SATELLOGIC®

NOW YOU SEE

IMAGERY PRODUCT SPECIFICATIONS

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SCOPE OF THIS DOCUMENT

This document describes specifications and attributes of the satellite imagery products and processing levels offered by Satellogic.

SATELLOGIC

IMAGERY PRODUCT SPECIFICATIONS

GLOSSARY

SATELLOGIC

AOI
Area of Interest

BOA
Bottom of the Atmosphere

DN
Digital Number

FMV
Full-Motion Video

GeoJSON
A file format for encoding a variety of geographic data structures

GeoTIFF
A standard metadata format which allows georeferencing information to be embed-ded within a georeferenced raster imagery (TIFF file)

GSD
Ground Sample Distance

Hyperspectral
(HS) Image data that stores information over a continuous range of the electromagnetic spectrum

ISO
International Organization for Standard-ization

KML
Keyhole Markup Languaget

LEO
Low Earth Orbit

LTDN
Local Time at the Descending Node

NewSat
Satellogic individual small satellites

OGC
Open Geospatial Consortium

POI
Point of Interest

QC
Quality Control

QA
Quality Assessment

SISR
Single Frame Image SuperResolution

SSO
Sun-Synchronous Orbit

STAC
SpatioTemporal Asset Catalog

Stripe(s)
A satellite capture mode based on a swath defined in 5km by 10km

Multispectral
Image data within specific wavelength ranges across the electromagnetic spectrum

TOA
Top of the Atmosphere

UTM
Universal Transverse Mercator

Wavelength
A measured distance between successive crests (or points) of an electromagnetic wave

WGS
World Geodetic System

XML
Extensible Markup Language

ABOUT SATELLOGIC

Founded in 2010, Satellogic specializes in Earth Observation data collection and analytical imagery solutions. Satellogic designs, builds and operates its own fleet of Earth observation satellites to frequently collect affordable high-resolution imagery for decision-making in a broad range of industrial, environmental and government applications.

Satellogic has reinvented the satellite from the ground up to create a smaller, lighter and more cost-effective system that can be produced at scale, capable of providing diverse and rich geospatial data at unmatched frequency, resolution and cost. This enables industries, governments, and organizations to monitor changes on a planetary-scale and make geospatial imagery a fundamental part of daily decision making.

SATELLITE CONSTELLATION

The Satellogic satellite constellation consists of individual small satellites, named NewSats. The satellites are launched subsequently, adding more and more satellites to the fleet each year, constantly improving coverage and image quality through the implementation of the newest technology.

Orbit
Sun-synchronous orbit (SSO)

LEO
Around 475km

LTDN
10:30 and 14:00 (Local Time)

