IPERLITE:
Level 1C/2A Product User Manual

Version: [1.0]
Date: 15-10-2026

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1 LEVEL1C DATA PRODUCTS

A Level 1C product contains the ortho-rectified radiometrically and geometrically calibrated, geo-located TOA (Top Of Atmosphere) data. The data is projected to a uniform and fixed grid in the Geographic Lat/Lon or UTM/WGS84 coordinate reference system.

1.1 Product content and structure

A Level 1C product is composed of a magnitude of files (i.e. image data and metadata) that are stored in a parent directory with a name that uniquely identifies the Level 1C product.

A Level 1C product is composed of following files and directories:

Name	Type	Description
<PRODUCTID>_CONTOUR.kml	File	KML (Keyhole Markup Language) vector file containing the footprint (i.e. contour) of the product and the embedded RGB quicklook. The figure below gives an example file opened in Google Earth: 
<PRODUCTID>_RGB.tiff	File	False-colour RGB quicklook file of the product. Refer to section 1.2.3 for further details on the format of the file.
<PRODUCTID>_RGB_PREVIEW.jpeg **<PRODUCTID>_RGB_PREVIEW.wld**	File	False-colour RGB preview (thumbnail) file of the product. Refer to section 1.2.4 for further details on the format of the file.
<PRODUCTID>.vrt	File	GDAL VRT (Virtual Raster Template) file representing a stacked multi-band hyper-spectral data cube of the RTOA datasets. Refer to section 1.2.2 for further details.
<PRODUCTID>.xml	File	Metadata file in the XML – format. The file is a plain text metadata file with a structure and syntax comprising key-value pairs organized in sections.

		Refer to section 1.3 for further details on the content of the metadata file.
<PRODUCTID>.data	Directory	Subdirectory containing the image data files of the product.

Table 1: Content and structure of a Level 1C product directory.

In the table above, the <PRODUCTID> represents the unique textual identifier of the product. Following convention is used:

```
IPERLITE_LEVEL1C_<START_DATE_TIME>_<STOP_DATE_TIME>_UTM_20M_V<VERSION>
```

Where:

- <START_DATE_TIME>: the start acquisition date and time (format: YYYYMMDDThhmmssZ)
- <STOP_DATE_TIME>: the stop acquisition date and time (format: YYYYMMDDThhmmssZ)
- <VERSION>: version identifier of the product (i.e. 001, 002, etc.)

As detailed in the table above, the image files are grouped into the "<PRODUCTID>.data" subdirectory.

Each image file has a unique suffix that identifies the type of data contained:

Suffix name	Data type	Units	No data	Coding	Description
RTOA<BAND>	Int16	-	-9999	Scale: 10000.0 Offset: 0.0	TOA reflectance data of spectral band <BAND>, where <BAND> is the one-based spectral band identifier.
VAA	Uint16	Degrees	65535	Scale: 100.0 Offset: 0.0	Satellite viewing azimuth angles
VZA	Uint16	Degrees	65535	Scale: 100.0 Offset: 0.0	Satellite viewing zenith angles
SAA	Uint16	Degrees	65535	Scale: 100.0 Offset: 0.0	Solar azimuth angles
SZA	Uint16	Degrees	65535	Scale: 100.0 Offset: 0.0	Solar zenith angles

Table 2: Image files of a Level 1C product.

1.2 File format specifications

1.2.1 Image files

Each band-specific image file listed in Table 2 is a single-band file saved in the Cloud Optimized GeoTIFF (COG) file format (http://cogeo.org/). It contains the pixel data stored at full resolution and additionally, multiple down sampled (i.e. with coarser resolution) overviews are added to the file, that are mainly used for fast display in zooming out operations in a GIS application.

The image files are saved in one of following CRS (Coordinate Reference System):

- Geographic Lat/Lon as defined in EPSG:4326
- UTM/WGS84 (Universal Transverse Mercator) as defined in EPSG:326xx (UTM northern hemisphere) and EPSG:327xx (UTM southern hemisphere), where xx indicates the UTM zone number ranging from 00 to 36.

Cubic convolution (bi-cubic) is used by default to do the resampling. Each image file is compressed using the lossless DEFLATE compression algorithm, with a block size of 512x512 pixels.

Following metadata tags are set in each COG image file:

Metadata tag	Description
NoData	The "no data" value of the dataset, as detailed in Table 2.
Description	A short textual description of the dataset.
Unit Type	The units of the dataset (e.g. "degrees", "meters", etc.). If set to "-", the dataset is unitless.
Offset	The offset to be applied to convert the pixel values to real physical units. Following formula needs to be applied to obtain physical values (PV) from the digital pixel value (DN): PV = DN * Scale + Offset Defaults to "0.0" if not available. Refer to Table 2 for the scale/offset factor of each dataset.
Scale	The scale factor to be applied to convert the pixel values to real physical units. Following formula needs to be applied to obtain physical values (PV) from the digital pixel value (DN): PV = DN * Scale + Offset Defaults to "1.0" if not available. Refer to Table 2 for the scale/offset factor of each dataset.
STATISTICS_MINIMUM	The minimum value in the image file.
STATISTICS_MAXIMUM	The maximum value in the image file.
STATISTICS_MEAN	The mean value in the image file.
STATISTICS_STDDEV	The standard deviation of the values in the image file.
STATISTICS_VALID_PERCENT	The percentage of pixels that are different from the "no data" value.
BAND_NUMBER	One-based band number.
BAND_NAME	Name of the band (Syntax: "B<BAND_NUMBER>") where <BAND_NUMBER> is the one-based band number.
DATASET_NAME	Name of the dataset as defined in Table 2.

Table 3: Metadata tags of Level1C product

1.2.2 Hyperspectral TOA reflectance data cube

As detailed in section 1.1, the hyperspectral image data are provided as a set of single-band image files. Each RTOA - file contains the top-of-atmosphere (TOA) reflectance values for one spectral band.

A GDAL Virtual Raster Template (VRT) file is also provided. This file references the individual band files and presents them as a single multiband hyperspectral data cube, without duplicating the image data.

Refer to https://gdal.org/en/stable/drivers/raster/vrt.html for further details on the GDAL VRT file format.

