QUICKBIRD IMAGERY PRODUCTS FAQ

What are QuickBird Imagery Products

QuickBird Imagery Products are available in three different product types.

- Basic Imagery is the least processed of the QuickBird product suite and is corrected for radiometric distortions, internal sensor geometry, optical distortions, and sensor distortions. Basic Imagery is neither geo-referenced nor mapped to a cartographic projection. Basic Imagery is provided with the QuickBird sensor model and is intended for sophisticated photogrammetric processing such as orthorectification. Basic Imagery is a scene-based product, meaning that it can only be ordered in scene increments. Basic Imagery is available as either black and white or multispectral products.
- Standard Imagery is a geo-referenced product, which is radiometrically calibrated, corrected for sensor and platform-induced distortions, and mapped to a cartographic projection. Standard Imagery is provided with image metadata and is intended for a wide variety of applications. Standard Imagery is an area-based product, meaning that the product is defined by your area of interest without reference to scenes. Standard Imagery is available as either black and white, multispectral, color, or pan-sharpened products.
- Orthorectified Imagery is a terrain corrected product, which is radiometrically calibrated, corrected for sensor and platform-induced distortions, and mapped to a cartographic projection. This product is GIS-ready and can be used as an image base map for a wide variety of applications where a high degree of absolute accuracy is required. Orthorectified Imagery is an area-based product, meaning that the product is defined by your area of interest without reference to scenes. Orthorectified Imagery is available as either black and white, multispectral, color, or pan-sharpened products.

How do you acquire DEMs and GCPs for Orthorectified Imagery Products?

When a customer places an order, we look at our ImageLibrary to determine if we have appropriate DEMs and GCPs to make the order. If we do not have the GCPs, we contact one of several companies that we have contracted with to collect the GCPs. DigitalGlobe uses different sources for DEMs. In the United States, we rely primarily on the National Elevation Data, while internationally we use SPOT5, RadarSat, or other sources, depending on the location of the order.

Can a customer supply their own DEMs and GCPs for an Orthorectified Imagery Product?

DigitalGlobe has a Custom Orthorectified Imagery product that is designed for customers who want to supply their own support data. Because the quality and accuracy of Orthorectified Imagery Products are primarily determined by the quality and accuracy of the DEMs and GCPs, DigitalGlobe cannot guarantee the final accuracy or quality of a product if the data are supplied by a customer. Please contact Customer Service for more information about format requirements for your support data.

What is the difference between Standard Imagery and Ortho Ready Standard Imagery?

Standard Imagery has a coarse DEM applied to it, which is used to normalize for topographic relief with respect to the reference ellipsoid. The degree of normalization is relatively small, so while this product has terrain corrections, it is not considered orthorectified. Because Standard Imagery has terrain corrections applied, it is not

suitable for orthorectification by the customer. Ortho Ready Standard Imagery has no topographic corrections. This product is mapped to the average base elevation of the terrain covered by each individual QuickBird scene. Other than the lack of terrain correction, Ortho Ready Standard Imagery products have all the same specifications as Standard Imagery products. Ortho Ready Standard Imagery can be orthorectified using ERDAS IMAGINE, PCI Geomatica, ENVI, and SOCET SET.

How do I know whether I need Standard Imagery or Ortho Ready Standard Imagery?

If you are not going to orthorectify your imagery, then a Standard Imagery product will provide a better absolute horizontal accuracy than an Ortho Ready Standard Imagery product. A coarse DEM is applied to Standard Imagery in an effort to minimize the effect of terrain distortions. Because Ortho Ready Standard Imagery is mapped to an average base elevation, the absolute horizontal accuracy may shift from its true location, especially in areas of high relief, if the user does not apply terrain corrections. This will be especially noticeable when comparing a Standard Image with an Ortho Ready Standard Image of the same area. Please note that Standard Imagery and Ortho Ready Standard Imagery both have the same absolute accuracy specification of 23 m, excluding viewing angle and topographic displacement. If your goal is to orthorectify your imagery, then Ortho Ready Standard Imagery is recommended.

Is it better to orthorectify your Basic or Ortho Ready Standard Imagery?

