

# Google Earth TM User Guide

Cloud Services | August 2013



# **Table of Contents**

		of Contents			
	List of Figures4				
Lis	st of	Tableserview of DGCS in Google Earth <sup>™</sup>	5		
1	Ove	erview of DGCS in Google Earth <sup>™</sup>	6		
	1.1	Introduction to DGCS EarthService <sup>™</sup>	6		
		1.1.1 EarthService Layers	6		
	1.2	Introduction to DGCS MapService	7		
		1.2.1 Service Details	7		
		1.2.2 MapService Capability	7		
	1.3	Introduction to DGCS Web Coverage Service (WCS)	7		
		1.3.1 Service Details	8		
	1.4	Google Earth System Requirements	8		
2	Acc	cessing DGCS in Google Earth	9		
	2.1	Opening DGCS in Google Earth	9		
		Adding DGCS EarthService (Imagery)			
		2.2.1 Accessing via a Web Browser			
		2.2.2 Adding EarthService as a Network Link			
	2.3	Accessing DGCS MapService (ImageryFootprint)			
		2.3.1 Adding MapService as a Network link			
	2.4	Accessing WCS via Google Earth (Delivery Service)	14		
		Verifying Layers in Google Earth			
		Installing Certificates			
		Working with Layers			
	,	2.7.1 Saving a Layer			
		2.7.2 Loading a Layer			
		2.7.3 Creating Layer Templates			
	2.8	Applying Filters			
3	Imp	proving Performance	24		
			24		
	3.1				
		Refreshing the Imagery	24		
	3.2	Refreshing the Imagery	24 24		
	3.2 3.3	Refreshing the Imagery	24 24 25		
	3.2 3.3 3.4	Refreshing the Imagery  Clearing Temporary Internet Files  Clearing the Google Cache  Uncheck Extraneous Layers in Google Earth	24 24 25 26		
4	3.2 3.3 3.4 3.5	Refreshing the Imagery  Clearing Temporary Internet Files  Clearing the Google Cache  Uncheck Extraneous Layers in Google Earth  Google Earth Toolbar	24 24 25 26 26		
4	3.2 3.3 3.4 3.5 <b>Go</b>	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache Uncheck Extraneous Layers in Google Earth Google Earth Toolbar	24 24 25 26 26 <b>28</b>		
4	3.2 3.3 3.4 3.5 <b>Goo</b> 4.1	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache Uncheck Extraneous Layers in Google Earth Google Earth Toolbar od to Know Layers	24 24 25 26 26 <b>28</b> 28		
4	3.2 3.3 3.4 3.5 <b>Goo</b> 4.1 4.2	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache Uncheck Extraneous Layers in Google Earth Google Earth Toolbar od to Know Layers Zoom Levels	24 25 26 26 <b>28</b> 28 28		
4	3.2 3.3 3.4 3.5 <b>Goo</b> 4.1 4.2 4.3	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache Uncheck Extraneous Layers in Google Earth Google Earth Toolbar od to Know Layers Zoom Levels Raster and Vector Data	24 25 26 26 28 28 28 29		
4	3.2 3.3 3.4 3.5 <b>Goo</b> 4.1 4.2 4.3 4.4	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache Uncheck Extraneous Layers in Google Earth Google Earth Toolbar Dod to Know Layers Zoom Levels Raster and Vector Data KML and KMZ	24 25 26 26 28 28 29 30		
4	3.2 3.3 3.4 3.5 <b>Goo</b> 4.1 4.2 4.3 4.4 4.5	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache Uncheck Extraneous Layers in Google Earth Google Earth Toolbar Layers Zoom Levels Raster and Vector Data KML and KMZ Metadata	24 24 25 26 26 28 28 29 30 31		
4	3.2 3.3 3.4 3.5 <b>Goo</b> 4.1 4.2 4.3 4.4 4.5 4.6	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache Uncheck Extraneous Layers in Google Earth Google Earth Toolbar Od to Know Layers Zoom Levels Raster and Vector Data KML and KMZ Metadata Image Content Specification	24 24 25 26 28 28 29 30 31 31		
4	3.2 3.3 3.4 3.5 <b>Goo</b> 4.1 4.2 4.3 4.4 4.5 4.6 4.7	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache Uncheck Extraneous Layers in Google Earth Google Earth Toolbar Dod to Know Layers Zoom Levels Raster and Vector Data KML and KMZ Metadata Image Content Specification DigitalGlobe Projection System	24 24 25 26 28 28 29 30 31 31 32		
4	3.2 3.3 3.4 3.5 <b>Goo</b> 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache Uncheck Extraneous Layers in Google Earth Google Earth Toolbar Od to Know Layers Zoom Levels Raster and Vector Data KML and KMZ Metadata Image Content Specification DigitalGlobe Projection System Stacking Profiles	24 24 25 26 28 28 29 30 31 31 32 34		
4	3.2 3.3 3.4 3.5 <b>Goo</b> 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9	Refreshing the Imagery Clearing Temporary Internet Files. Clearing the Google Cache. Uncheck Extraneous Layers in Google Earth Google Earth Toolbar od to Know.  Layers. Zoom Levels. Raster and Vector Data KML and KMZ Metadata. Image Content Specification DigitalGlobe Projection System Stacking Profiles. Bounding Box	24 25 26 26 28 28 29 30 31 31 32 34 35		
	3.2 3.3 3.4 3.5 <b>Got</b> 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 4.10	Refreshing the Imagery Clearing Temporary Internet Files. Clearing the Google Cache. Uncheck Extraneous Layers in Google Earth Google Earth Toolbar od to Know.  Layers Zoom Levels Raster and Vector Data KML and KMZ Metadata Image Content Specification DigitalGlobe Projection System Stacking Profiles. Bounding Box Ounderstanding URL and Parameters	24 24 25 26 28 28 29 30 31 32 34 35 35		
4	3.2 3.3 3.4 3.5 <b>Goo</b> 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 <b>4.9</b> 4.10 <b>Dig</b>	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache. Uncheck Extraneous Layers in Google Earth Google Earth Toolbar Dod to Know	24 24 25 26 28 28 29 30 31 31 32 34 35 35		
	3.2 3.3 3.4 3.5 <b>Good</b> 4.1 4.2 4.3 4.4 4.5 4.6 4.7 <b>Up</b> <b>Dig</b> 5.1	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache Uncheck Extraneous Layers in Google Earth Google Earth Toolbar Dod to Know  Layers Zoom Levels Raster and Vector Data KML and KMZ Metadata Image Content Specification DigitalGlobe Projection System Stacking Profiles Bounding Box Understanding URL and Parameters LitalGlobe Cloud Services (DGCS) Getting to Know DGCS	24 25 26 28 28 28 29 30 31 32 34 35 37 37		
	3.2 3.3 3.4 3.5 <b>Good</b> 4.1 4.2 4.3 4.4 4.5 4.6 4.7 <b>Up</b> <b>Dig</b> 5.1	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache Uncheck Extraneous Layers in Google Earth Google Earth Toolbar Od to Know Layers Zoom Levels Raster and Vector Data KML and KMZ Metadata Image Content Specification DigitalGlobe Projection System Stacking Profiles Bounding Box Understanding URL and Parameters italGlobe Cloud Services (DGCS) Getting to Know DGCS Things You Can Do with DGCS	24 25 26 28 28 29 30 31 31 32 34 35 37 37		
	3.2 3.3 3.4 3.5 <b>Good</b> 4.1 4.2 4.3 4.4 4.5 4.6 4.7 <b>Up</b> <b>Dig</b> 5.1	Refreshing the Imagery Clearing Temporary Internet Files. Clearing the Google Cache. Uncheck Extraneous Layers in Google Earth Google Earth Toolbar  od to Know.  Layers Zoom Levels. Raster and Vector Data KML and KMZ Metadata Image Content Specification DigitalGlobe Projection System. Stacking Profiles. Bounding Box Understanding URL and Parameters italGlobe Cloud Services (DGCS) Getting to Know DGCS Things You Can Do with DGCS 5.2.1 Search and Discovery	24 25 26 28 28 29 30 31 31 32 35 37 37 37		
	3.2 3.3 3.4 3.5 <b>Good</b> 4.1 4.2 4.3 4.4 4.5 4.6 4.7 <b>Up</b> <b>Dig</b> 5.1	Refreshing the Imagery Clearing Temporary Internet Files. Clearing the Google Cache. Uncheck Extraneous Layers in Google Earth. Google Earth Toolbar. Od to Know.  Layers Zoom Levels. Raster and Vector Data KML and KMZ Metadata Image Content Specification DigitalGlobe Projection System Stacking Profiles. Bounding Box OUnderstanding URL and Parameters italGlobe Cloud Services (DGCS). Getting to Know DGCS Things You Can Do with DGCS 5.2.1 Search and Discovery. 5.2.2 Image Delivery.	24 25 26 28 28 29 30 31 32 34 35 37 37 37 37		
	3.2 3.3 3.4 3.5 <b>Good</b> 4.1 4.2 4.3 4.4 4.5 4.6 4.7 <b>Up</b> <b>Dig</b> 5.1	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache. Uncheck Extraneous Layers in Google Earth Google Earth Toolbar od to Know  Layers Zoom Levels. Raster and Vector Data KML and KMZ Metadata Image Content Specification DigitalGlobe Projection System Stacking Profiles Bounding Box Understanding URL and Parameters italGlobe Cloud Services (DGCS) Getting to Know DGCS 5.2.1 Search and Discovery 5.2.2 Image Delivery 5.2.3 Data Integration	24 25 26 28 28 29 30 31 32 34 35 37 37 37 38 38		
	3.2 3.3 3.4 3.5 <b>Goo</b> 4.1 4.2 4.3 4.4 4.5 4.6 4.7 <b>Dig</b> 5.1 5.2	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache Uncheck Extraneous Layers in Google Earth Google Earth Toolbar od to Know  Layers Zoom Levels Raster and Vector Data KML and KMZ Metadata Image Content Specification DigitalGlobe Projection System Stacking Profiles Bounding Box Understanding URL and Parameters italGlobe Cloud Services (DGCS).  Getting to Know DGCS. Things You Can Do with DGCS 5.2.1 Search and Discovery 5.2.2 Image Delivery. 5.2.3 Data Integration 5.2.4 Authentication and Security	24 25 26 28 28 29 30 31 31 32 34 35 37 37 37 37 38 38		
	3.2 3.3 3.4 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 4.10 <b>Dig</b> 5.1 5.2	Refreshing the Imagery Clearing Temporary Internet Files Clearing the Google Cache. Uncheck Extraneous Layers in Google Earth Google Earth Toolbar od to Know  Layers Zoom Levels. Raster and Vector Data KML and KMZ Metadata Image Content Specification DigitalGlobe Projection System Stacking Profiles Bounding Box Understanding URL and Parameters italGlobe Cloud Services (DGCS) Getting to Know DGCS 5.2.1 Search and Discovery 5.2.2 Image Delivery 5.2.3 Data Integration	24 25 26 28 28 29 30 31 32 34 35 37 37 37 37 38 38 38		



