



BRIDGING SCIENCE AND JOURNALISM CURRICULUM PACKET

This curriculum packet includes lesson plans for high school science teachers to help their students make the connection between science and journalism. This packet is plug and play - meaning that one can decide to use all lesson plans or just a few. The choice is up to you!

Each lesson plan includes:

- Overview of the activity
- NGSS standards the lesson matches to
- Student learning objectives
- Instructions for the activity (and relevant answer keys if needed)
- Lesson outcomes
- Assessment options

This curriculum aims to help students build their creative and critical thinking, problem solving, communication and writing skills while exploring aspects of science phenomena in San Diego while using journalistic and scientific approaches to complete each lesson.

The lesson plans included are:

- Geoscience
- Storytelling with Science
- How to Think Like a Journalist
- Engineering a Sensor
- Mapping with Science Data

This curriculum packet was created and developed by:

**Amy Schmitz Weiss, Ph.D., Associate Professor of Journalism,
School of Journalism and Media Studies, San Diego State University
and**

**Kevin Robinson, MSC, College of Sciences lecturer, Department of Geological
Sciences, San Diego State University**

**with additional contributions from Lorie Hearn, Executive Director/Editor
*inewssource***

This project is part of the Center for Science and Media at San Diego State University in the School of Journalism and Media Studies. The Center for Science and Media is a collaboration of the School of Journalism and Media Studies with the College of Sciences in the areas of research, public service, and curriculum. The Center's mission is to educate the public about science, through the strategic and ethical use of media.

This digital curriculum was made possible through a grant made possible by the College of Professional Studies and Fine Arts at San Diego State University and the Online News Association.

We would like to thank the grantors for their support:

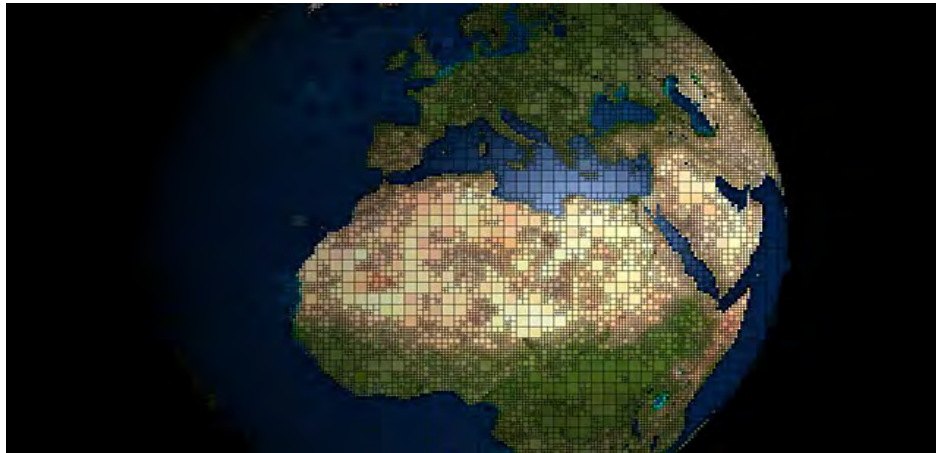


College of
PROFESSIONAL STUDIES AND FINE ARTS

Additional thanks to:



Note: Images used in this packet were taken by the authors and through Creative Commons licensing with proper attribution.



MAPPING SCIENCE DATA: AIR QUALITY

Easy Plotting and Analysis of Geospatial Data Using Google Earth

Lesson Plan Created by

Kevin Robinson, San Diego State University Department of Geological Sciences

ABOUT

This lesson focuses on how to map data using simple digital tools. Students can adapt the science phenomena to their needs in the class, but for this lesson we will focus on air quality. Any type of spatial data from a spreadsheet can be plotted in this way. Students can explore, research, and incorporate map-based data and educational resources to build an environmental science project

NGSS STANDARDS

Practices: Asking Questions and Defining Problems, Engaging in Argument from Evidence, Developing and Using Models, Carrying Out Investigations, Analyzing and Interpreting Data, Obtaining , Evaluating, and Communicating Information

Disciplinary Core Ideas: ESS3C-Human Impacts on Earth Systems

Cross Cutting Concepts: Patterns, Cause and Effect, Scale Proportion and Quantity, System and System Models, Interdependence of Science, Engineering, and Technology, Influence of Science, Engineering, and Technology on Society and the Natural World

LEARNING OBJECTIVES

Students will be able to:

- Collect/acquire GIS map data (geospatial)
- Use a map to discover and explain patterns
- Map data and plot contours to reveal spatial distribution
- Provide a narrative for the distribution of data (tell a story)

- Use both inductive and deductive skills to learn about the environment (either collect data and then ask questions, or ask questions and then find data)

ACTIVITIES

- Creation of a geospatial database
- Use Google Earth to display geospatial data (import .csv database), create a distribution pattern (contour lines, area analysis), and explain the results.
- Examine, analyze and report on various aspects of geospatial data using Google Earth and .kml/.kmz layers.