1.2.3 RGB quicklook file

The RGB quicklook file is a false-color image in the COG file format that is composed of four spectral bands each decoded as 8-bit unsigned integer values, where:

- The first three bands represent the red, green and blue colour channels. A colour enhancement algorithm has been applied on these bands to make the colours more vivid for visual use.
- The fourth layer represents the transparency (i.e. alpha) layer. All pixels for which the red, green or blue channel is equal to “no data” are made transparent. All other pixels are opaque.

The RGB quicklook file is in the same CRS (Coordinate Reference System) as the image files. The RGB quicklook file is compressed using the lossy JPEG compression algorithm, with a block size of 512x512 pixels.

An example is given in the figure below:



Figure 1: Example RGB quicklook file.

1.2.4 RGB-preview file

The RGB preview file is a false-color image in the JPEG file format. It is a file at sub-sampled (i.e. with coarser resolution) that is typically intended for fast visualization and visual inspection of the product.

The RGB preview file is compressed using the lossy JPEG compression algorithm, with a block size of 512x512 pixels. No CRS is assigned to the RGB preview file. Instead, a corresponding JPEG world file (*.wld) is located in the same folder as the JPEG preview file.

1.3 Metadata information

The metadata file describes the identity, provenance, spatial organisation, processing and interpretation of an IPERLITE Level1C product. Use the image file references to locate the data and the matching interpretation records to understand each image layer.

1.3.1 File format

The metadata is an XML document encoded as UTF-8. The XML declaration specifies version 1.0. Its root element is `Dimap_Document`, with the name attribute `IPERLITE-DIMAP`.

Elements are nested containers or value fields. Tag names are case sensitive. Attributes carry additional information: version identifies a format or catalogue version, unit declares a measurement unit, and `href` stores a URL or file path. Empty element text does not imply a missing reference when `href` is present.

1.3.2 Metadata structure

The main elements below are direct children of `Dimap_Document` and appear in the order shown. Subsequent tables describe their children; a slash in an element label indicates a nested child path relative to the named container. Repeated containers represent multiple records.

Element	Description
Metadata_Id	Identifies the metadata format, version and IPERLITE profile.
Dataset_Id	Identifies the product series and individual dataset, and states copyright.
Production	Records the producer, production and acquisition times, processing facility and acquisition request.
Dataset_Frame	Describes the geographic frame vertices and scene centre, with associated image coordinates.
Coordinate_Reference_System	Identifies the coordinate reference system and the reference catalogue.
Raster_CS	Defines the raster coordinate convention and pixel origin.
Raster_Dimensions	States the raster width, height and number of product bands or image layers.
Geoposition	Records the upper left map position and nominal pixel spacing.
Data_Processing	Records processing level, calibration references, instrument settings, Earth orientation inputs and quality indicators.
Dataset_Sources	Identifies input products and ancillary datasets used in processing.
Data_Access	Describes the image format and organisation, with one Data_File entry for each image file composing the product.
Image_Interpretation	Describes each image layer through a `Spectral_Band_Info` entry, including encoding, scaling and spectral information where applicable.

Table 4: Main metadata elements of IPERLITE Level1C product

Metadata_Id – element

Identifies the metadata format, version and IPERLITE profile.

Element	Description
METADATA_FORMAT	Metadata format identifier. The value is DIMAP; the version attribute records the DIMAP version, 2.2.0
METADATA_PROFILE	Application profile used to interpret the metadata: IPERLITE_DIMAP.

Table 5: Metadata_Id – element content

Dataset_Id – element

Identifies the product series and individual dataset, and states copyright.

Element	Description
DATASET_SERIES	Product family or series identifier: IPERLITE_LEVEL1C.
DATASET_NAME	Unique dataset identifier.
COPYRIGHT	Copyright statement supplied with the dataset.

Table 6: Dataset_Id – element content

Production – element

Records the producer, production and acquisition times, processing facility and acquisition request.

Element	Description
DATASET_PRODUCER_NAME	Name of the organisation producing the product.
DATASET_PRODUCER_URL	Producer website. The URL is stored in the `href` attribute; element text may be empty.
DATASET_PRODUCTION_DATE	Timestamp at which the product was produced. The syntax is an ISO 8601 UTC timestamp ending in Z. Example: `2026-10-07T14:28:34Z`
PRODUCT_START_TIME	Start of the acquisition interval covered by the product, expressed as a UTC timestamp. The syntax is an ISO 8601 UTC timestamp ending in Z. Example: `2026-09-22T07:07:55Z`
PRODUCT_STOP_TIME	End of the acquisition interval covered by the product, expressed as a UTC timestamp. The syntax is an ISO 8601 UTC timestamp ending in Z. Example: `2026-09-22T07:08:09Z`
PRODUCT_TYPE	Product type identifier; IPERLITE_LEVEL1C
PRODUCTION_FACILITY	Container for production software identification and processing centre. It is composed of following elements: **Element** / **Description** **SOFTWARE_NAME** – Name of the software used to produce the dataset. **SOFTWARE_VERSION** – Version identifier of the production software. **PROCESSING_CENTER** – Identifier of the processing centre.
PROGRAMMING_MODE	Acquisition programming mode: NOMINAL
PROGRAMMING_REQUEST_ID	Identifier of the acquisition programming request.

Table 7: Production – element content

Dataset_Frame – element

Describes the geographic frame vertices and scene centre, with associated image coordinates.

<table>
<tr><th>Element</th><th>Description</th></tr>
<tr><td>Vertex</td><td>Repeated frame vertex record. Each record contains four children, each with longitude, latitude, row and column:

<table>
<tr><th>Element</th><th>Description</th></tr>
<tr><td>FRAME_LON</td><td>Longitude coordinate (units: degrees)</td></tr>
<tr><td>FRAME_LAT</td><td>Latitude coordinate (units: degrees)</td></tr>
<tr><td>FRAME_ROW</td><td>Image row (one-based) associated with the frame location</td></tr>
<tr><td>FRAME_COL</td><td>Image column (one-based) associated with the frame location</td></tr>
</table>
</td></tr>
<tr><td>Scene_Center</td><td>Scene centre record, with longitude, latitude and associated row and column:

<table>
<tr><th>Element</th><th>Description</th></tr>
<tr><td>FRAME_LON</td><td>Longitude coordinate (units: degrees)</td></tr>
<tr><td>FRAME_LAT</td><td>Latitude coordinate (units: degrees)</td></tr>
<tr><td>FRAME_ROW</td><td>Image row (one-based) associated with the frame location</td></tr>
<tr><td>FRAME_COL</td><td>Image column (one-based) associated with the frame location</td></tr>
</table>
</td></tr>
</table>

Table 8: Dataset_Frame – element content

Coordinate_Reference_System – element

Identifies the coordinate reference system and the reference catalogue.