5.4.1 Web Map Service (WMS)	38
5.4.2 Web Map Tile Service (WMTS)	38
5.4.3 Web Feature Service (WFS)	38
5.4.4 Web Coverage Service (WCS)	39
5.5 Cloud Services Data Types	39
5.6 Advantages of DGCS	
5.6.1 Easy Operability	
5.6.2 The DigitalGlobe Constellation	
5.7 Support	40
5.8 References	40
Glossary	
•	43



# List of Figures

Figure 1.1 Schematic Representation of Earth Service Capability	
Figure 1.2 Schematic Representation of Map Service Capability	
Figure 2.1 Open KML VIA Web Browser	9
Figure 2.2 New Network Link Window	
Figure 2.3 Add Imagery Link Example in New Network Link dialog Box	
Figure 2.4 My Places Panel showing Imagery Layer	11
Figure 2.5 Imagery and Metadata Layers Under My Places	12
Figure 2.6 Metadata Layer Under My Places Panel (Expanded)	
Figure 2.7 Strips & Catalog IDs	
Figure 2.8 Viewing Attributes	
Figure 2.9 Move Layers to My Places	14
Figure 2.10 New Network Link Dialog box with WCS	14
Figure 2.11 Download button	
Figure 2.12 Image Format Download Links	
Figure 2.13 File Download dialog box	
Figure 2.14 View Map – WCS	
Figure 2.15 Making Layers Visible	
Figure 2.16 Security Alert Popup	
Figure 2.17 Certificate - General Tab	
Figure 2.18 Certificate Import Wizard	
Figure 2.19 Certificate Store Location	
Figure 2.20 Security Warning	
Figure 2.21 Save File Screen	
Figure 2.22 Loading a Layer	
Figure 2.23 Viewing Loaded Layers	
Figure 2.24 Adding the ConnectID to the nETWORK Link	
Figure 3.1 Internet Options dialog box	
Figure 3.2 Delete Browsing History	
Figure 3.3 Clear Cache	
Figure 3.4 Uncheck Extraneous Layers	
Figure 4.1 GIS Layers	
Figure 4.2 Zoom Levels	
Figure 4.3 Raster Data	
Figure 4.4 Vector Data	
Figure 4.5 Universal Transverse Mercator Grid	
Figure 4.6 Pictorial Representation of Bounding Box	
Figure 5.1 DGCS Processes	37



# **List of Tables**

Table 1.1	Specifications	6
Table 2.1	Metadata Colors	13
Table 2.2	Sample URLs	16
Table 2.3	Metadata Colors	17
	Filter Calls	
Table 3.1	Google Earth Toolbar	26
Table 4.1	Zoom Levels	29
	Content Specification of DigitalGlobe Satellite Services	
Table 4.3	List of Projection Systems Used by DigitalGlobe Products	32
Table 4.4	DGCS & Sample URLs	36
Table 5.1	Cloud Services Data Types	39



# 1 Overview of DGCS in Google Earth<sup>™</sup>

### 1.1 Introduction to DGCS EarthService<sup>™</sup>

EarthService<sup>™</sup> is a cached tile service compatible with Google Earth<sup>™</sup> mapping service that provides access to DigitalGlobe Imagery. EarthService provides native compatibility for KML-based Earth Viewers, including Google Earth.

A user connects to the service from the Google Earth client, and downloads pre-cached imagery tiles and metadata. All transactions are encrypted using HTTPS and include a unique User ID in the form of a ConnectID. These ConnectIDs are created for each user through Manager Services.

Figure 1.1 depicts the schematic representation of Earth Service capability.

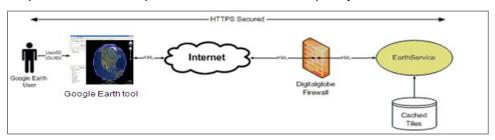


FIGURE 1.1 SCHEMATIC REPRESENTATION OF EARTH SERVICE CAPABILITY

#### 1.1.1 EARTHSERVICE LAYERS

#### CitySphereTileService

DigitalGlobe's CitySphere<sup>™</sup> product features 60 cm or better orthorectified color imagery for 300 pre-selected cities worldwide. These GIS-ready cities are available as off-the-shelf products and ready for immediate delivery. Each city is comprised of recent imagery, with initial imagery no older than 2006. The resolution and accuracy of CitySphere make it ideal for use as a basemap in your GIS, personal navigation mapping and mobile device applications, as well as many other location-based services.

**TABLE 1.1 SPECIFICATIONS** 

FEATURES	BENEFITS	ADVANTAGES
60 cm or better resolution	Clearly discern features	Increases your confidence for feature identification
1:4800, 1:12000 or 1:50000 orthomosaic	Highly accurate	Pinpoints features to within 2.5 meters
Current off-the-shelf imagery	Quick delivery of new imagery for your GIS	Easy procurement process
GIS-ready	Ready for immediate use	No extra effort or training required
Affordable pricing	Fits within your budget	Potential to avoid RFP process
Repeatable, consistent coverage	Known update schedule and known update area	Allows for easy budget planning

#### **FirstLook**

The Crisis Event Service (CES) provides access to pre- and post-event imagery over major disaster areas, as defined by the International Charter for Space and Major Disasters (http://www.disasterscharter.org/home), as well as user-defined areas approved by the DigitalGlobe Crisis Team. The layer includes imagery from DigitalGlobe's QuickBird, WorldView1, and WorldView2 satellite constellation. It also includes WFS that allows the user to query data availability by different metadata attributes.

The DigitalGlobe CES includes the following:



- EarthService is a cached-tile service compatible with Google Earth. The service also provides both imagery and metadata layers.
- A full featured Web Map Service (WMS) that provides both metadata and imagery layers to WMS clients.
- A full Web Feature Service (WFS) that allows querying of data features by attribute.

### 1.2 Introduction to DGCS MapService

The MapService provides raster imagery data in multiple resolutions for use in GIS applications in various formats that support the WMS standard. The DigitalGlobe WMS supports the following operations:

#### **GetCapabilities**

The GetCapabilities request is used to obtain information about the supported map layers, which include various layers of imagery and metadata.

#### **GetMap**

The GetMap request is used to retrieve footprint geometry and metadata of the layers contained in the Online Catalogs.

#### **GetFeatureInfo**

The GetFeatureInfo request is used to obtain metadata about the features displayed in map images that are retrieved via GetMap requests. Filter calls from Applying Filters on page 22 can also be included to specify a certain dataset for which information is required.

#### 1.2.1 SERVICE DETAILS

The DigitalGlobe WMS supports OGC WMS Version 1.1.1. The DigitalGlobe WMS supports KVP (Keyword Value Pair) request encoding only; SOAP (Simple Object Access Protocol) or other protocols are not supported.

The DigitalGlobe WMS supports map layers of both imagery and imagery metadata. The data for these layers is supplied in the following way:

- An imagery bounding box is returned when metadata layers are requested at smaller map scales (smaller than approximately 1:230,000). When a map scale larger than this is requested, only an image date is returned.
- No imagery is returned when imagery layers are requested at smaller map scales (smaller than approximately 1:200,000). At map scales larger than this, map images are returned.

#### 1.2.2 MAPSERVICE CAPABILITY

MapService enables a user to access metadata by connecting from any WMS-compliant software, like Google Earth. All transactions are encrypted using HTTPS and include the ConnectID.

The following figure depicts the schematic representation of MapService capability.

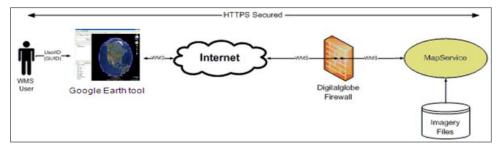


FIGURE 1.2 SCHEMATIC REPRESENTATION OF MAP SERVICE CAPABILITY

### 1.3 Introduction to DGCS Web Coverage Service (WCS)

The Web Coverage Service allows the end user to directly download raster imagery data in either JPEG2000 or GeoTIFF format. The WCS supports the following operations:



#### **GetCapabilities**

The GetCapabilities request is used to determine the supported Coverages; each FinishedCatalog product will be listed and described as a Coverage.

#### **DescribeCoverage**

The DescribeCoverage request is used to obtain the detailed description of a supported Coverage.

#### **GetCoverage**

The GetCoverage request is used to obtain the actual product pixels (imagery) for download.

#### 1.3.1 SERVICE DETAILS

The DigitalGlobe WCS supports KVP request encoding only; SOAP or other protocols are not supported.

