

A 'Google Earth' User Manual for Earth Science Teachers

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INTRODUCTION

Disclaimer: The work presented here is not associated with Google™ or GoogleEarth™ in any way.

Since its release in the summer of 2005, Google Earth has provided an uncomplicated means of combining satellite imagery with geological and geographic information in dramatic fashion. While satellite visualization tends to grab the student's attention, it remains necessary to integrate these techniques into lessons that include inquiry-based learning activities.

Topics that can be studied with the aid of Google Earth include, but aren't limited to:

- Glacial vs. stream valleys
- Glacial landforms
- Landscape regions of NY
- Shoreline processes such as wave refraction, long shore drift and associated landforms
- Igneous processes such as volcanoes and flows
- Impact craters and suspected impact craters
- Plate tectonics
- Erosion systems and cycles
- Fluvial processes - erosion and deposition
- Structural Geology
- Time of day and angle of insolation from shadows of tall objects
- Topographic maps
- Planetary features
- Ocean currents
- Atmospheric circulation patterns

This manual is designed to provide a description of how to use the program for all ability levels, from absolute novice to seasoned 'expert'. New techniques and methods are continuously being developed or identified. Therefore, this work is as complete as it can be at the time of its writing. Addition sections may be added at later dates.

This manual is not intended to provide specific examples of inquiry-based Google Earth activities. Rather, it is designed to provide the user with the skills necessary to apply this powerful program in such a way that they will see for themselves how to include Google Earth into their own classrooms.

GETTING AND INSTALLING GOOGLE EARTH

Google Earth can be downloaded from the internet site: <http://earth.google.com>. There is a free version as well as paid versions. The pay versions provide the user with more features and function, including the ability to upload GPS data directly into the program. This manual will focus on the features that are included and can be used with the free version.

To install the program, visit the web address above and follow their directions.

GOOGLE EARTH CONTROLS

After installing and opening Google Earth, the initial screen will appear as it does below.



The Google Earth program displays five separate frames. The main frame displays the Earth, which can be manipulated in numerous ways. The **Navigation** frame at the bottom of the screen can be used to control the view of the Earth. The **Search**, **Places**, and **Layers** frames are located on the left side of the screen.

SEARCH

The search frame can be used to find locations. The search can be done by entering a specific street address, a zip code, or longitude/latitude coordinates. A place location that is NOT as street address can not be searched. For example, a search for 'Mt. St. Helens' may result in a list of locations that have nothing to do with the volcano in Washington State.

It is also possible to search for business addresses and to get driving directions by using the appropriate search options.

PLACES

Files opened into Google Earth will be displayed here. The 'Sightseeing' folder is opened by default when Google Earth is started. This folder contains several placemarks which can be activated or deactivated by using the check-box next to the location. Locations can be visited individually by double-clicking on the place name. An automated tour of the locations in the 'Sightseeing' folder can be viewed by pressing the play button at the bottom of the Places frame. The Stop and Pause buttons work as they should. The development of Tours will be discussed in a later section.

Multiple files can be open at the same time. Each will appear as a new sub-folder in the places frame.

LAYERS

Google Earth comes with a list of standard layers that can be activated by clicking the adjacent check-box. Most layers are obvious and self-explanatory. The 'community' layers contain locations and information that have been posted by individuals in the extended Google Earth community. *Some are more useful than others.*

New layers are constantly being developed and can be downloaded from a variety of websites. When these layers are opened in Google Earth, they appear as locations in the **Places** frame rather than the **Layers** frame. They can be activated or deactivated through the checkbox next to each file.

NAVIGATION

The view of the Earth can be manipulated to display any position on Earth's surface from a wide variety of altitudes and angles. There are several ways to control the view: using the mouse, the keyboard, or the navigation frame at the bottom of the program.

➤ Mouse (PC with a wheel) Controls

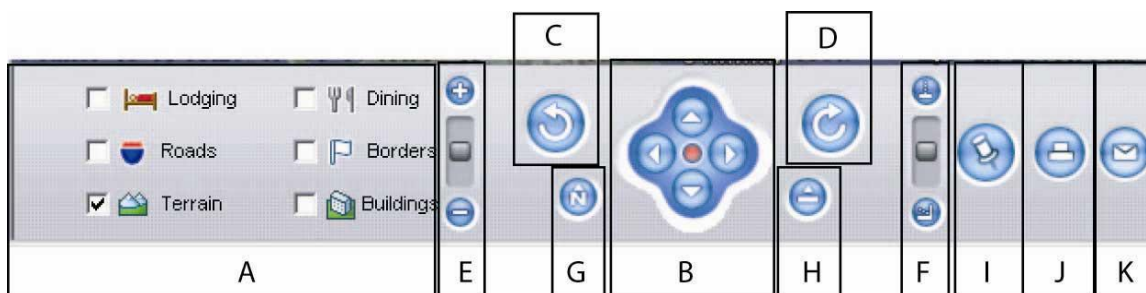
Function	Mouse Control
Move the view up/down and right/left	Hold left button, move mouse up/down, right/left
Zoom in	Hold right button, move mouse down
Zoom out	Hold right button, move mouse up
View at a more direct angle	Hold wheel/middle button, move mouse up
View at a less direct angle	Hold wheel/middle button, move mouse down
Rotate view clockwise	Hold wheel/middle button, move mouse right across the top of the screen
Rotate view counterclockwise	Hold wheel/middle button, move mouse left across the bottom of the screen