<table>
<tr><th>Element</th><th>Description</th></tr>
<tr><td>GEO_TABLES</td><td>Reference catalogue for coordinate system identifiers: EPSG</td></tr>
<tr><td>Horizontal_CS</td><td>Container describing the horizontal coordinate reference system.

<table>
<tr><th>Element</th><th>Description</th></tr>
<tr><td>HORIZONTAL_CS_TYPE</td><td>Declared horizontal coordinate system type (i.e. PROJECTED)</td></tr>
<tr><td>HORIZONTAL_CS_NAME</td><td>Human readable name of the horizontal coordinate system (i.e. GEOGRAPHIC LAT/LON)</td></tr>
<tr><td>HORIZONTAL_CS_CODE</td><td>Coordinate reference system identifier (i.e. EPSG:4326).</td></tr>
</table>
</td></tr>
</table>

Table 9: Coordinate_Reference_System – element content

Raster_CS – element

Defines the raster coordinate convention and pixel origin.

Element	Description
RASTER_CS_TYPE	Raster coordinate system type. CELL indicates a cell based raster convention.
PIXEL_ORIGIN	Pixel origin parameter, i.e. 0.5 indicating a half pixel origin convention.

Table 10: Raster_CS – element content

Raster_Dimensions – element

States the raster width, height and number of product bands or image layers.

Element	Description
NCOLS	Number of columns in the output rasters.
NROWS	Number of rows in the output rasters.
NBANDS	Number of product bands or image layers. With BAND_SEPARATE organisation, the example counts the separate image entries.

Table 11: Raster_Dimensions – element

Geoposition – element

Records the upper left map position and nominal pixel spacing.

Element	Description
ULXMAP	X coordinate of the upper left map position (units: degrees)
ULYMAP	Y coordinate of the upper left map position (units: degrees)
XDIM	Nominal pixel spacing in the X direction, i.e. 20 (meters).
YDIM	Nominal pixel spacing in the Y direction, i.e. 20 (meters).

Table 12: Geoposition – element content

Data_Processing – element

Records processing level, calibration references, instrument settings, Earth orientation inputs and quality indicators.

Element	Description
PROCESSING_LEVEL	Processing level of the delivered product: 1C
GEOMETRIC_PROCESSING	Filename identifying the geometric ICP file used.
RADIOMETRIC_PROCESSING	Filename identifying the radiometric ICP file used.
PROCESSING_OPTIONS	Container for processing configuration, composed of following children:

	<table><tr><th>Element</th><th>Description</th></tr><tr><td>FRAME_SEQUENCES</td><td>Number of frame sequences.</td></tr><tr><td>INSTRUMENT_CONFIGURATIONS</td><td>Container associating frame sequence information with instrument configuration records. Refer to Table 14 for further details.</td></tr><tr><td>LEAP_SECONDS</td><td>Leap second value (units: seconds).</td></tr><tr><td>POLAR_MOTION_X</td><td>X component of the polar motion input used in geometric processing (units: mas).</td></tr><tr><td>POLAR_MOTION_Y</td><td>Y component of the polar motion input used in geometric processing (units: mas)</td></tr><tr><td>POLAR_MOTION_DELTA_UT1</td><td>UT1 correction of the polar motion input used in geometric processing.</td></tr></table>
Quality	Container for geometric and radiometric quality indicators.

Table 13: Data_Processing – element content

Instrument_Configurations – element

Container associating frame sequence information with instrument configuration records.

Element	Description
FRAME_SEQUENCE	One-based identifier for the frame sequence, ranging from 1 to FRAME_SEQUENCES.
INSTRUMENT_CONFIGURATION	Instrument configuration record containing acquisition settings, compression, gain and image processing settings. It contains following children: <table><tr><th>Element</th><th>Description</th></tr><tr><td>IMAGE_ACQUISITION_CONFIGURATION</td><td>Container for acquisition settings, including time delay integration and black pixel handling.</td></tr><tr><td>COMPRESSION</td><td>Instrument compression setting or code.</td></tr><tr><td>GAIN</td><td>Instrument gain setting or code.</td></tr><tr><td>IMAGE_PROCESSING_CONFIGURATION</td><td>Container for detector correction identifiers, binning and cropping settings.</td></tr></table>

Table 14: Instrument_Configurations – element content

Image_Acquisition_Configuration – element

Container for acquisition settings, including time delay integration and black pixel handling.

Element	Description
TDI_FACTOR	Time delay integration factor recorded for acquisition.

TDI_ACCUMULATION_FACTOR	Time delay integration accumulation factor recorded for acquisition.
BLACK_PIXELS	Boolean flag recording the black pixel setting.

Table 15: Image_Acquisition_Configuration – element content

Image_Processing_Configuration – element

Container for detector correction identifiers, binning and cropping settings.

Element	Description
BAD_PIXELMAP_ID	Identifier of the bad pixel map setting used by the instrument configuration.
FPU_PRNU_CORRECTION_ID	Identifier of the pixel response non-uniformity correction map.
BINNING	Instrument binning setting or code.
CROPPING_COLUMNS	Container describing the retained detector column count and selected column ranges. It contains following children: **Element** / **Description** **NCOLS** – Number of detector columns retained by the column cropping configuration. **RANGE** – Selected detector index interval. RANGE repeats when multiple intervals are retained. **RANGE/ START** – Start index of a selected detector interval. **RANGE/ STOP** – Stop index of a selected detector interval.
CROPPING_SPECTRAL	Container describing the retained detector spectral row count and selected spectral row ranges. It contains following children: **Element** / **Description** **NROWS** – Number of detector spectral rows retained across the selected intervals. **RANGE** – Selected detector index interval. RANGE repeats when multiple intervals are retained. **RANGE/ START** – Start index of a selected detector interval. **RANGE/ STOP** – Stop index of a selected detector interval.