The WCS does NOT support the following optional capabilities:

- Range Subsetting
- STORE capability; all coverages are returned synchronously
  - → Because full-resolution imagery is being retrieved, sometimes over limited bandwidth connections, the WCS will determine the size of the requested product. If it exceeds 1GB, an exception will be returned. Since the limit is based on file size, larger areas can be downloaded if JPEG2000 format is requested instead of GeoTIFF.
  - → There will be a set of white-listed domains where a user can download unlimited quantities of Web Coverages. Users accessing the service from a non-white-listed domain will be limited to 1GB of downloaded data per day. Once this limit is exceeded, the user's ConnectID will be disabled from non-white-listed domains, this ConnectID will still be active from white-listed domains.

The WCS Service treats each available product as a separate coverage; therefore the imagery returned depends on the layer being accessed.

The parameter used to request coverage is the Feature Identifier. This makes it convenient to request metadata for the product via the Feature service, and then request the actual imagery product via the WCS, using the same identifier.

Since additional Coverages will become available as data is added to the Service, the response to a GetCapabilities request will be updated each time a new product available. Therefore, care should be taken if client-side caching of the results is utilized.

### 1.4 Google Earth System Requirements

- Operating System: Windows XP, Windows Vista, Windows 7
- CPU: Pentium 4 2.4GHz+ or AMD 2400xp+
- System Memory (RAM): 512MB
- Hard Disk: 2GB free space
- Network Speed: 768 Kbits/sec
- Graphics Card: 3D-capable with 32MB of VRAM
- Screen: 1280x1024, "32-bit True Color"
  - NOTE: Google-Earth's minimum and recommended system requirements for other Operating Systems are listed at: http://earth.google.com/support/bin/answer.py?hl=en&answer=20701
  - To install Google Earth, go to: http://earth.google.com/download-earth.html.



### 2 Accessing DGCS in Google Earth

### 2.1 Opening DGCS in Google Earth

DigitalGlobe Cloud Services can be accessed in one of the following ways:

- Double-click the KMZ or KML file provided by DigitalGlobe which will automatically open Google Earth and load the layers.
- DigitalGlobe layers can be added manually using the Web Service URLs provided by DigitalGlobe.

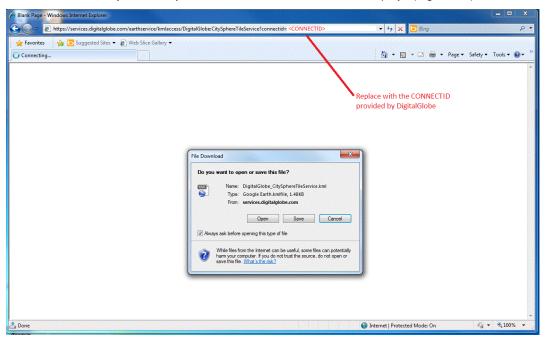
### 2.2 Adding DGCS EarthService (Imagery)

To access the DGCS EarthService, obtain a valid ConnectID from the DigitalGlobe Cloud Services Program Office. Once a ConnectID is obtained, EarthService can either be accessed via a web browser or by adding the URL as a network link.

#### 2.2.1 ACCESSING VIA A WEB BROWSER

To access DGCS EarthService via a Web browser:

- 1. Open a Web browser.
- In the URL address field, type the following: https://services.digitalglobe.com/earthservice/kmlaccess/DigitalGlobe:CitySphereTileService?connectid=
   onnectID>
  - Replace <ConnectID> with the ConnectID provided by DigitalGlobe.
  - Confirm your URL with your DigitalGlobe representative.
  - Ensure that there are no spaces in the URL.
- 3. Press the ENTER key on the keyboard. The File Download window displays (Figure 2.1).



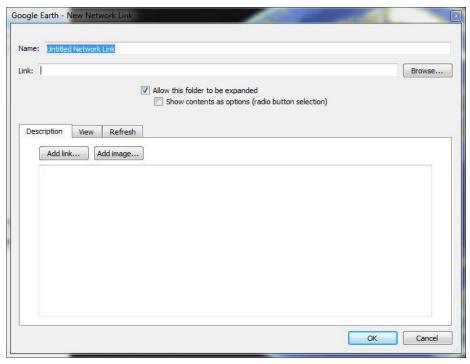
#### FIGURE 2.1 OPEN KML VIA WEB BROWSER

- 4. Click **Open**. Google Earth will automatically open and load the layers, which will be populated in the *My Places* panel.
  - NOTE: If you want to save the file for later, you can click Save and save it to your computer.



#### 2.2.2 ADDING EARTHSERVICE AS A NETWORK LINK

- 1. Open Google Earth by doing one of the following:
  - Double-clicking the Google Earth icon on the Desktop.
  - Clicking Start > All Programs > Google Earth > Google Earth.
- 5. From the Add menu, select Network Link. The New Network Link window displays (Figure 2.2).



#### FIGURE 2.2 NEW NETWORK LINK WINDOW

- 6. Enter a name in the **Name** field (Example: Imagery).
- 7. Type the EarthService URL in the **Link** field (Figure 2.3). A sample is provided below. Figure 2.3 shows the dialog box with the information entered.

Name: Imagery Sample URL:

https://services.digitalglobe.com/earthservice/kmlaccess/DigitalGlobe:CitySphereTileService?connectid=<ConnectID>

Replace <ConnectID> with the ConnectID provided by DigitalGlobe. The URL varies for different users; ensure that there are no spaces in the URL.



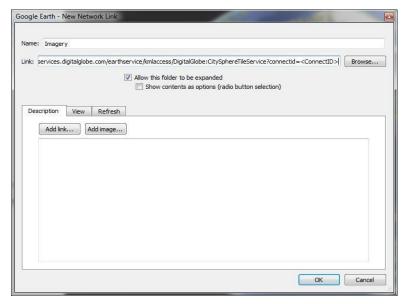


FIGURE 2.3 ADD IMAGERY LINK EXAMPLE IN NEW NETWORK LINK DIALOG BOX

8. Click **OK**. A new layer appears in the *Places* panel (see Figure 2.4).

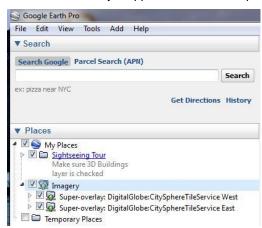


FIGURE 2.4 MY PLACES PANEL SHOWING IMAGERY LAYER

### 2.3 Accessing DGCS MapService (ImageryFootprint)

DGCS MapService can be added either as a network link or as an image overlay.

#### 2.3.1 ADDING MAPSERVICE AS A NETWORK LINK

Perform the following steps to add DGCS MapService as a network link.

- 1. From the Add menu, select Network Link. The New Network Link dialog box displays (Figure 2.2).
- 2. Enter a name in the **Name** field (Example: Imagery Metadata).
- 9. Type the EarthService URL in the Link field (Figure 2.3). A sample is provided below.

Name: Imagery Metadata

#### Sample URL

https://services.digitalglobe.com/mapservice/wmsaccess?height=1024&width=1024&layers=DigitalGlobe:ImageryFootprint&request=GetMap&service=wms&styles=date&format\_options=SUPEROVERL AY:false,KMPLACEMARK:false,KMSCORE:50,KMATTR:true,&srs=EPSG:4326&format=application/



vnd.google-earth.kml+xml&transparent=false&version=1.1.1&BBOX=-180,-90,180,90&connectid=<ConnectID>

Replace <ConnectID> with the ConnectID provided by DigitalGlobe. The URL varies for different users; ensure that there are no spaces in the URL.

10. Click **OK** to create required layers under the *Places* panel, as shown in the figure below.

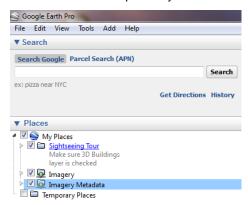


FIGURE 2.5 IMAGERY AND METADATA LAYERS UNDER MY PLACES

NOTE: If the folder icon shows a yellow or red ball,  $\Box$  , there is a problem with the layer. If the layer was just created, check the URL for errors. If the icon was green and turned to yellow or red, then the URL is probably bad or down.

The metadata populates in the *My Places* panel and can be expanded to display all of the imagery strips available (refer to Figure 2.6).

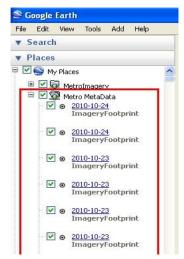


FIGURE 2.6 METADATA LAYER UNDER MY PLACES PANEL (EXPANDED)

The green dots in the imagery strips are Catalog IDs (Figure 2.7).





FIGURE 2.7 STRIPS & CATALOG IDS

11. Click the Catalog ID links to see metadata attributes for the strip (Figure 2.8). Double-click to zoom.



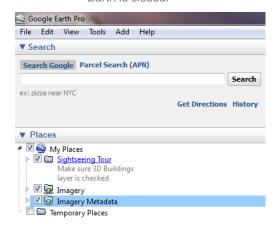
FIGURE 2.8 VIEWING ATTRIBUTES

TABLE 2.1 METADATA COLORS

COLOR	TIME FRAME
	Imagery less than 7 days old
	Imagery between 7 and 30 days old
	Imagery more than 30 days old



NOTE: Ensure sure that the layers are under My Places (as shown in Figure 2.11) because any layers stored in Temporary Places will not be saved when Google Earth is closed.



#### FIGURE 2.9 MOVE LAYERS TO MY PLACES

### 2.4 Accessing WCS via Google Earth (Delivery Service)

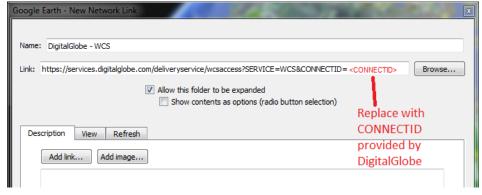
Perform the following steps to add DigitalGlobe Web Coverage Service as a network link.

- 1. From Google Earth's Add menu, select Network Link. The New Network Link window displays (Figure 2.2).
- 2. Enter a name in the **Name** field (Example: DigitalGlobe WCS).
- 3. Insert a WCS URL in the **Link** box, as illustrated in Figure 2.10. A sample is provided below. Figure 2.10 shows the dialog box with the information entered.