Acquisition modes
Point of Interest
Area Coverage and FMV

Maximum Off-Nadir Angle
25°

Minimum Sun Angle
15°

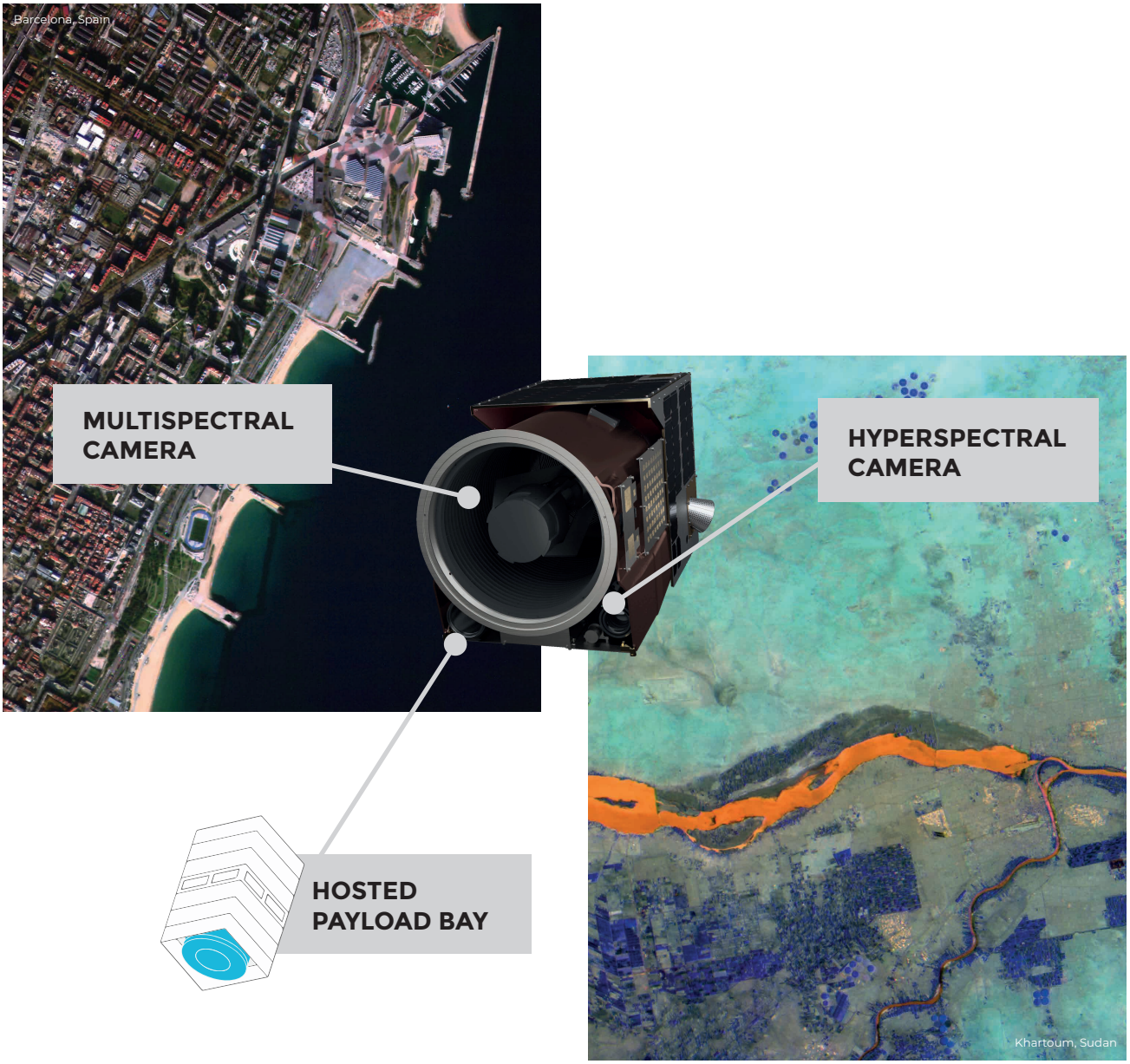
IMAGERY PRODUCT SPECIFICATIONS

IMAGERY SENSORS

Each of the NewSat satellites has the following sensors that are listed below:

- Multispectral sensor
- Hyperspectral sensor

The location of the cameras within the satellite can be seen in the following image:



IMAGERY PRODUCT SPECIFICATIONS

IMAGERY SENSORS

MULTISPECTRAL SENSOR

The multispectral sensor is a multispectral camera with 4 bands (red, green, blue and near-infrared), covering a wavelength range from 450 - 900nm. The camera system has a resulting GSD of 1m and a swath width of 5km.

PRODUCT	MULTISPECTRAL
Pixel Resolution (GSD) at nadir	0.99m (native resolution)
Number of Bands	4
Wavelengths	Blue: 450 - 510nm Green: 510 - 580nm Red: 590 - 690nm Near-IR: 750 - 900nm
Image Geoaccuracy	10m CE90
Image Delivery bits/pixel	8 or 16 bits
File Format	GeoTiff
File Compression	LZW lossless data compression
Image Metadata	Included
Projection	UTM/WGS84
Swath Width at Nadir	5km

