

RapidEye Image Product Metadata Changes and Addition of the 1B GeoTIFF format

On October 15, 2013 RapidEye will make changes to XML metadata files for both 1B and 3A products. At the same time, RapidEye is pleased to offer its existing 1B Basic product in GeoTIFF format.

These metadata changes and the use of the new 1B GeoTIFF may require you to update or patch your software to take full advantage of these changes. The default format for the 1B product will remain NITF 2.0 and users will have to specifically request the GeoTIFF format for 1Bs during the ordering process. Please be aware that not all software packages will immediately support this new 1B GeoTIFF format.

The current status of support in the major remote sensing and GIS software packages for the metadata changes and the new GeoTIFF product are:

- BAE Systems - SO CET GXP® 4.1 August patch, shipping in September 2013
- Exelis VIS - ENVI v5.0 SP3, released in May 2013
- ESRI® - 1B NITF and 3A products with new metadata will work in the current version 10.2, but handling of 1B GeoTIFF using the metadata will not be supported until v 10.2.2 in Spring 2014
- Intergraph® - ERDAS IMAGINE 2014, release in mid-November 2013
- PCI Geomatics - Geomatica2014, release in early October 2013

Note that ongoing or open orders will be produced when the older metadata (ISD version 3) until the completion of the order or contract. All new orders will be produced with the new metadata (ISD version 4). No orders will be processed with metadata version 3 after January 1, 2014.

The following sections describe the expected files for the new 1B GeoTIFF and the changes to the existing XML metadata.

Summary of Changes

The addition of a 1B product in GeoTIFF format requires a new file to contain the RPC values that are normally stored in the NITF file header. At the same time, RapidEye has decided to break apart the existing 1B XML metadata file into two separate files due to its large size in hopes of making it more useful and user friendly. The new 1B XML metadata file will contain mostly the same fields as the 3A XML metadata file with a few additions or deletions as described in the appropriate section of this document. A second XML metadata file for the 1B product will include all the information for spacecraft attitude, ephemeris, line time and temperature data that is only present for the 1B product.

The XML metadata file for the 3A GeoTIFF product remains the same with the exception of the deletions or changes shown in the main XML metadata section. No additional files are to be added to the 3A product fileset.

New 1B Product Filesset

The 1B product will be delivered with the following files:

- Image files in either NITF 2.0 (.ntf) or GeoTIFF 6.0 (.tif)
- Browse image file (.tif)
- Unusable Data Mask file (.tif)
- License file (.txt)
- Readme file (.txt)

(These files have been changed or are new)

- Main XML metadata file (*_metadata.xml)
- Spacecraft Information XML metadata file (*_sci.xml)
- Image RPC metadata (*_rpc.xml)

General XML Metadata File for All RapidEye Image Products

The table below describes the general XML metadata file that will be common to all RapidEye Standard Image products regardless of processing type or file format. Changed or added fields are shown in **green** with additional remarks in the “Comment” field.

General Metadata File Field Contents			
Field	Description	Range/ Value	Comments
“metaDataProperty” Block			
EarthObservationMetaData			
identifier	Root file name of the image		
acquisitionType	Type of image acquisition	NOMINAL	
productType	Product level of image	L1B L2A L3A	
status	Status type of image, if newly acquired or produced from a previously archived image	ACQUIRED ARCHIVED	

downloadedTo			
acquisitionStation	X-band downlink station that received image from satellite	Svalbard	
acquisitionDate	Date and time image was acquired by satellite		
archivedIn			
archivingCenter	Location where image is archived	BER	
archivingDate	Date product was archived		
archivingIdentifier	Catalog ID of product within the RE DMS processing system		
processing			
processorName	Name of ground processing system	DPS	
processorVersion	Version of RE DPS software used to process image		
nativeProductFormat	Native image format of the raw image data		
license			
licenseType	Name of selected license for the product		
resourceLink	Hyperlink to the physical license file		
versionIsd	Version of the ISD		Rev to v.4.0
orderId	Order ID of the product		
tileId	Tile ID of the product corresponding to the RE Tile Grid		Only for Level 2A and 3A products
pixelFormat	Number of bits per pixel in the product image file.	16U – 16 bit unsigned 16S – 16 bit signed	
“validTime” Block			
TimePeriod			
beginPosition	Start date and time of acquisition for source image take used to create product, in UTC		

