# Data Format Control Book

## Level 1C product

**V1.2**

**Updated: 13 March 2025**

# Contents

# References

This document and others in this series are meant to give descriptions of products published by *FarEarth* in a way that is readable by humans. The machine-readable schemas are published into a Github repository. A sample of a complete product and the individual files is available.

The version of this document is intended to match the executors and software with the same version numbers. The links below are for the specific schema and sample versions that match this document:

| Description | Link |
|---|---|
| A complete L1C product as published by the FarEarth system in a compressed format. | LANDSAT-9_OLI_20220804T083603_20220804T083634_L1C_R1C1.zip |
| The Github repository containing schema and markdown files for the L1C product. | Github: L1/V1.2/L1C/ |

# 1 Introduction

## 1.1 Background

The *FarEarth* processing system processes smallsat raw data into orthorectified map ready data. *FarEarth* can generate a wide variety of different products. These products all have different characteristics and levels of processing and correction. The Data Format Control Books presented in this series are a reference for the interpretation of the data and metadata.

*FarEarth* processes data through a series of levels. In general, the higher the level the more generic and less specific the data is. Data from different satellites at higher levels may be compared, whereas data from the lower levels is not suitable for comparison.

### RAW

RAW data as downlinked by the satellite. A variety of different binary formats are supported by *FarEarth*.

### Level 0

Level 0 products are made up of RAW data that has been reformatted. These products include additional data with the raw data downlinked by the satellite.

### Level 1

Level 1 data is radiometrically calibrated and geometrically corrected. Intermediate products may be useful, so Level 1 is broken down into further sub-steps:

| Sub-step | Definition |
|---|---|
| L1A | Generated by using the L0 as input. This is a non-destructive operation. The main purpose is to mark bad pixels (dropped/under saturated/over saturated). The pixel DN values are converted into radiance using radiometric calibration coefficients and the bands are systematically geolocated without resampling the pixels.<br>**See document:** FarEarth-L1A-Data-Format-Control-Book-V1_2.pdf |
| L1B | Generated by using the L1A as input. This is a destructive operation. The L1B product's pixel data is geometrically orthorectified and band-aligned, but the pixel data is not yet wrapped to a map projection. The pixel data is converted to top-of-atmosphere (TOA) reflectance or kept in radiance. Orthorectification and band alignment may either be performed using a systematic or precision model. A systematic model is constructed using only geometric calibration coefficients and the satellite's NavAtt data, while a precision model is a refined model using tiepoints. For orthorectification, tiepoints to an absolute reference image are used, and for band-alignment, relative tiepoints between bands are used.<br>**See document:** FarEarth-L1B-Data-Format-Control-Book-V1_2.pdf |
| L1C | Generated by using the L1B as input. This is a destructive operation. The L1C product is warped to a map projection. The pixel data is either in TOA reflectance or radiance. Some quality metrics are added to the product, such as geometric accuracy measurements (absolute and/or relative).<br>**See document:** FarEarth-L1C-Data-Format-Control-Book-V1_2.pdf (this document) |

*Table 1: Level 1 sub-steps*

### Level 2

Level 2 data have been radiometrically corrected and is geometrically similar to Level 1 data:

| Sub-step | Definition |
|---|---|
| L2A | The purpose of the L2A is to radiometrically correct the pixel data to account for atmospheric conditions. The reflective bands' pixel values are atmospherically corrected and converted to surface reflectance. |

*Table 2: Level 2 sub-steps*

## 1.2 Purpose and scope

The Data Format Control Books series, published by *Pinkmatter,* serves as a reference of data and information available in the different products produced by *FarEarth*. A data format control book is provided for every version of the processing chain that is used in *FarEarth*:


Our public Github (https://github.com/pinkmatter) repositories contain schemas and examples that may be used to verify the files documented here.