➤ Keyboard controls

Function	Keyboard Command 1	Keyboard Command 2
Move the view up/down and right/left	Arrow keys	
Zoom in	+ (plus key)	Ctrl and up arrow
Zoom out	- (minus key)	Ctrl and down arrow
View at a more direct angle	Page Up	Shift and up arrow
View at a less direct angle	Page Down	Shift and down arrow
Rotate view clockwise	Shift and left arrow	
Rotate view counterclockwise	Shift and right arrow	

➤ Navigation Frame

The lower frame of the Google Earth window (detail below) can be used to navigate around the Earth. The frame has been broken into different zones labeled A - K.



Zone	Function
A	Activates common layers
B	Moves the image in the direction pressed
C	Rotates the image counterclockwise
D	Rotates the image clockwise
E	Zooms in and out. Use either the buttons or the bar.
F	Changes the angle of the view (buttons or the bar). Up is more direct, down is less direct.
G	Resets the image so north is to the top of the screen
H	Resets the tilt to 90°
I	Adds a placemark
J	Prints the image
K	Emails the image

OPENING FILES

Google Earth files can be opened the same way that any other application would open files.

1. Start the Google Earth Program
2. Select **File > Open**.
3. Choose the appropriate file and press OK.

Google Earth files will be opened into the **Places** frame where they can be activated or deactivated by using the checkbox next to each placemark or layer.

FILE TYPES

Two basic Google Earth file types exist.

KML – The KML file is a "flat" file or text based file composed of Tags similar to XML or HTML.

KMZ – KMZ files are KML files that have been zipped up along with their related files, such as image overlays. This means that you can share image overlays and custom icons without having to publish the files on an external web server or mail them as an attachment with the KML.

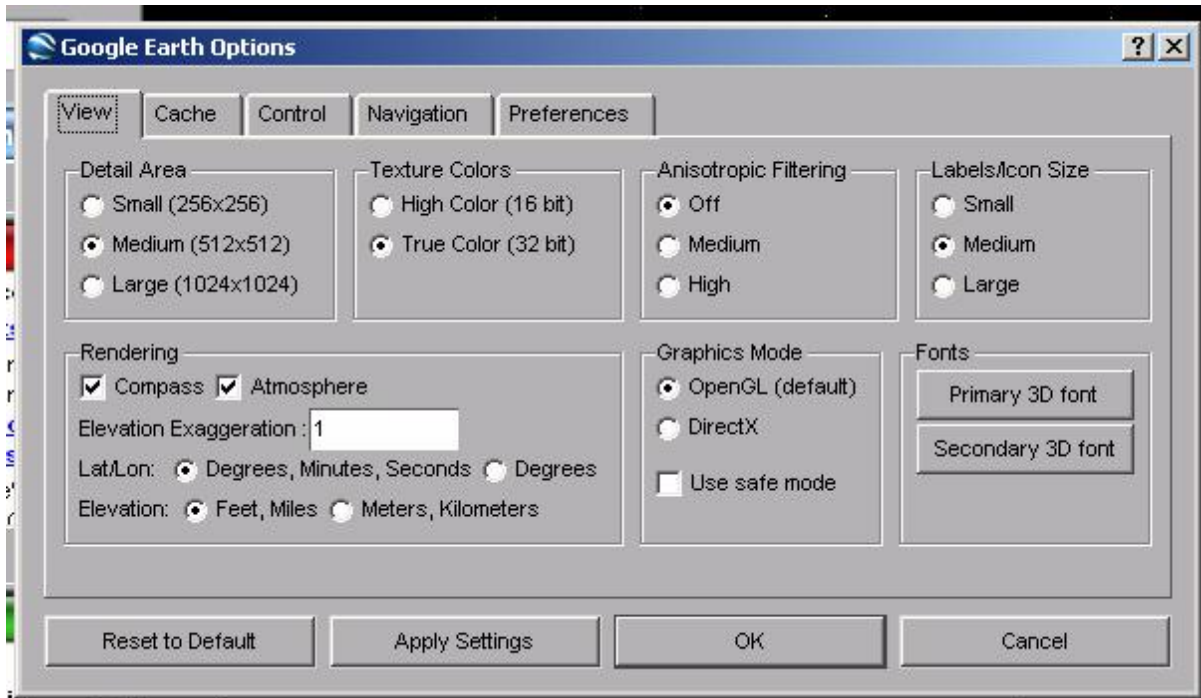
GOOGLE EARTH SETTINGS

Google Earth settings can be controlled to enhance the area of detail, vertical exaggeration, tour speeds, etc.

Access the settings by selecting **Tools > Options** to open the **Options** window.



