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GeoServNet (GSN) 3D Client

GeoServNet (GSN) is a suite of software that enables the distribution of both 2D and 3D geospatial information over a network. GSN has a Services Oriented Architecture (SOA) that is scalable, transparent and distributed. It utilizes Java and Java 3D technology and can be deployed with any platform. With GSN, geospatial information can be accessed anytime anywhere. The latest version of GeoServNet version 2.0 supports many 3D GIS navigation and query functions.

GSN 3D Client was developed to be OGC compatible for geospatial data access, display, processing and analysis in the Open GIS Critical Infrastructure Protection Initiative (CIPI). This client offers the end users of the CICE (Critical Infrastructure Collaborative Environment) to efficiently retrieve, visualize, query, and analyze integrated geospatial information (terrain, image, vector and other related information). The GSN 3D Client is a plug-and-play application client that can be viewed in any desktop web browser with authorization connecting to DOD, USGS, and GeoConnections Node. Consequently, this application client will also be ready to be a 3D client to the CGDI portal.

GSN 3D Client is a 3D visualization tool based on OGC WMS and WCS¹. It includes two main parts. One is a simple 2D navigation tool that provides a visual interface based on OGC WMS for defining the target area and features. Another is a smart 3D viewer that addresses the geospatial information of the target area and features. The smart 3D viewer also provides an interface for 3D operations including analysis. The 2D navigation tool starts the 3D viewer each time. All necessary data are retrieved from the CIPI Nodes via OGC specifications standardized interfaces. The 3D viewer can be further transplanted and started by any other 2D viewer that is compatible with OpenGIS Specifications.

GSN 3D Client is capable of performing the following functions:

- 3D view operation: pan, roam, zoom in, zoom out, rotate, fly through, translate etc.
- 3D view enhancement operation: show layer, hide layer, add layer, remove layer etc.
- 3D query operation: layer property etc.
- 3D analysis operation: profile, visibility analysis, visible area analysis and simple flood simulation etc.

Steps for Installing the OGC 3D Viewer

Step 1: Preliminary Requirements

Check your computer system first. We recommend that it meets the following requirements:

1. CPU: 1G Hz
2. Random Memory: 128 Mb
3. Video Card: Gforce 2 or above

¹ WCS (Web Coverage Service) Interoperability Program Report:
<http://www.opengis.org/techno/discussions/02-024.pdf>

Step 2: Download

Download and save, in any folder, the client package `ogc_3d_viewer.exe` from the GeoServNet OGC version link from the GeolCT website².

Step 3: Install

Install the OGC 3D Viewer by run or by double-clicking on `ogc_3d_viewer.exe` file. This will automatically start to install this package in your computer. You just need to follow the installation guide to choose the install folder and shortcut folder as well as the name for the OGC 3D Viewer, and finally click the install button to finish the installation.

By default, the install folder is `C:\Program Files\ OGC 3D Viewer`, the shortcut folder is your `\Start Menu\Programs`, and the name is `OGC 3D Viewer`. To start your OGC 3D Viewer, by default, click on `Start\Programs\OGC 3D Viewer`. To uninstall your installed OGC 3D Viewer application, you need to go to your `Control Panel\ Add/Remove Programs` to remove it.

2D Viewer Operation

After you install the OGC 3D Viewer, you can start the OGC 2D Viewer from `Start\Programs\OGC 3D Viewer`. The following sections introduce the 2D Viewer functions and operations:

- GSN OGC Client V1.5
- OGC Web Services

GSN OGC Client V1.5

If you run the OGC 2D/3D Viewer executable application, the Graphical User Interface of the OGC 2D Viewer, GSN OGC Client V1.5, as shown in Figure 36 below, will be launched.

