DGCS in ArcGIS User Guide

Cloud Service | August 2013

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1 ArcGIS Overview

1.1 Introduction

ArcGIS is a comprehensive suite of Geographic Information System (GIS) products that is used to display, create, and analyze geospatial data. This is developed by the Environmental Systems Research Institute (ESRI). ArcGIS comprises key components such as ArcGIS Desktop, ArcGIS Server, Mobile GIS, ArcGIS Explorer, and ArcGIS.com.

ArcGIS desktop is the principal product used by GIS professionals to manage, analyze, and compile geographic information. ArcGIS Server is an exhaustive server-based GIS that renders enterprise geo-data management capabilities and advanced GIS web services. Mobile GIS consists of a mobile device being used as a client to connect to Web GIS. ArcGIS Explorer is a free three-dimensional GIS viewer. ArcGIS.com is a web site used for working with online GIS maps and applications.

ArcEditor is a desktop ArcGIS application, which enables the user to create layered maps, perform basic spatial analysis, and consists of a set of advanced tools that are required to manipulate shapefiles and geodatabases.

ArcCatalog provides a catalog window that is used to organize and manage spatial and nonspatial data. It functions in a manner similar to Windows Explorer.

➔ As an alternative to using ArcCatalog, you can open and work with the Catalog window within ArcMap.

1.2 Installing the Application

Please visit the following link for detailed instructions on installation of the latest version of ArcGIS:
http://www.esri.com/software/arcgis/arcview/eval/evaluate.html

1.3 Supported Geospatial Services

Web Map Service (WMS) and Web Coverage service (WCS) are the two geospatial services that can be integrated with ArcGIS.

1.4 ArcMap and ArcCatalog Toolbars

Each icon of the toolbar of ArcMap and ArcCatalog is depicted below. This gives a better understanding about the icons in the user interface of the tool.

TABLE 1.1 ARCMAP TOOLBAR ICONS

ICON	TOOL TIP	DESCRIPTION
	Zoom in	Zoom in on the image.
	Zoom out	Zoom out of the image.
	Pan	Pan the image to obtain a better view.
	Full extent	Draw the image to full extent.
	Fixed zoom in	Selectively zoom in to a particular area of the image.
	Fixed zoom out	Selectively zoom out to a particular area of the image.
	Select elements	Select the desired feature.
	Identify	Identify the relevant area after the selection of a particular area on the map.
	Measure	Opens the Measure toolbox which helps you identify the area and perimeter of the feature.

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ICON	TOOL TIP	DESCRIPTION
	Find	Find a particular area on the map.
	Find route	Find the quickest way to a particular location.
	Go to XY	Move to the x- and y-coordinates.
	Create viewer window	Select a fixed area of zoom and view the image in the viewer window.
	New Map File	Create a new map file.
	Open	Open a map file that has already been created.
	Save	Save a map file.
	Print	Print a map file that has been created.
	Undo Add Layers	Undo the addition of layers to ArcMap.
	Add layers	Add layers to servers.
	Scale	View the map on this scale.
	Editor Toolbar	Edit the image using this icon.
	Table of Contents window	View the table of contents. This gives you a clear picture on the added layers and its components.
	Catalog window	View the catalog window. This consists of folders such as Home, Folder Connections, Toolboxes, Database Servers, Database connections, and GIS servers.
	Search window	Search for maps or layers.
	Arc Toolbox window	Opens the Arc Toolbox window for viewing various special extensions such as Geocoding Tools, Geostatistical Analyst Tools, Spatial Analyst Tools, and Tracking Analyst Tools. A host of other options are also available.
	Python window	View the display options of syntax in Python window.

TABLE 1.2 ARCCATALOG TOOLBAR ICONS

ICON	TOOL TIP	Description
	Connect to Folder	This icon is visible in ArcCatalog. You can choose the folder to which you want to connect.
	Catalog Tree window	This icon is visible in ArcCatalog. This option has the same function of Catalog window in ArcMap.

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2 DGCS in ArcGIS

2.1 Introduction

Web Map Service (WMS) provides raster imagery data in multiple resolutions for use in GIS applications in various formats. 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 the metadata of the layers contained in the online catalogs.

GetFeatureInfo

The *GetFeatureInfo* request is used to obtain metadata (information) about the features displayed in map images that are retrieved via GetMap requests.

2.2 WMS Capabilities

WMS enables the user to access metadata by connecting from any WMS compliant software, like ArcGIS. All transactions are encrypted using HTTPS and includes the ConnectID.

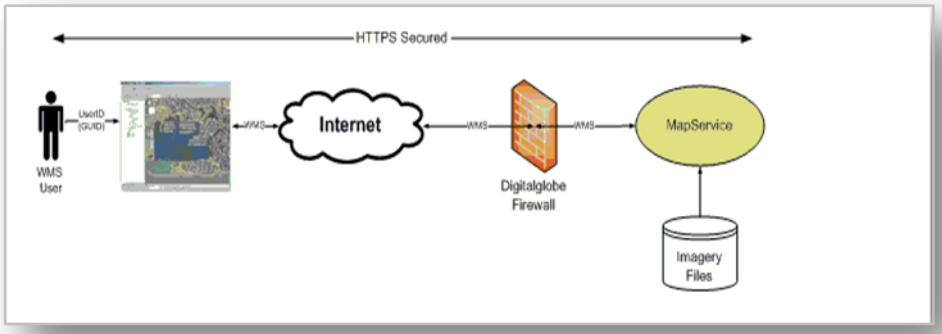

FIGURE 2.1 SCHEMATIC REPRESENTATION OF WEB MAP SERVICE CAPABILITY

2.3 Add WMS Server

ArcGIS has different versions that are available in the market. This document covers the integration of DGCS in ArcGIS 9.x and ArcGIS 10 versions. The integration steps are same for both versions. There may be differences in screen layouts in a few scenarios which are shown explicitly in the respective sections.

Follow the steps mentioned below to integrate WMS with ArcGIS.

1. Click **Programs**>**ArcGIS**>**ArcMap** to open ArcMap. This brings up the ArcMap screen to create new map (Figure 2.2 or Figure 2.3).

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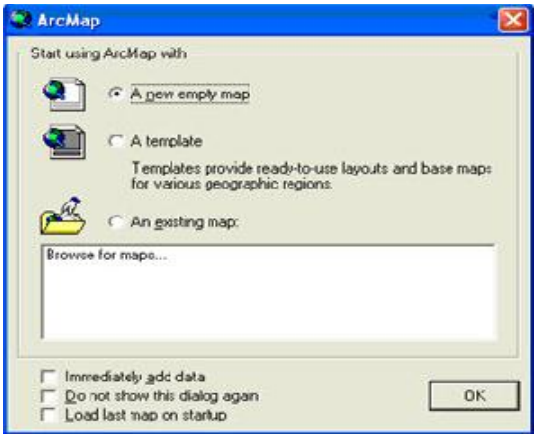

FIGURE 2.2 GETTING STARTED WINDOW IN ARCMAP 9.3

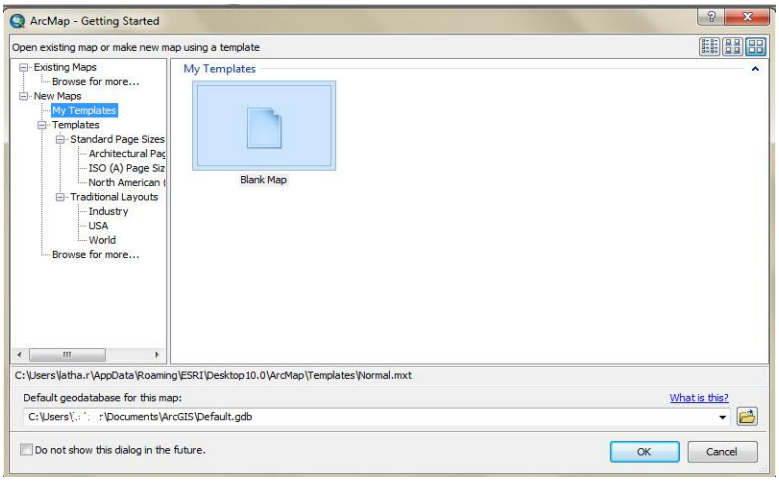

FIGURE 2.3 GETTING STARTED WINDOW IN ARCMAP 10

2. Click **OK**. The home page of ArcMap - ArcEditor displays (Figure 2.4).

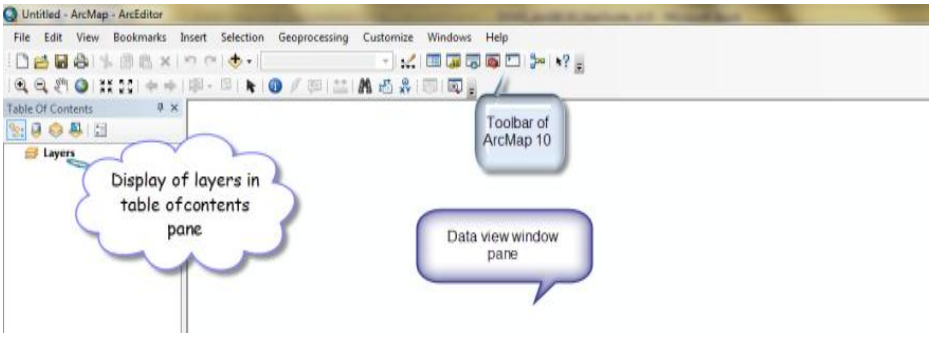

FIGURE 2.4 HOME PAGE OF ARCMAP - ARCEDITOR

3. Click the Add Data icon ( ) on the toolbar of ArcMap. The *Add Data* dialog box displays (Figure 2.5).

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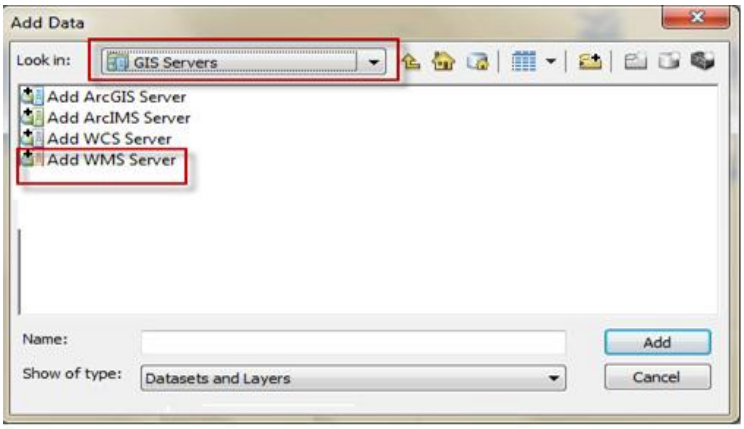

FIGURE 2.5 ADD DATA DIALOG BOX

4. From the **Look in** drop-down, select **GIS Servers**. The list will be populated with the list of GIS servers supported by ArcGIS for integration.
5. Select **Add WMS Server** and click the **Add** button. The *Add WMS Server* dialog box displays (Figure 2.6).

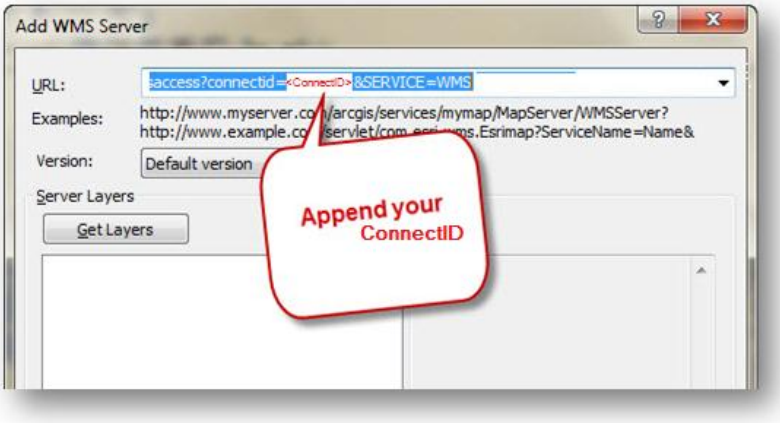

FIGURE 2.6 ADD WMS SERVER DIALOG BOX

6. Enter the details for the following fields in the *Add WMS Server* dialog box:
   - **URL.** Enter the WMS URL provided by DigitalGlobe.
     https://services.digitalglobe.com/mapservice/wmsaccess?SERVICE=WMS&connectid=<ConnectID>
     Replace <ConnectID> with the ConnectID provided by DigitalGlobe. The URL varies for different users and different layers. Please contact DigitalGlobe to get your URL. When typing the URL, ensure that there are no spaces.
   - **Version.** Select 1.1.1. Note that the latest specification released by OGC is 1.3.0. This version appears as the default version when you try to add WMS Server. The latest version implemented and supported by DigitalGlobe is 1.1.1.
   - **User.** (Optional) Only enter if DigitalGlobe provided you a user name.
   - **Password.** (Optional) Only enter if you have a password.
7. Click the **Get Layers** button. You will be connected to the DigitalGlobe WMS server and it will fetch the available layers. The layer tree structure displays just below the **Get Layers** button (refer to Figure 2.7).