## 1.3 Terminology

The following terminology is used in this document. This document is intended to describe L1C products that are produced by *FarEarth*. They do not include information on the structure of the files but rather descriptions on how to interpret and use them. Schemas and examples are provided as a reference for the structure and format of the L1C products:

| Term | Definition |
|---|---|
| Asset | An asset is a file that makes up part of a product. |
| GeoJSON | A IETF standard of encoding various geographic data structures based on RFC 7946 |
| ISO-8601 | ISO-8601 describes a format for date and time information. *FarEarth* makes use of the date and time in UTC variant of this standard in numerous places. An example of an ISO-8601-formatted string that *FarEarth* uses is: "2019-10-25T09:00:00Z" |
| NavAtt | Navigation and Attitude Data |
| Product | A product in *FarEarth* is a collection of related files with a product file |
| UTM/WGS84 | The Universal Transverse Mercator map projection using the World Geodetic System 84 ellipsoid. |

*Table 3: Common terminology*

# 2 Product structure

L1C products created by *FarEarth* are standard map-ready products. They are projected in UTM/WGS84, orthorectified and ready for downstream analysis or further correction. L1C product pixel values are presented in top of atmosphere reflectance or radiance.

All products created by and archived in *FarEarth* are represented by a product file. These files describe both the product at a high level and all the files that make up the product. Each file has a type and at least one role associated with it. The role describes the information and intended use of the file whilst the type describes the format of the file:

| Role | Asset Description | Section |
|---|---|---|
| data | Data assets are files that contain data that was captured by the satellite sensor. | 3 Data |
| metadata | Metadata files are files that contain data that provides context and information about the data assets. | 4 Metadata |
| quality | Quality Assessment assets provide information about data assets. | 5 Quality assessment |
| thumbnail | Thumbnail assets provide small overview images typically used in catalogues and web browsers. | 6 Thumbnail |

*Table 4: Asset roles*

# 3 Data files

Image data is included in an L1C product in TIFF format. Bands that have similar dimensions are grouped together in a file. Bands are included in the same order they appear in the band section in the metadata file. By default, L1C products produced by *FarEarth* use a data format of Int16 and a no data value of -9999.

The scale of the pixel values is given in the radiometric section of the metadata file. The following options are available and are dependent on the workflow and satellite:

| Property | Description |
|---|---|
| Digital Numbers | Pixel values in digital numbers as acquired by the sensor. Values have not been scaled to any units. |
| Radiance | Pixel values in radiance. Images in radiance have had an absolute radiometric calibration applied to the digital numbers. The value of each pixel is in units of watts per square meter per steradian $[\frac{W}{m^2\ sr}]$. |
| Top of Atmosphere Reflectance ($\times$ 10000) | The value of the pixels is the ratio of radiation reflected to the incident solar radiation, that is measured by a sensor above the atmosphere multiplied by $10^4$. Values are unitless. |

*Table 5: Pixel units*

Data files are published in Cloud Optimised Geotiff (COG) format that embeds geospatial data within the file. This allows you to open the file in 3rd party tools, and it will automatically be shown at its correct geolocation on the earth. LZW compression and a block size of 512 are used.

Pixels are nested in one of two ways depending on the configuration of the processors:

- Point nesting guarantees that the centre points of each pixel of lowest resolution image will be the centre point of a pixel for the higher resolution images. This implies that that bounding box of the images will not match.
- Area nesting guarantees that the top left corner of the pixels of the lowest resolution matches the top left corner of the images at lower resolutions. The bounding box of all images in the product will match.

Images processed by *FarEarth* from satellites with similar resolutions and projections over the same areas will have pixels that nest.

# 4 Metadata files

One or more metadata files are created with each *FarEarth* product. These files describe the context and conditions under which the data was acquired as well as derived properties of the data.

Metadata is available in a GeoJSON format which is compatible with a variety of software tools and third-party products. Below is a description of the metadata published with each product. Additional formats are available in *FarEarth*, the data and metadata in these formats are equivalent to the descriptions below:

| File | Description | Section |
|---|---|---|
| Product File | The product file contains metadata and references to the other files that make up a product. | 2 Product structure |
| Metadata | The main metadata file for the product. Typically has the extension *.geojson* and is readable by third-party applications | 4.1 Main metadata file |
| Viewing Angles | *FarEarth* may be configured to publish viewing angle data for blocks of pixels as well as average values for the scenes. This file has JSON structures that present the viewing angle data in a machine-readable format. | 4.2 Viewing angle metadata file |
| Pointing | The pointing file contains JSON data structure that represent the pointing accuracy of the product at different levels. | 4.4 Pointing file |
| GVerifyAbsolute | Quality of absolute geometric orthorectification. | 4.5 Geometric verification files |
| GVerifyRelative | Quality of relative geometric band-alignment. | 4.5 Geometric verification files |
| Spectral Response | A csv file with data representing the radiometric response of the sensor | 4.6 Radiometric Response |

*Table 6: Metadata files*

## 4.1 Main metadata file

The metadata file contains the metadata for the product in a GeoJSON compatible file. The metadata file is made up of a feature collection with a single feature representing the data in the product. The property values that are distinct to *FarEarth* are documented in this section.