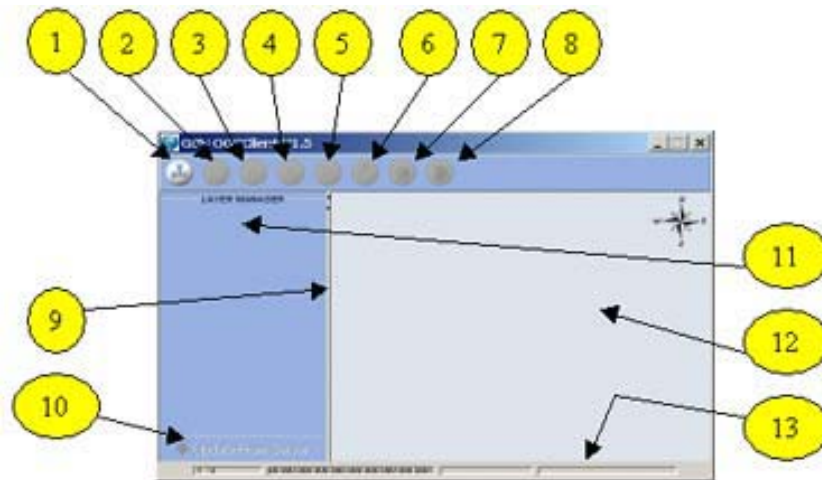


Figure 36: GSN OGC Client V1.5

1. *Connect to OGC Server button*: open the OGC Web Service dialog box by left-clicking on it first, or open the OGC Web Service dialog box and abandon all its stored data by left-clicking on it in the middle.
2. *Open OGC Server Properties Dialog Box button*: open the OGC Web Service dialog box by left-clicking on it.

² GeoServNet OGC 3D client download: <http://www.geoict.yorku.ca/plugin/ogc3dviewer.exe>

3. *Zoom in by specified window / times button*: enlarge the selected area by left-clicking on it first, and then left-clicking on the map. Or by pressing and holding the left mouse button and then moving the mouse downwards to select the zoom in area on the map.
4. *Zoom out 2x button*: shrink the map to a half by first left-clicking on it and then left-clicking on the map.
5. *To Full Extent button*: restore the map to its original size by left-clicking on it.
6. *Pan In Current Scale button*: move the map within the map area by left-clicking on it first and then pressing and holding the left mouse button and dragging.
7. *Identify the selected single feature button*: Query for selected single layer by first left-clicking on it and then left-clicking on the specific location on the map.
8. *Load 3D Analysis Window button*: start 3D Analysis Window by left-clicking on it.
9. *Split bar*: adjusts the space between the layer manager box and 2D map area by resting the mouse on the bar and pressing, holding the left mouse button and then dragging to left or right, or left-clicking on one of the arrows on the bar.
10. *Update From Server button*: update the map from the server remotely by left-clicking on it.
11. *Layer Manager pane*: use this to contain, select and set for a layer or layer group, as in Figure 37. All the operations on the layer or layer groups can be accessed from the popup menu by right-clicking on layer or layer group and listed below:
 - set current layer: set the selected layer as current layer
 - move layer to: move the selected layer to the top of the layer which you click on next
 - delete this layer: Delete selected layer or layer group
 - set transparent: set the layer's background color to be transparent.