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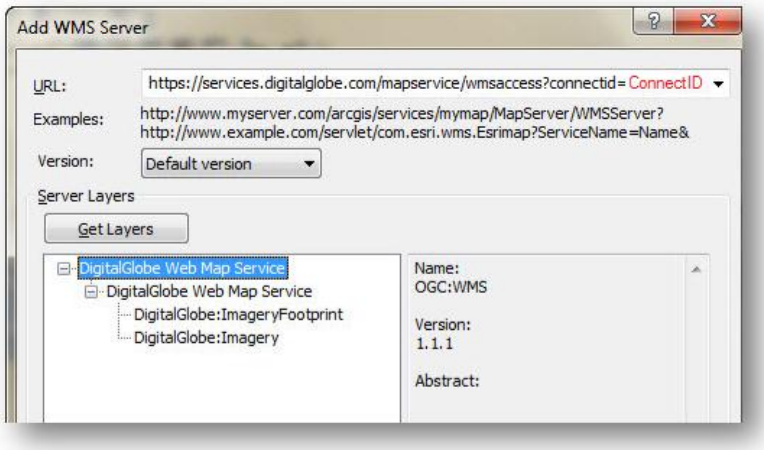

FIGURE 2.7 ADDITION OF DIGITALGLOBE WMS

8. Select **DigitalGlobe Web Map Service** as shown in Figure 2.7. Click **OK**. The name of the web service that you have added appears in the name field in the *Add Data* dialog box (Figure 2.8).

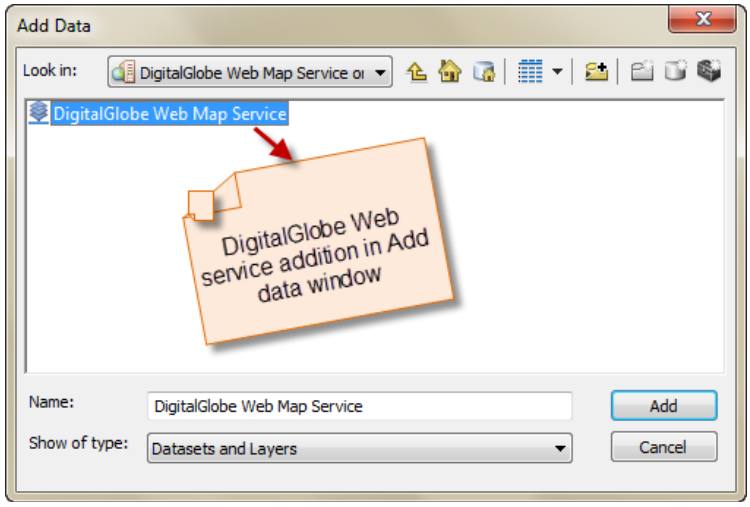

FIGURE 2.8 ADD DATA DIALOG BOX – WITH WMS

9. Select **DigitalGlobe Web Map Service** in the *Add Data* dialog box. The **Name** will be populated with "DigitalGlobe Web Map Service" as shown in Figure 2.8.
10. Click the **Add** button. The WMS layer gets integrated with ArcMap (refer to Figure 2.9).
    The DigitalGlobe Web Map Service is comprised of the following layers:

    - DigitalGlobe: ImageryFootprint
    - DigitalGlobe: Imagery

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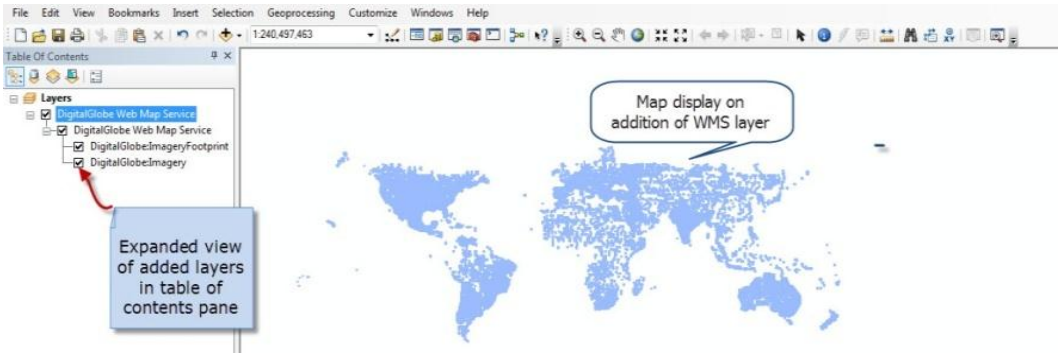

FIGURE 2.9 DISPLAY OF ADDED LAYERS

11. Click the **Zoom in** ( ) icon on toolbar to zoom in on the map and view your area of interest. The raster image is displayed as shown in Figure 2.10.

FIGURE 2.10 RASTER IMAGE DISPLAY

2.4 Saving a Layer

A layer can be saved after the successful completion of the integration process. The added layer will display in the table of contents pane in ArcMap.

To save a layer:

1. Right-click the **DigitalGlobe Web Map Service** under **Layers**. A menu displays (Figure 2.11).

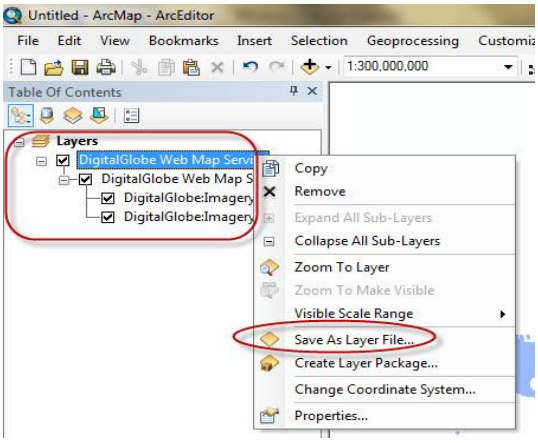

FIGURE 2.11 SAVE AS LAYER OPTION IN ARCMAP

2. Select **Save as Layer File…**. The *Save Layer* dialog box displays (Figure 2.12).

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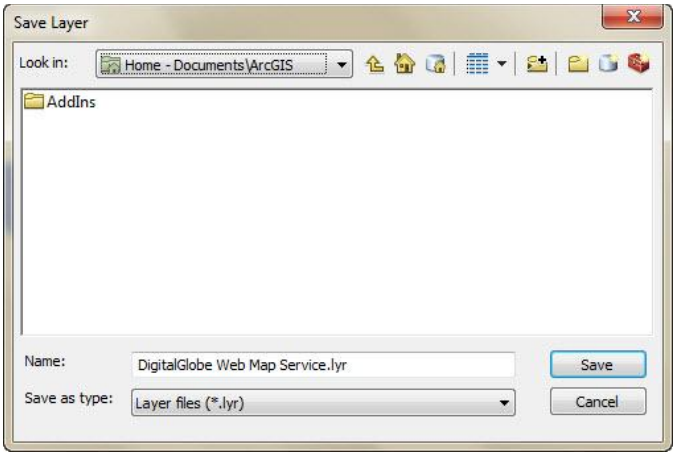

FIGURE 2.12 SAVE LAYER WINDOW

3. From the **Look In** drop-down, select a location to save the layer file.
4. In the **Name** field, type a name for the layer.
5. In the **Save as type** field, always choose **Layer files (*.lyr)**.

> ➔ The **Save as type** options include Layer files (*.lyr), 8.3 Layer files (*.lyr), 9.0/9.1 Layer files (*.lyr), 9.2 Layer files (*.lyr), and 9.3 Layer files (*.lyr). Numbers 8.3, 9.0/9.1, 9.2, and 9.3 represent older versions of ArcMap. The latest version is ArcMap 10.

2.5 Opening a Layer

Open a layer through one of these methods:

- Right-click Layers from the table of contents pane and select Add Data... option. The *Add Data* window displays (Figure 2.13).
- Click the add data icon ( ) on the toolbar of ArcMap. The *Add Data* window displays (Figure 2.13).
- Select the layer (file of extension **.lyr**) that you want to open. The layer should have been saved previously. Double-click the layer. The data for the layer gets added in the table of contents pane as shown in Figure 2.13.

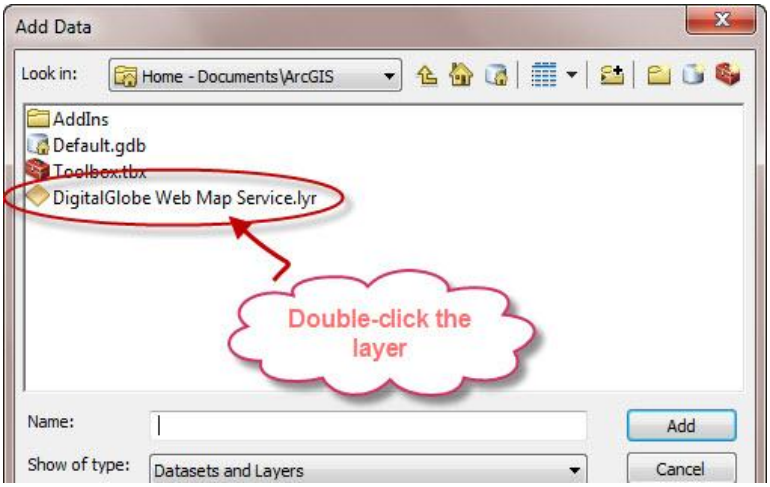

FIGURE 2.13 ADD DATA WINDOW FOR OPENING A LAYER

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2.6 Saving an ArcMap Document

You can save the entire ArcMap and use them by loading it when required. The ArcMap can be saved after the successful completion of the integration process i.e., after adding required layers in an ArcMap. The added layer displays in the table of contents pane in ArcMap. To save an ArcMap document, use the following instructions.

1. Click *File* on the ArcMap menu. There are three options for saving the ArcMap, namely *Save*, *Save As*, and *Save A Copy*. All of these execute the same function of saving the map. The differences are:
   - *Save* and *Save As* options are used to save the map in a desired location or default location on your system. You can name the file however you choose. The default extension that appears when the file gets saved is .mxd. These options are depicted in Figure 2.14.

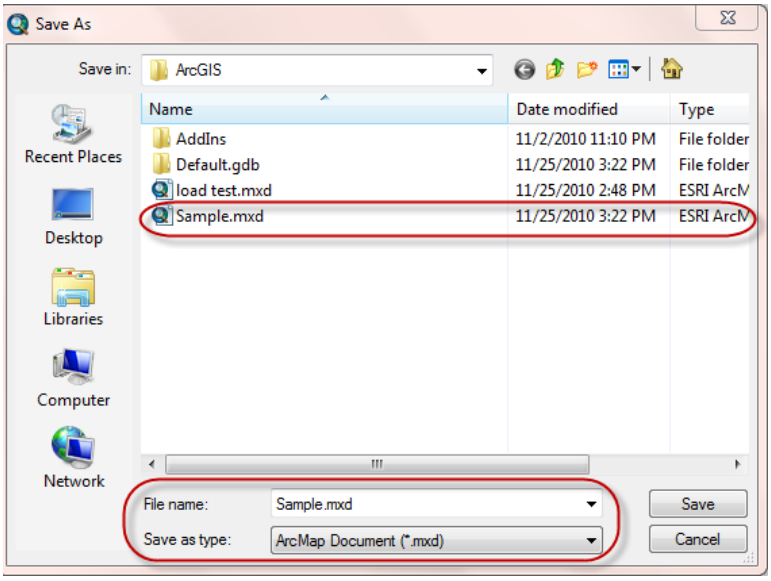

FIGURE 2.14 SAVING AN ARCMAP DOCUMENT THROUGH "SAVE AS"

   - *Save A Copy* is also used to save the map. The only difference is that it allows you to save the map to be compatible with the lower versions of ArcMap (namely 8.3, 9.0, 9.1/9.2, and 9.3). The file gets saved as another copy and is depicted in Figure 2.15.