Table 16: Image_Processing_Configuration – element content

Quality – element

Container for geometric and radiometric quality indicators.

Element	Description

<table>
<tr><td>GeometricCorrection</td><td>Container for geometric correction quality assessments. It contains two children:

<table><tr><th>Element</th><th>Description</th></tr><tr><td>Absolute</td><td>Quality assessment of absolute geometric correction. Possible values are GOOD or DEGRADED.</td></tr><tr><td>InterBand</td><td>Quality assessment of geometric alignment between spectral bands. Possible values are GOOD or DEGRADED</td></tr></table></td></tr>
<tr><td>RadiometricCorrection</td><td>Container for percentages of pixels in radiometric quality categories.

This element contains following children:

<table><tr><th>Element</th><th>Description</th></tr><tr><td>PercentPixelsRadiometryCorrect</td><td>Percentage of pixels classified as radiometrically correct.</td></tr><tr><td>PercentPixelsRadiometryMissing</td><td>Percentage of pixels classified as missing radiometry</td></tr><tr><td>PercentPixelsRadiometryNegative</td><td>Percentage of pixels classified as having negative radiometry.</td></tr><tr><td>PercentPixelsRadiometrySaturated</td><td>Percentage of pixels classified as radiometrically saturated.</td></tr></table></td></tr>
</table>

Table 17: Quality – element content

Dataset_Sources – element

Identifies input products and ancillary datasets used in processing.

<table>
<tr><th>Element</th><th>Description</th></tr>
<tr><td>Source_Information</td><td>Repeated source record. One record describes each input product or ancillary dataset.

It contains following children:

<table><tr><th>Element</th><th>Description</th></tr><tr><td>SOURCE_ID</td><td>Identifier of the source dataset or input product.</td></tr><tr><td>SOURCE_TYPE</td><td>Source category or product type, such as DEM.</td></tr><tr><td>SOURCE_DESCRIPTION</td><td>Human readable description of the source dataset or product.</td></tr></table></td></tr>
</table>

Table 18: Dataset_Sources – element content

Data_Access – element

Describes the image format and organisation, with one `Data_File` entry for each image file composing the product.

`Data_Access` is a file inventory. Its common fields describe the image format and storage organisation. It then contains one `Data_File` entry for each image file composing the product; the number of entries depends on the product contents.

Element	Description
DATA_FILE_FORMAT	Format of the image files: GEOTIFF.
DATA_FILE_FORMAT_DESC	Human readable description of the image file format.
DATA_FILE_ORGANISATION	Organisation of the image data. BAND_SEPARATE indicates that product layers are stored in separate image files.
Data_File	Repeated image file entry. An entry exists for every image file composing the product. It contains following children:

Element	Description
DATA_FILE_PATH	Location of the image file, stored in the href attribute. In the example it is a relative path into the product data directory.
BAND_INDEX	Product layer index linking a Data_File record to its Spectral_Band_Info record.

Resolve a relative `DATA_FILE_PATH` against the metadata file location while preserving the supplied filename. Match `Data_File/BAND_INDEX` to `Image_Interpretation/Spectral_Band_Info/BAND_INDEX` to obtain the corresponding layer description. A product index need not equal the channel number appearing in a filename or band name.

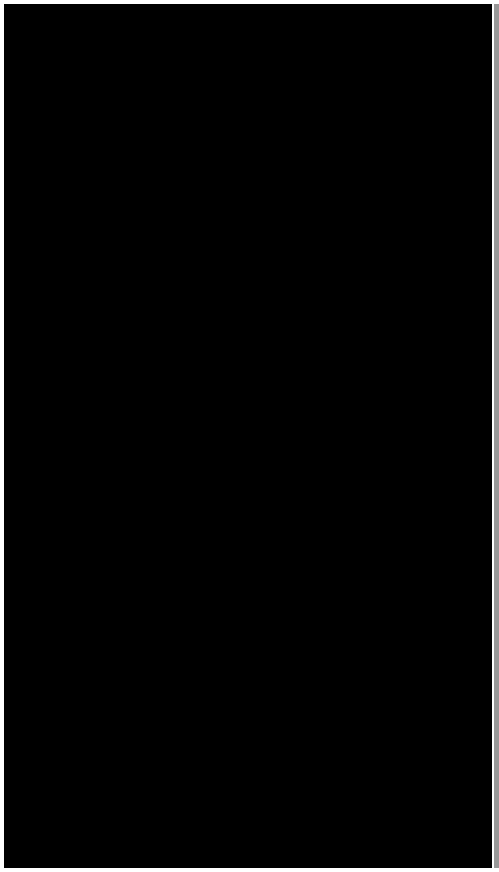
Image_Interpretation – element

Describes each image layer through a `Spectral_Band_Info` entry, including encoding, scaling and spectral information where applicable.

`Image_Interpretation` contains one `Spectral_Band_Info` entry for each product image layer. For the BAND_SEPARATE organisation shown here, this provides an interpretation entry for every image file. Despite its name, `Spectral_Band_Info` also describes ancillary layers such as viewing and solar angles.

Element	Description
Spectral_Band_Info	Repeated interpretation record for a product image layer. The same record structure describes spectral images and ancillary image layers. It is composed of following children:

Element	Description
BAND_INDEX	Product layer index linking a Data_File record to its Spectral_Band_Info record. The example uses zero based indices; this is distinct from a physical spectral channel number.



BAND_NAME	Short identifier of the image layer.
BAND_DESCRIPTION	Human readable description of the quantity represented by the image layer.
NO_DATA_VALUE	Stored sample value marking missing or invalid data. Mask this value before applying scaling.
PHYSICAL_UNIT	Unit of the interpreted physical quantity. It may indicate degrees or N/A for a quantity without a stated physical unit.
DATA_TYPE	Storage data type of the image samples, including signedness and bit depth.
SCALING_FACTOR	Multiplicative factor for converting valid stored samples to physical values.
SCALING_OFFSET	Additive offset associated with conversion of valid stored samples to physical values.
SPECTRAL_BAND_INDEX	Spectral channel identifier, distinct from BAND_INDEX. Present for spectral image layers in the example and absent for ancillary angle layers.
CENTRAL_WAVELENGTH_NM	Central wavelength of the spectral channel, expressed in nanometers.
FWHM	Full width at half maximum of the spectral response, expressed in nanometers.