When using RPCs for orthorectification, both Basic Imagery and Ortho Ready Standard Imagery produce comparable results. When processed using commercial software, RPCs, high quality DEM (e.g. DTED Level 2), and submeter GCPs, accuracies up to 3 meter RMSE can be expected. Slightly better results, up to 2 meter RMSE, may be obtained using the Basic Imagery and the QuickBird Sensor Model with high quality DEMs and submeter GCPs. Ortho Ready Standard Imagery, with a minimum order of 25km2, enables area-based orthorectification. Basic Imagery, with a minimum order of 1 scene (272km2), requires that an entire scene be orthorectified. Note that Ortho Ready Standard Imagery products that are tiled must be mosaicked back together prior to orthorectification because the metadata files are associated with the entire delivered image.

Are there special considerations for pan-sharpening an Ortho Ready Standard Imagery product?

The panchromatic (Pan) and multispectral (MS) sensors are offset from each other on the QuickBird focal plane. This means that the same point on the ground is imaged at a slightly different time by the pan and the MS sensors, resulting in a slightly different view angle. As a result, proper registration of these bands is dependent on placing the image in an accurate terrain model.

The Ortho Ready Standard products are mapped to an average base elevation per QuickBird scene, so that the user can apply their own DEM. In areas of relief this means that the registration of the bands is altered. This effect is exaggerated at high off-nadir angles or in areas where there is a lot of terrain relief. If pan-sharpening is attempted prior to applying a terrain model, then this misregistration can lead to a blurry, unacceptable product. To avoid this problem, orthorectify the imagery prior to pan-sharpening it.

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What is the spatial resolution of QuickBird Imagery Products?

The spatial resolution of QuickBird Imagery Products varies by processing level and off nadir angle.

	Black and White	Multispectral	Color and Pan-sharpened
Basic	61 cm to 1.14m as collected	2.44 m to 4.56 m as collected	not available
Standard	60 cm or 70 cm customer selected	2.4 m or 2.8 m customer selected	60 cm or 70 cm customer selected
Orthorectified	60 cm or 70 cm customer selected	2.4 m or 2.8 m customer selected	60 cm or 70 cm customer selected

Why does Basic Imagery have a different spatial resolution than your other product types?

Basic Imagery is a raw product that is delivered in the spatial resolution that it is collected. It is resampled to the nearest centimeter from its collected pixel resolution. Standard and Orthorectified Imagery, however, are geo-referenced products that have been resampled to a common map projection and resolution (60 cm or 70 cm). All Basic, Standard, and Orthorectified Imagery products have a uniform pixel spacing across the entire product.

What determines the spatial resolution of Basic Imagery?

The spatial resolution of Basic Imagery depends on the off-nadir angle at which the imagery is collected. Images collected closer to nadir have a smaller Ground Sample Distance than those collected further away from nadir. The following table describes the relationship between off-nadir angle and Ground Sample Distance for panchromatic imagery.

Off-nadir Angle	Ground Sample Distance (cm)
0	61
5	62
10	63
15	65
20	68
25	72
30	78
35	86
40	97
45	114

Why are you offering a 2 foot (60cm) product?

We are offering the 2-foot product for use by those customers that currently use 2-foot aerial imagery. Because of the QuickBird sensor design, our 2-foot product will have a resolution and quality (ability to discern details) as good as or better than typical 2-foot aerial photographic products at scales of 1" = 1000' (1:12,000). Direct digital collection and first order resampling allows full retention of quality and resolution, while multiple steps in conversion and handling of conventional aerial processing degrades the effective resolution.

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How can you "upsample" imagery to 2 feet (60cm)?

QuickBird typically collects imagery at a resolution that varies from 61 cm to 72 cm (0 to 25 degrees off-nadir). Inherent information becomes more apparent when resampled to a 60 cm (2 foot) pixel instead of a 70 cm pixel. Although resampling does not introduce more information into the imagery, it makes features more visually apparent, in much the same manner as professional imagery analysts use of a variety of viewing resolutions in their work to be able to extract the most information from an image.

What is the minimum order size?

The minimum order size for Standard Imagery products is 25 km^2 (10 mi^2) for ImageLibrary orders, 64 km^2 (25 mi^2) for Standard and Priority Tasking orders, and 100 km^2 (40 mi^2) for Rush Tasking orders. This small order size allows you to order and pay for only those areas you truly need to complete your project. The minimum order for Basic Imagery is a single scene. The minimum order for Orthorectified Imagery is 100km^2 for all ortho scales.

What is the scene size?