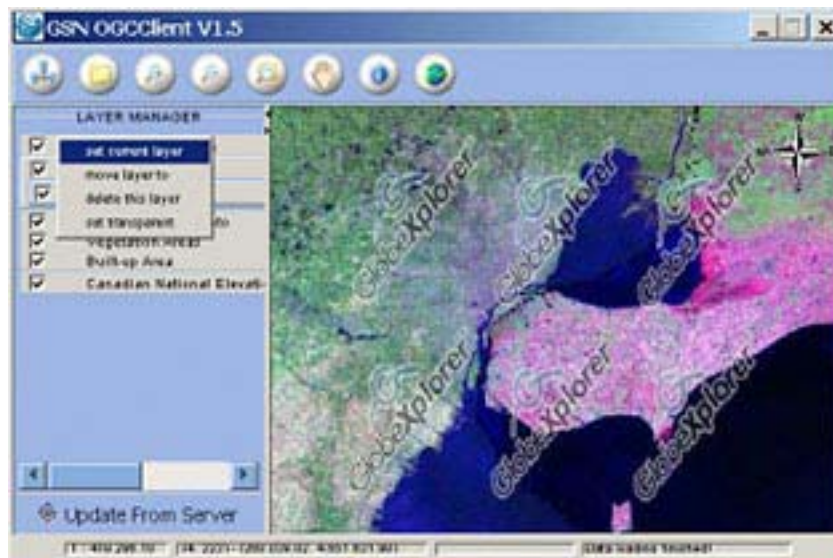


Figure 37: Layer Manager pane with a pop up menu

12. *2D Map viewer*: the area used to display the 2D map. All the operations on the 2D map can be accessed from item 3 to item 8 or from the Map viewer popup menu (Figure 38) by clicking the right mouse button on the map area; available functions are listed below:

- Zoom in (Same as No. 3 above)
- Zoom out (Same as No. 4 above)
- Pan (Same as No. 6 above)
- Query (Same as No. 7 above)
- 3D Viewer (Same as No. 8 above)

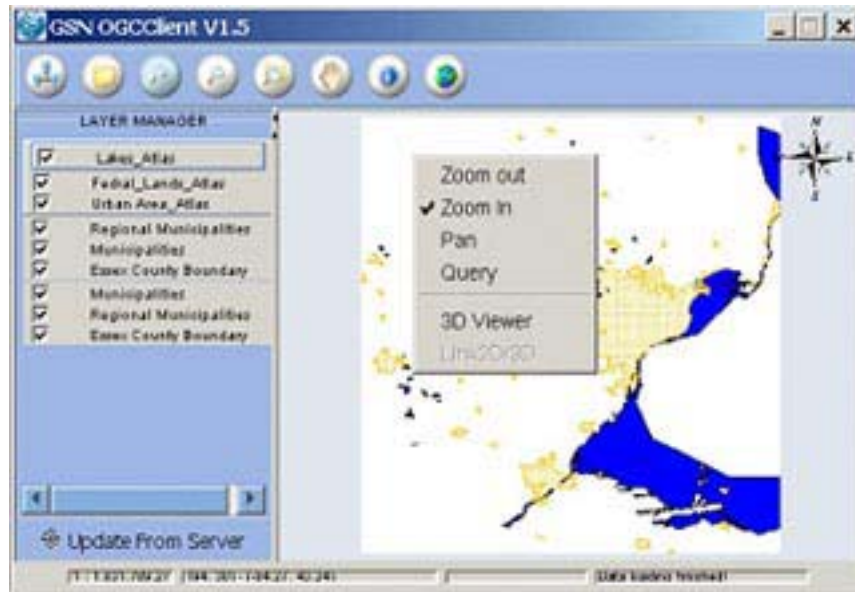


Figure 38: Map viewer popup menu

13. *States bar*: display the map scale, relative and absolute coordinates, progress bar and state message

OGC Web Services

After Connecting to the server by left mouse clicking on the OGC Server tab or by opening the OGC Server Properties Dialog Box Button on the 2D Viewer, the OGC Web Services dialog box will look as shown in Figure 39.