Instructions

(These steps below are based on air quality data the students and/or teacher collect or acquire from another source)

1. Read the following pages in the lesson plan about mapping data and its examples.
2. Learn and practice data contouring by doing data contouring worksheet in this lesson plan.
3. Collect air quality data: 1) Latitude, 2) Longitude, 3) Measured Value
4. Import formatted database (e.g. csv file) into Google Earth
5. Format data icons by color coding
6. Draw polygons to contour dataset

OUTCOMES

The students will be able to:

- Complete the contouring worksheet
- Create a map which helps depict and explain patterns in the environment whatever they may be
- Develop a narrative which utilizes a map to tell part of the story

ASSESSMENT

Students will be evaluated based on the completion of a short presentation and written summary. Products for presentation could include enhanced map images, graphs, cross sections, etc. Further assessment can be determined by the teacher.

MAPS: How to create simple maps of environmental data (geospatial)

Maps are representations of geospatial data and have played an important role throughout history. We use them every day to relate information to others. Compiling information from many different locations allows patterns and relationships to be better understood. Maps can be simple representations of one aspect about the world or they can be complex with layers of multiple types of data. A weather map can show many aspects of the environment that are critical to public safety. Weather scientists relate to a story by utilizing a map. Maps can be highly creative forms of communication with which you can tell stories about science, social science and history. Maps made at different times can show sequential change which allows us to better explain what is or has happened and also to make predictions about the future.

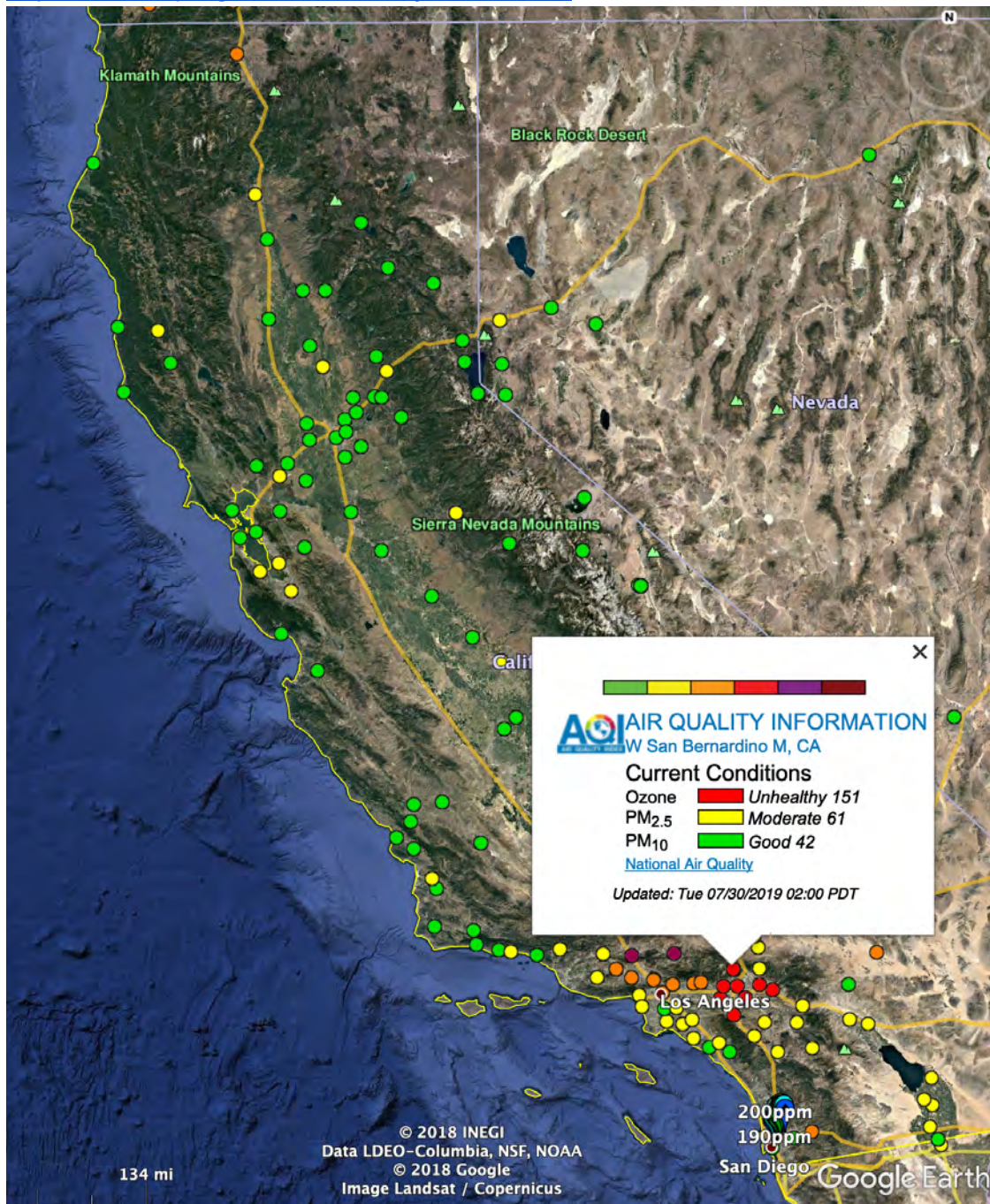
Nowadays, there are many tools to create maps. Starting with a base map we can digitally layer data to be able to represent more detail and patterns than ever before. This module uses Google Earth Pro because it is a free and useful tool for the display and analysis of geospatial data. Some simple steps will allow learners to layer KML (keyhole markup language) maps (geolocated data) onto satellite imagery for exploration and explanation, and also to associate a database (spreadsheet) to view the distribution and patterns represented by the data. Both of these techniques allow for exploration and further investigation. The map will then be used to give a more complete description and to facilitate the communication of environmental data.