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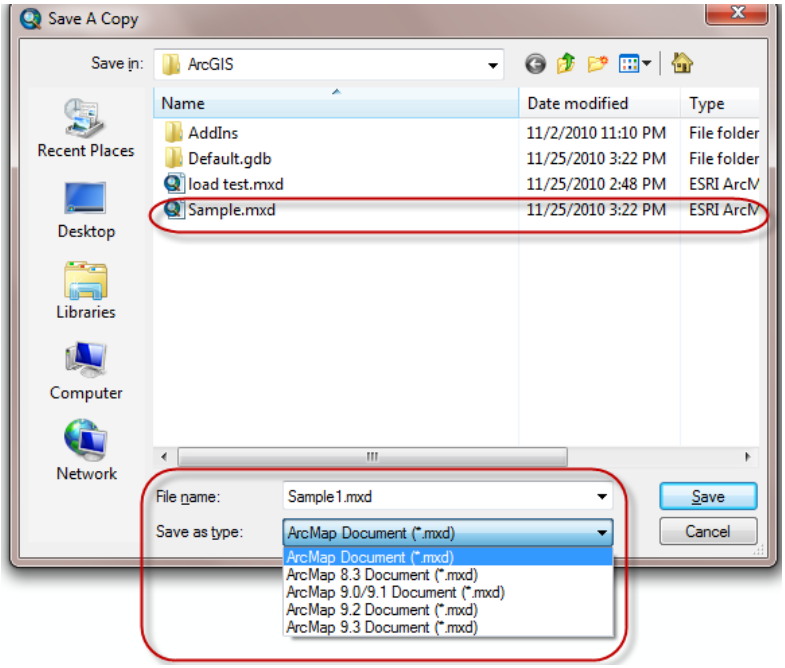

FIGURE 2.15 SAVING AN ARCMAP DOCUMENT THROUGH "SAVE A COPY"

2.7 Export Map

The "Export Map" option can be used to export a map from ArcMap. The map can be saved with any of the following file extensions: .emf, .eps, .ai, .pdf, .svg, .bmp, .jpg, .png, .tif, .gif

Resolution and Resample Rate are general image options available for the output image.

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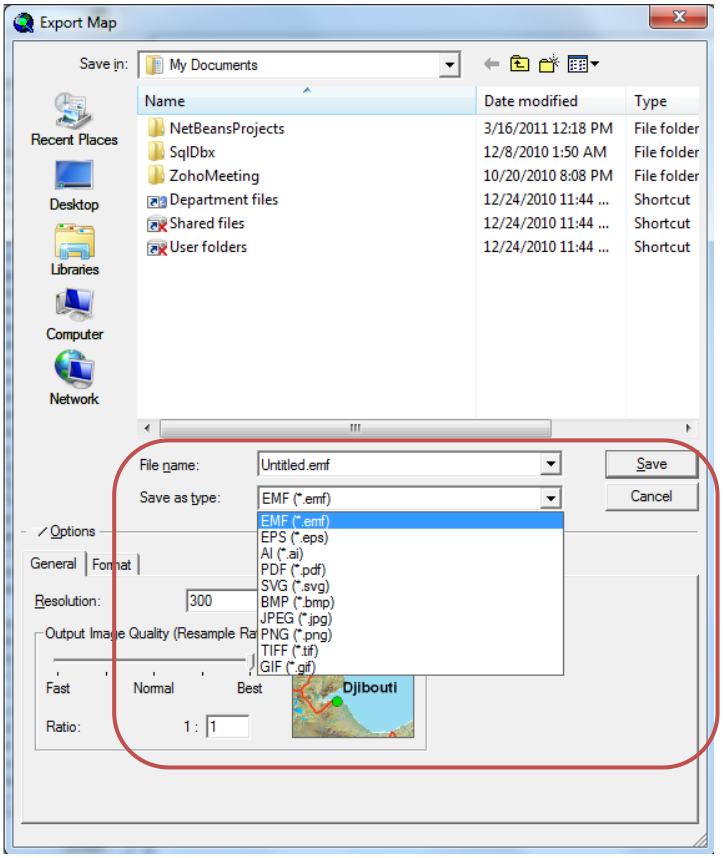

FIGURE 2.16 EXPORT MAP

2.8 Loading an ArcMap Document

You can load an ArcMap document in the Table of Contents pane. Follow the steps mentioned below to load an ArcMap document.

1. From the ArcMap **File** menu, select **Open**. The *Open* dialog box displays. Select the name of the file that you want to open. This is displayed in the figure below. The corresponding ArcMap opens up. File type extension is *.mxd.

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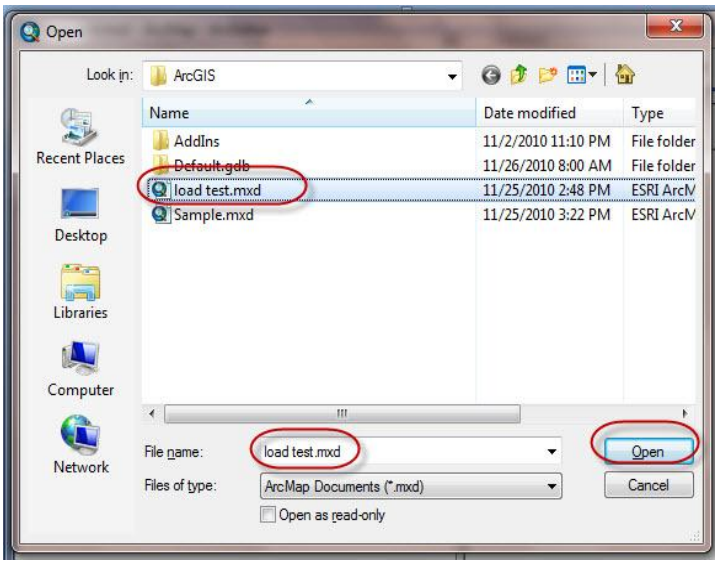

FIGURE 2.17 OPEN DIALOG BOX - LOADING AN ARCMAP DOCUMENT

2. Click **Open**.

2.9 Renaming WMS Server

There might be multiple entries for the same WMS server that you want to integrate with ArcMap. It is therefore difficult to identify the correct WMS server. ArcCatalog helps you in renaming the layers to facilitate easier identification of multiple entries. Unwanted entries can also be deleted using ArcCatalog.

2.9.1 RENAMING WMS SERVER ENTRY

WMS Server with similar names makes the process of identification cumbersome. It is therefore important to rename them. Similar names for WMS Server make it difficult to locate the exact URL used for the integration of WMS to ArcMap. ArcCatalog aids in the process of renaming the WMS Server. Multiple entries with a similar name for WMS Server are depicted below.

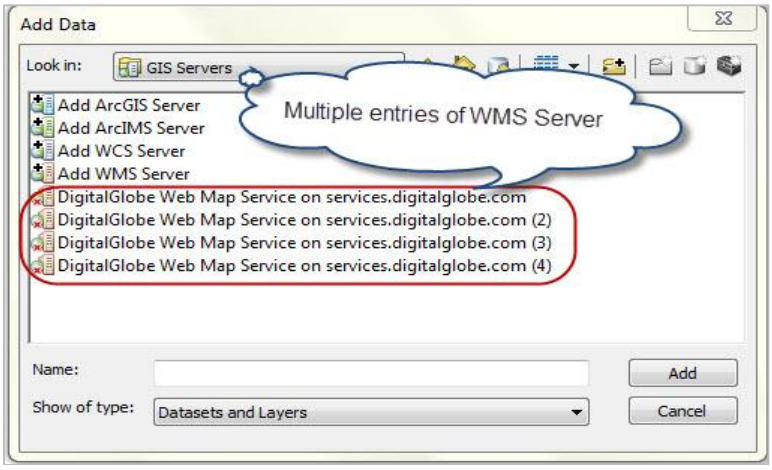

FIGURE 2.18 WMS SERVER WITH SIMILAR NAMES IN ARCMAP

Follow these steps to rename entries with similar name for WMS Server.

1. Select **Programs** > **ArcGIS** > **ArcCatalog**. ArcCatalog opens.
2. Click GIS Servers option in ArcCatalog-ArcEditor-FolderConnections window. A name of WMS Server with similar entries gets displayed and is depicted in Figure 2.18.

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3. Highlight a particular entry that you want to rename. Right-click this entry which has the option mentioned in parentheses. (Example: DigitalGlobe Web Map Service on services. digitalglobe.com (4)). It provides the option for renaming the web services. The name and the URL used for adding the WMS Server gets displayed in the right pane. The drop-down menu opens up. Properties and rename option of the highlighted entry is depicted below.

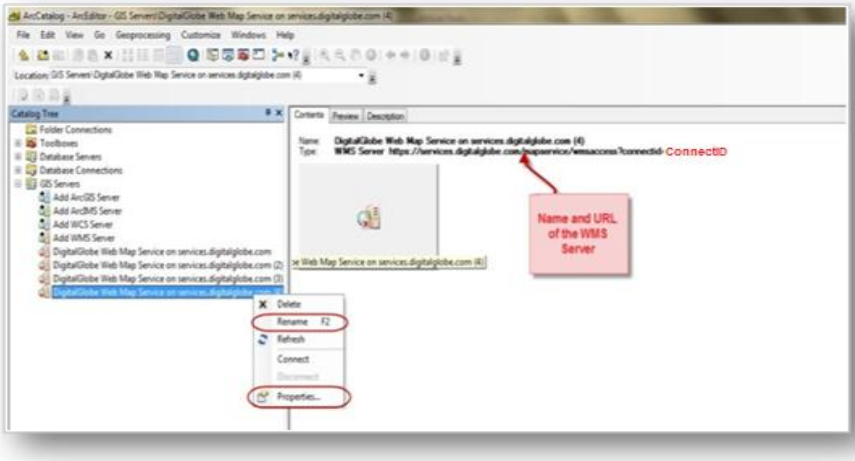

FIGURE 2.19 RENAME OPTION IN ARCCATALOG WINDOW

4. Click **Properties**. The *WMS Server Connection Properties* window opens. This is depicted below. The name, Server URL, and version get displayed in this window. The Server URL facilitates in identification of the entry that needs to be renamed.

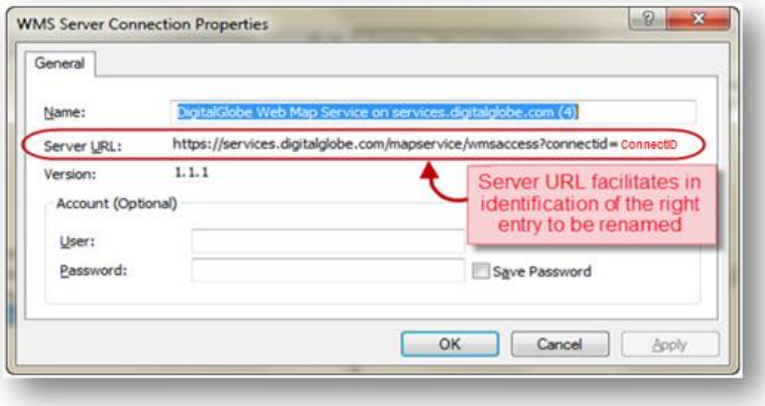

FIGURE 2.20 WMS SERVER CONNECTION PROPERTIES WINDOW

5. In the ArcCatalog-ArcEditor-GIS Servers screen, right-click the GIS Server name that you want to rename. The name appears in edit mode and allows you to rename the entry.
6. Enter an appropriate name.
7. Click **Enter**. The new name will be saved and reflected in ArcMap.

➔ Web Map service names with similar entries have an “x” mark on the globe. The “x” mark indicates that it is a duplicate entry.

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2.9.2 DELETING WMS SERVER ENTRY

WMS Server entries with similar names can be deleted to ensure that there is only one correct entry. ArcCatalog facilitates in deleting similar entries. There might be multiple entries which make it difficult to identify the correct entry that needs to be deleted. Follow the steps mentioned below to delete a WMS Server entry.

8. Click **Programs** > **ArcGIS** > **ArcCatalog** to open ArcCatalog.
9. Click the **GIS Servers** option in the *ArcCatalog-ArcEditor-FolderConnections* window. Figure 2.18 displays WMS Server with similar entries.
10. Highlight the specific WMS Server entry that you want to delete. Right-click this entry which has the option mentioned in parentheses (Example: DigitalGlobe Web Map Service on services. digitalglobe.com (2)).
11. From the right-click menu, select **Properties**. The *WMS Server Connection Properties* window displays (Figure 2.20). The name, Server URL, and version are displayed in this window. The Server URL facilitates in identification of the entry that needs to be deleted.
12. Right-click the entry you want to delete. A *Confirm Delete* dialog box displays.
13. Click **Yes**. The entry will be removed from the list of GIS Servers in ArcCatalog as well as ArcMap. This entry does not appear when you want to add a data layer to the GIS Servers in ArcMap.