Name: DigitalGlobe - WCS

Sample URL:
<a href="https://services.digitalglobe.com/deliveryservice/wcsaccess?SERVICE=WCS&CONNECTID=<ConnectID">https://services.digitalglobe.com/deliveryservice/wcsaccess?SERVICE=WCS&CONNECTID=<ConnectID></a>

Replace <ConnectID> with the ConnectID provided by DigitalGlobe. The URL varies for different users; ensure that there are no spaces in the URL.

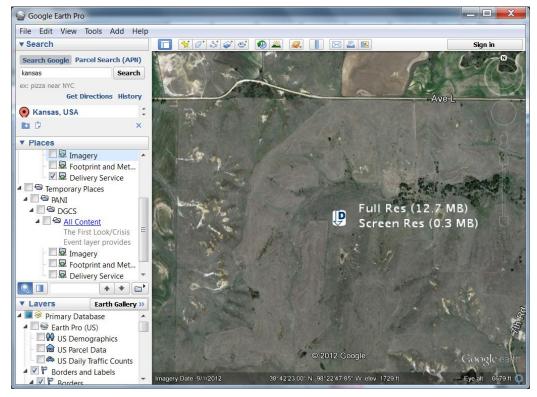


#### FIGURE 2.10 NEW NETWORK LINK DIALOG BOX WITH WCS

- 4. Click **OK**. WCS will populate in the *Places* column.
  - NOTE: If the .kml file is used for access, all of the layers will be loaded, including Delivery Service.

Zooming in on the map will eventually show various download icons (). The file sizes of downloading full resolution or screen resolution files in JPEG2000 format also shown (refer to Figure 2.12).





#### FIGURE 2.11 DOWNLOAD BUTTON

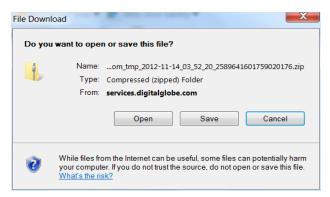
12. Click the download button to see all download options: JPEG2000, GeoTIFF, MrSID, or GeoPDF files at either full resolution or at screen resolution (Figure 2.12).



#### FIGURE 2.12 IMAGE FORMAT DOWNLOAD LINKS

13. Click one of the links to initiate the download. Confirmation text displays, stating that the download has been initiated. When the download is complete, a File Download dialog box displays (Figure 2.13).





#### FIGURE 2.13 FILE DOWNLOAD DIALOG BOX

- 14. Click **Save** to save the file to your computer.
- 15. Add the coverage to a map (like in ArcMap, as shown in Figure 2.14), or open it in a browser to view.

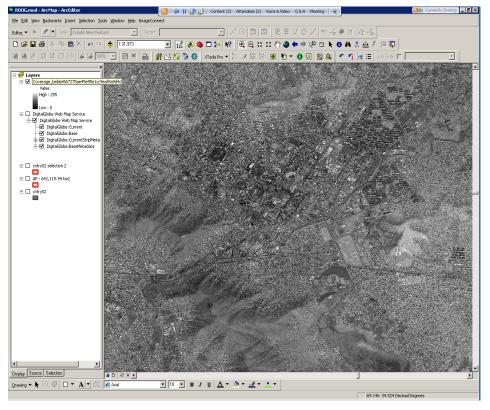


FIGURE 2.14 VIEW MAP - WCS

Refer to Table 2.2 for sample URLs.

TABLE 2.2 SAMPLE URLS

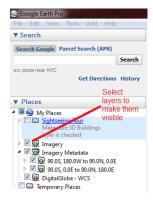
DGCS DATA LAYER	URL
EarthService (Imagery)	https://services.digitalglobe.com/earthservice/kmlaccess/DigitalGlobe:CitySphereTileService?connectid= <connectid></connectid>



MapService (ImageryFootprint)	https://services.digitalglobe.com/mapservice/wmsaccess?height=1024&widt h=1024&layers=DigitalGlobe:ImageryFootprint&request=GetMap&service= wms&styles=date&format_options=SUPEROVERLAY:false,KMPLACEMAR K:false,KMSCORE:50,KMATTR:true,&srs=EPSG:4326&format=application/ vnd.google-earth.kml+xml&transparent=false&version=1.1.1&BBOX=-180,- 90,180,90&connectid= <connectid></connectid>
Web Coverage Service	https://services.digitalglobe.com/deliveryservice/wcsaccess?SERVICE=WC S&CONNECTID= <connectid></connectid>

### 2.5 Verifying Layers in Google Earth

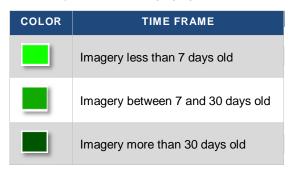
Select the checkboxes for all the layers under My Places in order to make them all visible (see Figure 2.15).



#### FIGURE 2.15 MAKING LAYERS VISIBLE

The metadata will show up at higher elevations as an outline with the timestamp at the center. The Region Tile's metadata is light blue in color. The metadata for strips is color-coded.

**TABLE 2.3 METADATA COLORS** 



Zoom to one of the Area of Interest (AOI) sites. You should start seeing the metadata at an altitude above 8,700 miles.

NOTE: The imagery layer is set to display at map scales of 1:200,000 and greater. This includes both EarthService and MapService. The best way to view coverage is to bring up the metadata layer (viewable at all scales) and then zoom in to the image strip until the imagery displays.

### 2.6 Installing Certificates

After creation of imagery and imagery metadata in Google Earth, the login may also prompt the user to verify the certificate for server authentication (Figure 2.16).

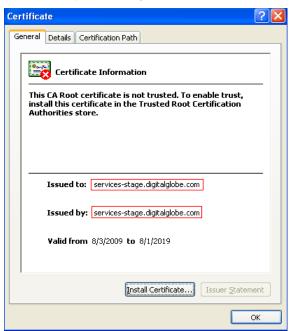




#### FIGURE 2.16 SECURITY ALERT POPUP

To install certificates, follow these steps:

1. In the Security Alert dialog box, click View Certificate. The Certificate dialog box displays (Figure 2.17).



#### FIGURE 2.17 CERTIFICATE - GENERAL TAB

16. Verify that the certificates are "services-stage" and click Install Certificate.... The Certificate Import Wizard opens (Figure 2.18).





#### FIGURE 2.18 CERTIFICATE IMPORT WIZARD

17. Click Next. The Certificate Store screen displays (Figure 2.19).



#### FIGURE 2.19 CERTIFICATE STORE LOCATION

- 18. Ensure that the option Automatically select the certificate store based on the type of certificate is selected. Click Next.
- 19. Click Finish. The Security Warning window displays (Figure 2.20).





#### FIGURE 2.20 SECURITY WARNING

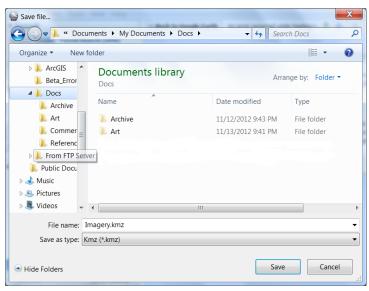
- 20. Click Yes.
- 21. A pop-up message stating, "The import was successful" appears. Click **OK** to complete the certificate installation.

### 2.7 Working with Layers

#### 2.7.1 SAVING A LAYER

To save a layer:

 On the Places panel, right-click a layer and select Save Place As. The Save File window displays (Figure 2.21).



#### FIGURE 2.21 SAVE FILE SCREEN

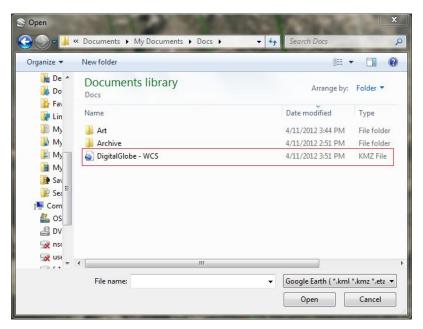
- The file name defaults to the name previously given to the layer. To change the name, edit the File name field.
- 23. From the Save as type drop-down, select Kmz (\*.kmz).
- 24. Click Save.

#### 2.7.2 LOADING A LAYER

To load a layer in Google Earth, perform the following steps:

1. From the **File** menu, select **Open**. The *Open* window appears (Figure 2.22).





#### FIGURE 2.22 LOADING A LAYER

25. Select the layer KMZ file you want to load and click **Open**. The layer will display under *Temporary Places* in the *Places* panel (Figure 2.23). Ensure that the checkbox next to the layer is selected in order to view the layer.

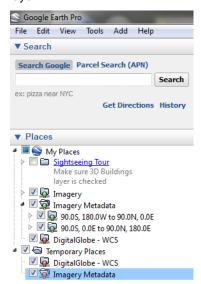


FIGURE 2.23 VIEWING LOADED LAYERS

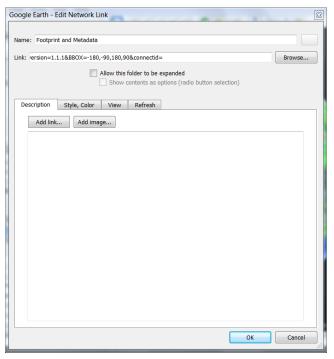
#### 2.7.3 CREATING LAYER TEMPLATES

You can use templates to easily create Google Earth layers. Create a template by following these steps:

- 1. Follow the steps mentioned in Adding EarthService as a Network Link on page 10 to create the layers. However, omit appending the <a href="ConnectID">ConnectID</a>> for each of the layers.
- 26. Save the layers as outlined in Working with Layers on page 20. These layers are saved in a file format that can easily be transferred to another computer.
- 27. To install the EarthService layer, select File > Open. The Open dialog box displays (Figure 2.22).
- 28. Navigate to the KMZ template file you created. This will create the template layer without the CONNECTID.
- 29. Right-click each layer and select **Properties**. The *Edit Network Link* window displays (see Figure 2.24).