endPosition	End date and time of acquisition for source image take used to create product, in UTC		
“using” Block			
EarthObservationEquipment			
platform			
shortName	Identifies the name of the satellite platform used to collect the image	RE00	
serialIdentifier	ID of the satellite that acquired the data	RE-1 to RE-5	
orbitType	Orbit type of satellite platform	LEO	
instrument			
shortName	Identifies the name of the satellite instrument used to collect the image	MSI	
sensor			
sensorType	Type of sensor used to acquire the data.	OPTICAL	
resolution	Spatial resolution of the sensor used to acquire the image, units in meters	6.5	
scanType	Type of scanning system used by the sensor	PUSHBROOM	
acquisitionParameters			
orbitDirection	The direction the satellite was traveling in its orbit when the image was acquired	DESCENDING	
incidenceAngle	The angle between the view direction of the satellite and a line perpendicular to the image or tile center.	0.0 to 90.0	

illuminationAzimuthAngle	Sun azimuth angle at center of product, in degrees from North (clockwise) at the time of the first image line		
illuminationElevationAngle	Sun elevation angle at center of product, in degrees		
azimuthAngle	The angle from true north at the image or tile center to the scan (line) direction at image center, in clockwise positive degrees.	0.0 to 360.0	
spaceCraftViewAngle	Spacecraft across-track off-nadir viewing angle used for imaging, in degrees with "+" being East and "-" being West		
acquisitionDateTime	Date and Time at which the data was imaged, in UTC. Note: the imaging times will be somewhat different for each spectral band. This field is not intended to provide accurate image time tagging and hence is simply the imaging time of some (unspecified) part of the image.		
"target" Block			
Footprint			
multiExtentOf			
posList	Position listing of the four corners of the image in geodetic coordinates in the format: ULX ULY URX URY LRX LRY LLX LLY ULX ULY where X = latitude and Y = longitude		
centerOf			

pos	Position of center of product in geodetic coordinate X and Y, where X = latitude and Y = longitude		
geographicLocation			
topLeft			
latitude	Latitude of top left corner in geodetic WGS84 coordinates		
longitude	Longitude of top left corner in geodetic WGS84 coordinates		
topRight			
latitude	Latitude of top right corner in geodetic WGS84 coordinates		
longitude	Longitude of top right corner in geodetic WGS84 coordinates		
bottomLeft			
latitude	Latitude of bottom left corner in geodetic WGS84 coordinates		
longitude	Longitude of bottom left corner in geodetic WGS84 coordinates		
bottomRight			
latitude	Latitude of bottom right corner in geodetic WGS84 coordinates		
longitude	Longitude of bottom right corner in geodetic WGS84 coordinates		
“resultOf” Block			
EarthObservationResult			
browse			
BrowseInformation			

type	Type of browse image that accompanies the image product as part of the ISD	QUICKLOOK	
referenceSystemIdentifier	Identifies the reference system used for the browse image		
fileName	Name of the browse image file		
product			
ProductInformation			
fileName	Name of image file.		
size	The size of the image product in kbytes		
productFormat	File format of the image product	GeoTIFF NITF2.0	
spatialReferenceSystem			
epsgCode	EPSG code that corresponds to the datum and projection information of the image		
geodeticDatum	Name of datum used for the map projection of the image		Add to 1B, set as 'WGS_1984'
projection	Projection system used for the image		Add to 1B, set as 'N/A'
projectionZone	Zone used for map projection		Add to 1B, set as 'N/A'
resamplingKernel	Resampling method used to produce the image. The list of possible algorithms is extendable.	NN = Nearest Neighbor CC = Cubic Convolution MTF = Modulation Transfer Function	
numRows	Number of rows (lines) in the image		
numColumns	Number of columns (pixels) per line in the image		
numBands	Number of bands in the image product	1 to 5	

rowGsd	The GSD of the rows (lines) within the image product		Add to 1B, set as 6.5
columnGsd	The GSD of the columns (pixels) within the image product		Add to 1B, set as 6.5
radiometricCorrectionApplied	Indicates whether radiometric correction has been applied to the image	true false	
radiometricCalibrationVersion	Version of the radiometric calibration file used to correct the file		Removed
geoCorrectionLevel	Level of correction applied to the image	Sensor for L1B images Systematic Geocorrection for 2A images Precision Geocorrection for 3A images	
elevationCorrectionApplied	Type of elevation correction applied to the image	false CoarseDEM FineDEM	
atmosphericCorrectionApplied	Indicates whether atmospheric correction has been applied to the image	true false	
atmosphericCorrectionParameters			
autoVisibility	Indicates whether the visibility was automatically calculated or defaulted	true false	
visibility	The visibility value used for atmospheric correction in km		
aerosolType	The aerosol type used for atmospheric correction	Rural Urban Maritime Desert	
waterVapor	The water vapor category used	Dry Mid-latitude Winter Fall US Standard Subarctic Summer Mid-latitude Summer Tropical	