2.10Properties of Layers

The WMS Server is added after the successful integration with ArcGIS. The table of contents pane displays the list of added servers. Right-click the server for which you want to see layers. A menu displays as shown in Figure 2.21.

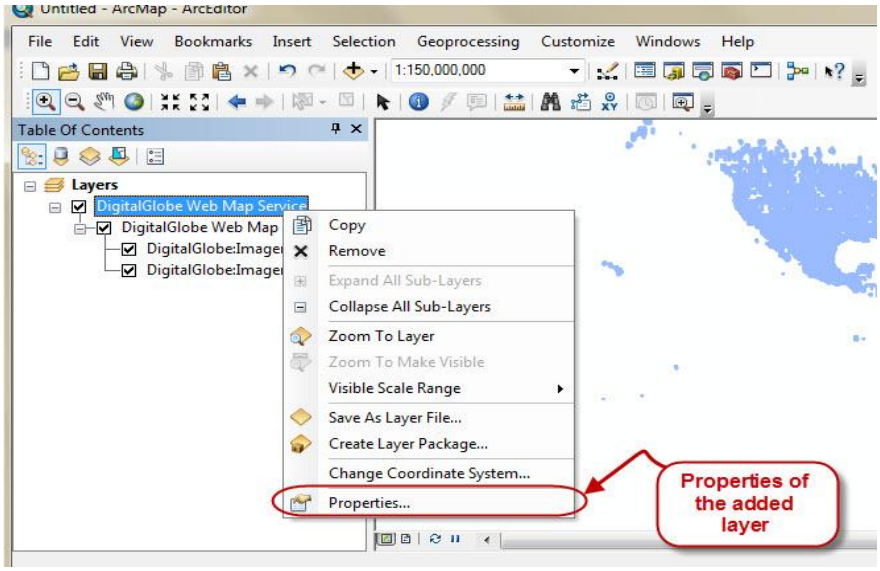

FIGURE 2.21 PROPERTIES OPTION OF THE LAYER

The sub-layers can be accessed through the *Layer Properties* dialog box. Click **Properties**. The *Layer Properties* dialog box displays (Figure 2.22).

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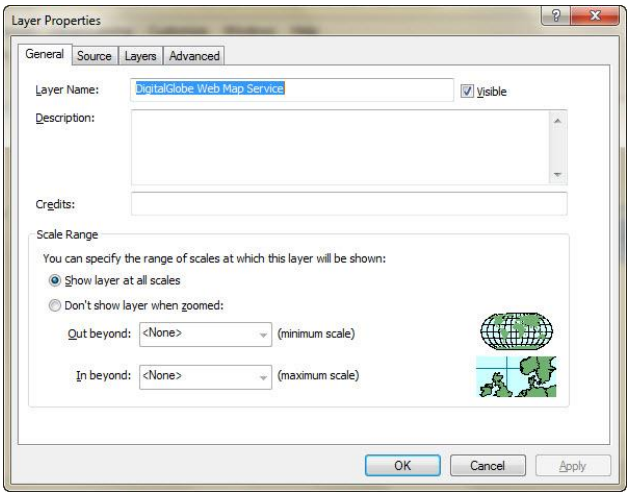

FIGURE 2.22 LAYER PROPERTIES DIALOG BOX – GENERAL TAB

There are four tabs in this window. They are **General**, **Source**, **Layers**, and **Advanced**. The **General** tab (Figure 2.22) displays the name of the layer that has been integrated, its description, and the scale range.

The **Source** tab (Figure 2.23) displays the extent of the image. There is a separate section on data source. Detailed information comprises data type, URL of the WMS Server, the geographic coordinate system, prime meridian, datum and angular unit are depicted in data source and is represented below.

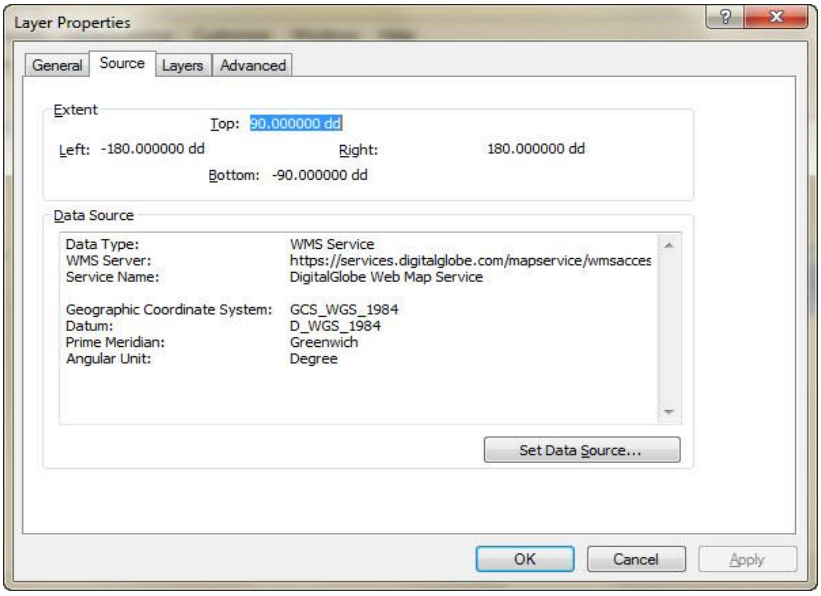

FIGURE 2.23 LAYER PROPERTIES DIALOG BOX - SOURCE TAB

The **Layers** tab (Figure 2.24), displays the sub layers of WMS service in the map. The sublayers can be rearranged to suit your convenience. Select the option **Just the layers listed below** to remove some of the sub layers from the map and the table of contents pane. The left pane displays all the layers and the sub layers of the service that you have added. The name, version, and abstract are displayed in the pane below **All layers**.

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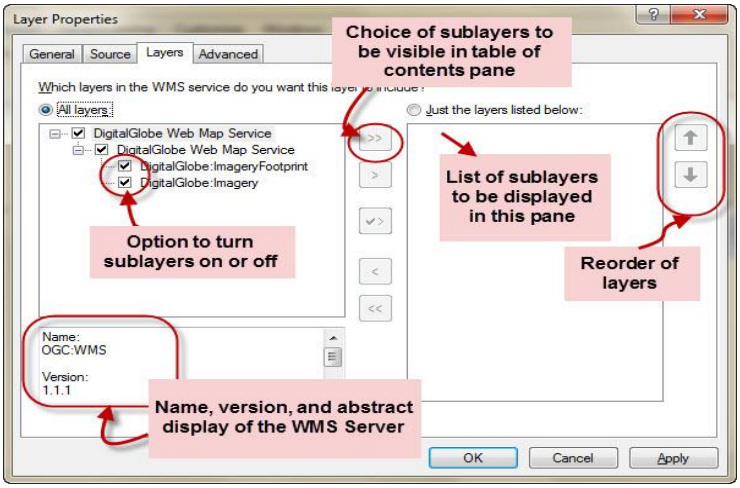

FIGURE 2.24 LAYER PROPERTIES DIALOG BOX – LAYER TAB

➔ Use the **Layers** tab to add or remove specific WMS sub layers from the table of contents. If you use the **All layers** option to add WMS group and WMS sub layers back to the table of contents, visibility for all the layers will be off.

The **Advanced** tab (Figure 2.25) displays options such as **Background**, **Transparent Color**, **Layer Transparency**, and **Layer Image Format**. Here, you can set the colors for the layer.

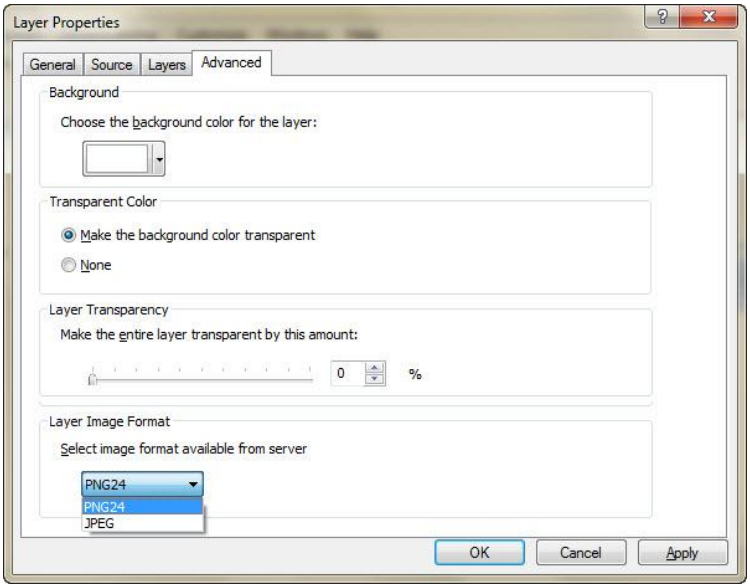

FIGURE 2.25 LAYER PROPERTIES DIALOG BOX - ADVANCED TAB

PNG is a general purpose format that will not reduce image quality. PNG returns a high-quality image that supports transparency. However, the file size can be much larger than other formats and is slower to download from the server. JPEG can be much faster since its size can be much smaller than a PNG. However, JPEG does not support transparency. JPEG is appropriate for imagery data. Choice of JPEG format improves the performance.

2.11 Web Coverage Service

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:

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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.

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3 DGCS in ArcGIS with Image Connect

3.1 Introduction

DigitalGlobe's ImageConnect is a unique GIS extension that instantly brings georeferenced high resolution satellite and aerial photos into your GIS project from the online library of DigitalGlobe. The user can eliminate the overhead of integrating different layers every time. ImageConnect embeds a simple, easy-to-use toolbar directly into the GIS workspace.

With ImageConnect, you can connect directly to the DigitalGlobe Cloud Services through plug-ins for desktop mapping software ArcGIS 9.x. Retrieving images from ImageConnect alleviates exporting and manipulating from multiple image sources and allows you to look for new images directly from the GIS solution. You can automatically save the images for further use. ImageConnect will show the most recent data and you can check the library for other images which DigitalGlobe has taken over time.

ImageConnect 2.0.3 is the latest version of ImageConnect which is currently supported by ArcGIS 9.x. ImageConnect 3.0 for ArcGIS 9.x and ArcGIS 10 are in pipeline for release by end of 2010.

3.2 Installing ImageConnect

Follow these steps to download and install ImageConnect on your system.

1. Go to http://www.digitalglobe.com/connectonline. This URL may vary for different versions of ImageConnect. Please contact DigitalGlobe to get the exact URL for your needs and also for information on the latest and compatible version of ImageConnect for your GIS client.
   When you attempt to download the Zip file, an authentication window prompts you to provide a valid user ID and password while downloading ImageConnect (Figure 3.1). This is a mandatory prerequisite before you proceed with the download.

FIGURE 3.1 AUTHENTICATION DIALOG BOX FOR IMAGECONNECT DOWNLOAD

2. Enter a valid user name and password and click *OK*. Your credentials will be authenticated and then you will see an option to Save/Open the requested file. Choose *Save* and extract the contents to get the file "ImageConnectCPSetup.msi" or "ImageConnect*.msi".
3. Double-click "ImageConnectCPSetup.msi" or "ImageConnect*.msi" to start the ImageConnect installation process. The ImageConnect welcome screen displays (Figure 3.2).

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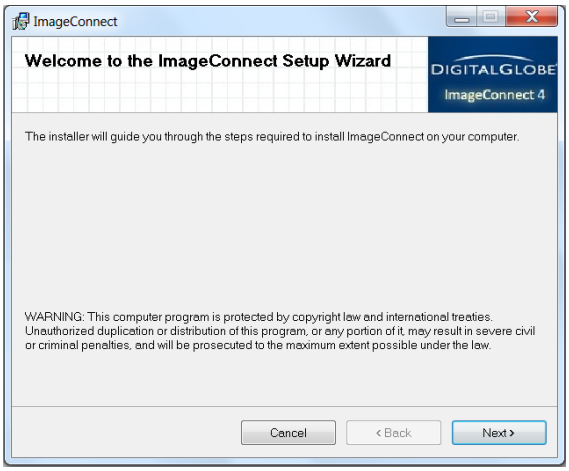

FIGURE 3.2 WELCOME SCREEN OF IMAGECONNECT

4. Click *Next* in the welcome screen of ImageConnect installation. The *Select Installation Folder* window displays (Figure 3.3).