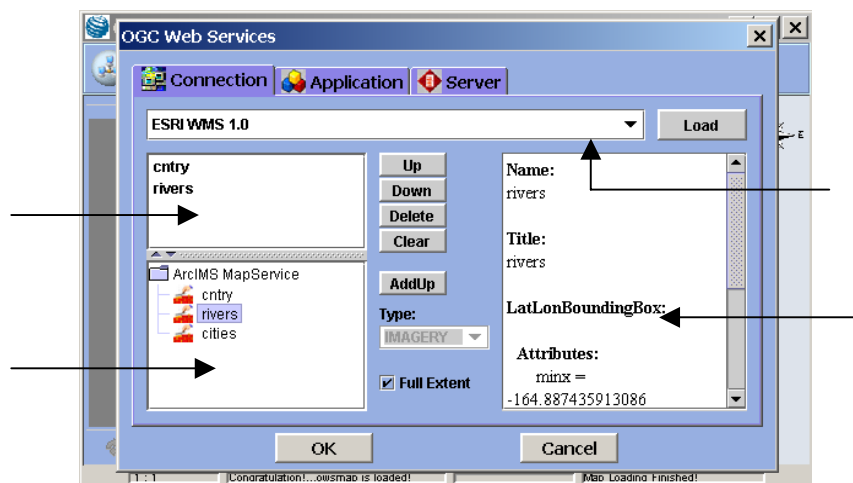


Figure 39: OGC Web Services dialog box

The OGC Web Service dialog box contains three tabbed panes and two buttons: Connection Pane, Application Pane, Server Pane, OK and Cancel as follows:

- Connection Pane: Used to connect and communicate with remote server.
- Application Pane: Used to display and edit user application.
- Server Pane: Used to display, add and edit the servers.
- Ok button: Used to validate and store the data of all the layers in the layer list pane within Connection pane, and to close the OGC Web Service dialog box.
- Cancel button: Used to abandon the selected layers and close the OGC Web Service dialog box.

Next, we will look at the details from each of three tabbed panes.

The Connection Pane (Figure 40) contains following components:

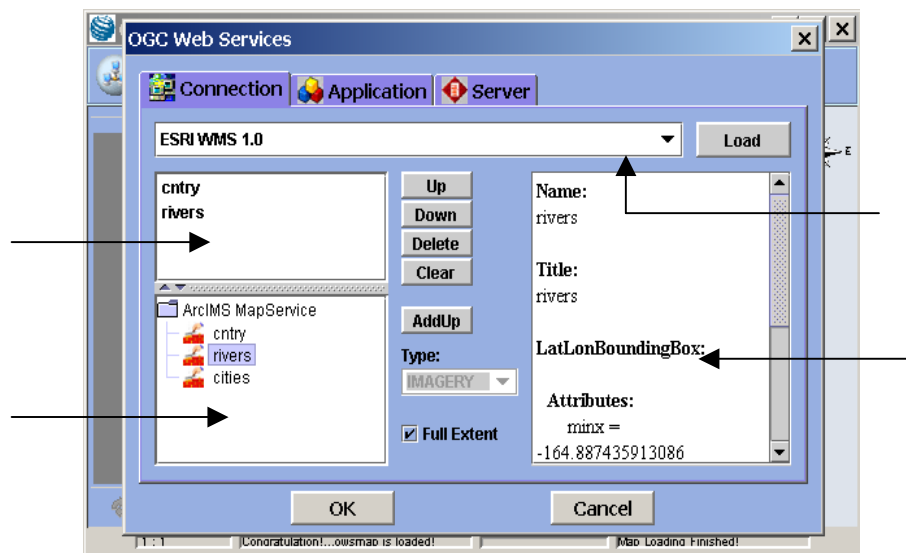


Figure 40: Connection Pane

- Selected server combo box: Select and display the selected server name from the server list
- Layer tree pane: Displays the layer tree. The operations involving the Layer tree pane:
 - Display layer data: Clicking on a layer once to select, high light and show its data in the layer data pane.
 - Add layer up to layer list: Double left click to add a layer to Selected layer list, or click AddUp button to add up the selected layer
- Layer list pane: Lists all the selected layers. Operations involving the Layer list pane:
 - Select a layer: Click on a layer to select, highlight and show its data.