30. In the Link field, type your ConnectID after the ...connectid=.



#### FIGURE 2.24 ADDING THE CONNECTID TO THE NETWORK LINK

- 31. Click **OK**.
- 32. Once created, move the layers to My Places in the Places panel (see Figure 2.9).

### 2.8 Applying Filters

When using MapService, you can filter the supplied data by including filter parameters in the WMS URL. Filters can be applied based on the following metadata attributes:

- Image Acquisition Date
- Cloud Cover Percentage
- Catalog ID
- Age in Days
- Off Nadir Angle
- Sun Elevation
- Sun Azimuth

Metadata filters begin with the following tag **CQL\_FILTER=**, while raster coverage (imagery) filters begin with the tag **COVERAGE\_CQL\_FILTER=**. Table 2.4 lists the available filters and their image calls.

**TABLE 2.4 FILTER CALLS** 

FILTER PARAMETER	DESCRIPTION	EXAMPLE CALL (PREFACED WITH &CQL_FILTER= OR &COVERAGE_CQL_FILTER=)
Catalog ID	The catalog ID for the image strip.	Catalog_identifier='1020010007808500'
Image Acquisition Date	The date that the image was acquired (in GMT).	Acquisition_date>'5/1/2009'
Age in Days  The age (in days) of the image from today's date.		Age_days<14
Off Nadir Angle  The off-nadir angle of the image. This is angle off 0-degrees that the satellite is pointed to take the image.		Off-nadir_angle<25



Cloud Cover %  The cloud cover percentage for the portion of the strip covering the area of interest.		Cloud_cover<.20
Sun Elevation	This is the angle between the horizon and the sun at time of acquisition or the sun elevation of the image.	Sun_elevation>15
This indicates (on a 360-degree scale) Sun Azimuth where the sun is in relation to the image on the ground or the sun azimuth of the image		sun_azimuth<240

→ NOTE: The value for cloud cover percentages are given in decimal format. For example, a value of 0.09 represents 9% cloud cover and a value of 0.99 represents 99% cloud cover. Values for Image dates and Catalog ID must be enclosed in apostrophes. For example, '5/7/2009'DGCS TIPS.



### 3 Improving Performance

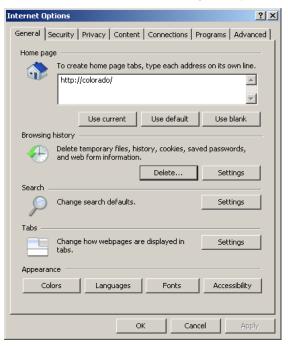
### 3.1 Refreshing the Imagery

The DGCS links do not refresh dynamically. In order for new imagery to populate in the DGCS layers, you must try to add the link again into your software or restart your application (if you have saved the layer in *My Places*). New imagery will not populate into your layer until the link is added again or the application is re-started.

### 3.2 Clearing Temporary Internet Files

Clearing your temporary Internet files can improve performance.

- In Internet Explorer, from the Tools menu, select Internet Options. The Internet Options dialog box displays (Figure 3.1).
- 33. On the General tab, under Browsing history, click the Delete button.



#### FIGURE 3.1 INTERNET OPTIONS DIALOG BOX

34. Click the buttons to delete Files, Cookies, History, and Forms. You can also select to delete Passwords but this will delete any saved passwords you have in your system, which generally do not use much memory.



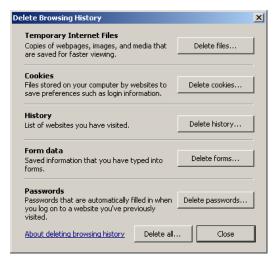


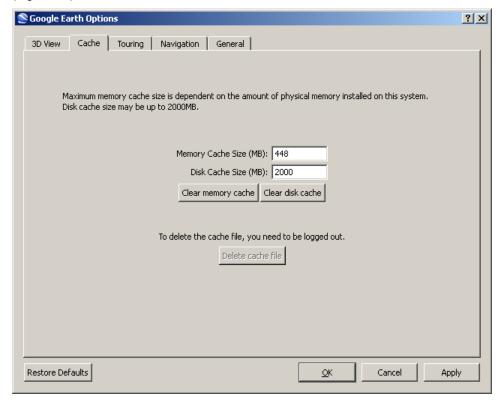
FIGURE 3.2 DELETE BROWSING HISTORY

35. When you are finished, click Close and then OK.

### 3.3 Clearing the Google Cache

Clearing out the Google Earth cache can improve performance.

 In Google Earth, from the **Tools** menu, select **Options**. The *Google Earth Options* dialog box displays (Figure 3.3).



#### FIGURE 3.3 CLEAR CACHE

- 36. On the Cache tab, click the Clear memory cache and Clear disk cache buttons.
- 37. Click OK.



### 3.4 Uncheck Extraneous Layers in Google Earth

If your layers seem to be running slowly, or if your computer runs slowly when the DGCS layers are loaded into a Google client, try this tip. From Google Earth's **View** menu, deselect some layers (for example, **Atmosphere**, **Sun**, **Historical Imagery**, and **Water Surface**).



FIGURE 3.4 UNCHECK EXTRANEOUS LAYERS

### 3.5 Google Earth Toolbar

The following table describes the buttons on the Google Earth toolbar.

**TABLE 3.1 GOOGLE EARTH TOOLBAR** 

BUTTON	NAME	DESCRIPTION
	Show/Hide Sidebar	Click to show/hide the sidebar.
<b>♦</b> <sup>†</sup>	Add Placemark	Click to mark a place on the map.
<b>⊘</b> <sup>+</sup>	Add Polygon	Click to add a polygon.
<b>3</b> <sup>+</sup>	Add Path	Click to add a path.
<b>⊘</b> <sup>†</sup>	Add Image Overlay	Click to overlay an image.
●	Record a Tour	Record your movements around the map, with or without audio narration.
<b>@</b>	Show Historical Imagery	View historical imagery over timelapse. Use the time slider to see images from a certain timeframe.
<b>*</b>	Show Sunlight	View the sun's position over the selected area. Use the time slider to see images during specific timeframes.
<b>∅</b> <sub>▼</sub>	Switch Planets	View the Earth, Sky, Mars or Moon.
	Show Ruler	Specify the measurements by which to guage the imagery.
$\boxtimes$	Email	Attach one of the following to an e-mail: screenshot, KML (for Google Earth), or Selected Placemark/Folder (for Google Earth).



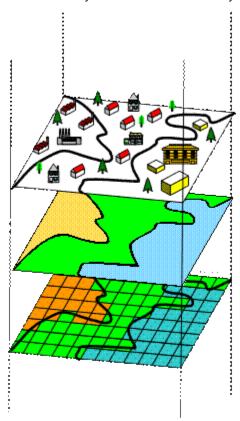
Print	Click to print one of the following: screenshot of 3D view, recent search results, or selected My Places folder
View in Google Maps	Click to open the image in Google Maps.



### 4 Good to Know

### 4.1 Layers

A *layer* refers to various overlays of data, each of which normally deals with one thematic topic. These overlays are registered to each other by the common coordinate system of the database.



#### FIGURE 4.1 GIS LAYERS

The figure above shows a map. The top layer shows the symbols representing the location of houses, factories, or commercial centers. The black lines represent the land use boundary. The middle layer shows the land use map and the bottom layer is the conversion from the land use map into raster model.

#### 4.2 Zoom Levels

Zoom Level is a capability for proportionately enlarging or reducing the scale of a figure or map.

DigitalGlobe Cloud Services uses a multiple-image layer to depict the globe, which depends upon spatial resolution. The displayed image at a particular zoom level will be directly proportionate to the spatial resolution of the satellite data. Each zoom level will display images based on the visibility factor and ground representation factor. The figure below illustrates the systematic display of satellite images based on the spatial resolution.



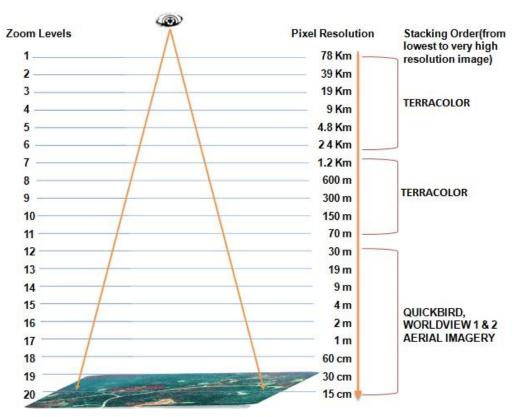


FIGURE 4.2 ZOOM LEVELS

DGCS offers 20 different zoom levels for displaying imagery. Each zoom level uses images from different sources, and provides varying resolution, as shown in Table 4.1.

**TABLE 4.1 ZOOM LEVELS** 

RESOLUTION LEVEL	PIXEL RESOLUTION	ZOOM LEVEL	SOURCE
Low	2.4 km to 7.8 km	1 to 6	terracolor
Medium	70 m to 1.2 km	7 to 11	terracolor
High	.15 m to 30 m	12 to 20	QB, WV1, WV2, aerial

Users have access to imagery based on their subscription with DigitalGlobe. Please contact us for more information about subscription levels.

#### 4.3 Raster and Vector Data

Raster data is an abstraction of the real world, where spatial data is expressed as a matrix of cells or pixels with spatial position implicit in the ordering of the pixels. With the raster data model, spatial data is not continuous, but divided into discrete units. This makes raster data particularly suitable for certain types of spatial operation, for example overlays or area calculations (refer to Figure 4.3). Raster structures may lead to increased storage in certain situations, since they store each cell in the matrix regardless of whether it is a feature or simply 'empty' space.



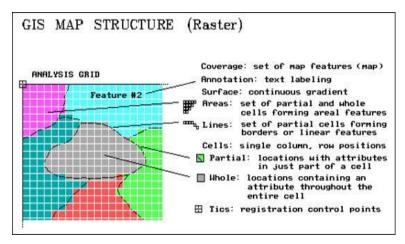


FIGURE 4.3 RASTER DATA

#### **Vector Data**

*Vector* is a data structure used to store spatial data. Vector data comprises lines or arcs, defined by beginning and end points, which meet at nodes. The locations of these nodes and the topological structure are usually stored explicitly. Features are defined by their boundaries only and curved lines are represented as a series of connecting arcs. Vector storage involves the storage of explicit topology, which raises overhead. However, it only stores those points which define a feature and all space outside these features is 'non-existent.'