hazeRemoval	Indicates whether haze removal was performed	true false	
roughTerrainCorrection	Indicates whether rough terrain correction was performed	true false	
bRDF	Indicates whether BRDF correction was performed	true false	
productAccuracy	Estimated product horizontal CE90 uncertainty, in meters		Removed
mask			
MaskInformation			
type	Type of mask file accompanying the image as part of the ISD	UNUSABLE DATA	
format	Format of the mask file	RASTER	
referenceSystemIdentifier	EPSG code that corresponds to the datum and projection information of the mask file		
fileName	File name of the mask file		
cloudCoverPercentage	Estimate of cloud cover within the image	-1 = not assessed 0-100	
cloudCoverPercentageAssessmentConfidence	Estimate of cloud cover assessment confidence in percentage	70	Removed
cloudCoverPercentageQuotationMode	Method of cloud cover determination	AUTOMATIC	
unusableDataPercentage	Percent of unusable data with the file		
The following group is repeated for each spectral band included in the image product			
bandSpecificMetadata			
bandNumber	Number (1-5) by which the spectral band is identified.	1 = Blue 2 = Green 3 = Red 4 = Red Edge 5 = Near IR	

startDateTime	Start time and date of band, in UTC		
endDateTime	End time and date of band, in UTC		
percentMissingLines	Percentage of missing lines in the source data of this band		
percentSuspectLines	Percentage of suspect lines (lines that contained downlink errors) in the source data for the band		
binning	Indicates the binning used (across track x along track)	1x1 2x2 3x3 1x2 2x1	
shifting	Indicates the sensor applied right shifting	none 1bit 2bits 3bits 4bits	
masking	Indicates the sensor applied masking	111, 110, 100, or 000	

radiometricScaleFactor	<p>Provides the parameter to convert the pixel value to radiance (for radiance product) or reflectance (for a reflectance product). To convert to radiance/reflectance engineering units, the pixel values should be multiplied by this scale factor. Hence the pixel values in the product are:</p> <p>Radiance product: (W/m² sr μm) / (Radiometric Scale Factor). The Radiometric Scale Factor is expected to be 1/100. For instance, a product pixel value of 1510 would represent radiance units of 15.1 W/m² sr μm.</p> <p>Reflectance product: Percentage / (Radiometric Scale Factor). The Radiometric Scale Factor is expected to be 1/100. For instance, a product pixel value of 1510 would represent 15.1% reflectance.</p>		
The remaining metadata fields are only included in the file for L1B RapidEye Basic products			
spacecraftInformationMetadataFile	Name of XML file containing attitude, ephemeris and time information for the 1B image		Only included for 1B product as pointer to the new XML file
rpcMetadataFile	Name of XML file containing RPC information for the 1B image		Only included for 1B product as pointer to the new RPC XML file

Existing fields changed/added:

- versionIsd, changed to v4.0
- geodeticDatum, added to the 1B metadata

- projection, added to the 1B metadata
- projectionZone, added to the 1B metadata and
- rowGsd, added to the 1B metadata
- columnGsd, added to the 1B metadata

Existing fields removed:

- radiometricCalibrationVersion
- productAccuracy
- cloudCoverPercentageAssessmentConfidence
- remove all fields starting with spacecraftAttitudeMetadata in 1B metadata and put in separate file (see next section)

New fields to be added:

- spacecraftInformationMetadataFile, this field would contain the file name of the attitude metadata
- rpcMetadataFile, this field would contain the file name of the file containing the RPC metadata

File name:

The file name for the general XML metadata file above will remain “_metadata.xml” for all products

New Spacecraft Information Metadata File for the 1B Product

This new file would contain all of the metadata fields currently only provided for the 1B Basic product starting with the spacecraftAttitudeMetadata field. It would have a new name and only be provided for either the 1B NITF or 1B GeoTIFF.