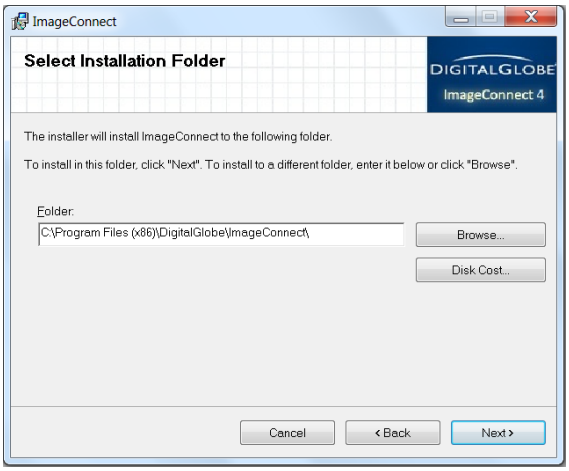

FIGURE 3.3 LOCATION AND INSTALLATION ACCESS OPTIONS – IMAGECONNECT

5. Browse to the folder where you want to install ImageConnect on your system. There are two other installation options, namely Everyone and Just me. Select the appropriate option and click *Next***.** The *Confirm Installation* window displays (Figure 3.4).

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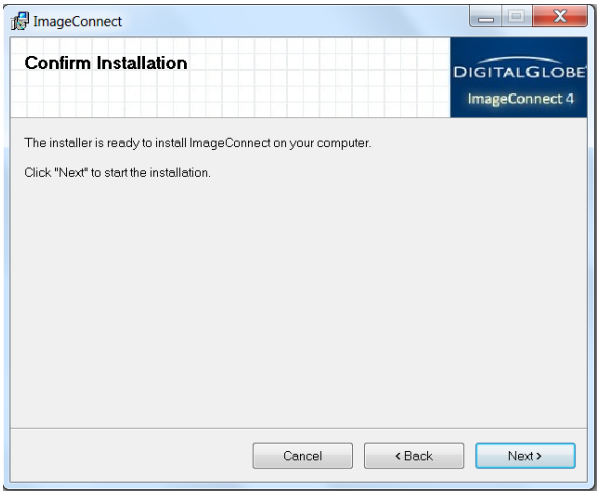

FIGURE 3.4 CONFIRM INSTALLATION WINDOW OF IMAGECONNECT

6. The *Installation Complete* window displays (Figure 3.5).

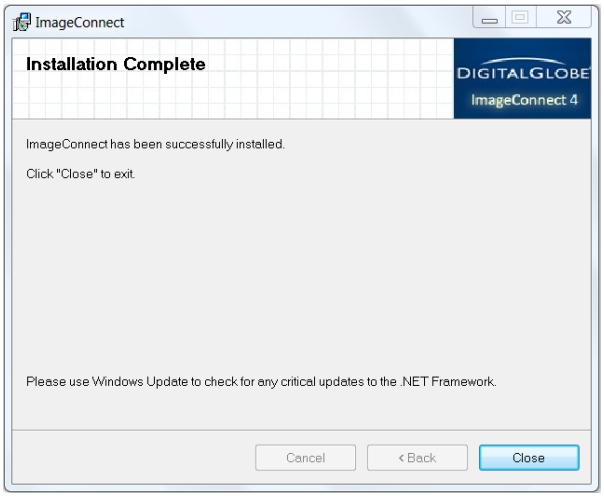

FIGURE 3.5 INSTALLATION COMPLETE WINDOW OF IMAGECONNECT

7. Click **Close** to finish the installation process.
8. After successful installation, DigitalGlobe will be added to the list of toolbars (see Figure 3.6). Select this option to bring the ImageConnect tool bar on to the tools section of the screen in ArcMap 9.x.

FIGURE 3.6 DISPLAY OF DIGITALGLOBE AFTER INSTALLATION OF IMAGECONNECT

The DigitalGlobe (ImageConnect) toolbar displays four icons, as shown in Table 3.1.

TABLE 3.1 TOOLBAR ICONS OF IMAGECONNECT

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ICON	TOOL TIP	DESCRIPTION
	Login and adjust various settings	You can logon and connect to various web services of DigitalGlobe using ImageConnect.
	Open Imagery Catalog	You can open the catalog of images created by ImageConnect.
	Download Imagery to file	You can download the images and save them in a file.
	CenterMap on Address	You can search for an area and a map of the corresponding area will display.

3.3 Connecting to DGCS via ImageConnect

To connect to DGCS via ImageConnect:

1. Click the icon on the ImageConnect toolbar. The *DigitalGlobe – Configure & Connect* window displays (Figure 3.7).

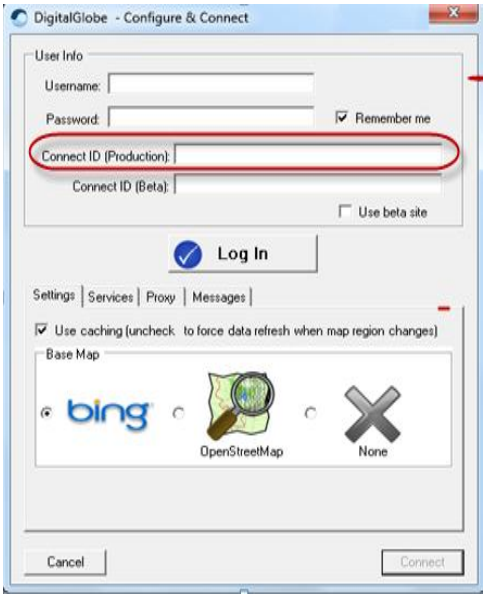

FIGURE 3.7 DIGITALGLOBE – CONFIGURE & CONNECT WINDOW

2. In the **Username** and **Password** fields, enter the username and password if they were provided by DigitalGlobe.
3. In the **ConnectID (Production)** field, enter the ConnectID provided by DigitalGlobe.
4. Select the **Use caching** option shown below the **Log In** button.
5. There are three options for the **Base Map**. Namely Bing, OpenStreetMap and None. This option displays the corresponding base map in the table of contents pane after login.
6. Click the **Services** tab and enter the production URL in the **Production** field. If you're not sure what your production URL is, please contact DigitalGlobe.

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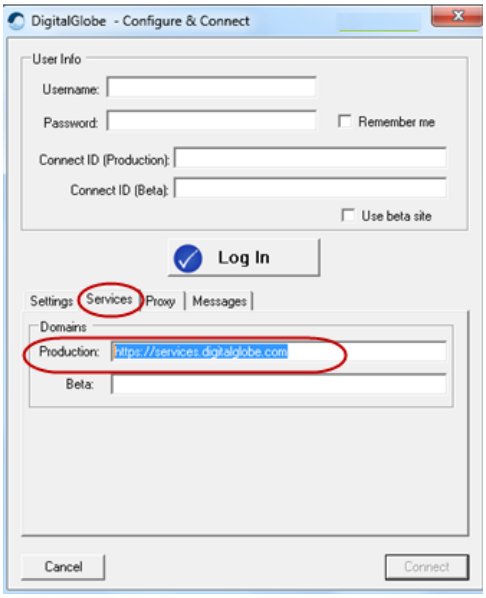

FIGURE 3.8 DIGITALGLOBE – CONFIGURE & CONNECT WINDOW, SERVICES TAB

7. Click the **Messages** tab to view any messages.

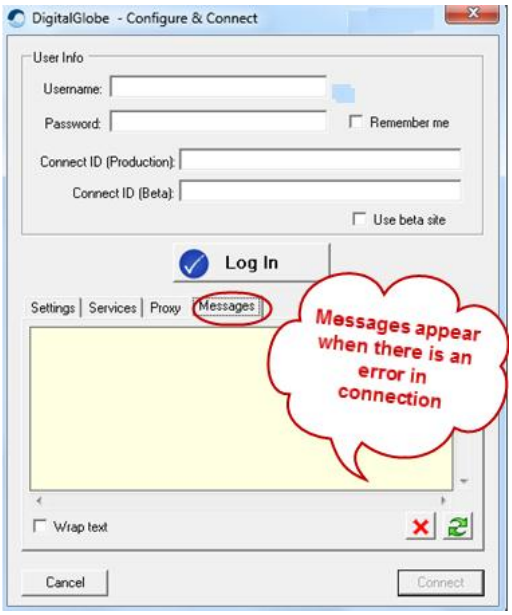

FIGURE 3.9 DIGITALGLOBE – CONFIGURE & CONNECT WINDOW, MESSAGES TAB

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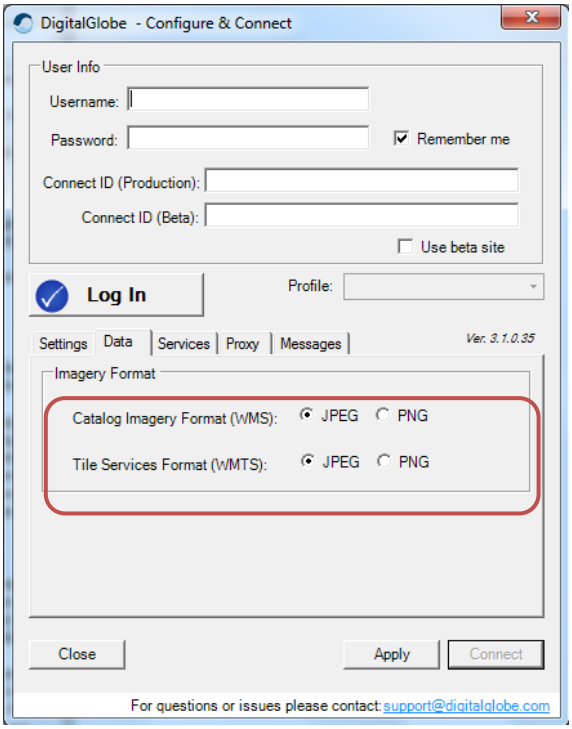

FIGURE 3.10 IMAGERY FORMAT

8. Catalog Imagery (WMS) and Tile Services (WMTS) formats can be individually set to show images as JPEG or PNG formats. The settings can be made from the *Configure & Connect* window, as shown in Figure 3.10
9. Click **Log In**. Your credentials will be authenticated.
10. Click **Connect**. An attempt will be made to connect to the web services that are available. The response of the connection to web services is displayed in Figure 3.11. A service with symbol ✓ implies successful connection and a service with the symbol × indicates that there is a problem with the connection.

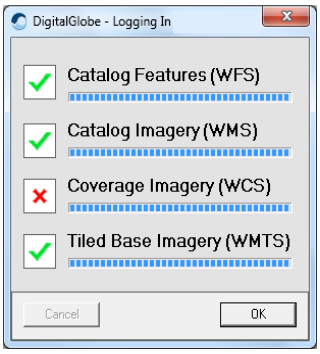

FIGURE 3.11 WEB SERVICE STATUS AFTER SUCCESSFUL LOG IN

11. Click **OK** to obtain a display of the connected services in the table of contents pane (Figure 3.12).

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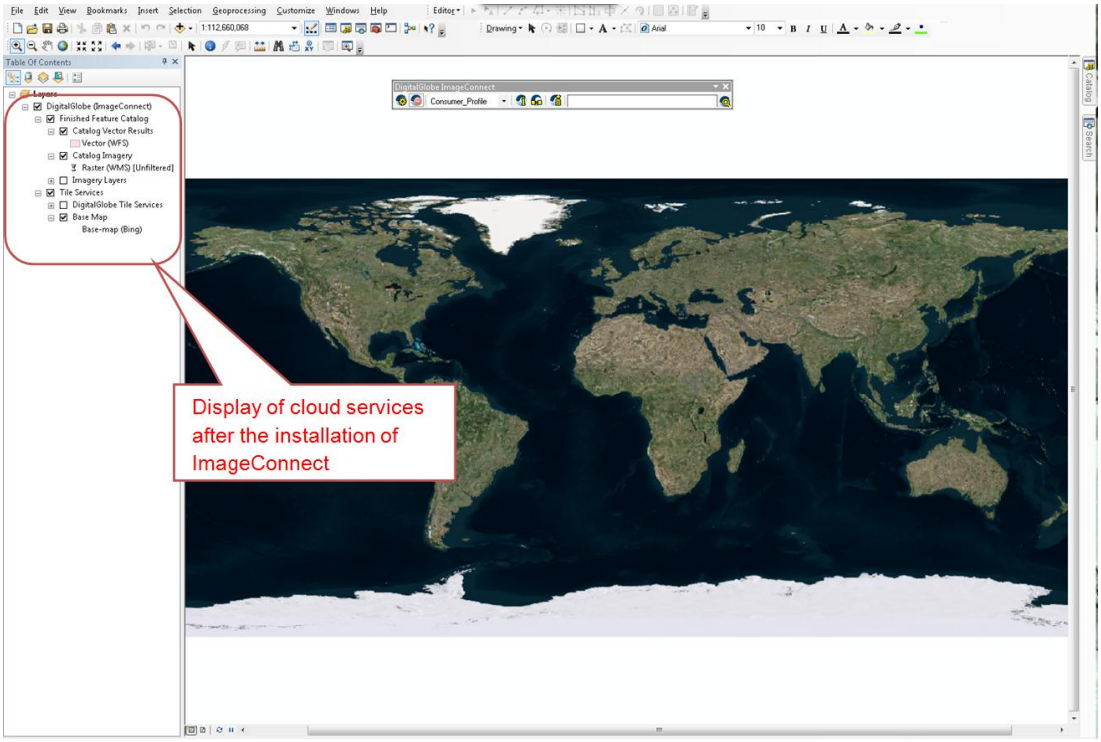

FIGURE 3.12 MAP DISPLAY ALONG WITH CORRESPONDING WEB SERVICES

3.4 WFS Display in ArcGIS 9.x

WFS can be viewed in ArcGIS 9.x with ImageConnect. The finished feature appears as pink colored rectangular boxes on the map and is displayed in Figure 3.13.