- Select layers: Ctrl + mouse clicking to select and highlight multiple layers.
- Layer data pane: Displays selected layer's data
- Load button: Connects to the selected remote server and load data from it.
- Up button: Moves the selected layer one row up in the Selected layer list pane.
- Down button: Moves the selected layer one row down in the Selected layer list pane.
- Delete button: Deletes one or multiple selected layers in the Selected layer list pane.
- Clear button: Clears all layers once in the Selected layer list pane.
- AddUp button: Adds a selected layer in the layer tree to in the Selected layer list pane.
- Map type combo box: Used to specify the map type.
- Full extent check box

The Application Pane (Figure 41) contains the following components:

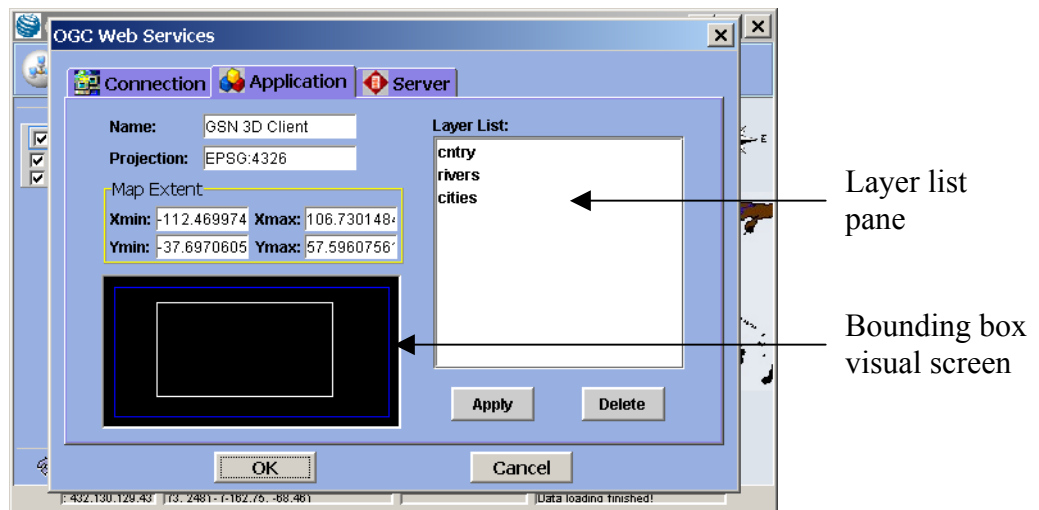


Figure 41: Application Pane

- Name: Display user application's name.
- Projection: Display user application's projection.
- Map extent: Display user application's map extent.
- Layer list pane: Display all the layers selected by user from the connection pane.
 - Clicking on a layer: to select, high light and visual its bounding box in the Bounding box visual screen
 - Ctrl + mouse click: to select and high light multiple layers
- Bounding box visual screen: display layer bounding boxes. Its functions and operations:
 - Display all the bounding boxes of the layers in the layer list pane with multiple colors.

- Draw and display the user defined bounding box by pressing and holding the left mouse button, then dragging it from left up to right down in the valid area.
- Clear the user bounding box by clicking on the screen.
- Apply button: Validate and store the data of the user defined bounding box, application name and projection.
- Delete button: Delete one or multiple selected layers in the layer list pane.

The Server Pane (Figure 42) contains the following components:



Figure 42: Server Pane

- Select Server combo box: List all the stored server names.
- Name text area: Display and edit the new or selected server's name.
- URL location text area: Display and edit the new or selected server's URL location.
- Version text area: Display and edit the new or selected server's version.
- Type text area: Display and edit the new or selected server's type.
- Image format text area: Display and edit the new or selected server's image format.
- Projection text area: Display and edit the new or selected server's projection.
- Get Capabilities text area: Display and edit the URL location of the new or selected server's capabilities.
- New button: Clear all the text areas to add a new server.
- Delete button: Delete the selected server and all its data from the server list combo box.
- Apply button: Validate and store the data from all the text areas to add in the new server.

Operate 2D Viewer by Example

The functions and operations of the 2D Viewer were discussed in the previous section. This section shows a step by step example of the typical operation of the 2D Viewer.

Step 1: Start or run the OGC 2D/3D Viewer: Run or double-click on `ogc_3d_viewer.exe` or the name you have given it. The GSN OGC Client V1.5 will appear on your screen.