**See Schema:** METADATA_V1_2.json

**See Sample:** LANDSAT-9_OLI_20220804T083603_20220804T083634_L1C_R1C1.geojson

## Product properties

| Property | Description |
|---|---|
| Descriptor | |
| Product ID | An identifier for this product. Identifiers do not necessarily need to be unique within the *FarEarth* catalogue, but it is recommended that the naming scheme be designed in such a way that it is unique |
| Product Type | For L1C products this is always L1C |
| Spacecraft | The name of spacecraft that captured this product |
| Sensors | A list of identifiers used to uniquely identify the sensor modules on the spacecraft |
| Temporal Range | A pair of ISO-8601 dates and times indicating the start and end of the period when the sensor was capturing pixels |
| Generation Date | An ISO-8601 date and time indicating when this product was generated |
| Scene Row | This is the along flight sub scene number |
| Scene Column | This is the across track sub scene number |
| Software | |
| Name | The software/executor used to generate the product |
| Version | The version of the software/executor used to generate the product |
| Thumbnails | A list of thumbnail images. These images are low resolution images that are suitable for catalogues and web browsers. |
| Name | The human readable name of the thumbnail |
| Image | The filename of the image |
| Thumbnail Image Type | Describes the format of the thumbnail images |
| Elevation | |
| Average MSL | The average Meters above Sea Level of the area covered in the product |
| Average HAE | The average Height Above Ellipsoid of the area covered in the product |
| Pixel Count | Number of pixels |
| Viewing Angles | The file containing the viewing angle information for the L1C product |
| Spectral Responses | The file containing the spectral responses of the bands |

*Table 7: Product properties*

## Sensors

This section of the metadata asset contains the details of each sensor on the spacecraft:

| Property | Description |
|---|---|
| Descriptor | The sensor descriptor is made up of properties describing the sensor |
| Name | An array of human readable names for the sensors on board the spacecraft |
| ID | An array of ids that the processing system uses internally to identify each sensor |
| Ancillaries | A list of the ancillary files or products that were used to process this image. Ancillaries provide the calibration information that was used. |
| Images | The images section is an array of grouped bands. These are known as images in *FarEarth*. Which group a band belongs to is configurable in *FarEarth*. Typically bands with similar GSDs are grouped together, bands with dissimilar GSDs cannot be grouped. The grouping does not affect the processing, it only affects the generated products. |
| Group | A human readable name for the group of bands |
| IDs | Identification of each band that makes up part of the image used by *FarEarth* |
| Bands | Identification of the bands that make up this image as used in *FarEarth* |
| Image | The filename of the data asset that corresponds with this image |
| QA Mask | The filename of the quality asset that corresponds with this image (see Section 5 Quality assessment ) |
| Radiometric | The radiometric section contains details of the radiometric properties of all the bands that are included in an image. |
| Units | This property specifies the units of the pixel data. See Section 3 Data files for more details. |
| ESUN | The mean effective exo-atmospheric solar irradiance per band |