The **View** tab allows the user to control many features including:



- The **Detail Area** controls how much of the screen is displayed in detail. A smaller area of detail allows for faster navigation and image rasterizing.
- The **Compass** option (under Rendering) toggles on or off the compass.
- The **Atmosphere** option (under Rendering) toggles on or off the atmosphere. The checked option displays the Earth during day and objects in the distance are viewed through a 'haze'. The unchecked option simulates the Earth on a clear night without the distance 'haze'.
- **Elevation Exaggeration** (under Rendering) allows vertical exaggeration to be increased or decreased. A setting of 1 displays the Earth's topography without exaggeration. Values between 1 and 3 can be entered.
- **Lat/Lon** and **Elevation** (under Rendering) controls the details of the units displayed in Google Earth.

GOOGLE EARTH TOURS

Tours are an effective way to automate a fly-by of Earth's geographic and geologic features. When properly constructed, they can act as an introduction to new content, as a supplement to developed labs or activities, or as part of a stand-alone technology-driven application.

DEVELOPING THE TOUR

Consider developing a list (mentally or written) of the desired locations for the tour. The following example creates a tour beginning with Marjum Canyon in the House Range of western Utah. Each stop will be assigned a unique placemark. The entire tour will be stored in a folder.

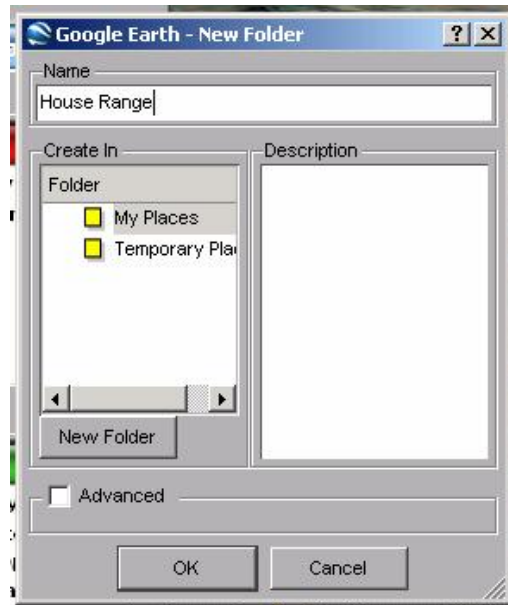
- a. Marjum Canyon
- b. Dome Canyon
- c. Wildhorse Canyon
- d. Notch Peak

CREATE THE TOUR FOLDER

In Google Earth, create a new folder for all the tour stops by selecting **Add > Folder**.



The folder being created will contain the each stop or placemark of the tour. Enter a name for the tour folder (ex. House Range). Press OK.




ADD PLACEMARKS

Set the image in the main frame to display Earth's features for the first stop of the tour. Consider the altitude, angle, and direction of the view. The orientation of the image will be stored along with the location.