A Basic Imagery QuickBird scene is approximately 16.5 km by 16.5 km at nadir, which is 272 km^2 (105 mi^2). At 25º off-nadir, Basic Imagery scene sizes exceed 375km^2 (145mi^2).

What options do I have in selecting my off-nadir angle?

Off-nadir angles may be specified by the customer, within the following constraints by product type. There must be at least a ten degree difference between the minimum and maximum off-nadir angle specified.

Product Level	Off nadir angle	GSD
Basic	0 to 45	As collected
Standard	0 to 45	60 or 70 cm
Ortho Ready Standard	0 to 45	60 or 70 cm
Orthos (1:50,000 and 1:12,000)	0 to 25	60 or 70 cm
Orthos (1:5,000 and 1:4,800)	0 to 15	60 or 70 cm

Please note that orders for Standard Imagery collected at greater than 30 degrees are resampled to a resolution very different from the native resolution.

What is the revisit time for QuickBird?

The revisit time for QuickBird depends on the latitude of your area of interest and the maximum off-nadir angle that you select. For example, an area of interest at 40^o latitude would have a revisit time of approximately 7 days at 0^o to 15^o off-nadir and a revisit time of approximately 4 days at 0^o to 25^o off-nadir. The revisit time directly affects the amount of time DigitalGlobe requires to collect your imagery. Orders specifying a maximum off-nadir angle of 0^o to 25^o can be collected faster than orders specifying a maximum off-nadir angle of 0^o to 15^o.

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Revisit Time in Days			
Latitude	0° to 15°	0° to 25°	0° to 45°
0	11	6	3
10	11	6	3
20	9	5	3
30	9	5	2
40	8	5	2
50	7	4	2
60	7	4	1
70	5	3	1
80	3	2	1

How can I view the DigitalGlobe ImageLibrary?

Visit our website at www.digitalglobe.com to browse the DigitalGlobe ImageLibrary, review available imagery, access browse imagery, and submit an order request. Our Customer Service department will respond to you within 24 hours to confirm price and discuss any additional ordering requirements.

How can I place an order?

DigitalGlobe accepts orders in several different ways:

- Through an authorized DigitalGlobe Reseller
- Through the DigitalGlobe direct sales team
- With a Customer Service Representative at 1-800-496-1225 or 1-303-702-5561
- Via fax at 1-303-702-5562
- Via email at orders@digitalglobe.com

Contact our Customer Service department to learn more about our products, to place an order, or to speak with one of our sales specialists.

How can I find an authorized DigitalGlobe Reseller?

To find an authorized DigitalGlobe Reseller, visit our website at www.digitalglobe.com and click on the "Find a Reseller" button. You may also contact a Customer Service Representative at 1-800-496-1225 or 1-303-702-5561 to be put in direct contact with a DigitalGlobe Reseller.

Can I use the products for multispectral analysis?

Yes, QuickBird multispectral data are ideally suited for analysis with 4 discrete bands.

What is the spectral range?

The QuickBird satellite collects data in 5 different spectral bands, as shown in the following table:

Product Option	Band	Spectral Range
Panchromatic	Black and White	450 - 900 nm
Multispectral	Blue	450 - 520 nm
	Green	520 - 600 nm
	Red	630 - 690 nm
	Near-Infrared	760 - 900 nm

How long of a collection window does DigitalGlobe suggest?

We suggest a 90 day collection window to ensure enough time to collect imagery that meets your specifications. This 90 day timeframe factors in variables such as off-nadir angle, revisit time, and cloud cover.

How do I define my geographic area of interest?

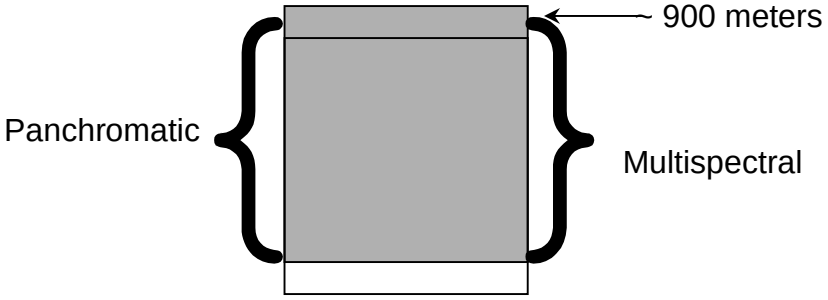
Customers may define their area of interest using the following methods.