Apply the data type, no data marker, physical unit and scaling values from each layer’s own record. Spectral channel index, central wavelength and response width are included where applicable; ancillary angle layers in the example omit these three fields. Do not assume that all layers share the same encoding or physical unit.

2 LEVEL2A DATA PRODUCTS

A Level2A product contains the ortho-rectified radiometrically and geometrically calibrated, geo-located and atmospherically corrected TOC (Top Of Canopy) data. The data is projected to a uniform and fixed grid in the Geographic Lat/Lon or UTM/WGS84 coordinate reference system.

2.1 Product content and structure

A Level 2A product is composed of a magnitude of files (i.e. image data and metadata) that are stored in a parent directory with a name that uniquely identifies the Level 2A product.

A Level 2A product is composed of following files and directories:

Name	Type	Description
<PRODUCTID>_CONTOUR.kml	File	KML (Keyhole Markup Language) vector file containing the footprint (i.e. contour) of the product and the embedded RGB quicklook. The figure below gives an example file opened in Google Earth: 
<PRODUCTID>_RGB.tiff	File	False-colour RGB quicklook file of the product. Refer to section 2.2.3 for further details on the format of the file.
<PRODUCTID>_RGB_PREVIEW.jpeg **<PRODUCTID>_RGB_PREVIEW.wld**	File	False-colour RGB preview (thumbnail) file of the product. Refer to section 2.2.4 for further details on the format of the file.
<PRODUCTID>.vrt	File	GDAL VRT (Virtual Raster Template) file representing a stacked multi-band hyper-spectral data cube of the RTOC datasets. Refer to section 2.2.2 for further details.
<PRODUCTID>.xml	File	Metadata file in the XML – format. The file is a plain text metadata file with a structure and syntax comprising key-value pairs organized in sections.

		Refer to section 2.3 for further details on the content of the metadata file.
<PRODUCTID>.data	Directory	Subdirectory containing the image data files of the product.

Table 19: Content and structure of a Level 2A product directory.

In the table above, the <PRODUCTID> represents the unique textual identifier of the product. Following convention is used:

```
IPERLITE_LEVEL2A_<START_DATE_TIME>_<STOP_DATE_TIME>_UTM_20M_V<VERSION>
```

Where:

- <START_DATE_TIME>: the start acquisition date and time (format: YYYYMMDDThhmmssZ)
- <STOP_DATE_TIME>: the stop acquisition date and time (format: YYYYMMDDThhmmssZ)
- <VERSION>: version identifier of the product (i.e. 001, 002, etc.)

As detailed in Table 19, the image files are grouped into the "<PRODUCTID>.data" subdirectory.

Each image file has a unique suffix that identifies the type of data contained:

Suffix name	Data type	Units	No data	Coding	Description
RTOC<BAND>	Int16	-	-9999	Scale: 10000.0 Offset: 0.0	TOC reflectance data of spectral band <BAND>, where <BAND> is the one-based spectral band identifier
VAA	Uint16	Degrees	65535	Scale: 100.0 Offset: 0.0	Satellite viewing azimuth angles.
VZA	Uint16	Degrees	65535	Scale: 100.0 Offset: 0.0	Satellite viewing zenith angles.
SAA	Uint16	Degrees	65535	Scale: 100.0 Offset: 0.0	Solar azimuth angles.
SZA	Uint16	Degrees	65535	Scale: 100.0 Offset: 0.0	Solar zenith angles.

Table 20: Image files of a Level 2A product

2.2 File format specifications

2.2.1 Image files

Each band-specific image file listed in Table 20 is a single-band file saved in the Cloud Optimized GeoTIFF (COG) file format (http://cogeo.org/). It contains the pixel data stored at full resolution and additionally, multiple down sampled (i.e. with coarser resolution) overviews

are added to the file, that are mainly used for fast display in zooming out operations in a GIS application.

The image files are saved in one of following CRS (Coordinate Reference System):

- Geographic Lat/Lon as defined in EPSG:4326
- UTM/WGS84 (Universal Transverse Mercator) as defined in EPSG:326xx (UTM northern hemisphere) and EPSG:327xx (UTM southern hemisphere), where xx indicates the UTM zone number ranging from 00 to 36.

Cubic convolution (bi-cubic) is used by default to do the resampling. Each image file is compressed using the lossless DEFLATE compression algorithm, with a block size of 512x512 pixels.

Following metadata tags are set in each COG image file:

Metadata tag	Description
NoData	The "no data" value of the dataset, as detailed in Table 20.
Description	A short textual description of the dataset.
Unit Type	The units of the dataset (e.g. "degrees", "meters", etc.). If set to "-", the dataset is unitless.
Offset	The offset to be applied to convert the pixel values to real physical units. Following formula needs to be applied to obtain physical values (PV) from the digital pixel value (DN): PV = DN * Scale + Offset Defaults to "0.0" if not available. Refer to Table 20 for the scale/offset factor of each dataset.
Scale	The scale factor to be applied to convert the pixel values to real physical units. Following formula needs to be applied to obtain physical values (PV) from the digital pixel value (DN): PV = DN * Scale + Offset Defaults to "1.0" if not available. Refer toTable 20 for the scale/offset factor of each dataset.
STATISTICS_MINIMUM	The minimum value in the image file.
STATISTICS_MAXIMUM	The maximum value in the image file.
STATISTICS_MEAN	The mean value in the image file.
STATISTICS_STDDEV	The standard deviation of the values in the image file.
STATISTICS_VALID_PERCENT	The percentage of pixels that are different from the "no data" value.
BAND_NUMBER	One-based band number.
BAND_NAME	Name of the band (Syntax: "B<BAND_NUMBER>") where <BAND_NUMBER> is the one-based band number.
DATASET_NAME	Name of the dataset as defined in Table 2.

Table 21: Metadata tags of Level2A product

2.2.2 Hyperspectral TOC reflectance data cube

As detailed in section 2.1, the hyperspectral image data are provided as a set of single-band image files. Each RTOC - file contains the top-of-canopy (TOC) reflectance values for one spectral band.