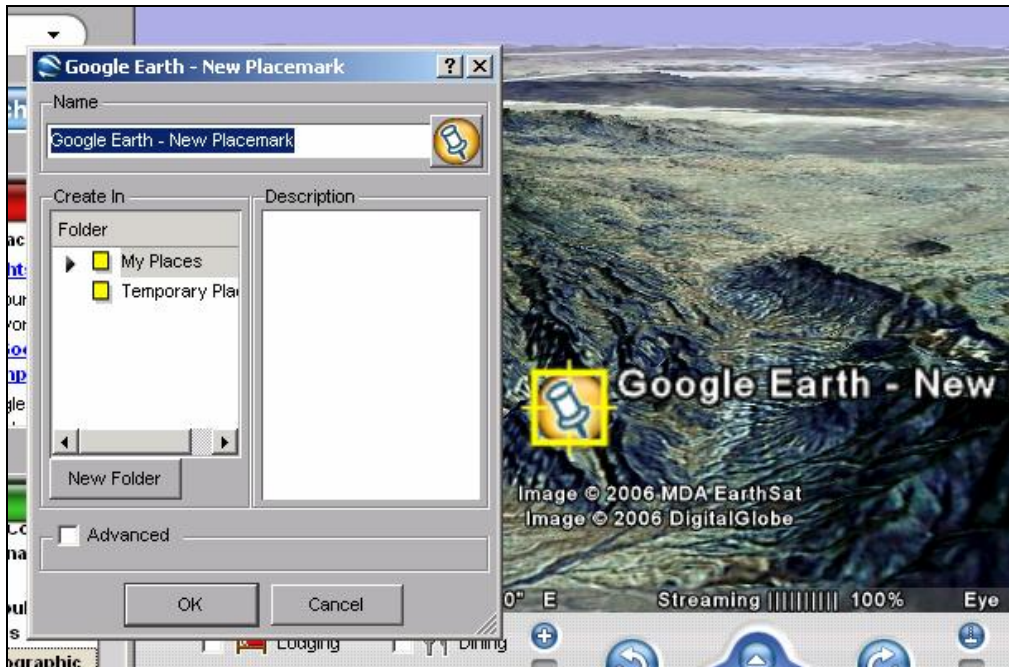
Create a new placemark by

Selecting the **Add > Placemark**



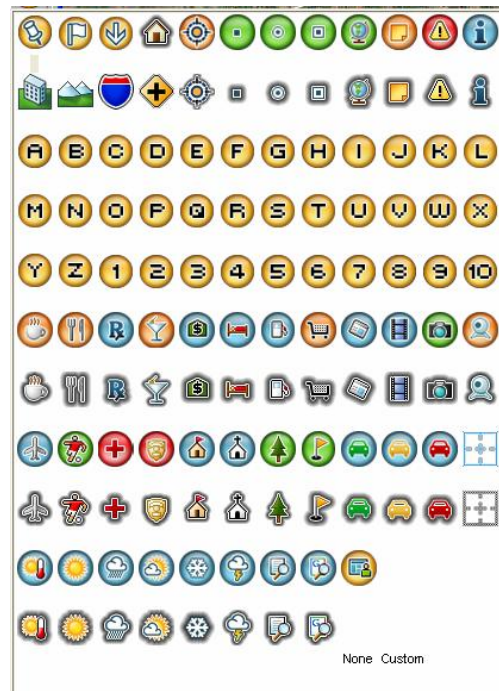
or by clicking on the blue **Add Placemark** icon () in the **Navigation Frame** at the bottom of the screen.

Either option will insert a yellow placemark (📌) and open a **New Placemark** window.



The placemark can be moved out of the middle of the view now. The saved view does not depend on the exact position of the placemark.

The yellow placemark indicator (📌) can be changed by pressing the icon in the top right of the **New Placemark** window. A selection of indicators (right) will become available. Choose the desired icon.



Enter a name for the first stop on the tour in the **New Placemark** window (ex. Marjum Canyon). Be sure it is being added into the newly created folder. Additional information about the placemark can be added in the Description window. (For more information, refer to the “Hyperlinks for Tour Stops or Overlay Images” section near the end of this manual)



Press OK and the placemark will be added to the tour folder in the **Places Frame**.

Repeat these steps for each additional placemark.



Each successive placemark will be added to the selected folder in the **Places Frame** on the left side of the screen.

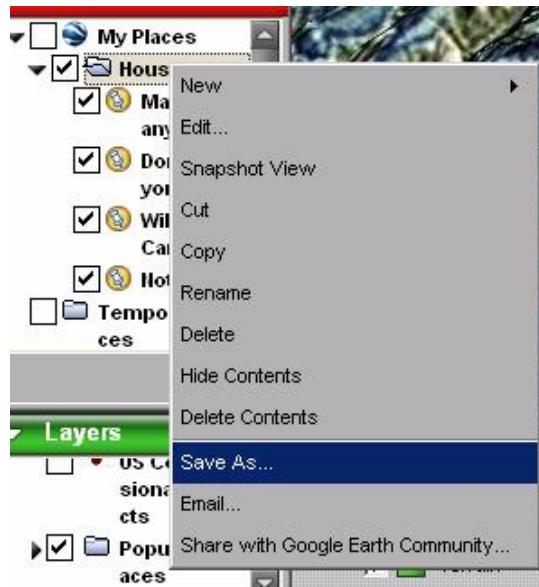
Tours play in order from the top down. Adding placemarks in a logical sequence may create a ‘backwards’ tour. Notice that the first location added (Marjum Canyon) is apparently the last stop on this tour. The tour stops can be rearranged by clicking and dragging each stop into its appropriate position in the tour list.

Hint: numbering the stops will help during the re-ordering process.

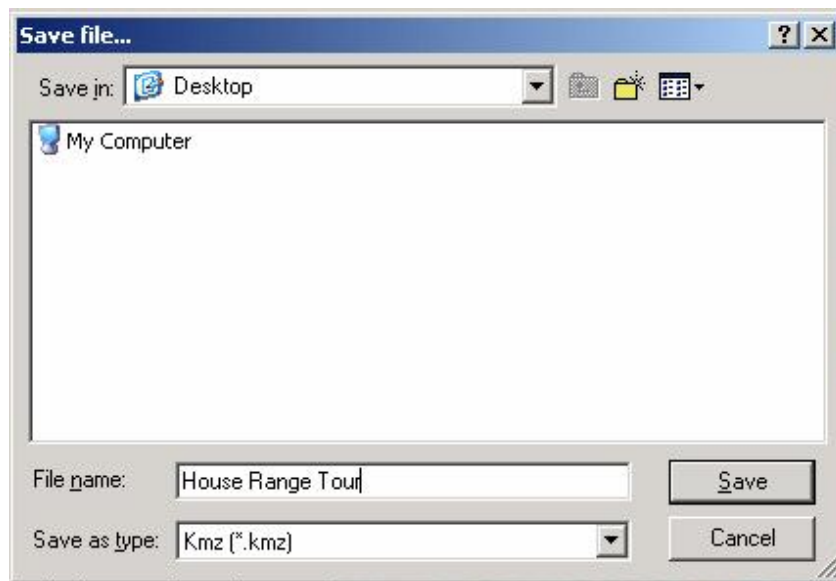
SAVING THE TOUR

Be sure that all the stops are arranged in the appropriate order within the **Places Frame** - the first stop will be at the top and the last stop will be at the bottom. Be sure that the tour folder and each stop are all 'checked'.

