Google Earth – an introduction

Google Earth “combines the power of Google Search with satellite imagery, maps, terrain and 3D buildings to put the world's geographic information at your fingertips.”
Google Earth displays satellite images of varying resolution of the Earth's surface, allowing users to see things like cities and houses looking perpendicularly down or at an oblique angle, with perspective.

The degree of resolution available is based somewhat on the points of interest and popularity, but most land (except for some islands) is covered in at least 15 meters of resolution. Melbourne, Victoria, Australia; Las Vegas, Nevada; and Cambridge, Cambridgeshire include examples of the highest resolution, at 15 cm (6 inches).

Google Earth allows users to search for addresses for some countries, enter coordinates, or simply use the mouse to browse to a location.

Most of the images shown in Google Earth have been acquired from one to three years ago.
If you visit the Luxor Hotel (Las Vegas) in Google Earth, and zoom to see in detail, you can easily read advertisements on the side of the building.
Acquisition time

Historical imagery available
1. **Search panel** - Use this to find places and directions and manage search results.

2. **Hide/Show sidebar** - Click this to conceal or display the side bar (Search, Places and Layers panels).

3. **Placemark** - Click this to add a placemark for a location.

4. **Polygon** - Click this to add a polygon.

5. **Path** - Click this to add a path (line or lines).

6. **Image Overlay** - Click this to add an image overlay on the Earth.

7. **Record a tour** – Click this to record a tour.
8. Show historical imagery – Use the time slider to move between acquisition dates.
9. Sun - Click this to display sunlight across the landscape.
10. Sky - Click this to view stars, constellations, planets and the Earth's moon.
11. Measure - Click this to measure a distance or area size.
12. Email - Click this to email a view or image.
13. Print - Click this to print the current view of the Earth.
14. Show in Google Maps - Click this to show the current view in Google Maps.
1. **Add Content** - Click this to import exciting content from the KML Gallery (e.g.: *Games 2010 3D Tour*).

2. **Places panel** - Use this to locate, save, organise and revisit placemarks.

3. **Layers panel** - Use this to display points of interest.

4. **Status bar** - View coordinate, elevation and imagery streaming status here.

Google Earth displays the approximate date of displayed imagery in the status bar. As you move the mouse over a location, this information depicts the date of the imagery. Note that this date is approximate only.
1. Click the **north-up button** to reset the view so that north is at the top of the screen. Click and drag the ring to rotate your view.

2. Use the **look joystick** to look around from a single vantage point, as if you were turning your head. Click an arrow to look in that direction or continue to press down on the mouse button to change your view. After clicking an arrow, move the mouse around on the joystick to change the direction of motion.

3. Use the **move joystick** to move your position from one place to another. Click an arrow to look in that direction or continue to press down on the mouse button to change your view. After clicking an arrow, move the mouse around on the joystick to change the direction of motion.

4. Use the **zoom slider** to zoom in or out (+ to zoom in, - to zoom out) or click the icons at the end of the slider. As you move closer to the ground, Google Earth swoops (tilts) to change your viewing angle to be parallel to the Earth's surface. You can turn off this automatic tilt (Tools > Options > Navigation > Navigation controls).

To have a 3D view you can use the scroll wheel.
Google Earth allows users to:

- search for addresses (schools, parks, islands, research locations)
- enter coordinates (of specific locations, satellite tagged animals, GPS, etc.)
- tilt and rotate the view to see 3D terrain and buildings
- or use the mouse to browse to any place in the world for a close up view

Example: look for 'Como' or coordinates: 45,81111 9,0825
**Show Lat/Long** - As you move the mouse pointer in the 3D viewer, latitude and longitude coordinates are displayed in the lower left corner of the 3D viewer.

By default, the display of these coordinates is in degrees, minutes, seconds (DD.MM.SS) or degrees, decimal minutes (DD MM.MMM).

You can choose the Degrees option to display geo-coordinates in decimal degrees.

In addition, you can display these coordinates using Universal Transverse Mercator.

<table>
<thead>
<tr>
<th>Pointer</th>
<th>Lat/Long</th>
<th>Elevation</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>37° 25' 18.94&quot; N 122° 05' 06.30&quot; W</td>
<td>10 ft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37° 42' 19.27° N -122° 08' 51.10&quot; W</td>
<td>2 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10° 3' 58'0954.57 m E 41'42073.74 m N</td>
<td>10 ft</td>
<td></td>
<td></td>
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</table>
* **Terrain quality** - Use this slider to set the terrain quality to lower (less detailed) quality with better performance or to higher (more detailed) quality with slower performance. To adjust the appearance of hills when you have terrain turned on in the 3D viewer, you can set the Elevation Exaggeration value from 0.0 to 3.0, including decimal values. The default setting for this value is 1.
Google Earth also has **digital elevation model** (DEM) data collected by NASA's Shuttle Radar Topography Mission. This means one can view the Grand Canyon or Mount Everest in three dimensions, instead of 2D like other map programs/sites.

Let's look again at the Como case:

You can use the scroll wheel to move in the 3D view and see the terrain.
In addition, Google has provided a layer allowing one to see **3D buildings** for many major cities.