A GDAL Virtual Raster Template (VRT) file is also provided. This file references the individual band files and presents them as a single multiband hyperspectral data cube, without duplicating the image data.

Refer to https://gdal.org/en/stable/drivers/raster/vrt.html for further details on the GDAL VRT file format.

2.2.3 RGB quicklook file

The RGB quicklook file is a false-color image in the COG file format that is composed of four spectral bands each decoded as 8-bit unsigned integer values, where:

- The first three bands represent the red, green and blue colour channels. A colour enhancement algorithm has been applied on these bands to make the colours more vivid for visual use.
- The fourth layer represents the transparency (i.e. alpha) layer. All pixels for which the red, green or blue channel is equal to “no data” are made transparent. All other pixels are opaque.

The RGB quicklook file is in the same CRS (Coordinate Reference System) as the image files. The RGB quicklook file is compressed using the lossy JPEG compression algorithm, with a block size of 512x512 pixels.

An example is given in the figure below:

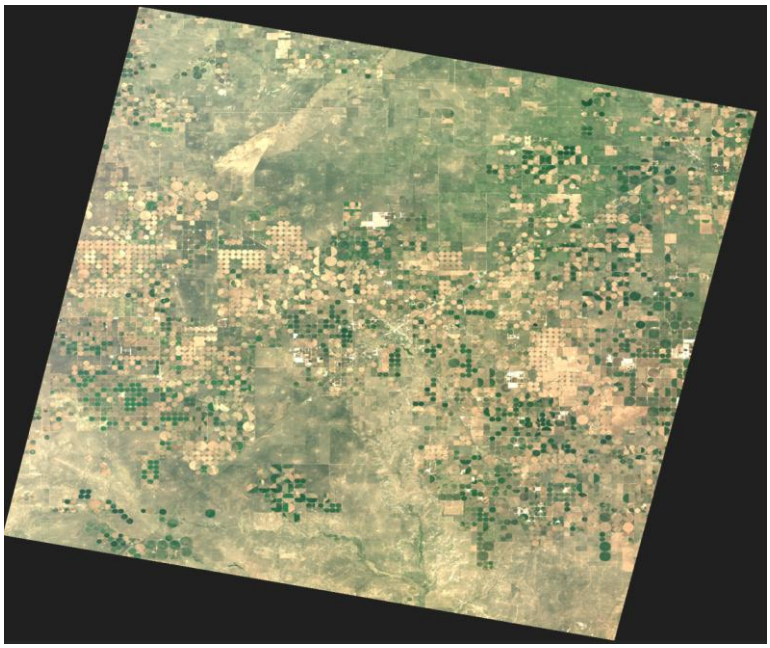


Figure 2: Example RGB quicklook file

2.2.4 RGB-preview file

The RGB preview file is a false-color image in the JPEG file format. It is a file at sub-sampled (i.e. with coarser resolution) that is typically intended for fast visualization and visual inspection of the product.

The RGB preview file is compressed using the lossy JPEG compression algorithm, with a block size of 512x512 pixels. No CRS is assigned to the RGB preview file. Instead, a corresponding JPEG world file (*.wld) is located in the same folder as the JPEG preview file.

2.3 Metadata information

The metadata file describes the identity, provenance, spatial organisation, processing and interpretation of an IPERLITE Level2A product. Use the image file references to locate the data and the matching interpretation records to understand each image layer.

2.3.1 File format

The metadata is an XML document encoded as UTF-8. The XML declaration specifies version 1.0. Its root element is `Dimap_Document`, with the name attribute `IPERLITE-DIMAP`.

Elements are nested containers or value fields. Tag names are case sensitive. Attributes carry additional information: version identifies a format or catalogue version, unit declares a measurement unit, and `href` stores a URL or file path. Empty element text does not imply a missing reference when `href` is present.

2.3.2 Metadata structure

The main elements below are direct children of `Dimap_Document` and appear in the order shown. Subsequent tables describe their children; a slash in an element label indicates a nested child path relative to the named container. Repeated containers represent multiple records.

Element	Description
Metadata_Id	Identifies the metadata format, version and IPERLITE profile.
Dataset_Id	Identifies the product series and individual dataset, and states copyright.
Production	Records the producer, production and acquisition times, processing facility and acquisition request.
Dataset_Frame	Describes the geographic frame vertices and scene centre, with associated image coordinates.
Coordinate_Reference_System	Identifies the coordinate reference system and the reference catalogue.
Raster_CS	Defines the raster coordinate convention and pixel origin.
Raster_Dimensions	States the raster width, height and number of product bands or image layers.
Geoposition	Records the upper left map position and nominal pixel spacing.

Data_Processing	Records processing level, calibration references, instrument settings, Earth orientation inputs and quality indicators.
Dataset_Sources	Identifies input products and ancillary datasets used in processing.
Data_Access	Describes the image format and organisation, with one Data_File entry for each image file composing the product.
Image_Interpretation	Describes each image layer through a `Spectral_Band_Info` entry, including encoding, scaling and spectral information where applicable.

Table 22: Main metadata elements of IPERLITE Level2A product

Metadata_Id – element

Identifies the metadata format, version and IPERLITE profile.

Element	Description
METADATA_FORMAT	Metadata format identifier. The value is DIMAP; the version attribute records the DIMAP version, 2.2.0
METADATA_PROFILE	Application profile used to interpret the metadata: IPERLITE_DIMAP.

Table 23: Metadata_Id – element content

Dataset_Id – element

Identifies the product series and individual dataset, and states copyright.

Element	Description
DATASET_SERIES	Product family or series identifier: IPERLITE_LEVEL2A.
DATASET_NAME	Unique dataset identifier.
COPYRIGHT	Copyright statement supplied with the dataset.

Table 24: Dataset_Id – element content

Production – element

Records the producer, production and acquisition times, processing facility and acquisition request.

Element	Description
DATASET_PRODUCER_NAME	Name of the organisation producing the product.
DATASET_PRODUCER_URL	Producer website. The URL is stored in the `href` attribute; element text may be empty.
DATASET_PRODUCTION_DATE	Timestamp at which the product was produced. The syntax is an ISO 8601 UTC timestamp ending in Z. Example: `2026-10-07T14:28:34Z`

<table>
<tr><td>PRODUCT_START_TIME</td><td>Start of the acquisition interval covered by the product, expressed as a UTC timestamp. The syntax is an ISO 8601 UTC timestamp ending in Z.