Right click on tour folder and select **Save As...**



A **Save file...** window will open. Name the file something reasonable and save it in a sensible location. The file extension will be *.kmz or *.kml. Either file type will work.



VIEWING TOURS IN GOOGLE EARTH

Select the tour to be viewed. Be sure each location is 'checked'. Press the play button at the bottom of the **Places Frame** to start your tour.

➤ To view a tour in Full Screen mode:

Be sure each location to be viewed is selected

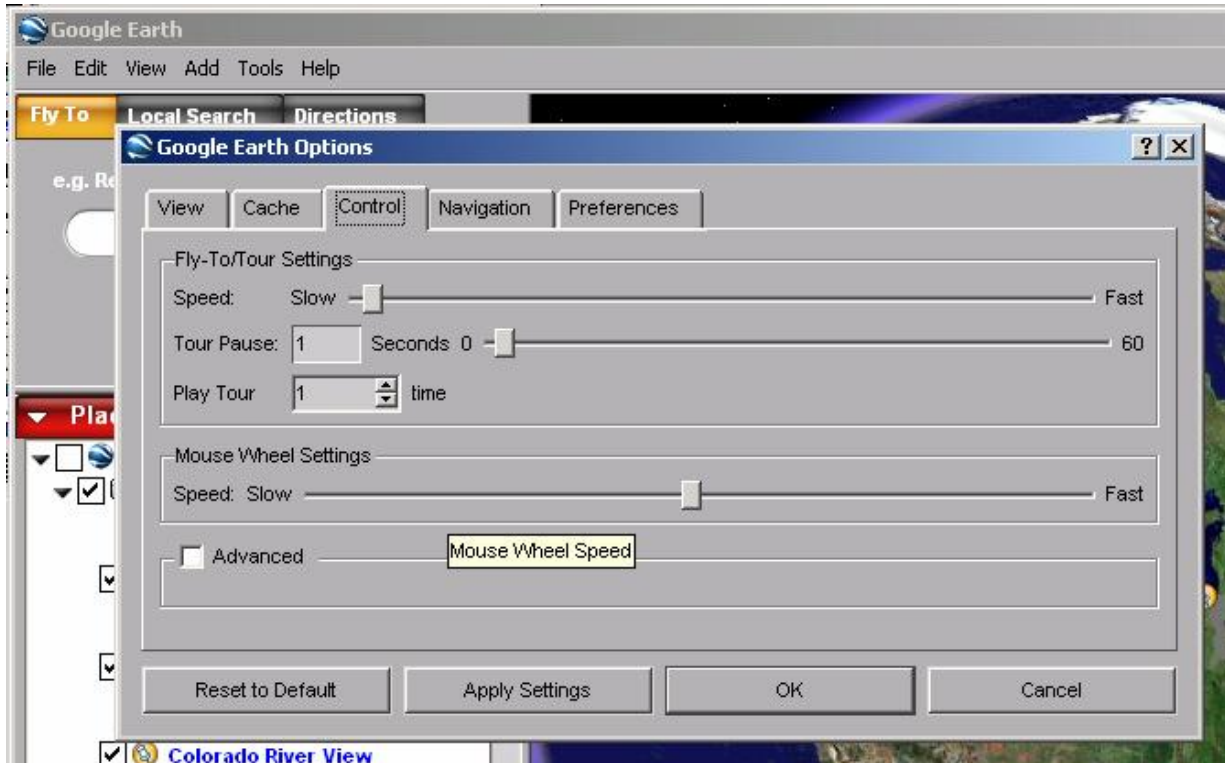
Press F11 to expand Google Earth into full screen mode.

Press F10 to begin the tour.



TOUR CONTROLS

Tour controls can be accessed by selecting **Tools > Options** and choosing the **Control** tab.



- The **Speed** setting controls how quickly the view changes from one stop to the next.
- **Tour Pause** controls the pause at each stop.
- **Play Tour** controls the number of times the tour is repeated.
- By selecting the **Advanced** option, additional settings can be accessed such as the fly-speed between stops (**fly speed**) and the overall **tour speed**.

Press OK when finished.

THE IMAGE OVERLAY FEATURE

The image overlay feature of Google Earth is a slightly more advanced, and therefore, more powerful use of the Google Earth program. This feature allows any digital image, such as a topographic map or an aerial photograph, to be 'draped' on the surface of the Earth and works in such a way that the topographic elevation under the image remains in place.