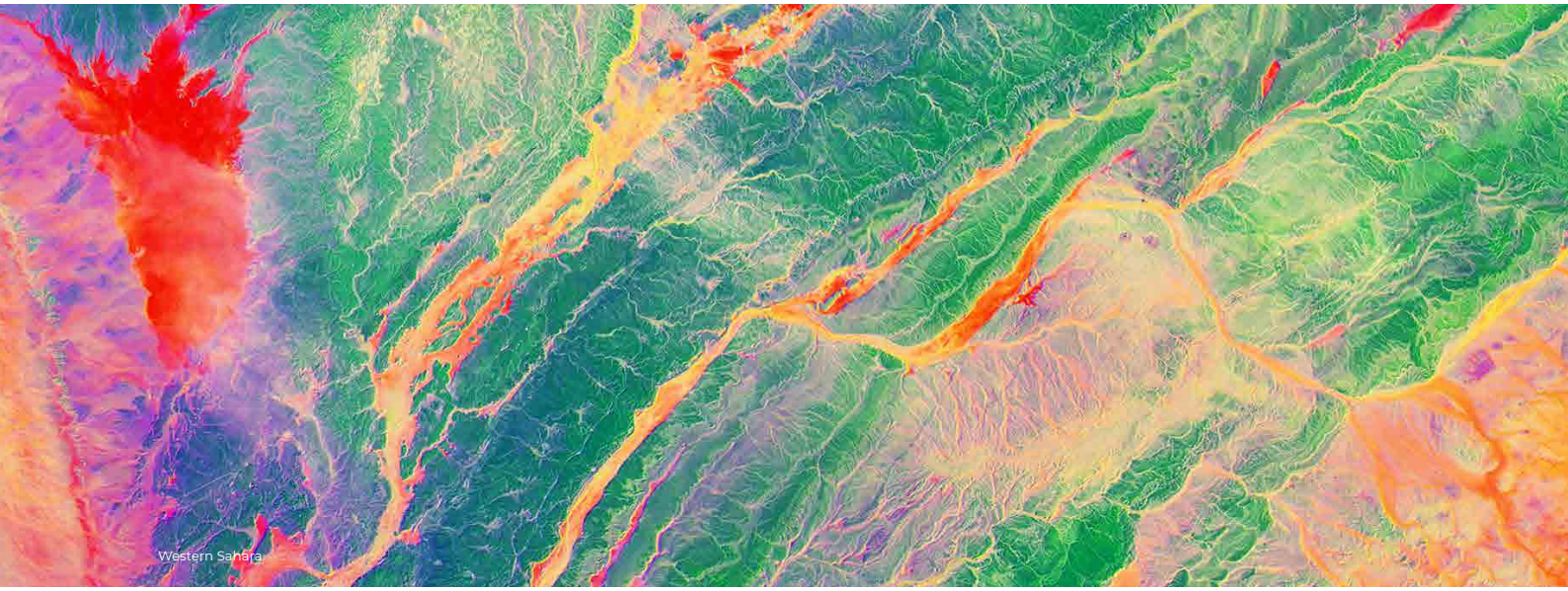
IMAGERY PRODUCT SPECIFICATIONS

IMAGERY SENSORS

HYPERSPECTRAL SENSOR

The hyperspectral cameras collect 25 meter imagery data at an altitude of around 475km. Its 29 visible to near-infrared (460 - 830nm) spectral bands are delivered ortho-rectified and GIS-ready.

PRODUCT	HYPERSPECTRAL
Pixel Resolution (GSD) at nadir	25m
Number of Bands	up to 29
Wavelengths	460 - 830nm 14 to 35 nm FWHM depending on the wavelength
Image Delivery bits/pixel	8 or 16 bits
File Format	GeoTiff
File Compression	LZW lossless data compression
Image Metadata	Included
Projection	UTM/WGS84
Swath Width at Nadir	125km



IMAGERY PRODUCT SPECIFICATIONS

MULTISPECTRAL IMAGERY PRODUCTS

SATELLOGIC

PRODUCT	BASIC	SUPERRESOLUTION
Pixel Resolution	0.99m GSD delivered as 1m	0.7m GSD
Number of Bands	4	4
Wavelengths	Blue: 450 - 510nm Green: 510 - 580nm Red: 590 - 690nm NIR: 750 - 900nm	Blue: 450 - 510nm Green: 510 - 580nm Red: 590 - 690nm NIR: 750 - 900nm
Image Delivery bits/pixel	10m CE90	10m CE90
File Format	GeoTiff	GeoTiff
File Compression	LZW lossless data compression	LZW lossless data compression
Image Metadata	Included	Included
Projection	UTM/WGS84	UTM/WGS84
Swath Width	5km	5km
Processing Levels	L1, L3 Sensor corrected, Orthorectified	L1, L3 Sensor corrected, Orthorectified

