

An Introduction to Geographic Information Systems (GIS)
“Free Software and Data for Recreational, Educational, and Geologic Investigations”

John Karachewski, PhD, PG, CHG

Traditionally, Geographic Information System (GIS) studies have been undertaken by sophisticated users, who integrated hardware, software, and data for capturing, managing, analyzing, and displaying geographically referenced information. Rapid and accelerating technological developments in hardware, such as computers, smart phones, and Global Positioning System (GPS) receivers, along with popular software such as Google Earth have made geographic data widely available to the general public. In addition, local, state, and federal government agencies are routinely and increasingly posting geographic data and online mapping services to their websites.

This presentation provides a brief introduction to gis concepts, but focuses on free software (Google Earth, ArcGIS Explorer, and ArcGIS Online) as well as environmental and geologic data for the San Francisco Bay area and California. Because most users are already familiar with Google Earth, only a brief discussion of select features, such as video tutorials, path/elevation profiles, and historical imagery will be provided. Although less known, more time will be devoted to ArcGIS Explorer due to its significantly greater functionality, especially with respect to different basemaps and rich data content. This presentation will also highlight examples of data available from the Association of Bay Area Governments (ABAG), California Geological Survey (CGS), and US Geological Survey (USGS), with an emphasis on natural hazards.

This presentation will also provide several case histories illustrating integration of GPS and GIS data for recreational and educational projects. I routinely use a recreational GPS unit to record my hiking or biking tracks and then use this data to both geotag my photographs and then view my route draped on USGS geologic maps in Google Earth. This approach has allowed me to gain new insights into the diversity and complexity of Bay area geology. I will also illustrate how multiple data sets for the Hayward Fault on the Cal campus were integrated to develop a new ArcGIS Explorer laboratory exercise for a class at Diablo Valley College. Lastly, I will provide examples of how gis analysis leads to improved understanding and recommendations for evaluating environmental investigations at hazardous waste sites.

In summary, the following list of websites provides a brief and partial compilation of environmental and geologic resources awaiting your discovery!

SOFTWARE

Google Earth

<http://www.google.com/earth/index.html>

Learn (video tutorials) <http://www.google.com/earth/learn/>

ArcGIS Explorer

<http://www.esri.com/software/arcgis/explorer/index.html>

Demos (video tutorials) <http://www.esri.com/software/arcgis/explorer/demos.html>

Geo-reference Add-On

<http://blogs.esri.com/Info/blogs/arcgisexplorerblog/archive/2010/12/17/georeferencing-add-in-for-explorer-desktop.aspx>

ArcGIS Online (create, store, and manage maps, apps, and data, and share resources in the cloud)

<http://www.esri.com/software/arcgis/arcgisonline/features/personal-use.html>

GIS DATA AND ONLINE MAP VIEWERS

Association of Bay Area Governments (ABAG) Map Portal

<http://gis.abag.ca.gov/>

California Natural Resources Agency / Map Server (library of gis layers)

<http://atlas.resources.ca.gov/>

Cal-Atlas (geospatial clearinghouse)

<http://atlas.ca.gov/>

California Emergency Management Agency | Hazard Mitigation Portal – MyHazards
Learn About Natural Hazards In Your Neighborhood

<http://myhazards.calema.ca.gov/>

California EPA – Department of Toxic Substances Control (DTSC) Envirostor

<http://www.envirostor.dtsc.ca.gov/public/>

California EPA – State Water Resources Control Board - Geotracker

<http://geotracker.waterboards.ca.gov/>

California Geological Survey (online interactive 1:250,000 geologic and faults maps)

http://www.consrv.ca.gov/cgs/information/geologic_mapping/Pages/index.aspx

California Geological Survey - Alquist-Priolo Earthquake Fault Zone Maps

http://www.quake.ca.gov/gmaps/ap/ap_maps.htm

California Geological Survey - Tsunami Inundation Maps (Access Interactive Tsunami Maps using Google Maps)

http://www.quake.ca.gov/gmaps/tsunami/tsunami_maps.htm

National Atlas (click on “Map Layers” to view data for download – including Geology Chapter)

<http://www.nationalatlas.gov/>

Northern California Earthquake Data Center (NCEDC)

<http://www.ncedc.org/>

San Francisco Estuary Institute – EcoAtlas

<http://www.sfei.org/ecoatlas>

Southern California Earthquake Data Center (SCEDC)

<http://www.data.scec.org/>

USGS - The National Map: Historical Topographic Map Collection

<http://nationalmap.gov/historical/>

USGS – Earth Explorer (satellite images, aerial photographs, and cartographic products)

<http://earthexplorer.usgs.gov/>

USGS - Knowles, Noah. 2010. Potential Inundation Due to Rising Sea Levels in the San Francisco Bay Region. *San Francisco Estuary and Watershed Science*, 8:1. Available at http://escholarship.org/uc/search?entity=jmie_sfews;volume=8;issue=1.

Data from website: <http://cascade.wr.usgs.gov/data/Task2b-SFBay/data.shtm>

USGS - San Francisco Bay Region Geology and Geologic Hazards
(**Google Earth geologic maps for ALL Bay area counties**)
<http://geomaps.wr.usgs.gov/sfgeo/geologic/downloads.html>

USGS - San Francisco Bay Region Geology (older website with detailed maps and gis data: pdfs for printing and professional ArcGIS license required for extracting and viewing digital files)
<http://geomaps.wr.usgs.gov/sfbay/index.html>

USGS - Quaternary Fault and Fold Database of the United States (Google Earth files or GIS Shapefiles)
<http://earthquake.usgs.gov/hazards/qfaults/>

Biography: **Dr. John Karachewski** provides geologic and GIS support for the Cleanup Program at the California-EPA in the Department of Toxic Substances Control (DTSC) in Berkeley. John has conducted geology and environmental projects throughout the western United States from Colorado to Alaska to Midway Island and throughout California. He received his Master's degree from Western Washington University and his doctorate from the Colorado School of Mines. John has volunteered for nearly every officer position at NCGS and is currently serving as program chairman for the third time. John is also currently president of the San Francisco Bay Area Branch for the Groundwater Resources Association of California. This spring, he is also co-teaching a maps and cartography class with Jim Ellis at Diablo Valley College. He is also leading five geology hikes this year for the Point Reyes National Seashore Association.