Step 2: Open the OGC Web Services: Left-click on the Connect to OGC Server button to open the OGC Web Services window.

Step 3: Load data from server(s) using the Connection pane.

Step 3a: Select PCI WCS 0.7 CIPI server.

Step 3b: Load layer data: press Load button and wait for the layer tree to appear in the layer tree pane as in Figure 43:



Figure 43: Load Data & Select Layers

Step 3c: Select layer(s): traverse the layer tree to select a layer, check layer data from the right layer data pane, add the selected layer up to the layer list pane by double-click on it or push AddUp button. Manipulate the selected layers in the layer list pane using Up, Down, Delete and Clear buttons. Select map Type as DEM and let Full Extent be checked.

Step 3d: Store layers data and load map data: Press OK button (Figure 44). Press Cancel button to deselect.



Figure 44: Store Layer Data and Load Map Data

Step 3e: Select layer(s) from another servers: repeat processes from Step 1 to Step 4 above for each server. For example, select layers from Cubewerx WMS server, USGS WMS server, GlobeExplorer WMS server.

Step 4: Manipulate the layers and 2D maps in the 2D Viewer.

Main operations:

- To display one or more map layers within one layer group which surrounded by blue rectangle and are from the same server, check the layer or layers you want to show under Layer Manager, uncheck all the rest and push the Update From Server to reload wanted map data.
- To display map layers not in one layer group (from different servers), only if the top layer or layers are transparent, the transparent layers and the first non-transparent map layer can be seen. The rest under them will be blocked.
- Use the buttons in the toolbar to zoom in, zoom out, restore full extent, to move the map around, to query to the current layer and to launch 3D Viewer. To add another layer into the Layer Manager, use the Open OGC Server Properties Dialog Box button, and repeat the steps in 3 above. To give up all the loaded layers in the 2D Viewer and start from very beginning, push Connect to OGC Server button.

Step 5: To create and edit your own application, use the Application pane introduced under section 'OGC Web Services' by pressing Open OGC Server Properties Dialog Box button, and clicking on Application pane tab.

Step 6: To add a new server or edit an existed one, use the Server pane introduced under section 'OGC Web Services' by pressing Open OGC Server Properties Dialog Box button, and clicking on Server pane tab.

1. 3 D Viewer Operations

After launching the 3D Analysis Window by left-clicking on the Load button or selecting 3D Viewer from the popup menu, or selecting Launch 3D from the menu that appears by right-clicking on the map area on the 2D Viewer, the 3D Viewer will be launched as shown Figure 45:

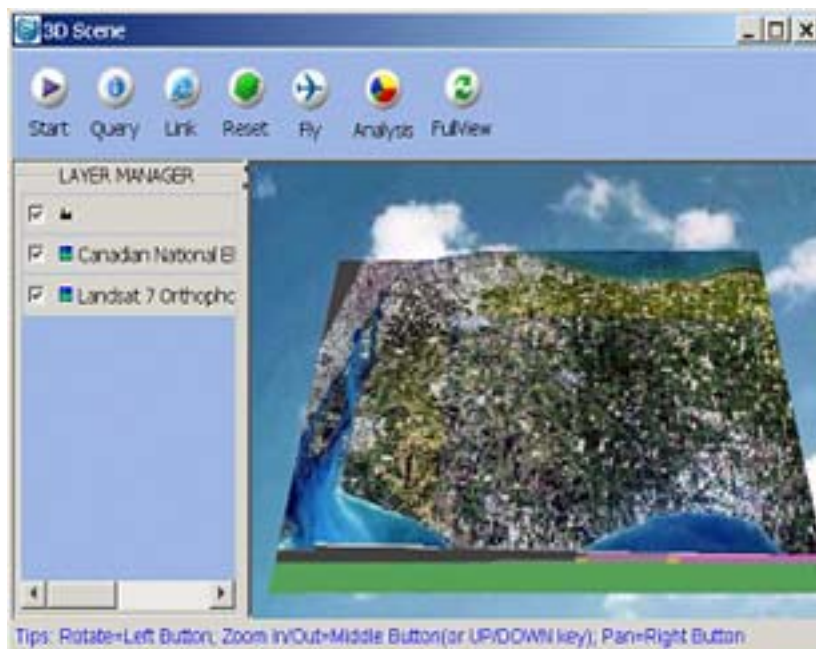


Figure 45: 3D Viewer - 3D Scene

Main functions and operations are the following:

1. Start/Stop: start/stop rotating 3D map by left-clicking on it
2. Query: Query from 3D viewer for current layer (Same as No. 7 in section 9.6.1)
3. Link: Show Hyper Link Document by left-clicking on it
4. Reset: Set All Layer on to Terrain by left-clicking on it
5. Fly: left-click on it to prompt up the Flight Control Panel to set for auto-flying
6. Analysis: there are four GIS Analysis Functions under its submenu. The submenu appears after a left-click on it.
 - *3D Location*: Get 3D location coordinates from the 2D map. To get 3D location coordinates, first left-click on the Analysis button and select the 3D Location submenu. Then left-click on the on the 2D map location of the 3D location whose coordinates you want to get. A pop up box shows you the 3D location coordinates and a red flag indicate the location on the 3D map.
 - *Profile & Distance*: Show the height change and distance information of multiple points on the selected path from 2D map. After choosing the Profile & Distance submenu, select the path you want from 2D map. Single click to select point, double click to end. Then a pop up box Profile will show you the diagram of the profile and distance.
 - *Critical Surface*: Add a critical layer, such as the surface of water, to the 3D map, and the layer also is added into the Layer Manager pane.
 - *Viewshed*: Find the viewable areas on the DEM layer with selected shed color on 3D map from dedicated location selected from 2D map. To show the viewable areas on the 3D map, after selected the Viewshed submenu, first select the location you would like to view from 3D Map. View from on the 2D map, a pop up box Color Chooser will show up. Use the scroll bar to a color and left-click on the OK button. Then you can find your view location indicated by a red flag and the viewable areas from the location are showed with your selected color on the 3D map.
7. FullView: Show 3D Full View by left-clicking on it.
8. The moveable toolbar: All the 7 buttons above are located on the moveable toolbar. It can be moved out and back from the 3D Scene. To move out the toolbar, hold the left

mouse button on the toolbar and drag the mouse. To restore the remote toolbar, left-click on the close button on the upper right corner of the toolbar.

9. *Split bar*: Adjusts the space between the Layer Manager box and the 3D Map Viewer, like the one on the 2D Viewer.

10. *Layer Manager*: List and manipulate all the selected layers in a group manner.

Operations as follows:

- *No DEM Data check box*: Add or not add DEM Data to the 3D map by checking or not checking.
- Settings for the No DEM Data layer:

Color setting: Color setting for height slots. To set color, first check the No DEM Data check box and set it as current layer, then right-click on the name of the layer and select the color submenu from the pop up menu. The color setting box named Terrain Legend will pop up as in Figure 46. Then choose a number from the class number combo box and press the OK button.

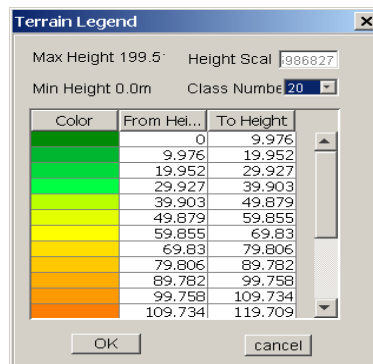


Figure 46: Terrain Legend

Height scale setting: Change height scale. To set height scale, first check the No DEM Data check box and set it as current layer; then right-click on the name of the layer and select the height scale submenu from the pop up menu. The Change Height Scale box will pop up. Use the scroll bar to set the height scale and press the OK button.