PRODUCT	FMV	
Pixel Resolution	0.99m	File Format	MP4 (High Definition)
Number of Bands	1	FMV Processing	Stabilized and Enhanced
Wavelengths	monochromatic	Image Metadata	Included
Duration	Up to 60 seconds	Scene size	5km x 5km
Frame Rate	10fps		

IMAGERY PRODUCT SPECIFICATIONS

MULTISPECTRAL IMAGERY PRODUCTS


Tucson, Arizona, US

> ACQUISITION MODES

POINT OF INTEREST

This acquisition mode is based on coordinates in latitude and longitude degrees that define a Point of Interest (POI). This acquisition mode covers an area of 50km^2 (5km by 10km) using a single stripe.

AREA COVERAGE

This acquisition mode is based on a polygon that defines an Area of Interest. This acquisition mode can cover a variable area depending on height and width of the polygon. Multiple captures will cover the requested AOI with multiple stripes with partial overlap (10%).

> RESOLUTION

BASIC

The basic resolution of the multispectral imagery products is 99cm GSD native at nadir for all four bands. The product is delivered at 1m.

SUPERRESOLUTION

SuperResolution enhances the spatial resolution of our multispectral imagery products, to 70cm using proprietary processing techniques. This improves the clarity of the original image with minimal disruption to the integrity of radiometric values, creating a product optimized for machine learning and AI applications.


Melbourne, Australia

IMAGERY PRODUCT SPECIFICATIONS

MULTISPECTRAL IMAGERY PRODUCTS

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> PROCESSING LEVELS

L1 ANALYTICS PRODUCT

The L1 Top of the Atmosphere (TOA) reflectance records measurements in physical units and enables analysts to perform basic classifications and analytics. The imagery is radiometrically and geometrically corrected.

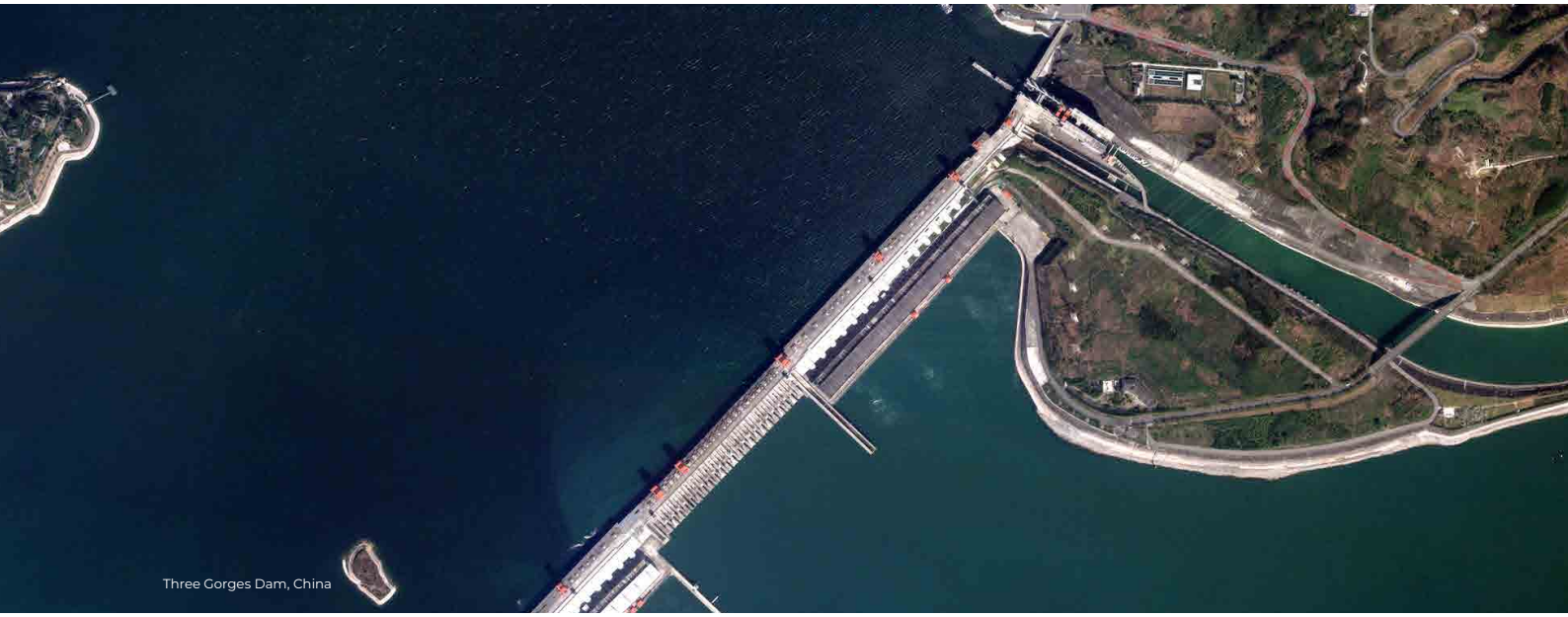
- Radiometric corrected imagery (TOA reflectance imagery)
- TOA Reflectance values (0 to 1) multiplied by a factor 10000 (10e4) to avoid float numbers
- Corrected for sensor and optical distortions (sensor corrected)
- Corrected for terrain distortions (orthorectified)
- This level is available for basic (1m) and SuperResolution (70cm).