Spacecraft Information Metadata File Field Contents			
Field	Description	Range/Value	Comment
“metaDataProperty” Block			
parentImageFile	Name of the 1B image the metadata file belongs to		
parentMetadataFile	Name of the main metadata file for the 1B image		
spacecraftAttitudeMetadata			
attitudeMeasurement	Attitude measurements are provided for the time period during which the image data was captured. The time interval between measurements is 1 second		
measurementTime	UTC Time of measurement		
measurements			

roll	Roll attitude measurement in radians		
pitch	Pitch attitude measurement in radians		
yaw	Yaw attitude measurement in radians		
spacecraftEphemerisMetadata			
ephemerisMeasurement	Ephemeris measurements are provided for the time period during which the image data was captured. The time interval between measurements is 1 second. The coordinate system for the ephemeris measurements is WGS-84 (Earth Centered Earth Fixed) Cartesian coordinates		
measurementTime	UTC Time of measurement		
position			
x	Position of x-axis, in meters		
y	Position of y-axis, in meters		
z	Position of z-axis, in meters		
velocity			
vx	Velocity of x-axis in meters/sec		
vy	Velocity of y-axis in meters/sec		
vz	Velocity of z-axis in meters/sec		
lineTimeMetadata – This group is repeated for each band present in the image product			
bandNumber	Band number of the spectral band	1 = Blue 2 = Green 3 = Red 4 = Red Edge 5 = Near IR	
lineInformation	Record for each line in the image file for this band		
imagingTime	UTC Date/Time line imaged		
lineMissing	Indicates whether the line was missing from the input data	true false	
spacecraftTemperatureMetadata			
temperatureMeasurements			
averageFocalPlaneTemperature	Average temperature (over imaging time) from each of the temperature sensors on the focal plane. There are		

	4 temperature sensors		
averageTelescopeTemperature	Average temperature (over imaging time) from each of the temperature sensors in the telescope. There are 4 temperature sensor		
cameraGeometryMetadata			
focalLength	Focal length of the idealized sensor model, in meters		
firstDetectorXCoord	First detector coordinate on the x-axis of the focal plane for the idealized camera model, in meters		
firstDetectorYCoord	First detector coordinate on the y-axis of the focal plane for the idealized camera model, in meters		
detectorPitch	Size of the detector, in meters		
radiometricCalibrationMetadata – This group is repeated for each band present in the image product			
bandNumber	Band number of the spectral band	1 = Blue 2 = Green 3 = Red 4 = Red Edge 5 = Near IR	
perDetectorData	Record for each detector		
gain	Identifies gain used to radiometrically correct the product		
offset	Identifies offset used to radiometrically correct the product		
deadDetectorIndicator	Indicates where the detector is performing outside of its specification and is considered to be dead	true false	

File Name:

This file will be named in accordance with the existing 1B naming structure, but would contain the appendage “_sci.xml”. For example:

2012-07-17T123456_RE2_1B-NAC_0123456789_0123456789_sci.xml

New Image RCP Metadata File for the 1B Product

The following information related to the RPCs will be included into an XML file and included with both NITF and GeoTIFF versions of the 1B product.

Image RPC Metadata File Field Contents			
Field	Description	Range/Value	Comment
parentImageFile	Name of the 1B image the metadata file belongs to		
parentMetadataFile	Name of the main metadata file for the 1B image		
success		1	
errBias	Error bias. 68% non time-varying error estimate assumes correlated images	0000.00 to 9999.99	
errRand	Error random. 68% non time-varying error estimate assumes uncorrelated images	0000.00 to 9999.99	
lineOff	Line offset	0000000 to 9999999	
sampOff	Sample offset	0000000 to 9999999	
latOff	Geodetic latitude offset	+90.0000	
longOff	Geodetic longitude offset	+180.0000	
heightOff	Geodetic height offset	+9999	
lineScale	Line scale	000001 to 999999	
sampScale	Sample scale	000001 to 999999	
latScale	Geodetic latitude scale	+90.0000	
longScale	Geodetic longitude scale	+180.0000	
heightScale	Geodetic height scale	+9999	
lineNumCoeff	Line numerator coefficient: 20 coefficients for the polynomial in the Numerator of the r sub n equation. All values are expressed in scientific notation.	-1.000000E+00 to +1.000000E+00	
lineDenCoeff	Line denominator coefficient: 20 coefficients for the polynomial in the Denominator of the r sub n equation. All values are expressed in scientific notation.	-1.000000E+00 to +1.000000E+00	
sampleNumCoeff	Sample numerator coefficient: 20 coefficients for the polynomial in the Numerator of the r sub n equation. All values are expressed in scientific notation.	-1.000000E+00 to +1.000000E+00	
sampleDenCoeff	Sample denominator coefficient: 20 coefficients for the polynomial in the Denominator of the r sub n equation. All values are expressed in scientific notation.	-1.000000E+00 to +1.000000E+00	

File Name

This file will be named in accordance with the existing 1B naming structure, but would contain the appendage “_rcp.xml”. For example:

2012-07-17T123456_RE2_1B-NAC_0123456789_0123456789_rpc.xml