Example:

2026-09-22T07:07:55Z</td></tr>
<tr><td>PRODUCT_STOP_TIME</td><td>End of the acquisition interval covered by the product, expressed as a UTC timestamp. The syntax is an ISO 8601 UTC timestamp ending in Z.

Example:

2026-09-22T07:08:09Z</td></tr>
<tr><td>PRODUCT_TYPE</td><td>Product type identifier; IPERLITE_LEVEL2A</td></tr>
<tr><td>PRODUCTION_FACILITY</td><td>Container for production software identification and processing centre. It is composed of following elements:

<table><tr><th>Element</th><th>Description</th></tr><tr><td>SOFTWARE_NAME</td><td>Name of the software used to produce the dataset.</td></tr><tr><td>SOFTWARE_VERSION</td><td>Version identifier of the production software.</td></tr><tr><td>PROCESSING_CENTER</td><td>Identifier of the processing centre.</td></tr></table></td></tr>
<tr><td>PROGRAMMING_MODE</td><td>Acquisition programming mode: NOMINAL</td></tr>
<tr><td>PROGRAMMING_REQUEST_ID</td><td>Identifier of the acquisition programming request.</td></tr>
</table>

Table 25: Production – element content

Dataset_Frame – element

Describes the geographic frame vertices and scene centre, with associated image coordinates.

<table>
<tr><th>Element</th><th>Description</th></tr>
<tr><td>Vertex</td><td>Repeated frame vertex record. Each record contains four children, each with longitude, latitude, row and column:

<table><tr><th>Element</th><th>Description</th></tr><tr><td>FRAME_LON</td><td>Longitude coordinate (units: degrees)</td></tr><tr><td>FRAME_LAT</td><td>Latitude coordinate (units: degrees)</td></tr><tr><td>FRAME_ROW</td><td>Image row (one-based) associated with the frame location</td></tr><tr><td>FRAME_COL</td><td>Image column (one-based) associated with the frame location</td></tr></table></td></tr>
<tr><td>Scene_Center</td><td>Scene centre record, with longitude, latitude and associated row and column:

<table><tr><th>Element</th><th>Description</th></tr><tr><td>FRAME_LON</td><td>Longitude coordinate (units: degrees)</td></tr><tr><td>FRAME_LAT</td><td>Latitude coordinate (units: degrees)</td></tr><tr><td>FRAME_ROW</td><td>Image row (one-based) associated with the frame location</td></tr></table></td></tr>
</table>

	FRAME_COL	Image column (one-based) associated with the frame location

Table 26: Dataset_Frame – element content

Coordinate_Reference_System – element

Identifies the coordinate reference system and the reference catalogue.

Element	Description
GEO_TABLES	Reference catalogue for coordinate system identifiers: EPSG
Horizontal_CS	Container describing the horizontal coordinate reference system. This element contains following children:

Element	Description
HORIZONTAL_CS_TYPE	Declared horizontal coordinate system type (i.e. PROJECTED)
HORIZONTAL_CS_NAME	Human readable name of the horizontal coordinate system (i.e. GEOGRAPHIC LAT/LON)
HORIZONTAL_CS_CODE	Coordinate reference system identifier (i.e. EPSG:4326).

Table 27: Coordinate_Reference_System – element content

Raster_CS – element

Defines the raster coordinate convention and pixel origin.

Element	Description
RASTER_CS_TYPE	Raster coordinate system type. CELL indicates a cell based raster convention.
PIXEL_ORIGIN	Pixel origin parameter, i.e. 0.5 indicating a half pixel origin convention.

Table 28: Raster_CS – element content

Raster_Dimensions – element

States the raster width, height and number of product bands or image layers.

Element	Description
NCOLS	Number of columns in the output rasters.
NROWS	Number of rows in the output rasters.
NBANDS	Number of product bands or image layers. With BAND_SEPARATE organisation, the example counts the separate image entries.

Table 29: Raster_Dimensions – element

Geoposition – element

Records the upper left map position and nominal pixel spacing.

Element	Description
ULXMAP	X coordinate of the upper left map position (units: degrees)
ULYMAP	Y coordinate of the upper left map position (units: degrees)
XDIM	Nominal pixel spacing in the X direction, i.e. 20 (meters).
YDIM	Nominal pixel spacing in the Y direction, i.e. 20 (meters).

Table 30: Geoposition – element content

Data_Processing – element

Records processing level, calibration references, instrument settings, Earth orientation inputs and quality indicators.

Element	Description
PROCESSING_LEVEL	Processing level of the delivered product: 2A
GEOMETRIC_PROCESSING	Filename identifying the geometric ICP file used.
RADIOMETRIC_PROCESSING	Filename identifying the radiometric ICP file used.
PROCESSING_OPTIONS	Container for processing configuration, composed of following children:
Quality	Container for geometric and radiometric quality indicators.

Element	Description
FRAME_SEQUENCES	Number of frame sequences.
INSTRUMENT_CONFIGURATIONS	Container associating frame sequence information with instrument configuration records. Refer to Table 32 for further details.
LEAP_SECONDS	Leap second value (units: seconds).
POLAR_MOTION_X	X component of the polar motion input used in geometric processing (units: mas).
POLAR_MOTION_Y	Y component of the polar motion input used in geometric processing (units: mas)
POLAR_MOTION_DELTA_UT1	UT1 correction of the polar motion input used in geometric processing.

Table 31: Data_Processing – element content

Instrument_Configurations – element

Container associating frame sequence information with instrument configuration records.

Element	Description
FRAME_SEQUENCE	One-based identifier for the frame sequence, ranging from 1 to FRAME_SEQUENCES.
INSTRUMENT_CONFIGURATION	Instrument configuration record containing acquisition settings, compression, gain and image processing settings. It contains following children:

Element	Description
IMAGE_ACQUISITION_CONFIGURATION	Container for acquisition settings, including time delay integration and black pixel handling.
COMPRESSION	Instrument compression setting or code.
GAIN	Instrument gain setting or code.
IMAGE_PROCESSING_CONFIGURATION	Container for detector correction identifiers, binning and cropping settings.