L3 VISUAL PRODUCT

The L3 visual product is processed to create a 3-band RGB for visual interpretation. The imagery is color-corrected and geometrically corrected.

- Corrected for sensor and optical (sensor corrected)
- Corrected for terrain distortions (orthorectified)

This product is delivered alongside a L1 product in 1m or 70cm.

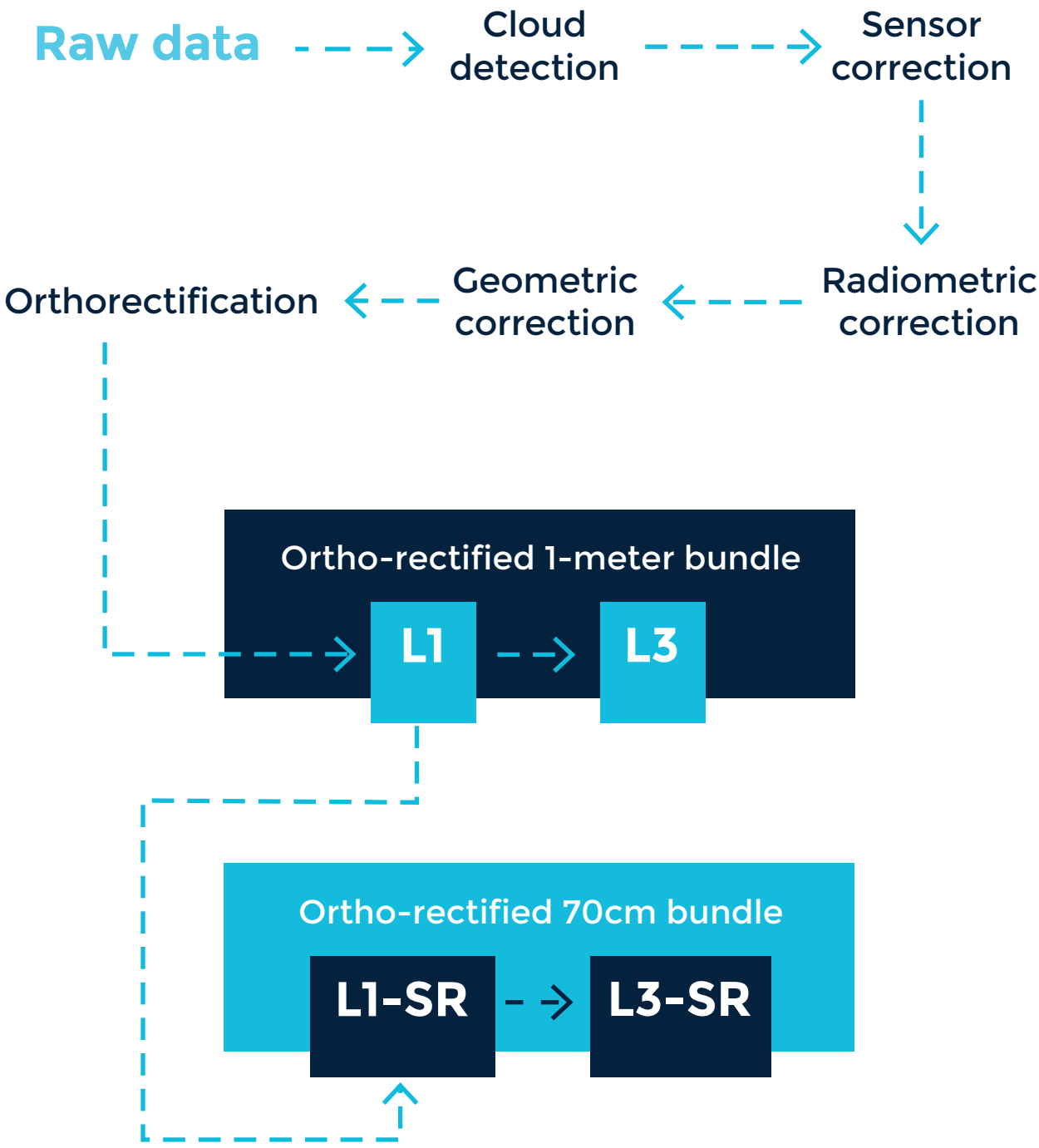


Three Gorges Dam, China

IMAGERY PRODUCT SPECIFICATIONS

IMAGE PROCESSING

The following diagram illustrates our image processing workflow, which begins upon receiving raw data and is completed after the transfer of processed data to the Satellogic catalog:



IMAGERY PRODUCT SPECIFICATIONS

FILE NAMING CONVENTION

Satellogic raster file names are generated using the following convention:

<date>_<time>_<Company (S)> /<satellite_id> _ <product>_ <payload>. <file_extension>

Example:

20200304_1445130_SN4_L1_MS.tif

Date	YYYYMMDD
Time	HHMMSS (in UTC), observed at center of image
Company	Satellogic - "S"
Satellite ID	Newsat number, "N7", "N8", etc
Product	"L1"=Reflectance (TOA), "L3"=Visual
SuperResolution	"SR"=SuperResolution
Payload	"MS"=Multispectral, "HS"=Hyperspectral
File Extension	File extension, '.tif', '.json', '.shp', etc

The same naming convention applies to all ancillary files, like metadata, footprints, etc. In case the SuperResolution algorithm has been applied to both processing levels L1 and L3, "SR" will be included between product and payload references.

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Iowa, USA

IMAGERY PRODUCT SPECIFICATIONS

METADATA

Satellogic is committed to understanding and meeting the quality needs and expectations of our customers. We have adopted an imagery metadata industry standard for delivering raster products: STAC (SpatioTemporal Asset Catalog). This methodology provides a common language to describe a range of geospatial information to a wider audience.

IMAGERY PRODUCT SPECIFICATIONS

METADATA

SATELLOGIC

STAC