| | |
|---|---|
| Spectral | The spectral range of a band, given in terms of the center wavelength (in nm) and full-width-at-half-maximum (FWHM) (in nm) |
| Earth Sun Distance | The distance between the Earth and the Sun in astronomical units |
| Geometric | The properties in the geometric section are applicable to all the bands in the image. Each image has a separate geometric section |
| Quality | This property indicates whether a systematic or precision band alignment strategy was followed for the band. See the description for orthorectification below for details. |
| Dimensions | The dimensions of the image file on disk (width and height) |
| Resolution | The resolution of one pixel. (The units depend on the projection) |
| Geometry | The envelope in map coordinates of the pixel data |
| Projection | The projection of the image on disk. For example, EPSG:4326 or EPSG:32655. This will determine the resolution and geometry map units |
| Angles | |
| Sun Azimuth | Sun azimuth angle. From the scene center point on the ground, this is the angle between true north and the sun. Measured clockwise in degrees (0° - 360°). |
| Sun Elevation | Sun elevation angle. The angle from the tangent of the scene center point to the sun. Measured from the horizon in degrees (-90° to 90°). Negative values indicate the sun is below the horizon, e.g. sun elevation of -10° means the data was captured during nautical twilight. |
| View Off Nadir | The angle from the sensor between nadir (straight down) and the scene center. Measured in degrees (0° - 90°). |
| View Incidence | The incidence angle is the angle between the vertical (normal) to the intercepting surface and the line of sight back to the satellite at the scene center. Measured in degrees (0° - 90°). |
| View Azimuth | Viewing azimuth angle. The angle measured from the sub-satellite point (point on the ground below the platform) between the scene center and true north. Measured clockwise from north in degrees (0° - 360°). |
| Quality | |
| Orthorectification | The orthorectification type is either **systematic** or **precision**.<br><br>Systematic orthorectification uses calibration coefficients, NavAtt data, and rough reference data such as the mean height above ellipsoid for the image.<br><br>Precision orthorectification uses tiepoints and reference data to refine the geolocation of the image to higher accuracies. Individual pixels of the Digital Elevation Model (DEM) are used to determine precisely where the pixel is.<br><br>The quality metrics in *FarEarth* rely on an image being precision orthorectified to determine deviations from a reference data set. The orthorectification type of an image is precision if every band has an orthorectification type of precision. |
| Metrics | Metrics are listed in this property if the orthorectification type is precision. The metrics are identical to the metrics in the pointing files in Section 4.4 Pointing files |

*Table 8: Sensors section of the L1C product metadata properties*

## Geometry

The geometry section defines the full footprint of the image. It is formatted according to RFC 7946, as outlined in Section 3.1:

| Property | Description |
|---|---|
| Type | The type of shape that is described in the coordinates property |
| Coordinates | A list of coordinates that describe the position of the image on the Earth |

*Table 9: Geometry properties of the session*

## 4.2 Viewing angle metadata file

The viewing angle file provides the same viewing angle data as the viewing angle in the metadata file for blocks of pixels instead averaged across the whole scene. This is to provide additional detail for applications that require it.

**See Schema:** VIEW_ANGLES_V1_2.json

**See Sample:** LANDSAT-9_OLI_20220804T083603_20220804T083634_L1C_R1C1_ANGLES.json

| Property | Meaning |
|---|---|
| Solar Zenith | The zenith is the angle from the zenith to the sun in degrees. It is equivalent to *90° - sun elevation* |
| Solar Azimuth | The azimuth is the angle at the center of the block from true north to the sun measured clockwise in degrees |
| Viewing Incidence Angles | |
| Viewing Zenith | The incidence angle zenith is the angle between the vertical (normal) to the intercepting surface at the centre point of the image or block and the line of sight back to the satellite. Measured in degrees (0° - 90°). |
| Viewing Azimuth | Viewing azimuth angle. The angle measured from the sub-satellite point (point on the ground below the platform) between the scene center and true north. Measured clockwise from north in degrees (0° - 360°). |
| Mean Sun Angle | Mean zenith and azimuth sun angles |
| Mean Viewing Incidence Angles | An array of mean zenith and azimuth viewing incidence angles for each band |

*Table 10: Viewing angle properties*

| Property | Meaning |
|---|---|
| Column Step Size | The column size is how many columns map units are included in each block |
| Column Step Unit | The unit of measurement used by the Column Step Size |
| Row Step Size | The row size is how many rows map units are included in each block |
| Row Step Unit | The unit of measurement used by the Row Step Size |
| Values | A square 2 dimensional array of values starting at the upper left, for example values[3][5] is row 3, column 5. “Nan” is used to indicate no data values |

*Table 11: Data format for block data*

## 4.3 Viewing angle image files

Viewing angle data is also provided in *.tif* data files that contain the same information as Section 4.2 Viewing angle metadata file. This data is geolocated to the same projection as the image and may be stacked on the image data to process it further. Two types of files are provided in a compressed file:

**See Sample:** LANDSAT-9_OLI_20220804T083603_20220804T083634_L1C_R1C1_PAN_PAN_1_VIEW_ANGLE.tif

### Solar angle

A single solar angle file is provided. The extent of this image may exceed the dimensions of the processed image. Data is encoded in the following bands:

| Band | Meaning |
|---|---|
| Band 1: Solar Zenith | See Zenith in section 4.2 Viewing angle metadata file |
| Band 2: Solar Azimuth | See Azimuth in section 4.2 Viewing angle metadata file |

*Table 12: Solar angle properties*

### View angle

A view angle file is provided for each band that is processed. Data is encoded in the following bands:

| Band | Meaning |
|---|---|
| Band 1: View Incidence Zenith | See Zenith in section 4.2 Viewing angle metadata file |
| Band 2: View Incidence Azimuth | See Azimuth in section 4.2 Viewing angle metadata file |

*Table 13: View angle data file bands*

## 4.4 Pointing files

The pointing file contains data structures containing the latitude and longitude of different pixels at different levels of processing. This information is useful for determining the accuracy of the satellites' attitude and ephemeris data. Measurements are provided for each sensor. This section is only published if the product is precision orthorectified.