CREATE/GET YOUR IMAGE OVERLAY

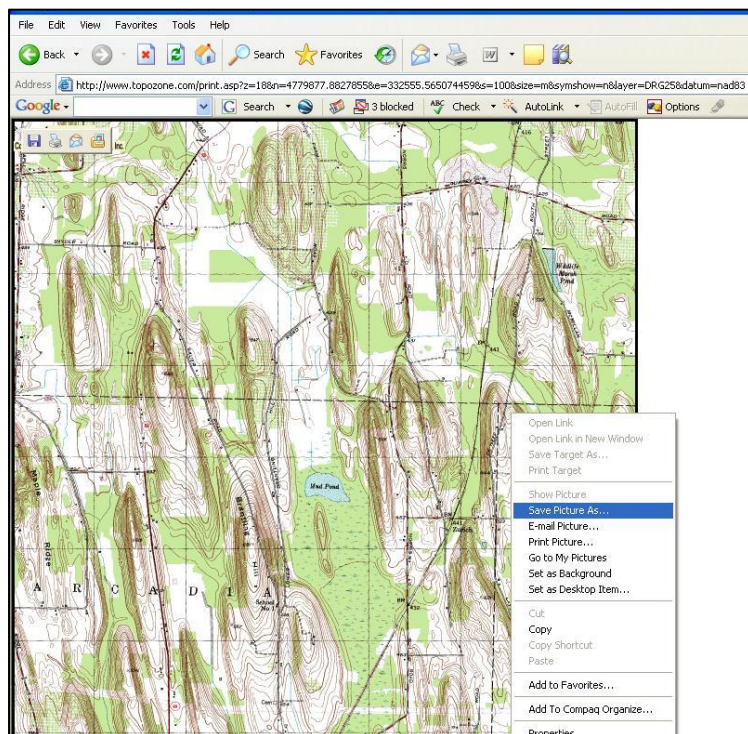
Pick the subject area. For the purposes of these directions, an overlay of a topographic map will be used.

The image used for the overlay must be saved as a .jpg, .bmp, or some other compatible digital image.

The image to the right is a screen capture from www.topozone.com.

The image is a topographic map of the Mud Pond region of Wayne County, NY which is known for its extensive drumlin field.

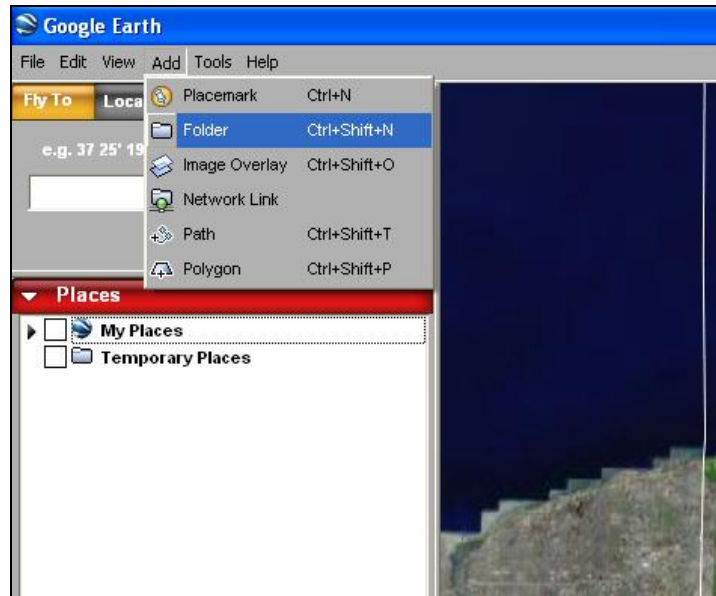
Right-click on the image and select **save as...** to capture the image. Save the image in a sensible location.



Overlay images can also be scanned from existing maps or images, which can then be used exactly as an image obtained from the internet.

INSERT YOUR IMAGE OVERLAY

In Google Earth, create a new folder for the Overlay Image and any associated information by selecting **Add > Folder**.



This will open a **New Folder** window that will store the overlay image and any additional associated tour stops. Name the folder (ex. Drumlins). Press OK.



Set the view in the main Google Earth window to match approximately the size and orientation of the map or image file you saved earlier.

Insert the digital overlay image by selecting **Add > Image Overlay**.



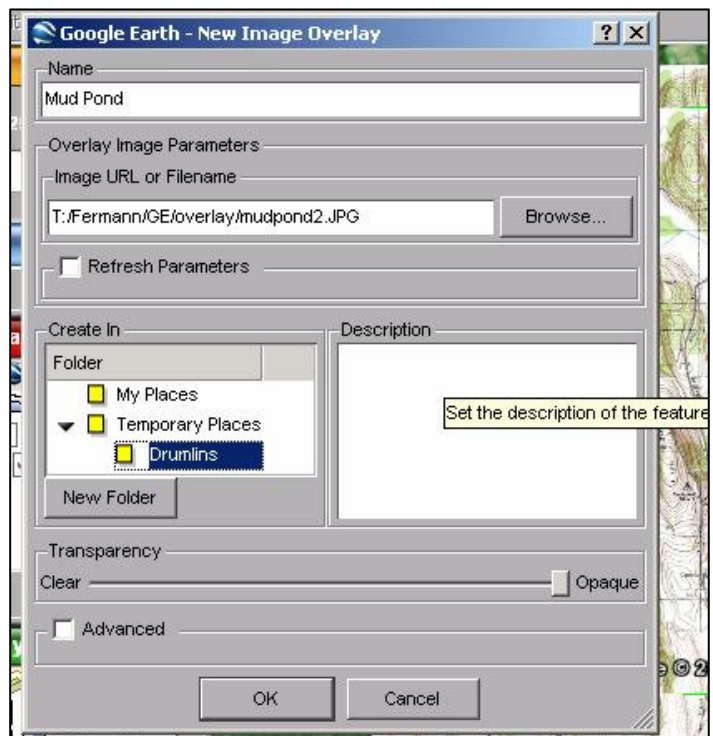
Give the overlay image an appropriate name (ex. Mud Pond).