Satellogic has adopted an emerging method for exposing raster data endpoints for cataloged GeoTIFFs and optimizing the files for the cloud—enabling a better user experience across web platforms. We provide a GeoJSON file capturing spatial-temporal data that can more easily be indexed and discovered.

IDENTIFIER	DESCRIPTION
STAC Version	The STAC version the Item implements
ID	Unique item identifier assigned by provider
Bounding Box	Bounding Box of the asset represented by this Item, in lat/long degrees
Title	A human language title describing the Item
Date & Time	The searchable date and time of the assets, in UTC
Created Time	Creation date and time of the corresponding data, in UTC
License	Item's license
Provider	Organization capturing, producing, processing, hosting and publishing this data
Platform	Unique name of the specific platform to which the instrument is attached
Instrument	Name of instrument or sensor used
Constellation	Name of the constellation to which the platform belongs
GSD	Ground Sample Distance at the sensor, in meters (m)
Projection	EPSG code of the datasource
Bands	An array of available bands where each object is a Band Object
Cloud Cover	Estimate of cloud cover, in percentage
Sun Elevation	Sun elevation angle, in degrees
Off Nadir	The angle from the sensor between nadir (straight down) and the scene center, in degrees
Exposure	Sensor exposure time to light, in seconds
Type	Type of the GeoJSON Object
Satellite ID	Unique name of the Satellite
Product Level	Name used to refer to that processing level properties

METADATA

ISO 19115-2

Satellogic adheres to industry standards governing metadata schemas that align with ISO standards. Our adoption of ISO 19115 (ISO metadata standard) ensures that information about sensor identification, image extent, quality, spatial and temporal aspects, content, spatial references, distributions, and other properties of digital geographic data are provided in a XML format for customers seeking to integrate Satellogic map-ready orthorectified raster data directly into their workflows.