What follows are some examples of how one maps data.

Example: Data Layered on Map

This is a KML layer of real-time Air Quality Information (AQI) from the US EPA

<https://www.epa.gov/airnow/today/airnow.kml>



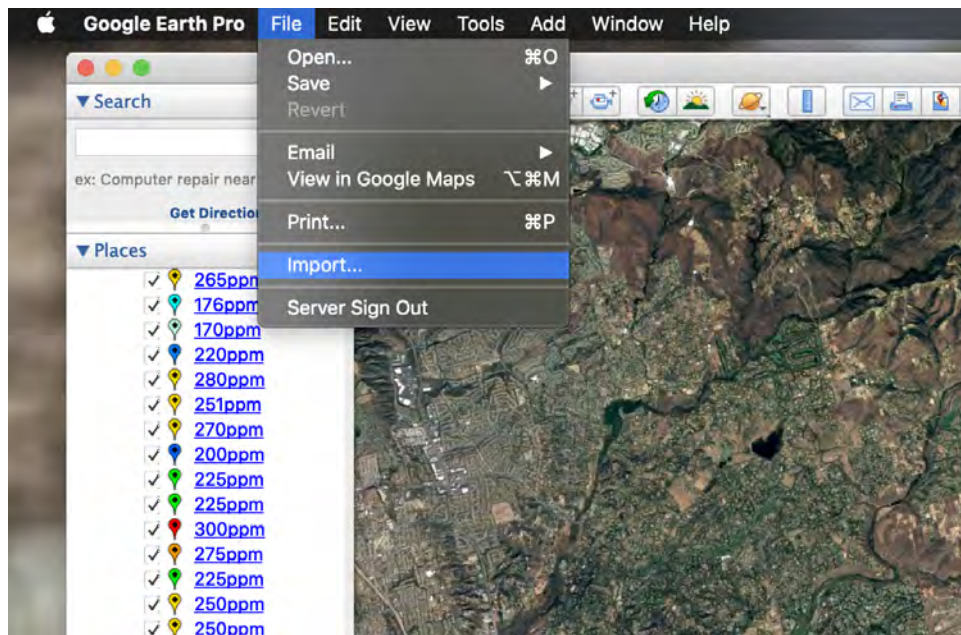
Example: Dataset

This is an example of a dataset to import into Google Earth. It consists of air quality data, Latitude, Longitude, and description. This information can easily be listed in a spreadsheet and saved as a .xls or .csv file.