A vector-based GIS is defined by the spatial and thematic representation of its geographic data. According to the characteristics of this data model, geographic objects are explicitly represented and, within the spatial characteristics, the thematic aspects are associated.

There are different ways of organizing this double database (spatial and thematic). Usually, vector systems are composed of two components: the one that manages spatial data and the one that manages thematic data. This is the named hybrid organization system, as it links a relational database for the attributes with a topological one for the spatial data. A key element in these kinds of systems is the **identifier** of every object. This identifier is unique and different for each object and allows the system to connect both databases. Refer to Figure 4.4.

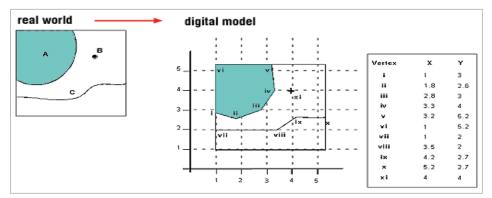


FIGURE 4.4 VECTOR DATA

#### 4.4 KML and KMZ

Keyhole Markup Language (KML) is a file format used to display geographic data in an Earth browser such as Google Earth, Google Maps, and Google Maps for mobile.

A Keyhole Markup Language Zip (KMZ) file consists of a main KML file and zero or more supporting files that are packaged using a Zip utility into one unit, called an archive. The KMZ file can then be stored and emailed as a single entity. A network link can fetch a KMZ file from a web server. When the KMZ file is unzipped, the main .kml file and its supporting files are separated into their original formats and directory structure, with their original filenames and extensions. In addition to being an archive format, the zip format is also compressed. So an archive can include only



a single large KML file. Depending on the content of the KML file, this process typically results in 10:1 compression. Your 10 Kbyte KML file can be served with a 1 Kbyte KMZ file.

Google Earth and Google Maps can read KML and KMZ files directly, and they can save files as KMZ files. By default, the main KML file is named doc.kml.

#### 4.5 Metadata

Metadata is a summary document providing content, quality, type, creation, and spatial information about a data set. It can be stored in any format such as a text file, Extensible Markup Language (XML), or database record. Because of its small size compared to the data it describes, metadata is more easily shareable. By creating metadata and sharing it with others, information about existing data becomes readily available to anyone seeking it. Metadata makes data discovery easier and reduces data duplication.

GIS metadata has a spatial component such as the extent of the Earth's surface the data covers. Metadata can describe GIS data, a GIS Cloud Service, or an online metadata catalog. Metadata can also describe non-electronic data, such as paper maps or offline electronic data such as data stored on CD or tape media. Open standards for metadata enable the data clearinghouse concept, also known as a catalog service.

### 4.6 Image Content Specification

The key features of satellite imagery are provided in this section.

#### Coverage

The spatial and temporal extent(s) pertaining to the satellite coverage relates to the content of the image, rather than its collection or management. Likely coverage includes the spatial location (whether it is a grid reference, place name, or more ephemeral locator) and temporal period (whether a date, date range, or period label.

#### **Sensors**

Each satellite carries sensors which measure the amount of visible light, thermal (infrared) radiation, and radiation from other parts of the electromagnetic spectrum coming from the Earth. Each sensor is only sensitive to a small part of the spectrum. So, multiple sensors are fitted to each scanner.

#### Resolution

The level of image detail or sharpness is determined by how many picture elements compose an area of display or corresponding raster object. Resolution may refer to sensors, raster objects, or displays. Low-resolution display devices produce images with a grainy visual texture. High-resolution displays use such small picture elements that they can produce a near-photographic quality image.

#### **Accuracy**

The difference between the locations of an object as specified in GIS, and its true location in the real world.

#### Refresh

The temporal change of the satellite image archive.

#### **Cloud Cover**

Cloud cover (also known as cloudiness, cloud age or cloud amount) refers to the fraction of the sky obscured by clouds when observed from a particular location. The coverage is represented by percentile.

#### **Off-Nadir Angle**

Nadir is when the satellite is looking straight down. QuickBird, a high resolution satellite owned and operated by DigitalGlobe, can be rotated to see targets on either side or ahead or behind. High off-nadir angles can mean lower quality in terms of geo-location accuracy and resolution, while tall objects can conceal targets.

For new acquisitions, you can define the off-nadir range preferred. 0-10° is the minimum (better quality, but very long acquisition windows due to low revisit); 0-25° gives a good balance between quality and revisit time.



TABLE 4.2 CONTENT SPECIFICATION OF DIGITALGLOBE SATELLITE SERVICES

	CITYSPHERE	ADDITIONAL WORLD METROS	COUNTRY COVERAGE	PRECISION AERIAL (U.S. & EUROPE)	WORLD BASE MOSAIC
SUMMARY	Full color mosaic of the world's top metros	Full color mosaic of the world's top metros, population, cultural features	Extensive country coverage of DigitalGlobe's archive of 40 top countries	High resolution aerial imagery	Mid resolution imagery layer covering the Earth's entire land mass
COVERAGE	300 Top world metros	Over 1500 population and cultural features	Deep strip coverage of urban, rural and coastal areas	Entire continental US and much of Western Europe	Every continent and most islands, excluding Antarctica
SENSORS	Primarily QuickBird, WorldView-2, aerial in some regions	QuickBird, WorldView-2	QuickBird, WorldView-2	DigitalGlobe aerial (metros), USDA, NAIP, USGS, Nat 1 map, USGS DOQQ	NASA LandSat satellites
RESOLUTION	60 cm or better	60 cm	60 cm	1 m to 16 cm	15 m
ACCURACY	Primarily 1:12,000, some 1:4800 and 1:50,000	1:50,000	1:50,000	1:12,000 to 1:4800	1:200,000
REFRESH	Yearly	Varies. Updated periodically at DigitalGlobe discretion	Varies. Additional content added quarterly	Varies by location	Varies
CLOUD COVER	Less than 10%	Less than 10%	Less than 20%	Cloud free	Cloud free
OFF-NADIR ANGLE	Less than 20°	Less than 25°	Less than 20°	Varies	Varies

### 4.7 DigitalGlobe Projection System

Projection is a mathematical means of converting the three-dimensional model of the Earth's surface to represent a two-dimensional medium – on plain paper or a computer screen. There are different methods to represent the Earth's surface and each one has its own unique characteristics. Selection of a map projection system plays a key role for any kind of GIS. DigitalGlobe uses the following types of projection for their products:

TABLE 4.3 LIST OF PROJECTION SYSTEMS USED BY DIGITALGLOBE PRODUCTS

S.NO	EPSG CODE	DATUM	COORDINATE SYSTEM	ZONES
1	3395	WGS 84	World Mercator	
2	26903 - 26923	NAD 83	UTM	3N - 23N
3	900913	WGS 84	Simple Mercator	



S.NO	EPSG CODE	DATUM	COORDINATE SYSTEM	ZONES
4	4269	NAD 83	GEOGCS GCS	
5	26703 - 26722	NAD 27	UTM	3N-23N
6	4267	NAD 27	GEOGCS GCS	
7	27700	OSGB 1936	British National Grid	
8	4231	European_1987	GEOGCS GCS	
9	32201-32230 & 32301 - 32360	WGS72	UTM	1N-60N and 1s-60s
10	4322	WGS 72	GEOGCS GCS	

#### **European Petroleum Survey Group (EPSG)**

EPSG Geodetic Parameter Dataset, or EPSG dataset, is maintained by the Geodesy Subcommittee of the Surveying & Positioning Committee of the International Association of Oil & Gas Producers (OGP). The European Petroleum Survey Group table defines numeric identifiers (the EPSG code) for many common projections and associate projection or coordinate metadata (such as measurement units or central meridian) for each identifier.

The EPSG codes can be used to identify the Coordinate Reference System (CRS) for coordinates used in dataset encoded in GML (Geography Markup Language). They can also be used to request the desired map projection for a Web Map Service (WMS) GetMap request.

#### **Datum**

Datum is a mathematical model which approximates the shape of the Earth. The datum is physically represented by a framework of ground monuments whose position has been accurately measured and calculated on the reference surface (such as benchmarks). Lines of latitude and longitude on a map are referenced to a specific map datum.

#### **Coordinate System**

A coordinate system is a geometrical measurement of a position, using one or more reference points. Coordinate system is a standardized method for assigning codes to locations, so that locations can be found using the code alone. Standardized coordinate systems use absolute locations. Some of the standard coordinate systems used are as follows:

- Geographic coordinates (Lat-long, geodetic lat long, Earth Centered Earth Fixed XYZ)
- Universal Transverse Mercator (UTM) system
- World Mercator

#### World Geodetic System - 84

The World Geodetic System - 1984 (WGS 84) coordinate system is a Conventional Terrestrial System (CTS), realized by modifying the Navy Navigation Satellite System (NNSS), or TRANSIT, Doppler Reference Frame (NSWC 9Z-2) in origin and scale, and rotating it to bring its reference meridian into coincidence with the Bureau International de l'Heure (BIH) - defined zero meridian.

Origin and axes of the WGS 84 coordinate system are defined as following:

- Origin = Earth's centre of mass
- Z-Axis = Direction of the Conventional Terrestrial Pole (CTP) for polar motion, as defined by BIH on the basis of the coordinates adopted for the BIH stations
- X-Axis = Intersection of the WGS 84 reference meridian plane and the plane of the CTP's equator, the reference meridian being the zero meridian defined by the BIH on the basis of the coordinates adopted for the BIH stations
- Y-Axis = Completes a right-handed, Earth Centered, Earth Fixed (ECEF) orthogonal coordinate system, measured in the plane of the CTP equator, 90° East of the x-axis.