Since 2010 also Milan is in 3D. *(Remember to turn on '3D buildings' layer).*
Use the Data Import feature to import your custom geographic data into Google Earth and view it as you would any of the layers in the Layers panel. When you use this import feature, you are importing two basic types of data:

* **Vector Data** - Vector data consists of points, lines, paths and polygons. Once you import vector data into the Google Earth application, you can change its appearance or content in the same way you would when editing placemarks and folders.

* **Imagery Data** - You can import imagery data such as aerial maps or topographical maps and have the imagery projected properly over the base imagery in the 3D viewer. For this to work, the imagery file itself must be in the proper format. Imagery of this type is referred to as GIS imagery.

**Note** - Import features are available only to Google Earth Pro and EC users.

Google Earth can import those formats:

- **Google Earth** (*.kml, *.kmz, *.eta, *.ini)
- **COLLADA Model file** (*.dae)

from version 6
**Keyhole Markup Language** (KML) is an XML-based language schema for expressing geographic annotation and visualization on existing or future Internet-based, two-dimensional maps and three-dimensional Earth browsers. KML was developed for use with Google Earth.

The KML file specifies a set of features (placemarks, images, polygons, 3D models, textual descriptions, etc.) for display in Google Earth, Maps and Mobile, or any other 3D earth browser (geobrowser) implementing the KML encoding. Each place always has a longitude and a latitude.

For its reference system, KML uses 3D geographic coordinates: longitude, latitude and altitude, in that order. The longitude, latitude components are as defined by the World Geodetic System of 1984 (WGS84). The vertical component (altitude) is measured from the WGS84 EGM96 Geoid vertical datum. If altitude is omitted from a coordinate string, e.g. (-122.917, 49.2623) then the default value of 0 (approximately sea level) is assumed for the altitude component, i.e. (-122.917, 49.2623, 0) is assumed.

A formal definition of the coordinate reference system (encoded as GML) used by KML is contained in the OGC KML 2.2 Specification. This definition references well-known EPSG CRS components.

KML files are very often distributed in KMZ files, which are zipped files with a .kmz extension.
With ArcGIS10 you can directly export in kml format:

- **Conversion Tools > To KML**: allows you to export a layer or a map to a KML (zipped in a '.kmz')

**Layer To KML**
This tool converts a feature or raster layer into a KML file containing a translation of ESRI geometries and symbology. This file is compressed using ZIP compression, has a .kmz extension, and can be read by any KML client including ArcGIS Explorer, ArcGlobe, and Google Earth.

NB: the layer has to be georeferenced
Conversion Tools > To KML

Layer to be exported

Output file name

Output scale: the scale at which to export the layer. The symbology of the layer is driven by this scale. Only numeric characters should be entered. If there's no scale dependency, then this parameter is not required and can be set to any numeric value, such as 1.

Data content properties

Extent (optional): the geographic extent of the area to be exported. Either define the extent box (in the WGS84 coordinate system) or choose a layer or map document that defines an extent using the File Selection button and text field.

Output image properties
MapTiler is a graphical application for online map publishing. Your map can create overlay of standard maps like Google Maps, Microsoft VirtualEarth or OpenStreetMap and can be also visualized in 3D form by Google Earth.

Supported files for conversion: TIFF/GeoTIFF, MrSID, ECW, JPEG2000, Erdas HFA, NOAA BSB, JPEG and more...

MapTiler is graphical interface for GDAL2Tiles utility, which is part of GDAL.

GDAL2Tiles converts geographic raster data (TIFF/GeoTIFF, ECW, NOAA, ...) into a directory of small tiles (images with size 256x256 pixels), which you can simply copy to your webserver and the map is published. Then anybody can comfortably explore your maps on-line without having to do extensive server configuration.
You can add an image/raster map using this tool but you have to adjust the map in order to overlap with the satellite image of the area. Georeferenced images are not located in the right place simply opening them... pay attention!

In green you can see tools to rotate, move and resize the image in order to overlap the considered area.
You can easily import .gpx data in Google Earth:
With Google Earth 6 you can import directly .nmea files:
WMS Imagery (1)

Add > Image Overlay

To add a WMS layer you have to add a new image overlay and then on 'Refresh' tab you can set WMS parameters:

WMS server

Available layers
E. g.: Let’s try to add a WMS layer from Environmental Ministry web server on Como area

http://www.pcn.minambiente.it/PCNDYN/catalogowms.jsp?lan=en

- Railways wms (fuse 32):

http://wms.pcn.minambiente.it/cgi-bin/mapserv.exe?
map=/ms_ogc/service/ferrovie_32.map
Let's put a placemark on a point of interest

**Name:** name of the placemark

**Icon:** select the icon that you want to use

**Description:** enter the description of the POI. You can use HTML language.
E.g.: San Fedele Church (Como)
You can do the same with polygons and lines...
Pay attention to the image displacements!
Have a look at:

15°17′54.56″ N 19°25′46.70″ E  
10°54′13.81″ N 19°56′06.25″ E  
15.298693,19.429661  
37.401437,-116.86773  
52.069207,4.3139865  
50.010083,-110.113006  
44.244273,7.76973  
10.903497,19.93229

References:

http://earth.google.co.uk/intl/en_uk/userguide/v5/#getting_to_know

http://www.opengeospatial.org/standards/kml

http://www.pcn.minambiente.it/PCNDYN/catalogowms.jsp?lan=it

http://www.maptiler.org/

http://en.wikipedia.org/wiki/GPS_eXchange_Format