	
Thumbnail	URL of thumbnail image	
Longitude	Longitude	
Latitude	Latitude	
Rad5126	Center wavelength 512.6 radiance value Spectral value	296 fields
...		
Rad25879	Center wavelength 258.79 radiance value Spectral value	

2.6.7.2. LRS Data Output Format

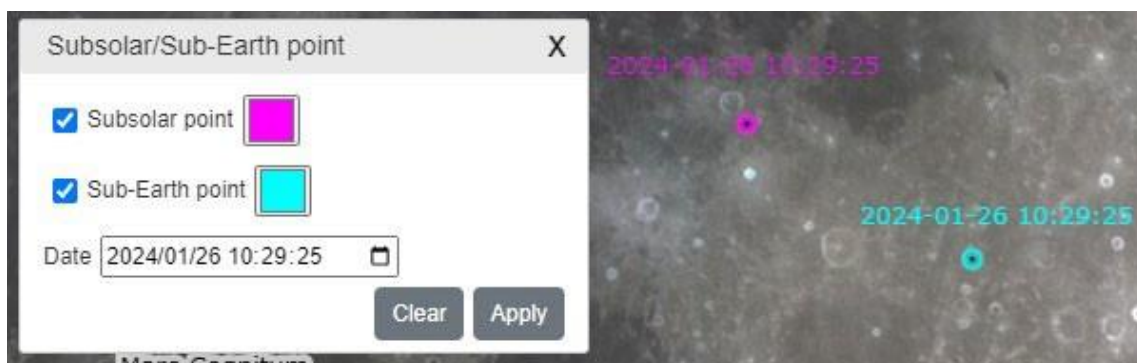
Data fields output as Shapefile and CSV files are as follows.

Field name	[Explanation]	Remarks
FID	Shape unique	Does not output when downloading to CSV.
Shape	Shape unique	Does not output when downloading to CSV.
Lon_start	Longitude at start of segment	
Lat_start	Latitude at start of segment	
Lon_end	Longitude at end of segment	
Lat_end	Latitude at end of segment	
Img_url	Data URL	
Lbl_url	LBL URL	
Thumbnail	URL of thumbnail image	

2.6.8. Subsolar/Sub-Earth Point

Indicates subsolar point and sub-Earth point on the lunar surface with dates that can be freely determined. Points displayed are displayed as the shape layer “Subsolar/Sub-Earth point.”

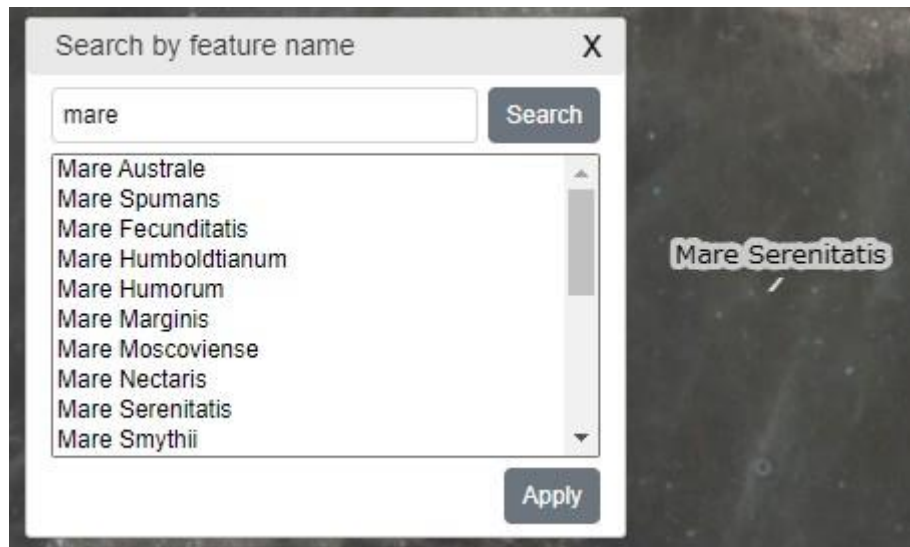
The operation is performed as shown below.



Item	Content
Subsolar/ Sub-Earth point	Displays the subsolar /Sub-Earth point specified in the check boxes.
Date	Specifies the dates the subsolar /Sub-Earth points are created.
Clear	Deletes all created subsolar /Sub-Earth points.
Apply	Creates subsolar/Sub-Earth points with the set values.

2.6.9. Search by Feature Name

Displays a list of feature names on lunar surface by searching keywords. Select a location and click the “Apply” button to move to that location.



End