Air Data Points

Latitude	Longitude	NAME	DESCRIPTION
32° 54' 22.69" N	117° 08' 39.75" W	190ppm	LOCATION 1
32° 53' 15.44" N	117° 09' 10.42" W	200ppm	LOCATION 2
32° 55' 13.01" N	117° 07' 18.09" W	180ppm	LOCATION 3
32° 57' 16.47" N	117° 06' 21.92" W	190ppm	LOCATION 4
32° 54' 53.05" N	117° 06' 51.54" W	340ppm	LOCATION 5
32° 57' 07.34" N	117° 06' 01.21" W	295ppm	LOCATION 6
32° 59' 31.21" N	117° 05' 24.87" W	185ppm	LOCATION 7
32° 58' 54.05" N	117° 04' 39.56" W	265ppm	LOCATION 8
32° 58' 11.67" N	117° 08' 09.44" W	176ppm	LOCATION 9
33° 00' 32.47" N	117° 06' 42.87" W	170ppm	LOCATION 10
32° 55' 30.75" N	117° 05' 16.44" W	220ppm	LOCATION 11
33° 01' 47.85" N	117° 04' 14.07" W	280ppm	LOCATION 12
32° 56' 45.63" N	117° 05' 36.00" W	251ppm	LOCATION 13
33° 00' 52.14" N	117° 04' 06.45" W	270ppm	LOCATION 14
32° 58' 49.29" N	117° 01' 43.00" W	200ppm	LOCATION 15
32° 56' 08.32" N	117° 04' 38.29" W	225ppm	LOCATION 16
32° 59' 12.92" N	117° 03' 20.69" W	225ppm	LOCATION 17
32° 54' 36.76" N	117° 06' 39.37" W	300ppm	LOCATION 18
32° 54' 21.16" N	117° 06' 16.30" W	275ppm	LOCATION 19
32° 54' 02.95" N	117° 05' 50.34" W	225ppm	LOCATION 20
32° 54' 19.57" N	117° 05' 55.72" W	250ppm	LOCATION 21
33° 00' 30.68" N	117° 03' 38.98" W	250ppm	LOCATION 22
33° 00' 54.14" N	117° 02' 20.60" W	190ppm	LOCATION 23

How to Map Data in Google Earth



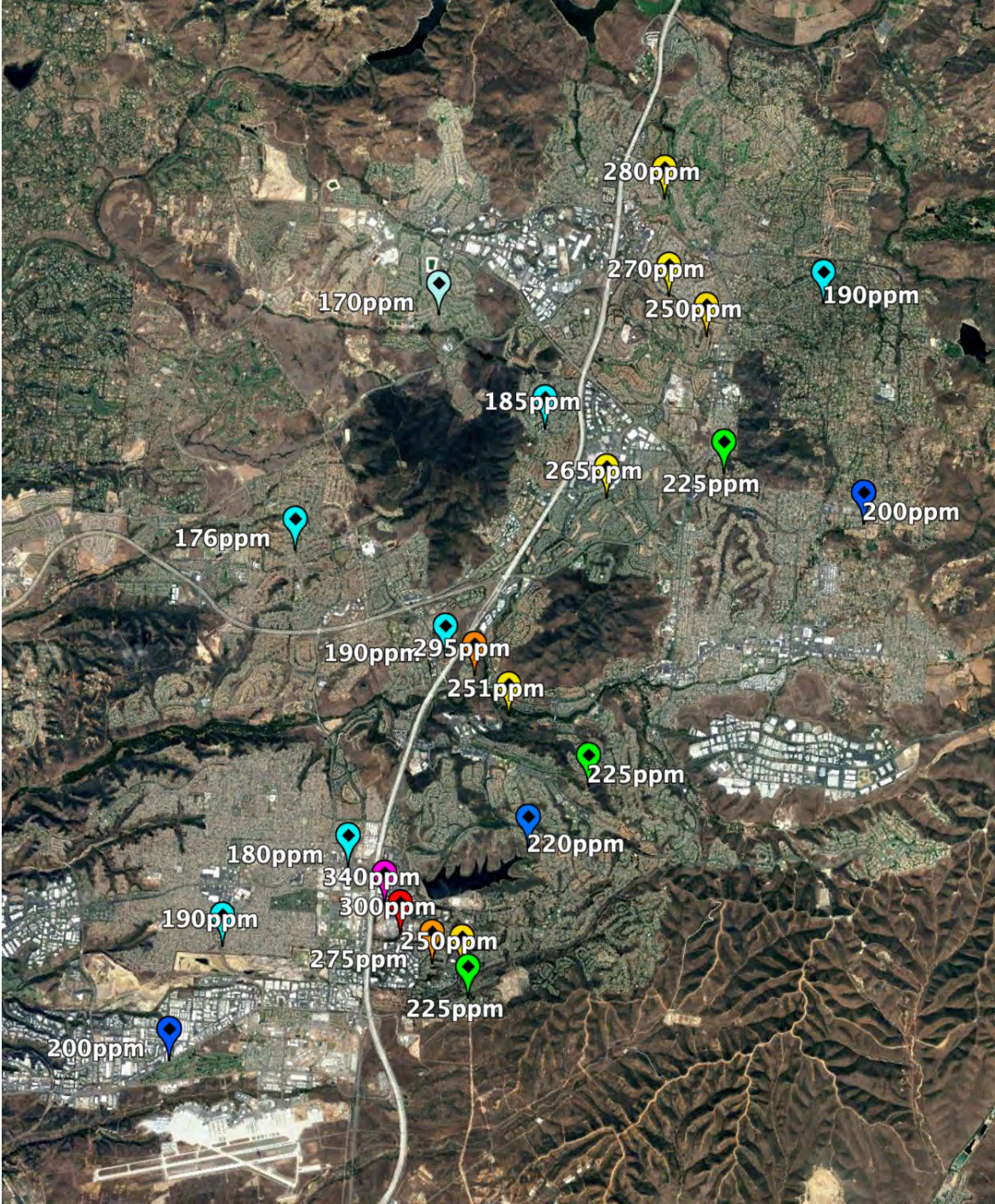
File/Import is how to upload a .csv file in Google Earth (the format you chose can be edited later).