- *Set current layer*: Select a layer within the Layer Manager pane and set it as the current layer by left-click on the layer name make sure there is a pink rectangle surrounding the layer name.
- *BaseHeight setting*: Set base height for selected layer group. To set base height for selected layer group, first set the layer group as current layer group, then right-click on the names of the layer group and select the BaseHeight submenu from the pop up menu. The Change Base Height pop up box shows up. Use the scroll bar to set the base height and press the OK button.

11. *3D map viewer*: This is used to display the 3D map. To manipulate the 3D map by pressing and holding the left mouse button and moving the mouse around.

Operate 3D Viewer by Example

The previous sections showed how to use the 2D Viewer and all the functions and operations of the 3D Viewer. The next section shows how to use the 3D Viewer, using examples in a typical operation order.

Step 1: Launch 3D Viewer: After all the wanted map layers are loaded and managed under the Layer Manager in the 2D Viewer, left-click on Load 3D Analysis Window button on the toolbar or select 3D Viewer from the popup menu after right-clicking in the map area on the 2D Viewer. The 3D Viewer will be launched.

Step 2: Start/Stop rotating the 3D map by clicking on Start/Stop.

Step 3: Query to the current layer: First set a current layer to query, then click the Query button, then left mouse-click on a specific location on the 2D map or 3D map that you want information about. A pop up information box will give you the queried message.

Step 4: Reset all layers with base height not zero on to Terrain by left-clicking on Reset button. For example, in Figure 47, set ArcIMS MapService layer's base height to 1000 to separate it out of the Terrain. Push the Reset button to set the separated layers back to Terrain.

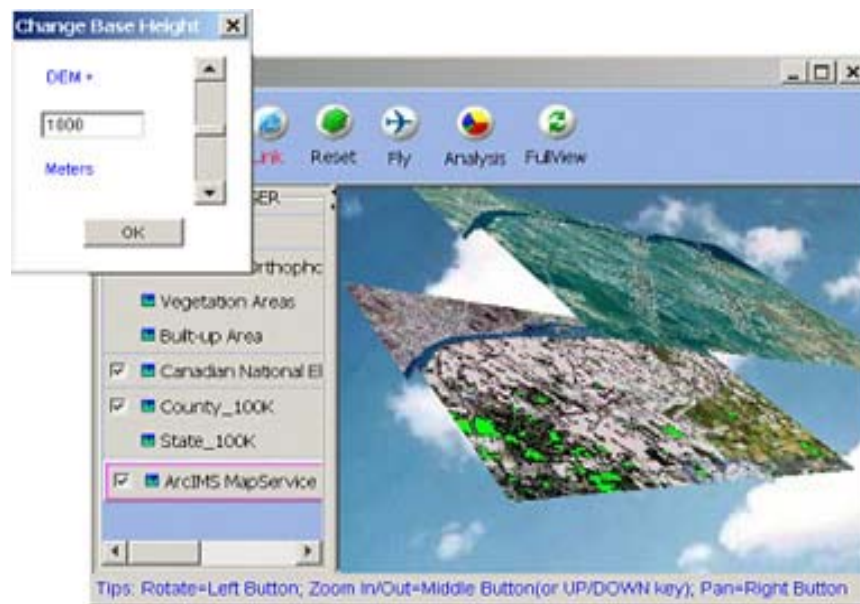


Figure 47: Set base height for ArcIMS MapService layer

Step 5: Auto-flying with selected path, height, speed and view deegree with the following steps:

Step 5a: Push Fly button, then set Height, Speed and Pitch in the Flight Control Panel.

Step 5b: Set path by push Path button on Flight Control Panel, then by single-clicks to select a specific fly path, double-click to end the selection (Figure 48).

Step 5c: Push the Start or Stop button on Flight Control Panel to start or stop the fly.

Step 6: Analysis: its functions and operations.

Step 7: Push FullView button at any time to set 3D map to its original full extent view.

Step 8: To manipulate the 3D map by you mouse: within 3D map area, press and hold the left mouse button and move the mouse around to display the 3D map in any direction.



Figure 48: Setting Path, Height, Speed and Pitch