- Via fax, specify the upper left and lower right coordinates or specify a center point coordinate and the height and width of your area of interest on your order form.
- Via email, specify coordinates in shapefile format or in an ASCII text file (ArcInfo generate file format) and email to Customer Service at orders@digitalglobe.com.

Please note that coordinates specified in lat/long decimal degrees, based on the WGS84 ellipsoid are preferred.

Why are the Panchromatic and Multispectral bands offset from each other for Basic Imagery?

Because Basic Imagery is scene-based and has minimal corrections, the panchromatic and multispectral products are offset by approximately 900 meters. This is because the pan and MS sensors are slightly offset from each other on the QuickBird focal plane. This means that even though the panchromatic and multispectral sensors collect data simultaneously, they do not view the same patch of ground at the same time. Standard Imagery and Orthorectified Imagery products have additional corrections, including the co-registration of the pan and MS bands.



Can I use your imagery with my software?

Yes, DigitalGlobe subscribes to an “Open Systems” approach and we have worked with major software providers, such as Leica Geosystems (ERDAS), PCI (Geomatics), BAE (Socet Set), and Sensor Systems (Remote View), to ensure that you can use QuickBird Imagery Products with the software you are currently using. Currently both PCI Geomatics and Socet Set support the QuickBird Rigorous Sensor Model.

What is Bit Depth?

Bit depth refers to the amount of energy that is stored in an image. To understand bit depth, you have to relate what you see in an image to the way that computers store data. Computers work with binary data, meaning that every number has a value of 0 or 1. To get more complex numbers, you have to string binary numbers together. For example, a string of two binary numbers (referred to as 2-bit data) would result in 4 possible values: 00, 01, 10, and 11. Take that concept a step further and think about 8-bit data. That would result in 2^8 or 256 possible values. Applying this back to imagery, 8-bit data allows you to store 256 possible values in each pixel. If you are viewing an image in gray tones, 0 corresponds to black, 255 corresponds to white, and all the levels in between correspond to different shades of gray.

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What Bit Depth does QuickBird data use?

QuickBird collects data using an 11-bit dynamic range. This allows 2^{11} or 2048 possible intensity values for each pixel. Because computers cannot read 11-bit data, DigitalGlobe delivers data in either 8-bit or 16-bit format. The 8-bit data requires that QuickBird's 11-bit data be compressed. Therefore, data spanning 2048 values is rescaled to 256 values. If data are ordered in 16-bit format, the original 11 bits of data are simply stored in a 16-bit file. Placeholders are added to account for the 5 bit data difference, but no stretching is performed. The question of whether to order 8 or 16 bit depth is often defined by what your imagery software can support and your intended use.

Why do I need to resample an image?

When a digital image is acquired, the pixels do not line up with any regular coordinate grid. Resampling is necessary to align the pixels in an image to a coordinate grid. Resampling involves the following operations (from Lillesand and Kiefer, *Remote Sensing and Image Interpretation*, 3rd ed., Wiley, New York, 1994.):

1. The coordinates of each element of the original image are transformed to their corresponding location in the new regular coordinate grid.
2. A pixel in the output grid will not generally overlay a pixel in the original image matrix. Therefore, the intensity value, or digital number (DN) eventually assigned to a cell in the output grid is determined using the pixel values that surround its position in the original grid.

What resampling methods does DigitalGlobe offer?

DigitalGlobe offers nearest neighbor, 2x2 bilinear, 4x4 cubic convolution, 8-point sinc, MTF kernel, and the pansharpening kernel as resampling methods.

How do the resampling methods work?

When raw data are transformed into a coordinate grid, data are shifted, and it is necessary to use a resampling method to determine what data value to assign to each new, transformed pixel. Each of the methods offered by DigitalGlobe uses different ways to determine what digital number will be assigned to each transformed pixel within the new coordinate grid.

The **nearest-neighbor interpolation** is the simplest of the resampling methods. The original pixel value whose center is closest to the center of the new pixel location is used. This resampling method does not modify the original intensity values of the pixels. This method can result in a disjointed or blocky image because no averaging is performed. In addition, some data may be lost or duplicated depending on how the original data relates to the new coordinate grid. This method is preferred for customers who require the original intensity of the pixel values to remain unaltered.