Select the digital image you saved through the Browse button.

Be sure the image is being created in the correct folder (Drumlins).

Press OK.

The digital image will now be draped across the surface of Google Earth.



EDIT YOUR OVERLAY IMAGE

Your image will most likely NOT be oriented or sized exactly as it should be. It will, therefore, be necessary to edit or skew its size so that it matches exactly with Google Earth. (If you know the exact latitude and longitude of all four sides of your image, please skip the 'Easy' Image Overlay Edit section below. **This is rare.**)



In the **Places** menu on the left side of the screen, right-click on the image layer and select **Edit....**

This will open an **Edit Image Overlay** window and will place:

- green markers at each corner of your overlay image
- a green cross in the center of the image
- a peculiar green diamond in the middle of the left side of your image

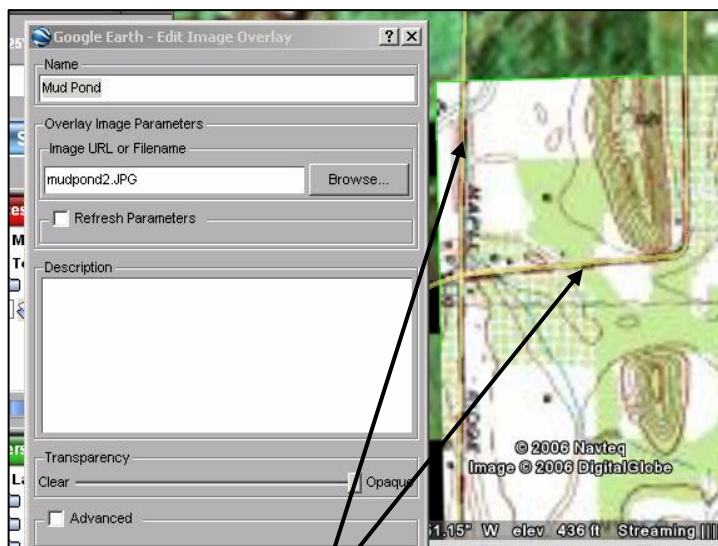
Each of these can be respectively used to resize, move, and rotate the image on the Google Earth screen.

Using landmarks from both the overlay image and Google Earth begin to resize the overlay image. It is often easiest to activate the roads layer

(☒ Roads) which can serve as landmarks. Resizing the image requires patience and some practice. Begin resizing in one corner of the image, and work in a sequential manner around the image.

Once all the landmarks are lined up, press OK in the Edit window.

The image should now be oriented and draped in exactly the right location on Google Earth.



Alignment has been achieved when landmarks in all four corners are match as they do in the top left corner of this image.

➤ 'Easy' Image Overlay Edit

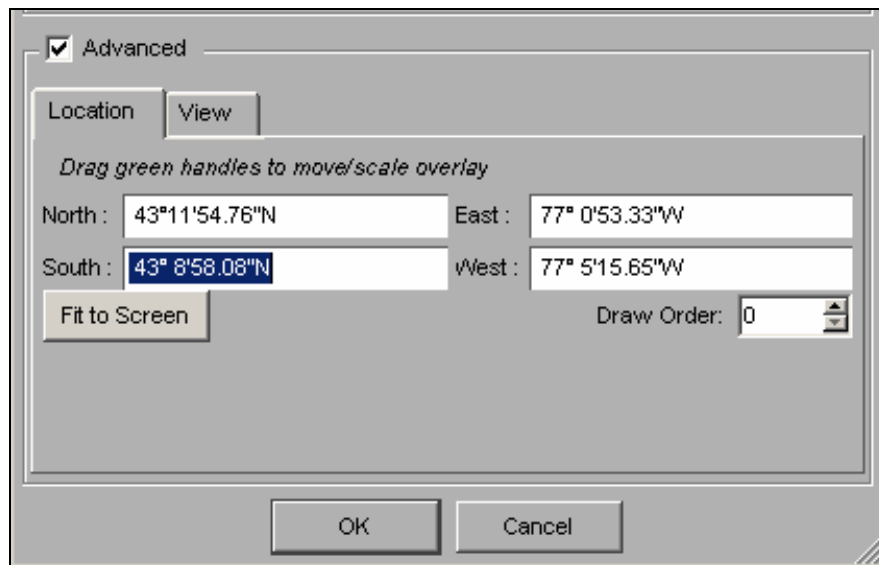
If the exact longitude and latitude of each side of the image overlay are known, they can be entered directly into the **Advanced** section of the **Edit Image Overlay** window.

In the **Places** menu on the left side of the screen, right-click on the image layer and select **Edit...**.

Activate the **Advanced** options by checking the box next to Advanced.

Select the **Location** tab.

Enter the specific coordinates for each side of the overlay image.