For the specific steps on how to import the data, follow these steps:

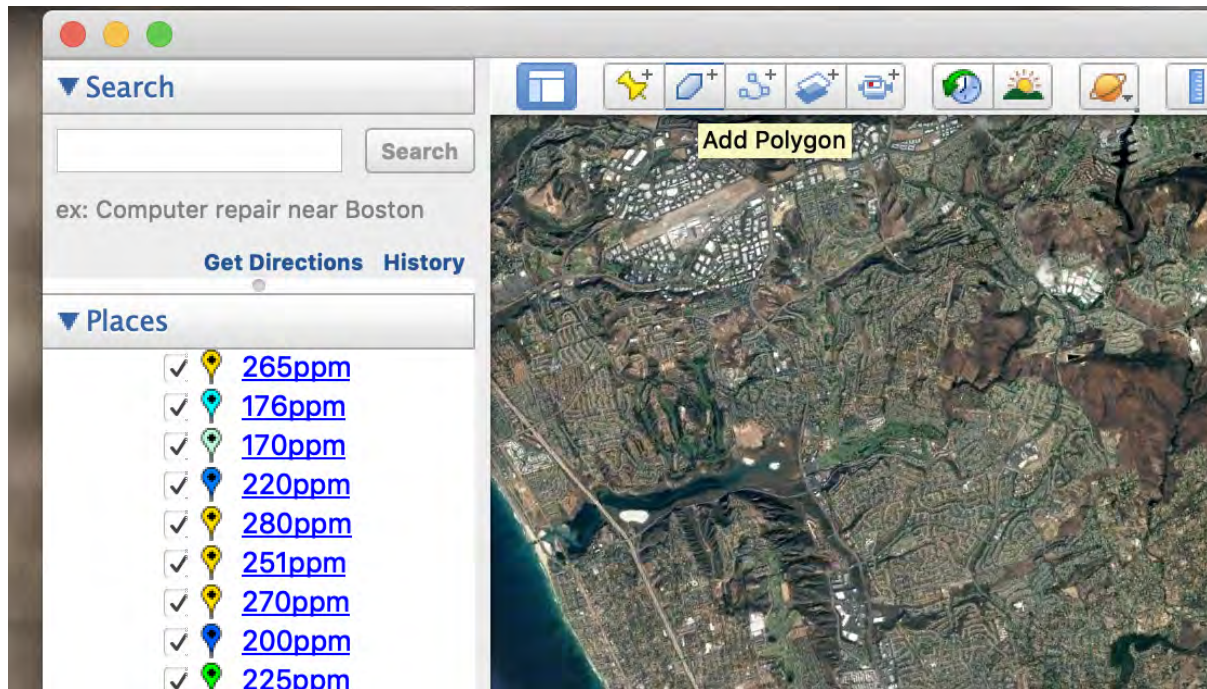
<https://support.google.com/earth/answer/176685?hl=en>

Example: Mapping Data

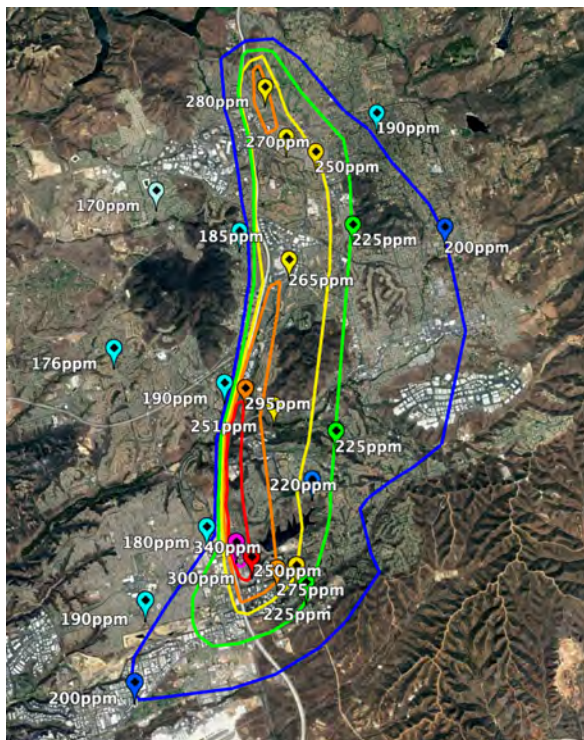
In this hypothetical situation below (partially based on real AQ measurements across a freeway), the variations in air quality are colored based on their value and then contours are added to reveal a pattern of distribution using the polygon tool. Even small variations like these parts per million differences can be seen to form a pattern.