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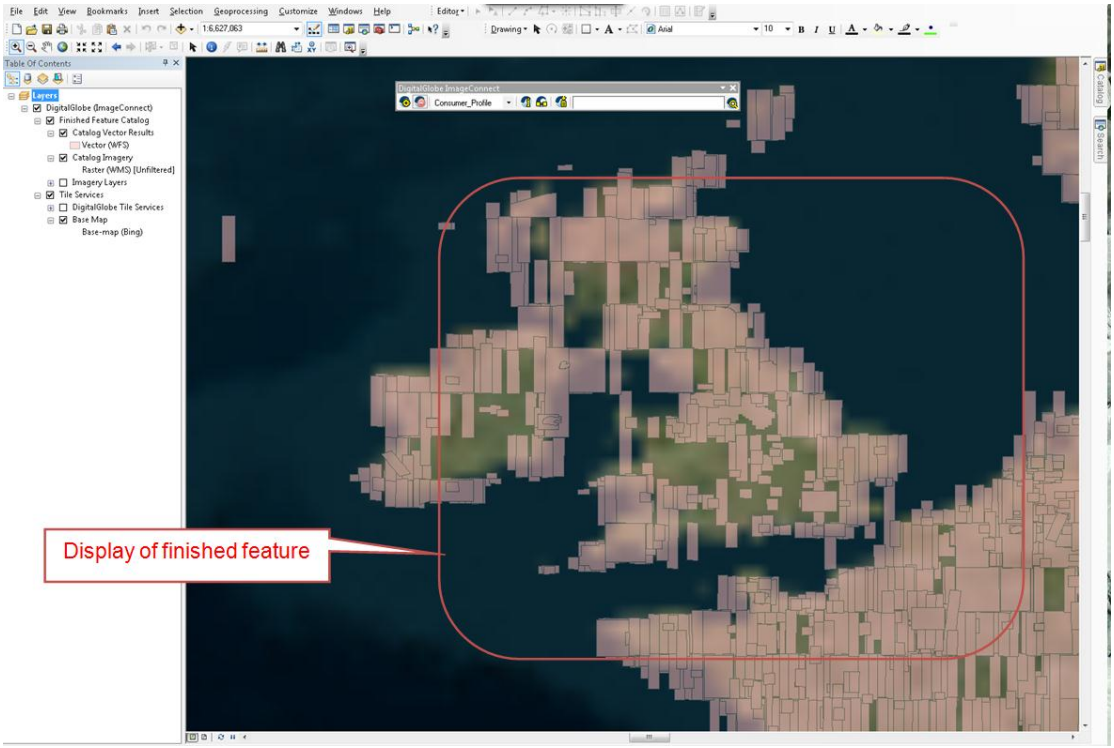

FIGURE 3.13 DISPLAY OF FINISHED FEATURE

➔ TIP: Double-click the color icon to customize the appearance of color for finished features. The finished feature will display in the color you chose.

Zoom into a particular finished feature to view the feature and its details. Click (identify icon) on ArcGIS 9.x toolbar. Details of the finished feature and its parameters are visible in the *Identify* window (Figure 3.14).

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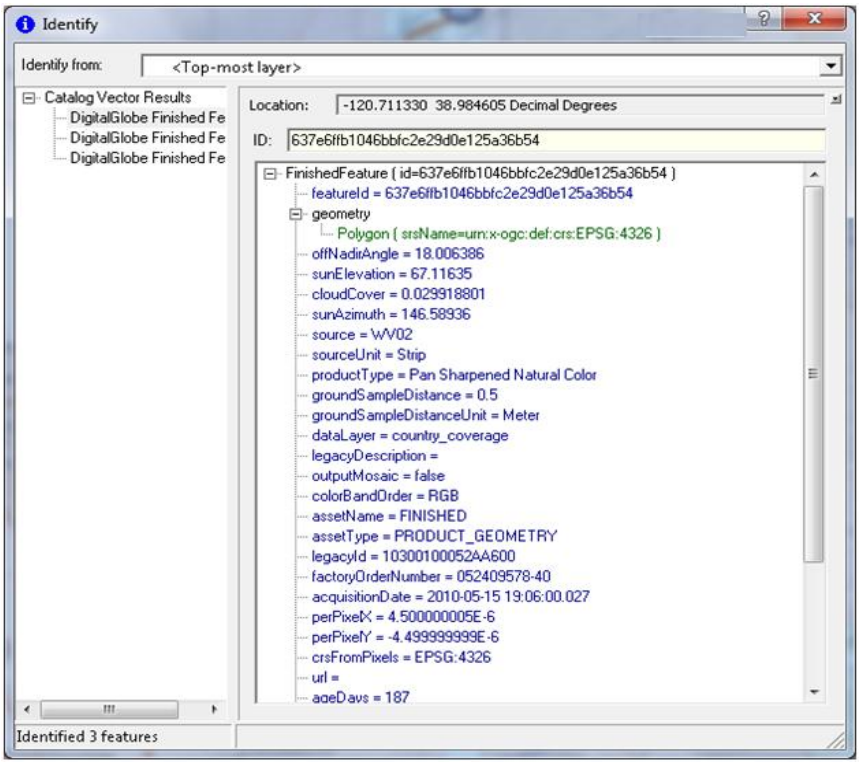

FIGURE 3.14 DETAILS OF FINISHED FEATURE IN IDENTIFY WINDOW

Zoom in to a particular feature to view the map corresponding to your area of interest (Figure 3.15). This image is from the Imagery Layer of WMS.

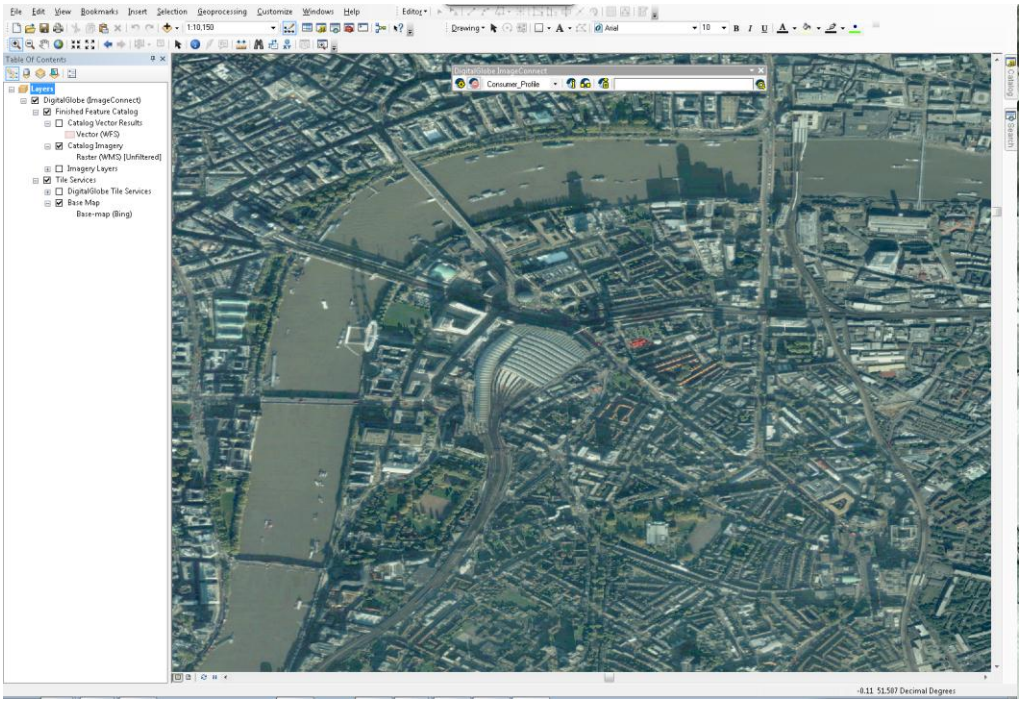

FIGURE 3.15 IMAGE DISPLAY AFTER ZOOMING INTO A FINISHED FEATURE

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3.5 Catalog Info Tool

WFS displays several finished features on the map. Select a region on the map and click the Open Imagery Catalog icon from the ImageConnect toolbar. The *DigitalGlobe – Catalog Info Tool* window displays all the finished features from that region. These features display parameters such as ID of the feature, Acquisition date, Cloud cover, Accuracy, and Color Bands (Figure 3.16).

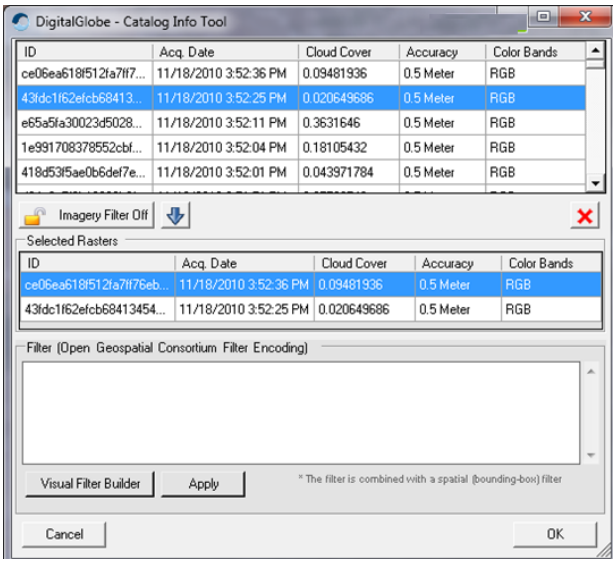

FIGURE 3.16 DIGITALGLOBE – CATALOG INFO TOOL WINDOW

To view details of a raster, double-click a row. The *Finished Feature* window displays and lists detailed information for the selected feature (Figure 3.17).

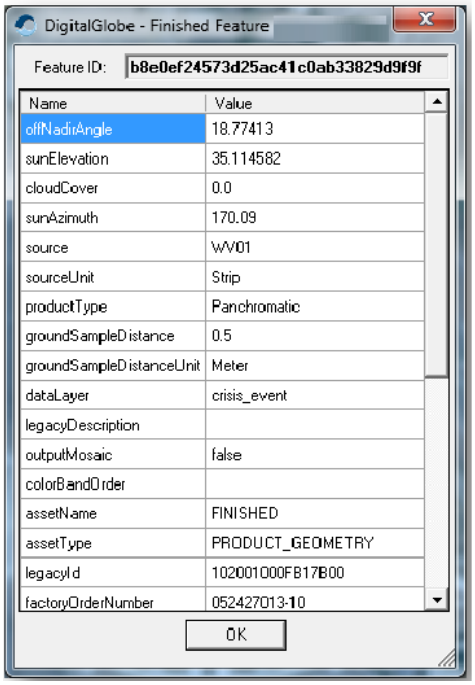

FIGURE 3.17 DIGITALGLOBE – FINISHED FEATURE INFORMATION

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You can filter the features by selecting the required features from the features grid and move down using the button in the *DigitalGlobe – Catalog Info Tool* window. You can clear the filter selection by clicking the button , which clears the features moved down and bring back all the features in the view area.