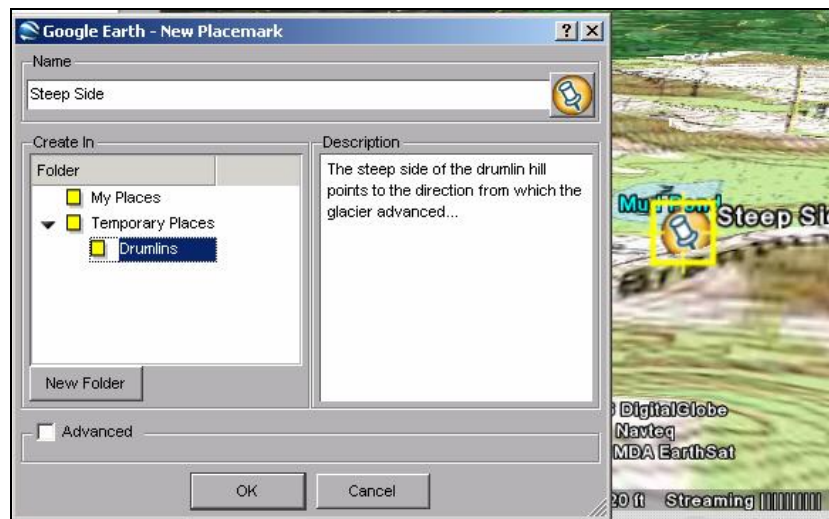
Press OK when finished. The image should now be positioned in the correct location.

Some minor adjustment of the overlay image may still be necessary.

ADD PLACEMARKS TO YOUR OVERLAY IMAGE

The image can now be manipulated and have placemarks added at-will. Any new placemarks should be added to the folder containing the image overlay (ex. Drumlins)

See the earlier *Creating Google Earth Tours* section for details.



HYPERLINKS FOR TOUR STOPS OR OVERLAY IMAGES

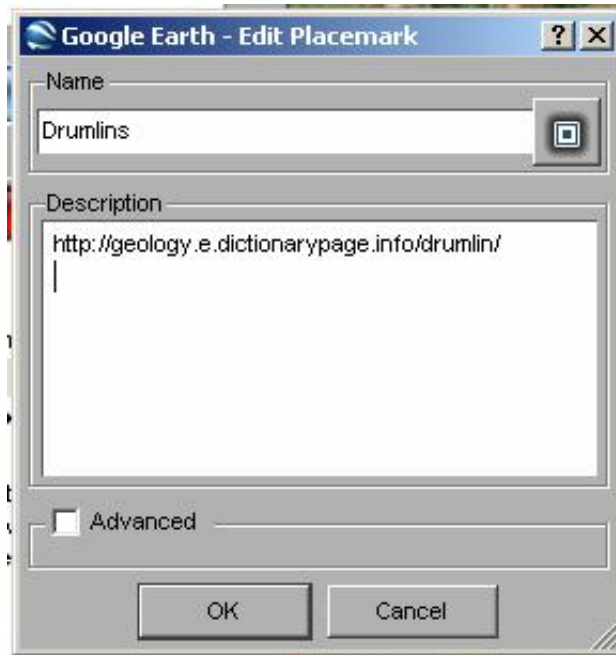
Adding hyperlinks to the image overlay or a tour stop allows additional web-based information to be readily available.

Right-click on the Placemark or Image overlay and select **Edit...** to open the **Edit Placemark** window.



A description of the site as well as hyperlinks to outside websites can be added to the description of the placemark.

Hyperlinks can be added by cutting and pasting the IP Address (<http://www.....>) in the description.



A smoother way to incorporate hyperlinks into the description requires the use of HTML code.

To turn a word or description in a sentence into a hyperlink, the following HTML code must be used in the Placemark Description:

Link Description

All characters must be entered. The *link URL* must be replaced with the appropriate <http://www....> The Link Description will be replaced with the word or phrase that will act as the link.

➤ Hyperlink Example

The following example can be entered to link the definition of a drumlin to the word drumlin:

The Drumlin field near Mud Pond in Wayne County, NY is one of the finest examples of these glacial deposits in NY State.

When the placemark is then visited and selected, this sentence will appear in a bubble with the hyperlink activated.

When the hyperlink is clicked, an external web-browser window will appear and be directed to the specified link.



SAVE YOUR OVERLAY IMAGE

When saving a folder that contains an image overlay and additional placemarks, a .kmz file will be created.

Right-click on the folder containing the overlay and placemarks and select **Save As....**



This will open a new **Save File...** window.

Name your file something appropriate, save it in a reasonable location, select .kmz as the file type, and press Save.

SUMMARY

Google Earth provides unique opportunity and perspective for students to visualize the world, especially for locations that students are unlikely to visit. The ability to easily manipulate the program to yield content-specific information makes the application useful to all Earth Science classrooms. The information contained in this manual will hopefully provide educators with the ability to utilize the Google Earth program in a variety of methods in their own classrooms.

Additional information and examples of technology-driven activities can be found at the following websites:

<http://www.eastchester.k12.ny.us/schools/hs/teachers/fermann/GE.htm>
and <http://www.bedford.k12.ny.us/flhs/science/geoscience/GEs/default.html>.