2x2 bilinear interpolation involves greater computational complexity. In this approach, the four pixels (2x2 array) in the original image that are nearest to the new pixel location are considered. The DNs from these four pixels are synthesized using a distance-weighted average to calculate the new pixel value. Bilinear interpolation produces a final image with a smoother appearance than an image processed using the nearest neighbor method. Some extreme DN values may be lost, however, resulting in less distinct edges.

4x4 cubic convolution is a more rigorous resampling technique that considers the nearest 16 pixels (4x4 array) in the original image that are nearest to the new pixel location. The DNs from these 16 pixels are synthesized using a polynomial calculation. This method produces a smoother appearance than the nearest neighbor method while providing slightly sharper edge detail than the bilinear interpolation method.

8-point Sinc uses a damped sinc function [(sin x)/x] within an 8 by 8 window to determine the value of the destination pixel. Theoretically, this is the most rigorous resampling method that is discussed here.

MTF Kernel uses an 8 by 8 pixel window to determine the value of the destination pixel. This resampling method is optimized for the actual MTF response of the QuickBird sensor and produces sharp edge detail.

How do I know which resampling method to choose?

The resampling method that is right for you depends on your application and the end product requirements. For non-pansharpened imagery, the nearest neighbor interpolation is most appropriate for customers who require the original pixel intensity values to remain intact. For example, customers using data to assess vegetative health would probably prefer to use the nearest neighbor method. For other customers who are more interested in the overall appearance of the image rather than the original pixel values, cubic convolution or 8-point sinc is recommended. These methods produce smooth images while maintaining sharp edge detail, making them acceptable for most practical applications.

If you are ordering a pan-sharpened product, the DigitalGlobe proprietary Pan-Sharpening Kernel is highly recommend over all other resampling kernels. For more technical information regarding this Pan-Sharpening Kernel, please contact Customer Service.

When would it be beneficial to order imagery with the Dynamic Range Adjustment (DRA) Option?

Dynamic Range Adjustment is a visual enhancement applied to QuickBird imagery. The DRA enhancement consists of two parts: color correction and contrast enhancement. It is intended for users who do not have the tools to custom stretch the imagery. This enhancement is strictly visual and does not affect the geographic location of the imagery pixels. The pixel values of the original data cannot be recovered from the DRA product owing to the complexity of the transformation involved. As such, the DRA option is not recommended for those users intending to perform scientific analysis or spectral classification using QuickBird imagery data.

What are imagery tiles?

Some QuickBird Imagery Products cannot fit in their entirety on all available media types or may be cumbersome to work with due to their large size, DigitalGlobe offers you the option to break up imagery into smaller pieces called tiles. Tiles may be defined by pixel based grids or by map based coordinates. Pixel based tiles may be defined by approximately 8,000 pixels by 8,000 pixels (8k x 8k), 14,000 pixels by 14,000 pixels (14k x 14k), or 16,000 by 16,000 pixels (16k x16k). Map based tiles are based on map coordinates in product units and are defined by a specified tile size and tile overlap. Customers who do not wish to tile their imagery may change their media type to one that will accommodate the full size of their product, but should understand

that large data files may be difficult to import into some software packages. Please note that most image processing, GIS, and cartographic applications cannot open files over 2 GB in size.

Are there special considerations when working with imagery tiles?

Some commercial software packages have difficulty displaying tiled data that has not been mosaiced. This is because the software treats imagery tiles as individual units, rather than pieces of a larger, seamless imagery file. If you experience problems when opening tiled imagery such as poor tonal balance, stretching between tile boundaries, or sliver tiles (where there is sliver of imagery surrounded by blackfill which displays simply as white/black), then your tiles should be mosaiced back together. Most commercially available image processing applications have tools for mosaicking. This should be a straightforward process, performed simply to knit your tiles back into one image fabric. Since QuickBird imagery comes tonally balanced and is created without overlaps, your tiles should fit together evenly when mosaiced. Because of this, there is typically little need to use the advanced options provided in image processing software packages for the purposes of mosaicking and displaying QuickBird imagery. If you do not wish to mosaic your imagery, please request that it be delivered on a media that does not require tiling.

What are the file sizes of your imagery?

QuickBird Imagery Products vary in file sizes depending on numerous factors such as the product type, spectral options, ground sample distance, and bit depth. Approximate file sizes for area-based products (Standard and Orthorectified Imagery Products) are shown in the following table.