3.6 Visual Filter Builder

Visual Filter Builder is an advanced feature of ImageConnect which facilitates the filtering of features based on different parameters. This is done by executing a query using Common Query Language (CQL).

Click “Visual Filter Builder” button in DigitalGlobe-Catalog Info tool window to open the DigitalGlobe- Filter Builder window. You can create a query using different properties and bounding values. The properties and comparison attributes are illustrated in the figure below. The results of this query filters and returns appropriate data in an XML format.

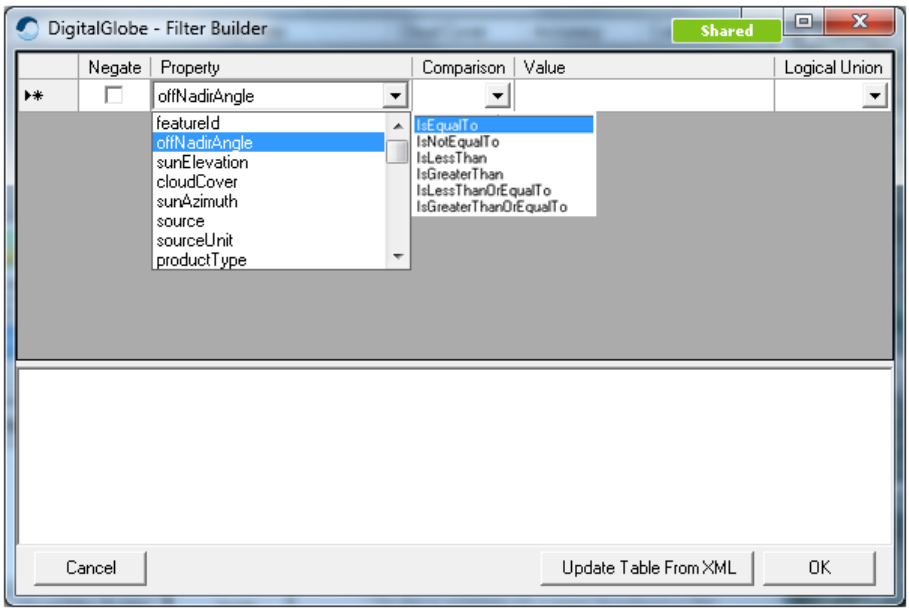

FIGURE 3.18 DIGITALGLOBE – FILTER BUILDER WINDOW

3.7 Center Map on Address in ImageConnect

Search and locate address on Map is another powerful feature of ImageConnect. It aids in searching your area of interest and locates them on the map very accurately. In the search box, type a particular area and then click the icon on the DigitalGlobe ImageConnect toolbar. An image is returned if the queried area is available in the list of images.

3.8 WMTS Display in ArcGIS 9.x

You can connect to WMTS using ImageConnect in ArcGIS 9.x. WMTS has three different layers. They are CitySphereTileService, CountryCoverageTileService, and CrisisEventTileService. The specification for these layers is listed in the table below. The image appears in a tiled format.

CitySphereTileService

DigitalGlobe’s CitySphere™ 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 comprises recent imagery, with initial imagery not older than 2006. The resolution and accuracy of CitySphere makes it ideal for use as a basemap in GIS, personal navigation mapping, mobile device applications, and other location based services.

TABLE 3.2 SPECIFICATIONS

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FEATURES	BENEFITS	ADVANTAGES
60 cm or better resolution	Clearly discern features	Increases your confidence for feature identification
1:4800, 1:12,000 or 1:50,000 orthomosaic	Highly accurate	Pinpoints features to within 2.5 m
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

CrisisEvent

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, WorldView-1, and Worldview-2 satellite constellations. It also includes WFS that allows the user to query data availability by different metadata attributes.

The DigitalGlobe CES includes a full featured Web Map Service (WMS) that provides both metadata and imagery layers to WMS clients.

3.9 WMS Display in ArcGIS 9.x

You can also connect to WMS in ArcGIS 9.x with ImageConnect. This service is visible under Catalog Imagery in the table of contents pane. The image is available in a raster format (see Figure 3.19).

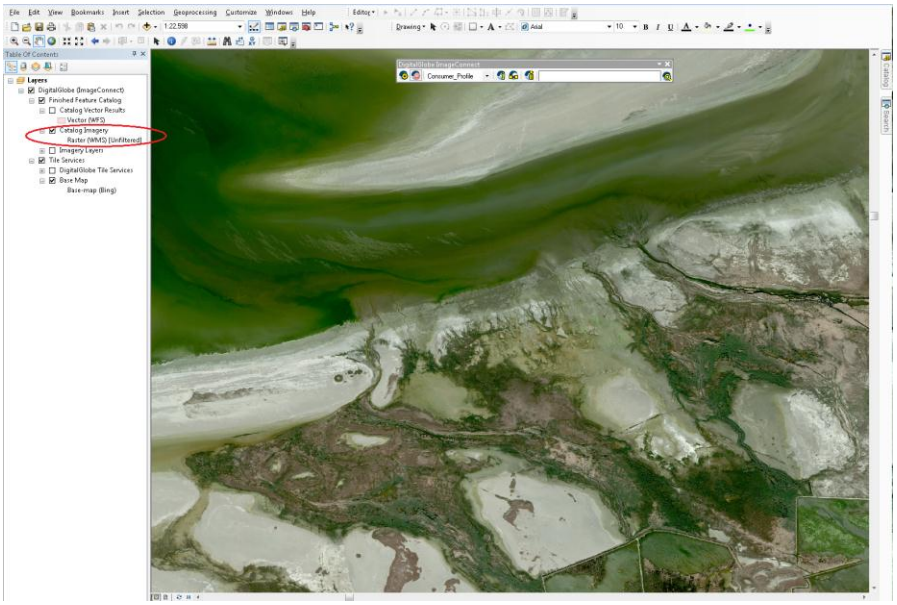

FIGURE 3.19 WMS RASTER IMAGE DISPLAY IN ARCGIS 9.X

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4 Tips

4.1 Full Extent Map

A rotating globe ( ) is displayed at the status bar of ArcMap when an image is drawn. It takes a couple of minutes for the map and the zoomed in image to be displayed so please wait to see the complete image. If the process is interrupted it may take more time than expected to load an image.

4.2 View Multiple Scales on Map

Use the Create Viewer Window tool on the Data Frame Tools toolbar to open windows to let you view multiple scales at once. Viewer windows are fully functioning live ArcMap displays, so all tools and navigation shortcuts work inside them.

4.3 Querying an Image Service Layer

The identify tools icon ( ) helps you to query for the pixel values in an image service layer. This icon provides you detailed information about a feature displayed in ArcMap. When you use the identify tool, it displays the images of top-most layer by default. The tool essentially functions based on selection of options in layers drop-down list. The different options in the layers drop-down list are Topmost layer, Visible layer, Selectable layer, and All layers.
The Selectable layers option in the Identify window can be useful if you set it as your default because it restricts Identify to the same set of layers on which interactive selection operates. In this way, you can use the Selection tab in the table of contents or the Selection > Set Selectable Layers dialog box to specify exactly which layers you want to identify.

4.4 Display of Map Tips

Map Tips provide an additional way to present information about map features to people who use maps with ArcMap. Map Tips go beyond simply labeling the features with text by providing interactive access to data via the map.

Map Tips pop up as you move the mouse pointer over a feature, providing a quick way to see the name of a feature or a particular piece of information without having to use the Identify tool, which gives you all the feature's attributes when you click a feature.

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5 Good to Know

5.1 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.

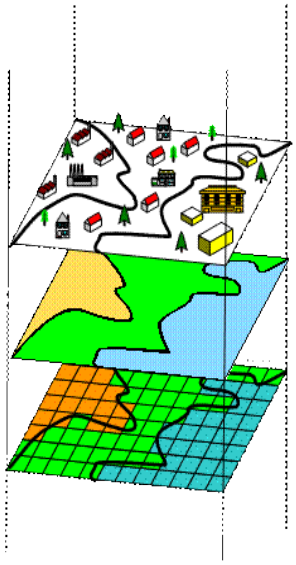

FIGURE 5.1 GIS LAYERS

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.

5.2 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.

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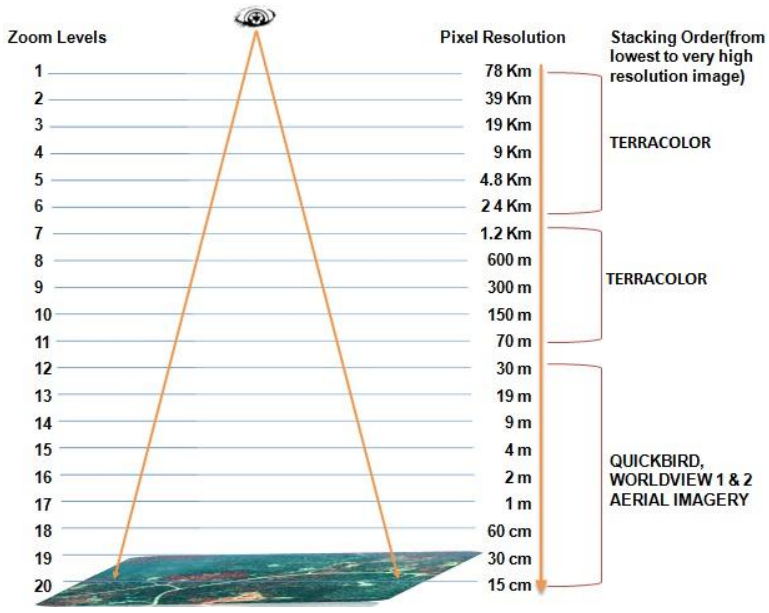

FIGURE 5.2 ZOOM LEVELS

DGCS offers 20 different zoom levels for displaying imagery. Each zoom level uses images from different sources, and provides varying resolution (refer to Table 5.1).

TABLE 5.1 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.

5.3 Raster and Vector Data

Raster Data

Raster is a method for the storage, processing and display of spatial data. Each area is divided into rows and columns, which form a regular grid structure. Each cell must be rectangular in shape, but not necessarily a square. Each cell within this matrix contains location co-ordinates, as well as an attribute value. The spatial location of each cell is implicitly contained within the ordering of the matrix, unlike a vector structure, which stores topology explicitly. Areas containing the same attribute value are recognized as such, however, raster structures cannot identify the boundaries of such areas as polygons.

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 Figure 5.3). 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.

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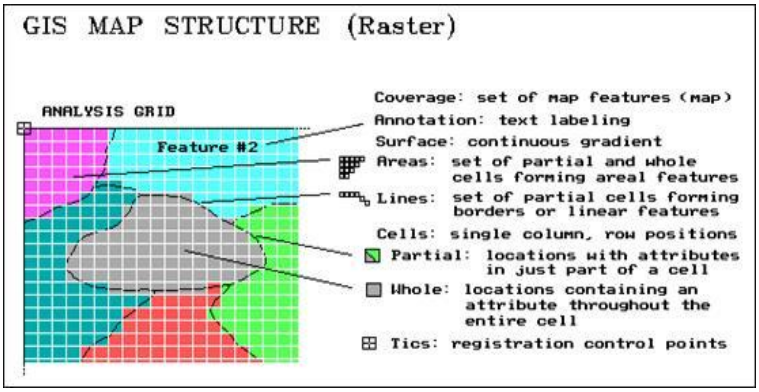

FIGURE 5.3 RASTER DATA

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 data bases. Refer to Figure 5.4.

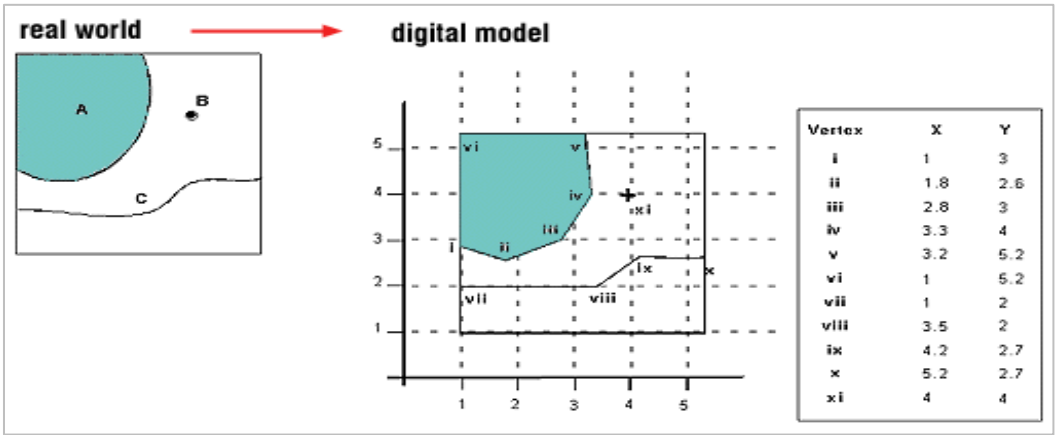

FIGURE 5.4 VECTOR DATA

5.4 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

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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.