**See Schema:** POINTING_V1_2.json

**See Sample:** LANDSAT-9_OLI_20220804T083603_20220804T083634_L1C_R1C1_POINTING.json

| Property | Meaning |
|---|---|
| Location | A short string indicating the pixel being measured, UL means Upper Left, LR means Lower Right and CENTER means the center of the image. |
| Raw Location | Latitude and longitude of the pixel as reported by the satellite. No rotations or corrections have been applied |
| Systematic Location | Latitude and longitude of the pixel as reported by the satellite after the image has been systematically orthorectified. This location has been corrected using the calibrated data and digital elevation models only |
| Precision Location | Latitude and longitude of the pixel as reported by the satellite after the image has been precision orthorectified. This location has been corrected using the calibrated data and digital elevation models and then accurately located using reference data |
| Raw To Systematic Disparity Meter | The difference between the locations in Raw Location and Systematic Location converted to meters |
| Raw To Precision Disparity Meter | The difference between the locations in Raw Location and Precision Location converted to meters |
| Systematic To Precision Disparity Meter | The difference between the locations in Systematic Location and Precision Location converted to meters |

*Table 14: Pointing file data structures*

These metrics are tracked because they can provide insights into the accuracy of the satellite's sensors. They are used as part of a larger collection of metrics to determine when new calibration data is required to maintain the quality of the images that are processed.

The raw to systematic disparity should only change when calibration data is updated, or between images captured over areas with different elevations.

The raw to precision and systematic to precision disparities are expected to degrade over time as sensors age and become less accurate. When measured over time they are a good indicator of the average error of the sensors.

## 4.5 Geometric verification files

The geometric verification files are produced as quality assessment files for every image. Two variants of the files are available, absolute and relative:

- Absolute products compare the master band of the image with reference data and contain the measured geometric error of tiepoints found on the image
- Relative products compare bands of the image and contain the measured geometric error of tiepoints found on the image

The comparison between the master band of an image and a reference image, and two bands of an image are performed in the same way. Tiepoints are collected for both the reference and the band being measured. These

tiepoints are independent of the tiepoints collected to process the image. The tiepoints between the reference and the image are matched to find similar ones. The distance between the geolocation of the tiepoints on the reference image and the tiepoints on the processed image is measured.

### Geometric verification absolute thumbnail

The geometric verification thumbnail that is produced by *FarEarth* is a visual indication of the tiepoints that were matched as part of the process above. The colour of the points indicates the difference between the reference and image in pixels at the GSD of the image.

**See Sample:** GVER_ABS_RED.png

### Geometric verification relative thumbnails

The relative geometric verification thumbnails that are produced by *FarEarth* is a visual indication of the tiepoints that were matched as part of the process above between the bands of the image. The colour of the points indicates the difference between the reference and image in pixels at the GSD of the image. These thumbnails are compressed into an archive before being included in the product.

**See Sample:** GVER_REL_BLUE_GREEN.png

### Geometric verification absolute metadata file

The geometric verification absolute metadata file contains the information shown in the geometric verification absolute thumbnail image in a data structure.

**See Schema:** GVER_ABS_V1_2.json

**See Sample:** LANDSAT-9_OLI_20220804T083603_20220804T083634_L1C_R1C1_GVER_ABS.json

| Property | Meaning |
|---|---|
| Pixel Color Mappings | A legend that is used for the thumbnail in Image Name |
| ID | Id of the band that was used in the comparison |
| Reference Resolution | The resolution of the reference data that was used for the comparison |
| Reference Spacecraft | The name of the spacecraft or mission that acquired the reference imagery |
| Image Name | The filename of the thumbnail image that corresponds the data in this file |
| Disparities XY In Meters | An array of the distance in meters from the reference tiepoints to the image tiepoints |
| Coordinates Lon/Lat | An array of coordinates of the tiepoints on the reference image and the image. These are stored as: [lon_ref, lat_ref, lon_img, lat_img] for each tiepoint |

*Table 15: Geometric verification absolute metadata file*

### Geometric verification relative metadata file

The geometric verification relative metadata file is similar to the geometric verification absolute metadata file except it contains measurements between the band combinations that were measured.