Table 32: Instrument_Configurations – element content

Image_Acquisition_Configuration – element

Container for acquisition settings, including time delay integration and black pixel handling.

Element	Description
TDI_FACTOR	Time delay integration factor recorded for acquisition.
TDI_ACCUMULATION_FACTOR	Time delay integration accumulation factor recorded for acquisition.
BLACK_PIXELS	Boolean flag recording the black pixel setting.

Table 33: Image_Acquisition_Configuration – element content

Image_Processing_Configuration – element

Container for detector correction identifiers, binning and cropping settings.

Element	Description
BAD_PIXELMAP_ID	Identifier of the bad pixel map setting used by the instrument configuration.
FPU_PRNU_CORRECTION_ID	Identifier of the pixel response non-uniformity correction map.
BINNING	Instrument binning setting or code.
CROPPING_COLUMNS	Container describing the retained detector column count and selected column ranges. It contains following children:

Element	Description
NCOLS	Number of detector columns retained by the column cropping configuration.
RANGE	Selected detector index interval. RANGE repeats when multiple intervals are retained.

	RANGE/ START: Start index of a selected detector interval. RANGE/ STOP: Stop index of a selected detector interval.
CROPPING_SPECTRAL	Container describing the retained detector spectral row count and selected spectral row ranges. It contains following children: **Element** / **Description** **NROWS**: Number of detector spectral rows retained across the selected intervals. **RANGE**: Selected detector index interval. RANGE repeats when multiple intervals are retained. **RANGE/ START**: Start index of a selected detector interval. **RANGE/ STOP**: Stop index of a selected detector interval.

Table 34: Image_Processing_Configuration – element content

Quality – element

Container for geometric and radiometric quality indicators.

Element	Description
GeometricCorrection	Container for geometric correction quality assessments. It contains two children: **Element** / **Description** **Absolute**: Quality assessment of absolute geometric correction. Possible values are GOOD or DEGRADED. **InterBand**: Quality assessment of geometric alignment between spectral bands. Possible values are GOOD or DEGRADED
RadiometricCorrection	Container for percentages of pixels in radiometric quality categories. **Element** / **Description** **PercentPixelsRadiometryCorrect**: Percentage of pixels classified as radiometrically correct. **PercentPixelsRadiometryMissing**: Percentage of pixels classified as missing radiometry **PercentPixelsRadiometryNegative**: Percentage of pixels classified as having negative radiometry. **PercentPixelsRadiometrySaturated**: Percentage of pixels classified as radiometrically saturated.

Table 35: Quality – element content

Dataset_Sources – element

Identifies input products and ancillary datasets used in processing.

Element	Description
Source_Information	Repeated source record. One record describes each input product or ancillary dataset. It contains following children: **Element** / **Description** **SOURCE_ID** — Identifier of the source dataset or input product. **SOURCE_TYPE** — Source category or product type, such as DEM. **SOURCE_DESCRIPTION** — Human readable description of the source dataset or product.

Table 36: Dataset_Sources – element content

Data_Access – element

Describes the image format and organisation, with one `Data_File` entry for each image file composing the product.

`Data_Access` is a file inventory. Its common fields describe the image format and storage organisation. It then contains one `Data_File` entry for each image file composing the product; the number of entries depends on the product contents.

Element	Description
DATA_FILE_FORMAT	Format of the image files: GEOTIFF.
DATA_FILE_FORMAT_DESC	Human readable description of the image file format.
DATA_FILE_ORGANISATION	Organisation of the image data. BAND_SEPARATE indicates that product layers are stored in separate image files.
Data_File	Repeated image file entry. An entry exists for every image file composing the product. It contains following children: **Element** / **Description** **DATA_FILE_PATH** — Location of the image file, stored in the href attribute. In the example it is a relative path into the product data directory. **BAND_INDEX** — Product layer index linking a Data_File record to its Spectral_Band_Info record.

Resolve a relative `DATA_FILE_PATH` against the metadata file location while preserving the supplied filename. Match `Data_File/BAND_INDEX` to `Image_Interpretation/Spectral_Band_Info/BAND_INDEX` to obtain the corresponding layer description. A product index need not equal the channel number appearing in a filename or band name.

Image_Interpretation – element

Describes each image layer through a `Spectral_Band_Info` entry, including encoding, scaling and spectral information where applicable.

`Image_Interpretation` contains one `Spectral_Band_Info` entry for each product image layer. For the BAND_SEPARATE organisation shown here, this provides an interpretation entry for every image file. Despite its name, `Spectral_Band_Info` also describes ancillary layers such as viewing and solar angles.

Element	Description
Spectral_Band_Info	Repeated interpretation record for a product image layer. The same record structure describes spectral images and ancillary image layers. It is composed of following children:

Element	Description
BAND_INDEX	Product layer index linking a Data_File record to its Spectral_Band_Info record. The example uses zero based indices; this is distinct from a physical spectral channel number.
BAND_NAME	Short identifier of the image layer.
BAND_DESCRIPTION	Human readable description of the quantity represented by the image layer.
NO_DATA_VALUE	Stored sample value marking missing or invalid data. Mask this value before applying scaling.
PHYSICAL_UNIT	Unit of the interpreted physical quantity. It may indicate degrees or N/A for a quantity without a stated physical unit.
DATA_TYPE	Storage data type of the image samples, including signedness and bit depth.
SCALING_FACTOR	Multiplicative factor for converting valid stored samples to physical values.
SCALING_OFFSET	Additive offset associated with conversion of valid stored samples to physical values.
SPECTRAL_BAND_INDEX	Spectral channel identifier, distinct from BAND_INDEX. Present for spectral image layers in the example and absent for ancillary angle layers.
CENTRAL_WAVELENGTH_NM	Central wavelength of the spectral channel, expressed in nanometers.
FWHM	Full width at half maximum of the spectral response, expressed in nanometers.

Apply the data type, no data marker, physical unit and scaling values from each layer’s own record. Spectral channel index, central wavelength and response width are included where applicable; ancillary angle layers in the example omit these three fields. Do not assume that all layers share the same encoding or physical unit.