Map Example: Use of Polygons



The polygon tool is used to hand-contour the data to create the image above.

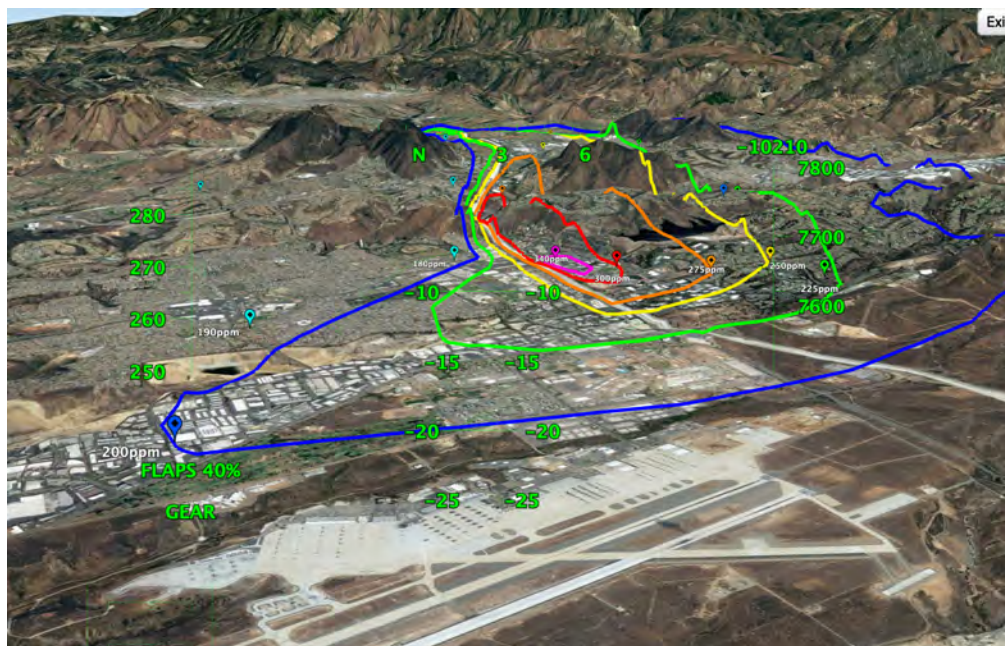


Drawing the areas take practice, start at the lowest values and work up, that way the next highest area will be on top of the first drawn area (lowest value) if you want to fill in the areas with color. In this example, I drew the blue line encircling the area with concentrations above 200ppm, then the green line 225-249ppm, then the 250 yellow, 275 orange, 300 red, and 325 hot pink.

Note: The polygon tool will create a series of control points (by clicking to create points and a shape) to define a general path that encircles the previously plotted (imported .csv) data. This "rough" area shape can then be adjusted by dragging the control points and adding more points to refine the area shape.

Example: Making a Movie in Google Earth

Another useful Google Earth tool to employ for a powerful presentation is to create a tour that can be made into a movie (Google Earth Movie Maker), where you can “fly through the data” so to speak. Below is a fly-through tour of the modeled air quality along the Interstate 5 in San Diego.

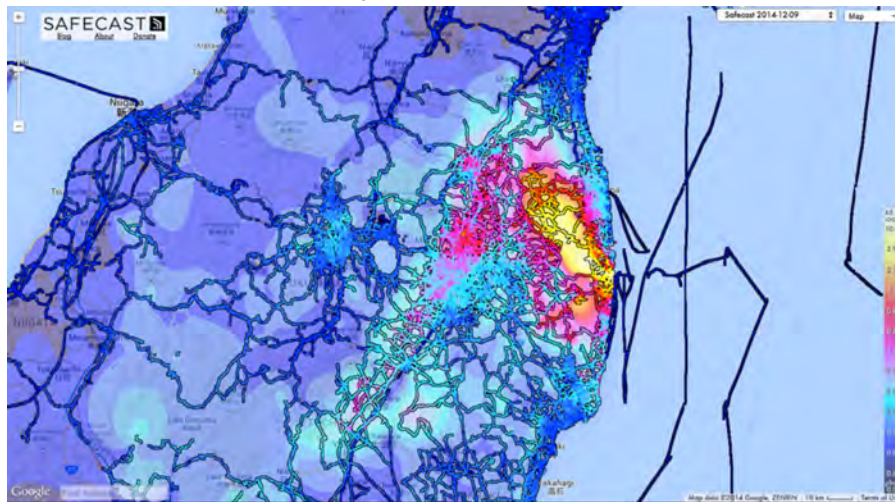


With a joystick connected you can fly through the image in an F-16 Viper. This can be a stimulating way for students to explore the mapped dataset. F-16 over Miramar Air Station heading 040 (NW) at 7700 feet on a pass over the mapped area.