	Product Option and Ground Sample Distance								Bit depth
	Black & White		Color (3-band)		Multispectral		Pansharpened (4-band)		
	60 cm	70 cm	60 cm	70 cm	2.4 m	2.8 m	60 cm	70 cm	
Standard and Orthorectified Imagery (1 km^2)	3 MB	2.2 MB	8.5 MB	6.3 MB	0.75 MB	0.55 MB	11.3 MB	8.4 MB	8
	6 MB	4.4 MB	17.0 MB	12.6 MB	1.5 MB	1.1 MB	22.6 MB	16.8 MB	16
Standard and Orthorectified Imagery (100 km^2)	300 MB	220 MB	850 MB	630 MB	75 MB	55 MB	1130 MB	840 MB	8
	600 MB	440 MB	1700 MB	1260 MB	150 MB	110 MB	2260 MB	1680 MB	16

The file sizes are given for a 1 km^2 increment of imagery so that you may calculate an approximate file size based on the size of your area of interest. For example, if you want to know how large a 25 km^2 Black and White Standard Imagery Product, ordered as 60 cm, 16 bit data would be, find the appropriate cell in the table above and multiply by your order size to get an estimated file size (6 MB x 25 km^2 = 150 MB). The area of the minimum bounding rectangle of your order polygon rather than your order polygon area alone will give you the most accurate estimation of your file size.

Approximate file sizes for Basic Imagery and for Standard Imagery and Orthorectified Imagery tiles are given in the following table.

	Black & White	Color (3-band)	Multispectral	Pansharpened (4-band)	Bit Depth
Basic Imagery (one scene)	800 MB	NA	200 MB	NA	8
	1600 MB	NA	400 MB	NA	16
Standard and Orthorectified Imagery (8k x 8k tile)	75 MB	200 MB	20 MB	270 MB	8
	150 MB	400 MB	40 MB	540 MB	16
Standard and Orthorectified Imagery (16k x 16k tile)	300 MB	800 MB	75 MB	1080 MB	8
	600 MB	1600 MB	150 MB	2160 MB	16

How long does it take to produce and deliver products?

After DigitalGlobe has successfully collected all of the appropriate data, we will process your order to the specified product and order parameters. The table below describes the estimated delivery timelines based on the combination of the product and order parameters you choose.

	Standard Tasking	Priority Tasking	Rush Tasking	ImageLibrary	Rush ImageLibrary
Basic[1]	3 days	3 days	60 hours	3 days	24 hours
Standard[1]	3 days	3 days	60 hours	3 days	24 hours
Standard - Pan-sharpened[1]	3 days	3 days	60 hours	3 days	48 hours
Orthorectified[1]	5 days	5 days	N/A	5 days	N/A
Orthomosaic - less than 1500km2	12 days	12 days	N/A	12 days	N/A
Orthomosaic - more than 1500km2	20 days	20 days	N/A	20 days	N/A

[1]Processing assumes one image. Additional contiguous scenes in a single order will add a nominal number of days.

Processing timelines for all Orthorectified Products do not begin until all imagery is collected and all the necessary support data (DEMs and GCPs) are received. The timeframe to obtain DEMs and GCPs depend on the geographic location of your area of interest. Large orders may require additional processing time. Please do not hesitate to contact Customer Service to check on the status and progress of your order. Delivery can be expected 2 to 3 days after order shipment.

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Why do you offer GeoTIFF instead of TIFF?

The GeoTIFF 1.0 file format fully complies with the TIFF 6.0 specifications, but it has the added ability to store geographic information within its file tags. Therefore, GeoTIFF was selected over the TIFF format as the preferred file format. For Basic Imagery products, which are not geo-referenced, the file tags containing geographic information are simply not specified. Software packages that do not read the GeoTIFF format will simply ignore the geographic file tags and open the file as a TIFF.

How does DigitalGlobe deal with clouds?

DigitalGlobe attempts to collect imagery with the lowest possible cloud cover to meet your needs. However, cloud cover is difficult to predict and therefore all imagery products containing ≤20% cloud cover will be delivered. For Orthorectified Imagery products, 0% cloud cover may be requested for a price uplift. For area-based products, the cloud cover assessment is performed on your Order Polygon. For scene-based products, the cloud cover assessment is performed on the full scene.