5.5 Image Content Specification

A descriptive note about the key features of satellite imagery is provided below.

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

A measure of 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, the customer 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 5.2 CONTENT SPECIFICATION OF DIGITALGLOBE SATELLITE SERVICES

	CITYSPHERE	ADDITIONAL WORLD METROS	COUNTRY COVERAGE	PRECISION AERIAL (US AND 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

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	CITYSPHERE	ADDITIONAL WORLD METROS	COUNTRY COVERAGE	PRECISION AERIAL (US AND EUROPE)	WORLD BASE MOSAIC
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

5.6 DigitalGlobe Projection System

Projection is a mathematical means of converting the 3-dimensional model of the Earth's surface to represent a 2-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.

Table 5.3 lists the types of projection that DigitalGlobe uses.

TABLE 5.3 LIST OF PROJECTION SYSTEM 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	
4	4269	NAD 83	GEOGCS GCS	

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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 the 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

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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 5.5). 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.

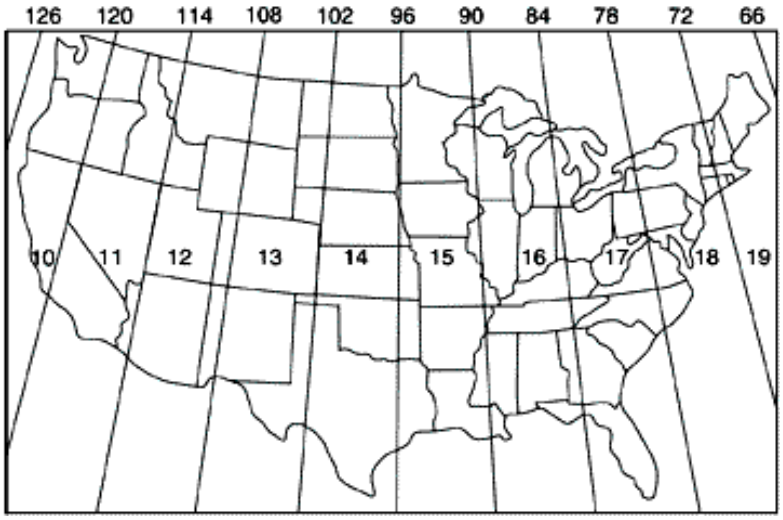

FIGURE 5.5 UNIVERSAL TRANSVERSE MERCATOR GRID

5.7 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 will provide four different stacking profiles.

Most-Recent

This stacking profile provides the most-recent image among available images as the default.

Lowest Cloud Cover

This stacking profile will return the image with the lowest available cloud cover by default.

Best Accuracy

This stacking profile will return the image with the best available accuracy by default.

Color Only

This stacking profile excludes all panchromatic/black and white imagery from default responses.

5.8 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 ranges, 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.

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The four bounding box values indicate the outside edges of a rectangle, as in the following figure: 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.

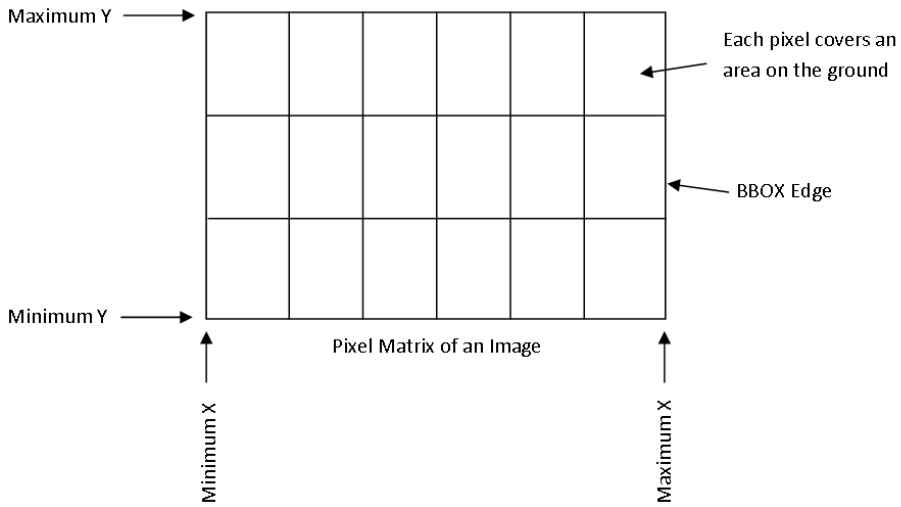

FIGURE 5.6 PICTORIAL REPRESENTATION OF BOUNDING BOX (BBOX)

5.9 Understanding URL and Parameters

WMS and WCS are the two types of web services that can be integrated with ArcMap. The sample URL for integrating Web Map Service with ArcMap is given below. Ensure that the service marked in red color is chosen appropriately for integration. Replace the CONNECTID with the CONNECTID provided to you by DigitalGlobe Inc.

TABLE 5.4 WEB SERVICES AND URL FOR INTEGRATION WITH ARCMAP

SERVICE	LAYER	URL
WMS	Imagery	https://services.digitalglobe.com/mapservice/wmsaccess?connectid=<CONNECTID>&SERVICE=WMS
	Imagery Footprint	
WCS		<<To do>>

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6 DigitalGlobe Cloud Services (DGCS)

6.1 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.

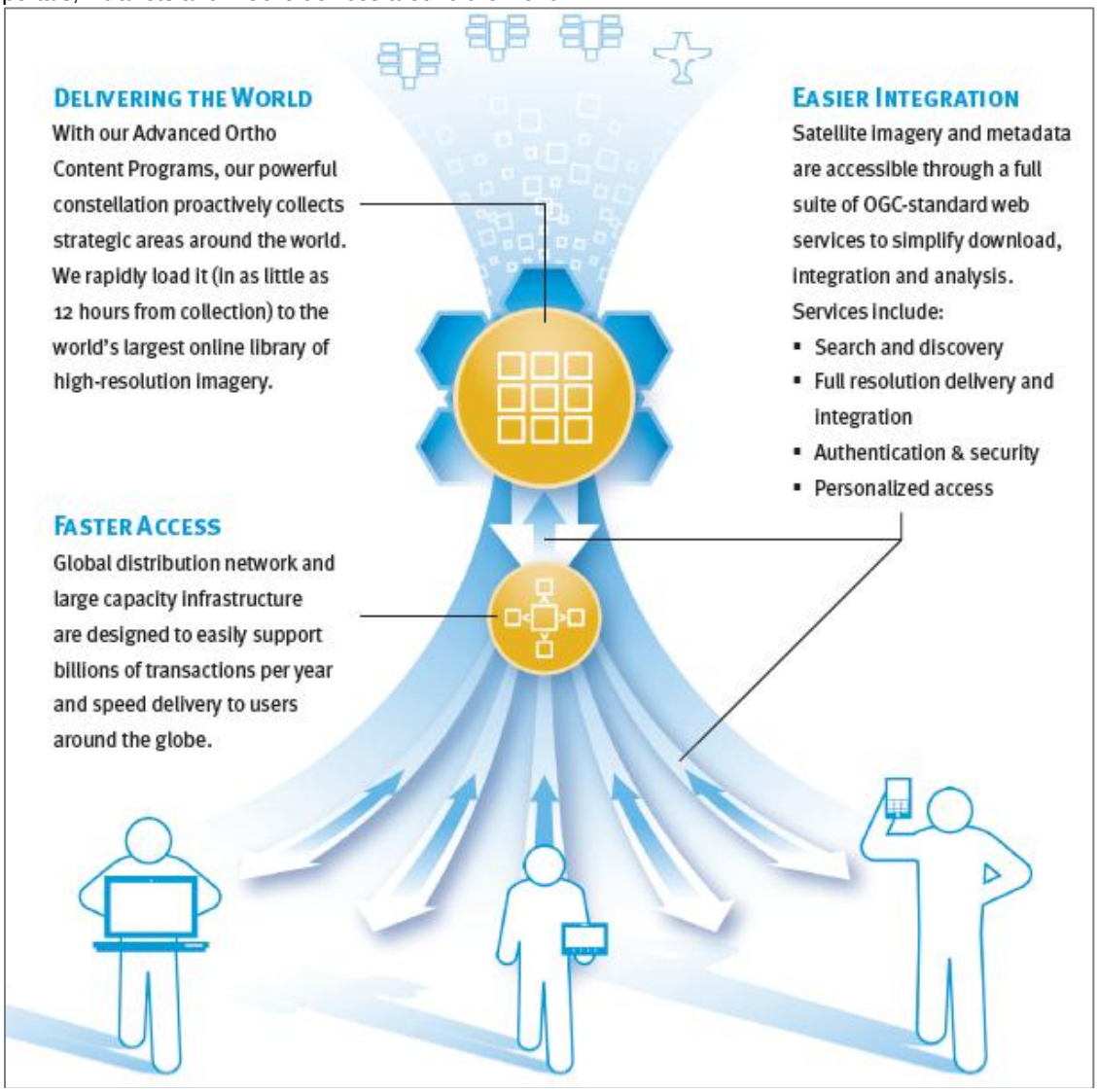

FIGURE 6.1 DGCS PROCESSES

➔ The Open Geospatial Consortium Inc. (OGC) is a non-profit, international, voluntary consensus standards organization that is leading the development of standards for geospatial and location based services.

6.2 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

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access and view imagery, the associated data points or metadata specific to imagery and types of imagery (e.g. vector, raster, etc.).

6.2.1 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.

6.2.2 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.

6.2.3 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.

6.2.4 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

6.3 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.

6.4 Types of DGCS and Definitions

6.4.1 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.

6.4.2 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

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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.

6.4.3 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.

6.4.4 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.

6.5 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 Table 6.1.

TABLE 6.1 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.

6.6 Advantages of DGCS

6.6.1 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.

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6.6.2 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^2 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

6.7 ArcGIS System Requirements

The minimum system requirements for the installation of ArcGIS Desktop 10 are listed below:

- **Operating System**: Windows XP or Windows Vista or Windows 7
- **CPU Speed**: 2.2 GHz dual core or higher
- **Processor:** Intel Core Duo, Pentium 4 or Xeon Processors
- System Memory (RAM): 2 GB or higher
- **Hard Disk**: 2GB free space
- Screen Resolution: 1280x1024
- **Display Properties**: 24 bit color depth
- .NET Framework 3.5 SP1 must be installed prior to installation of ArcGIS Desktop
- Minimum installation of Microsoft Internet Explorer Version 7.0 or higher
- Python 2.6x and Numerical Python 1.3.0 is required for geo-processing tools of ArcGIS Desktop 10.

The minimum system requirements for the installation of ArcGIS Desktop 9.x are listed below:

- **Operating System**: Windows XP or Windows Vista or Windows 7 or Windows 2000 Professional or Windows 2008
- **CPU Speed**: 1.6 GHz dual core or higher
- **Processor:** Intel Core Duo, Pentium 4 or Xeon Processors
- System Memory (RAM): 2 GB or higher
- **Hard Disk**: 1 GB minimum free space
- Disk space: 3.2 GB
- Screen Resolution: 1024x768
- **Internet Explorer requirement**: Microsoft Internet Explorer version 7.0/8.0
- .NET Framework 2.0 must be installed prior to installation of ArcGIS Desktop
- Minimum installation of Microsoft Internet Explorer Version 7.0 or higher
- Python 2.5.1 and Numerical Python 1.0.3 are required for geo-processing tools of ArcGIS Desktop 10.

6.8 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.

6.9 References

- http://www.opengeospatial.org/standards
- http://en.wikipedia.org/wiki/Web_Map_Service
- http://en.wikipedia.org/wiki/Web_Feature_Service

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- 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

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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.

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.

Nearest Neighbor Interpolation

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

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.

Partition

The unit of measure based on the tile zoom level grid for tar file creation for imagery tiles. All tiles and associated metadata for a partition will be tar-compressed into a single file.

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.

WFS

Web Feature Service.

WMS

Web Map Service.

WMTS

Web Map Tile Service.

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