#### Universal Transverse Mercator

The National Imagery and Mapping Agency (NIMA) (formerly the Defense Mapping Agency) adopted a special grid for military use throughout the world called the Universal Transverse Mercator (UTM) grid. In this grid, the world is divided into 60 north-south zones, each covering a strip 6° wide in longitude. These zones are numbered consecutively beginning with Zone 1, between 180° and 174° west longitude, and progressing eastward to Zone 60, between 174° and 180° east longitude. Thus, the conterminous 48 States are covered by 10 zones, from Zone 10 on the west coast through Zone 19 in New England (Figure 4.5). In each zone, coordinates are measured north and east in meters. (One meter equals 39.37 inches, or slightly more than 1 yard.) The northing values are measured continuously from zero at the Equator, in a northerly direction. To avoid negative numbers for locations south of the Equator, NIMA's cartographers assigned the Equator an arbitrary false northing value of 10,000,000 meters. A central meridian through the middle of each 6° zone is assigned an easting value of 500,000 meters. Grid values to the west of this central meridian are less than 500,000; to the east, more than 500,000.

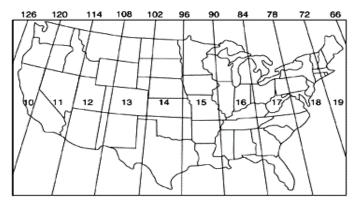


FIGURE 4.5 UNIVERSAL TRANSVERSE MERCATOR GRID

### 4.8 Stacking Profiles

Stacking Profiles are configurable by customer and account. Stacking profiles determine which imagery is displayed first in cases where a particular image is not requested but multiple are available. These stacking profiles will be used to help customize the same library for different segments, users and needs. It determines the default imagery according to a user or account preference. If a request is made to DigitalGlobe's services for a particular area (but not for a particular image ID or metadata), Stacking Profiles "choose" which image to respond to the request. DigitalGlobe provides four stacking profiles:

#### **Default**

The default stacking profile provides the most-recent image among available images as the default. There is no low resolution base mosaic. This profile begins returning imagery at zoom level 13.

#### **Cloud Cover**

The Cloud Cover stacking profile will return the image with the lowest available cloud cover by default. The base mosaic for this dataset is NaturalVue. Available for all zoom levels.

#### **Accuracy**

The Accuracy stacking profile will return the image with the best available accuracy by default. The base mosaic for this dataset is NaturalVue. Available for all zoom levels.

#### **Currency RGB**

The Currency RGB profile excludes all panchromatic/black and white imagery from default responses, with the most-recent imagery displayed. Available for all zoom levels.



#### **True Currency**

The True Currency stacking profile provides the most-recent image among available images as the default. The base mosaic for this dataset is NaturalVue. Available for all zoom levels.

#### **Global Currency**

The Global Currency stacking profile provides the most-recent image among available images as the default. The base mosaic for this dataset is TerraColor. Available for all zoom levels.

#### Consumer

The Consumer stacking profile provides the most-aesthetic image by default, preferring aerial where available, then mosaics, then color imagery. The base mosaic for this dataset is TerraColor. Available at all zoom levels.

### 4.9 Bounding Box

The Bounding Box (BBOX) is a set of four comma-separated decimal, scientific notation or integer values representing the geo referenced bounding parameters of Area of Interest (AOI). These values specify the Minimum X, Minimum Y, Maximum X, and Maximum Y (in that order), expressed in units of the Spatial Reference System (SRS) of the request, such that a rectangular area is defined in those units.

The four Bounding Box values indicate the outside edges of a rectangle. In Figure 4.6, Minimum X is the left edge, Maximum X the right, Minimum Y the bottom, and Maximum Y the top. The relation of the Bounding Box to the image pixel matrix is shown in the figure: the bounding box goes around the "outside" of the pixels of the image rather than through the centers of the border pixels. In this context, individual pixels have an area.

#### Rules to follow while defining BBOX:

- A Bounding Box should not have zero area.
- Minimum X should be less than or equal to the Maximum X. Minimum Y should be less than or equal to the Maximum Y.

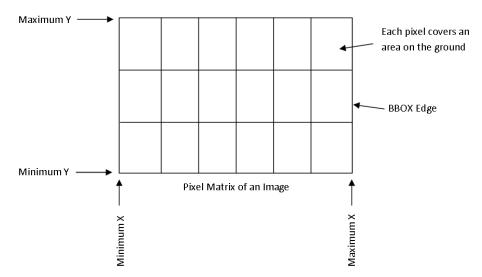


FIGURE 4.6 PICTORIAL REPRESENTATION OF BOUNDING BOX

### 4.10 Understanding URL and Parameters

The following table provides sample URLs for adding the DGCS in Google Earth. From the **Sample URL**, you may note that the parameter (marked in red) calls the corresponding **Service**.



#### TABLE 4.4 DGCS & SAMPLE URLS

SERVICE	LAYER	SAMPLE URL
EarthService (Imagery)	CitySphereTileService	https://services.digitalglobe.com/earthservice/kmlaccess/DigitalGlobe:CitySphereTileService?connectid= <connectid></connectid>
	CountryCoverageTileSer vice	https://services.digitalglobe.com/earthservice/kmlaccess/DigitalG lobe:CountryCoverageTileService?connectid= <connectid></connectid>
	CrisisEventTileService	https://services.digitalglobe.com/earthservice/kmlaccess/DigitalGlobe:CrisisEventTileService?connectid= <connectid></connectid>
MapService (ImageryFootprint)	ImageryFootprint	https://services.digitalglobe.com/mapservice/wmsaccess?height =1024&width=1024&layers=DigitalGlobe:ImageryFootprint&requ est=GetMap&service=wms&styles=date&format_options=SUPE ROVERLAY:false,KMPLACEMARK:false,KMSCORE:50,KMATT R:true,&srs=EPSG:4326&format=application/vnd.google-earth.kml+xml&transparent=false&version=1.1.1&BBOX=-180,-90,180,90&connectid= <connectid></connectid>
Web Coverage Service	DeliveryService	https://services.digitalglobe.com/deliveryservice/wcsaccess?SE RVICE=WCS&CONNECTID= <connectid></connectid>



### 5 DigitalGlobe Cloud Services (DGCS)

### 5.1 Getting to Know DGCS

DigitalGlobe's Cloud Services unlock the power of the world's largest online library of high-resolution Advanced Ortho imagery. With our extensive suite of OGC-compatible Cloud Services combined with our powerful hosting infrastructure, we can instantly deliver current, high-resolution imagery and geospatial information to desktops, portals, intranets and mobile devices around the world.

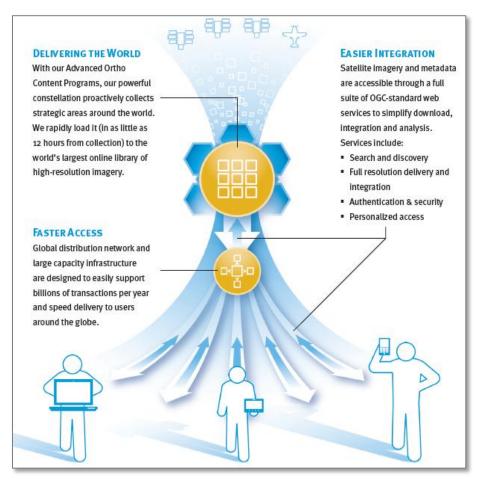


FIGURE 5.1 DGCS PROCESSES

### 5.2 Things You Can Do with DGCS

The DigitalGlobe Cloud Services (DGCS) layers have been designed based on the Open Geospatial Consortium (OGC) standards and can be integrated easily with most GIS software clients and portals. It gives users the ability to access and view imagery, the associated data points or metadata specific to imagery and types of imagery (e.g. vector, raster, etc.).

#### 5.2.1 SEARCH AND DISCOVERY

DigitalGlobe provides you with multiple ways to search the ImageLibrary, identify what imagery is available, and even access preview imagery for visual assessment. With these services, you can create a highly customized interface for your application, and let users discover imagery using the criteria that are important to them. DigitalGlobe supports OGC-compliant WFS, that offers metadata as well as access to low resolution imagery previews.



#### 5.2.2 IMAGE DELIVERY

Get maximum flexibility with access to high-resolution imagery in a wide range of compressed and uncompressed formats that can be integrated into nearly any kind of geospatial application.

- Supports major OGC standards, including WMS, WMTS, WCS, WFS and KML
- Compressed formats include JPEG, PNG, geospatial PDF, MrSID and more
- Uncompressed format includes GeoTIFF
- EarthService provides native compatibility for KML-based Earth Viewers, including Google Earth
- ImageConnect plug-in delivers georeferenced, multi-temporal imagery into your ArcGIS application via a simple yet powerful interface.

#### 5.2.3 DATA INTEGRATION

DigitalGlobe can host your geo-located data and deliver it alongside content from our ImageLibrary. By leveraging DGCS, we can provide you with a single, centralized solution for all your geospatial applications, from Google Earth to desktop GIS, Oracle Spatial or custom enterprise applications.

#### 5.2.4 AUTHENTICATION AND SECURITY

DigitalGlobe recognizes that geospatial data can contain very sensitive information; therefore we have implemented the necessary security measures to ensure that your data is yours alone.

- 128-bit SSL encryption
- Access to custom imagery catalogs based on rigorous authentication
- Optional behind-the-firewall solutions that can be deployed within your secure environment

#### 5.3 Personalized Access

DGCS enables us to create tailored imagery programs to suit your needs, from the entire globe to a set of strategic sites. Whether you are supporting navigation devices or monitoring specific areas of interest, we can deliver the right imagery, at the right time, for the right price.