**See Schema:** GVER_REL_V1_2.json

**See Sample:** LANDSAT-9_OLI_20220804T083603_20220804T083634_L1C_R1C1_GVER_REL.json

| Property | Meaning |
|---|---|
| Pixel Color Mappings | A legend that is used for the thumbnail in Image Name |
| Measurements | An array that repeats the below data for each band combination that is measured |
| From | The band id of the reference band used in this comparison |
| To | The band id of the image that is being measured |
| Image Name | The filename of the thumbnail image that corresponds the data in this file |
| Disparities XY In Meters | An array of the distances in meters from the reference tiepoints to the image tiepoints. These are stored as [x_distance, y_distance] for each tiepoint |

| | |
|---|---|
| Coordinates Lon/Lat | An array of coordinates of the tiepoints on the reference image and the image. These are stored as: [lon_ref, lat_ref, lon_img, lat_img] for each tiepoint |

*Table 16: Geometric verification relative metadata file*

### Interpretation

The geometric verification thumbnails are used to determine the quality of the processed image. An accurately processed image will have a uniform distribution of tiepoints across the whole image that have small disparities. The difference in response between the different bands needs to be considered when interpreting the geometric verification results. For example, typical BLUE and GREEN bands are spectrally very similar when comparing the bands individually but the BLUE and NIR bands are spectrally separated, and less correlation is expected and normal.

Patterns in the disparities generally indicate that there is some satellite movement that is not being accounted for in the processing.

Isolated islands of tiepoints that are different from their surroundings can indicate an inaccurate DEM or inaccurate modelling of the radiometric properties of the sensor.

## 4.6 Radiometric Response

The radiometric response of the sensor is included in the L1C product as a CSV file. The CSV file has a header row, the first column is the x-axis wavelength. Following this is the radiometric response for each band.

**See Sample:** LANDSAT-9_OLI_20220804T083603_20220804T083634_L1C_R1C1_SPECTRAL_RESPONSE.csv

| x-axis(um) | band1 | band2 | band3 | band4 | … |
|---|---|---|---|---|---|
| 0.4000128478 | 0.0 | 0.0 | 1.53017677E-4 | 0.0 | |
| 0.4006134492 | 0.0 | 0.0 | -1.6947116E-4 | 2.66482800E-4 | |
| 0.4012140505 | 0.0 | -6.8684477E-5 | -4.6930260E-5 | 1.46200368E-4 | |
| … | | | | | |

*Table 17: Example radiometric response data*

# 5 Quality assessment files

A quality assessment asset is made up of pixel data that indicates conditions that may have had an impact on the processing of an image. A quality assessment asset is published for each image group. Each data asset has an accompanying quality asset. If the image group is made up of multiple bands, the descriptions in Table 18 apply to one or more bands.

The map projection of the quality asset is identical to the corresponding data asset so that pixels may be identified and masked easily.

**See Sample:** LANDSAT-9_OLI_20220804T083603_20220804T083634_L1C_R1C1_PAN_QA.tif

| Value | Meaning |
|---|---|
| 0 | No special information regarding this pixel. |
| 1 | The pixel is undersaturated, this means that the value measured for this pixel is at the minimum limit that the sensor is capable of measuring and this pixel is uncertain. |
| 2 | The pixel is oversaturated, this means that the value measured for this pixel is at the maximum limit that the sensor is capable of measuring and this pixel is uncertain. |

*Table 18: Quality asset pixel values*

# 6 Thumbnail files

Thumbnail assets are low resolution images produced by *FarEarth* that provide an overview of the product. Thumbnail assets are suitable for consumption in a web browser without special handling. Every product created by *FarEarth* will contain at least a single thumbnail. The format of the asset depends on how the product was produced and is documented in both the asset list and metadata asset.

Products may also include overview, visual or graphic assets that provide similar benefits but have a different format and are more specific to an aspect of the product.

**See Sample:** LANDSAT-9_OLI_20220804T083603_20220804T083634_L1C_R1C1_RGB.png