More Examples of Mapping Data

Here's an example of a citizen-science air-sensor mapping effort with Safecast Sensors following the 2011 Fukushima disaster in Japan. Below, the values of radioactivity are shown across central Japan. More details here:

<https://blog.nationalgeographic.org/2016/02/13/how-citizen-science-changed-the-way-fukushima-radiation-is-reported/>



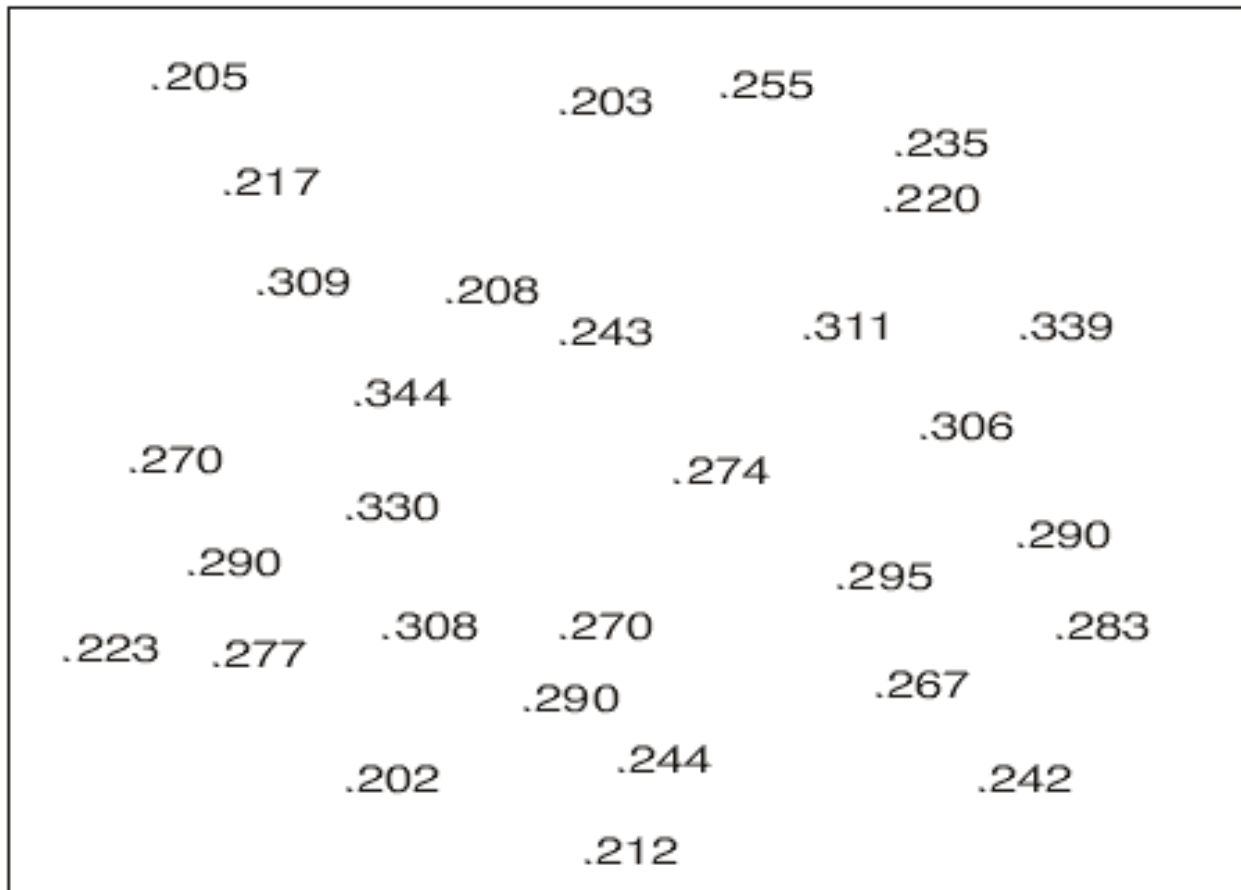
Here's a Google Street-View of air quality data from Oakland California. Here's a link to the Interactive Map: <https://www.edf.org/airqualitymaps/oakland/pollution-and-health-concerns-west-oakland>