### 5.4 Types of DGCS and Definitions

#### 5.4.1 WEB MAP SERVICE (WMS)

The DigitalGlobe Web Map Service (WMS) provides a simple HTTPS interface for requesting geo-registered map images from one or more distributed geospatial databases. A WMS request defines the geographic layer(s) and area of interest (AOI) to be processed. The response to the request is one or more geo-registered map images (returned as JPEG, PNG, etc.) that can be displayed in a browser application. The interface also supports the ability to specify whether the returned images should be transparent so that layers from multiple servers can be combined or not.

#### 5.4.2 WEB MAP TILE SERVICE (WMTS)

A WMTS-enabled server application can serve map tiles of spatially referenced data using tile images with predefined content, extent, and resolution.

The DigitalGlobe WMTS provides raster imagery data at multiple resolutions in predefined imagery tiles in PNG format. The Web Map Tile Service is similar to Web Map Service, but it enables better server performance in applications that involve several simultaneous requests. To improve performance, rather than creating a new image for each request, it returns small pre-generated images or reuses identical previous requests that follow a discrete set of tile matrices. This service is optimized for rapid image tile delivery for display on portals or applications where response time is of primary concern.

### 5.4.3 WEB FEATURE SERVICE (WFS)

The OGC WFS Interface Standard provides an interface allowing requests for geographical features across the web using platform-independent calls. While a WMS interface or online mapping portals like Google Maps return only an image, which end-users cannot edit or spatially analyze, the XML-based GML furnishes the default payload-encoding for transporting the geographic features. Other formats like shapefiles can also serve for transport. The OpenGIS GML Simple Features Profile is designed to increase interoperability between WFS servers and improve the ease of implementation of the WFS standard.



#### 5.4.4 WEB COVERAGE SERVICE (WCS)

The DigitalGlobe Web Coverage Service allows the end user to directly download raster imagery data. WCS supports four types of formats, namely; Geospatial PDF, MrSID, JPEG200 and GeoTIFF. The Service treats each available product as a separate coverage; therefore the imagery returned depends on the layer being accessed. If data is requested from the current layer, then the returned imagery product is a portion of a current layer strip collection. If the data is requested from the base layer, then the returned imagery product is a portion of a base layer.

### 5.5 Cloud Services Data Types

The DGCS system provides access to imagery, imagery products, and imagery metadata over the World Wide Web via a suite of standards-based, OGC-compliant Cloud Services. These services provide access to products contained in DigitalGlobe's Online Catalogs. These catalogs contain metadata describing each of the available imagery products.

The data available from these catalogs via each of the services is summarized in the table below.

#### **TABLE 5.1 CLOUD SERVICES DATA TYPES**

SERVICE	TYPE OF DATA	DESCRIPTION
Web Map Service	Product metadata; Raster maps	Provides product metadata and map images for the OGC Layers of the online imagery catalogs.
Web Map Tile Service	Tiled raster maps	Provides cached map tiles at multiple levels of resolution. Tiles are provided for specific OGC Layers.
Web Feature Service	Product metadata	Provides product metadata in Geographic Markup Language (GML) format for each online imagery catalog.
Web Coverage Service	Full-resolution imagery	Provides downloadable products for defined coverage areas; each product in the online finished product catalogs constitutes a separate coverage.

The remainder of this document describes the detailed capabilities and data provided by each of the Cloud Services.

### 5.6 Advantages of DGCS

#### 5.6.1 EASY OPERABILITY

DGCS is powerful and easy to use. The advantages that emphasize easy operability are:

- Compatibility with most of the leading GIS software tools
- Minimal technical intervention for setting up the service
- Functionalities are uncomplicated and easy for user initiation
- Cloud Services can be easily integrated to custom applications, if required.

#### 5.6.2 THE DIGITALGLOBE CONSTELLATION

DigitalGlobe owns and operates the most agile and sophisticated constellation of high-resolution commercial Earth imaging satellites. QuickBird, WorldView-1 and WorldView-2 together are capable of collecting over 500 million km<sup>2</sup> of quality imagery per year and offering intraday revisit times around the globe. Add to that our aerial program offering wall-to-wall coverage of the U.S. and Western Europe.

There is no longer a question of whether timely imagery is available. If we don't already have what you need in our vast ImageLibrary, we can get it faster than ever before. With the addition of our newest satellite, WorldView-2:

- 80% of tasking orders were delivered within 25 days\*
- 80% of Select Plus tasking orders were completed within 11 days\*

Our constellation features several technical advantages:

- Largest sub-meter high-resolution constellation
- Highest collection capacity
- Outstanding geolocational accuracy
- Largest high-resolution swath width
- Greatest in-track stereo collection
- Most spectral diversity commercially available



### 5.7 Support

DigitalGlobe has worked to simplify the process of getting your imagery-supported applications up and running quickly. We can provide you with robust documentation and SDKs to speed up the implementation process, as well as extensions to standard GIS applications. Plus, our professional services team is ready to assist you in integrating our Cloud Services into your custom enterprise environment.

Please contact DigitalGlobe at 800.496.1225 or cloudservices@digitalglobe.com.

#### 5.8 References

- http://www.opengeospatial.org/standards
- http://en.wikipedia.org/wiki/Web\_Map\_Service
- http://en.wikipedia.org/wiki/Web\_Feature\_Service
- http://www.opengeospatial.org/standards/wcs
- http://en.wikipedia.org/wiki/GIS#OGC\_standards
- http://www.wikipedia.org/
- http://en.wikipedia.org/wiki/Geography Markup Language



## Glossary

#### **AOI**

Area of Interest. The area on the Earth that you want to view.

#### **Bilinear Interpolation**

Bilinear interpolation uses the value of the four nearest cell centers to determine the value on the output raster. The new value is a weighted average of these four values, adjusted to account for their distance from the center of the output cell. The result is a smoother-looking surface than provided by "nearest neighbor".

#### **Bicubic Interpolation**

Bicubic interpolation combines data points on a two-dimensional grid. This method outputs the smoothest surface of all interpolation methods.

#### **Geographic Projection**

#### **GeoTIFF** format

A GeoTIFF file is a TIFF file that is embedded with geographic data tags.

#### **GML**

Geography Markup Language. GML is XML code used to express geographical features.

#### JPEG2000 format

The JPEG2000 format is a JPEG format that was introduced in the year 2000. It has considerable advantages over basic JPEG format including error resilience and progressive transmission.

#### MrSid format

Multi-Resolution Seamless Image Database. This format compresses large raster images while maintaining the image quality.

#### **National Imagery Transmission Format**

See NITF format.

#### **Nearest Neighbor Interpolation**

Uses the value of the closest point and disregards all other values, yielding a piecewise-constant interpolant.

#### **NITF** format

National Imagery Transmission Format. A United States Department of Defense standard for transmitting and storing digital imagery.

#### **OGC**

Open GIS Consortium. An international standards organization comprised of commercial, governmental, nonprofit and research organizations. They support geospatial content development as well as data processing and sharing.

#### **OWS**

OGC Web Service Common.

#### **Seamlines**

Overlapping raster datasets can be blended along the seamline by a specified width. Seamlines are created with the Seamline extension tools, and are stored as shapefiles within the image service definition.

#### **Universal Transverse Mercator Geographic Coordinate System**

See UTM.



#### **UTM**

Universal Transverse Mercator Geographic Coordinate System. UTM utilizes a two-dimensional Cartesian system to specify locations on the Earth's surface.

#### **WCS**

Web Coverage Service.

#### **WebCGM**

Web Computer Graphics Metafile.

#### **WFS**

Web Feature Service.

#### **WMS**

Web Map Service.

#### **WMTS**

Web Map Tile Service.



# Index

accuracy, overview, 31	layer
age in days, call, 22	creating templates of, 21
bounding box	loading, 20
details, 7	saving, 20
overview, 35	layers
catalogID, call, 22	illustrated, 28
CitySphereTileService, overview, 6	making visible, 17
cloud cover %, call, 23	overview, 28
cloud cover, overview, 31	sample URLs, 16
ConnectID	verifying in Google Earth, 17
adding to link, 22	Map Service
description, 6	adding as a network link, 11
Coordinate System, overview, 33	Map Service capability, illustrated, 7
coverage, overview, 31	MapService, overview, 7
data layers, sample URLs, 16	metadata, colors of, 13, 17
·	
Datum, overview, 33	metadata, overview, 31
DGCS	network link
accessing in Google Earth, 9	example URL, 10
adding imagery, 9	off nadir angle, call, 22
authentication and security, 38	off-nadir angle, overview, 31
constellation, 39	projection system, overview, 32
data integration, 38	raster data
data layers, sample URLs, 16	illustrated, 30
image delivery, 38	raster data, overview, 29
overview, 37	refresh, overview, 31
personalized access, 38	resolution, overview, 31
search and discovery, 37	sensors, overview, 31
support, 40	stacking profiles, overview, 34
Digital Globe Cloud Services. See DGCS	sun azimuth, call, 23
EarthService	sun elevation, call, 23
adding as network link, 10	temporary Internet files, clearing, 24
illustrated, 6	Universal Transverse Mercator
layers, 6	illustrated, 34
opening in Web browser, 9	overview, 34
overview, 6	vector data
EPSG, overview, 33	illustrated, 30
European Petroleum Survey Group. See EPSG	overview, 29
filter calls, 22, 26	view map, WCS, 16
filters, applying, 22	WCS
FirstLook, overview, 6	capabilities not supported, 8
Google cache, clearing, 25	overview, 7, 39
Google Earth	view map, 16
hiding layers, 26	Web Coverage Service. See WCS
installing, 8	Web Feature Service. See WFS
system requirements, 8	Web Map Service. See WMS
GoogleEarth, opening DGCS in, 9	Web Map Tile Service. See WMTS
hiding layers in Google Earth, 26	WFS, overview, 38
image acquisition date, call, 22	WMS
imagery, refreshing, 24	overview, 38
Internet files, clearing, 24	version supported, 7
KML, oveview, 30	WMTS, overview, 38 World Goodetic System, everyiow, 33
KMZ, overview, 30	World Geodetic System, overview, 33
DGCS IN GOOGLE EARTH – USER GUIDE	



zoom levels illustrated, 29

overview, 28