The following table shows the metadata fields according to ISO 19115-2:

IDENTIFIER	DESCRIPTION
Metadata file identifier	Unique ID
Language	Language used for metadata
Character set	Full name of the character coding standard used for the metadata set
Contact	Company responsible for the metadata information
Metadata date stamp	Date that the data was created
Metadata standard name	Name of the metadata standard used
Metadata standard version	Version of the metadata standard used
Spatial representation information	Digital representation of spatial information on the dataset
Reference System information	Description of the spatial reference system used
Metadata extension information	Information describing metadata extensions
Identification Information	Basic information about the data identification
Content information	Extended information about the image data characteristics
Distribution information	Information about the distribution of the resource
Data quality information	Overall assessment of quality of the dataset
Metadata constraints	Restrictions on the access and use of metadata
Metadata maintenance	Information about frequency of metadata updates

IMAGERY PRODUCT SPECIFICATIONS

COORDINATE REFERENCE SYSTEM

SATELLOGIC

All the products are delivered in the Universal Transverse Mercator (UTM) projected coordinate system. This system assigns coordinates to locations on the surface of the Earth using 60 defined UTM zones of 6 degrees each with minimized distortion within the zones.
The WGS84 ellipsoid is used as the base model (Datum) for the UTM coordinate system. Each UTM zone is designed with an European Petroleum Survey Group (EPSG) code.

Projected coordinate system	Universal Transverse Mercator (UTM)
UTM zones	60
Zone size	6 degrees
Datum	WGS84
Organization code	EPSG

Example:

WGS 1984 UTM Zone 30N
EPSG: 32630

Bangkok, Thailand.

IMAGERY PRODUCT SPECIFICATIONS

DATA DELIVERY

All EO products are delivered orthorectified and GIS-ready. For each acquisition, a delivery zip file is generated containing the following elements:

ELEMENT	DESCRIPTION
L1	16-bit 4-band (blue, green red and NIR) georeferenced raster in GeoTIFF format, for analysis purposes in UINT: • Top-of-Atmosphere (TOA) Reflectance • Scaled to TOA reflectance, unitless, values between (0.0 and 1.0) multiplied by a factor 10000 (10e4) to avoid float numbers
L3	8-bit 3-band (red, green, blue) georeferenced raster in GeoTIFF format for visualization purposes in BYTE: • Color corrected • Doesn't reflect meaningful physical values
Cloud mask	Boolean raster mask, set to True at those pixels which contain thick clouds 8-bit (Byte) 1-band georeferenced raster in GeoTIFF format: • Cloud Mask • Clouds: DN 128
Preview	8-Bit 3-band (red, green, blue) in PNG format for preview purposes.
Thumbnail	8-Bit 3-band (red, green, blue) in PNG format for thumbnail view purposes.
Metadata	GeoJson file containing capture-related metadata in STAC format at item level. XML file containing capture-related metadata ISO compliant.
Footprint	Kml file with the rectangular capture footprint.

Bosaso, Somalia

IMAGERY PRODUCT SPECIFICATIONS

RADIOMETRIC ACCURACY

Satellogic imagery's radiometric accuracy is attained through a combination of lab measurements and on-orbit vicarious calibrations against a well calibrated source. By using calibration data retrieved from these two methods, the conversion from DNs to Top of Atmosphere Reflectance is performed.

The on-orbit calibration method is based on processing data retrieved from crossovers with a well calibrated source (Sentinel2) on pseudo-invariant calibration sites. This allows the continuous tracking of radiometric stability and the improvement of the calibration in case it is needed. The main location used for vicarious campaigns is the Railroad Valley calibration site, where the radiometric accuracy of Satellogic's L1 products was evaluated at 10%.

Murowa Diamond Mine, Zimbabwe