Contouring Data Worksheet

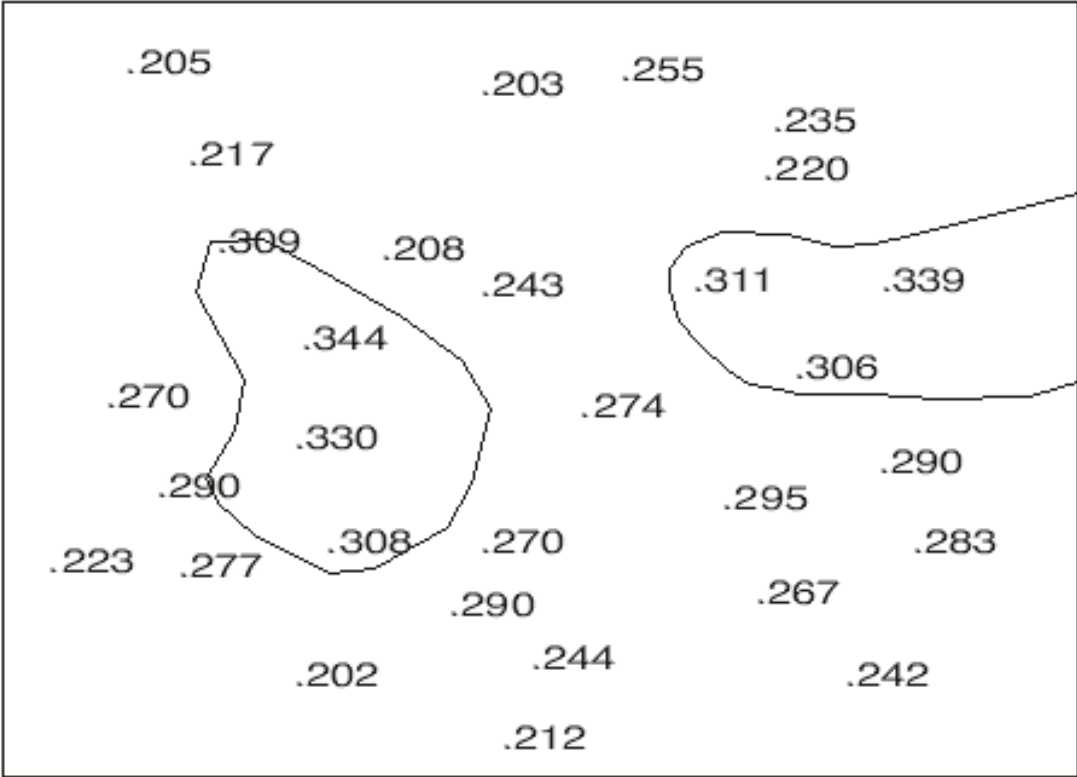
Let's try to contour some data points. Let's contour a dataset which will allow us to see any spatial pattern to the distribution. This method can be used with a variety of data. The process involves critical and creative thinking. This exercise requires patience and critical thinking. The contour lines will connect places of equal value. Start by looking at the range of values. What is the value of the largest contour?

- Draw in the .300 lines which will encircle (close-in) the values above .300. (Interpolation of line placement will result in lines being closer to some numbers than others. For instance the .300 line will be located closer to .306 than .311.)
- Then draw the .250 line.
- More lines for .325, .275, and .225 will complete the contour map.
- The contour interval is .025.



ANSWER KEY - STEP BY STEP

1. Add .300 contour line:



ADDITIONAL MAP RESOURCES FOR TEACHERS

Google Earth is a free and easy way to plot values and hand contour data to reveal distribution. Images are easy to create and the maps can be examined from multiple perspectives (including 3D). This imagery can help us understand and communicate qualities of the environment. Google can help map air quality data using sensors from their “street view” cars. There are several other ways to create maps.

There is also ArcGIS online which is free for educational use (one has to create a free user account). It has different map making capabilities with more flexibility in base maps and data display. There are many user examples that show the versatility of this platform. It can also import .csv spreadsheet data and generate contour maps. The full-fledged ESRI ArcGIS desktop software is free to schools, it does take time to learn, it is the industry standard and a powerful tool for science, education, and business. GIS skills are essential for numerous 21st century jobs. This lesson can be advanced to more sophisticated levels with ArcGIS if time and resources permit.

Key Terms from Lesson and More Information

KML(Keyhole Markup Language) is the map-language used by Google Earth

Link to coding page https://developers.google.com/kml/documentation/kml_tut

Excel to KML <https://www.earthpoint.us/ExcelToKml.aspx>

Excel to .csv is described here

There are a plethora of KML/KMZ layers available that can be drag/dropped into Google Earth.

Search: Examples of KML/KMZ layers for Google Earth.

Hot-Keys will help with putting in layers into Google Earth:

<https://support.google.com/earth/answer/148114?hl=en>

Air Pollution Research and Map Resources

National Weather Service

https://www.weather.gov/gis/NWS_KMLFiles

EPA/ArcGIS-Interactive Air Quality Monitoring Data

<https://epa.maps.arcgis.com/apps/webappviewer/index.html?id=5f239fd3e72f424f98ef3d5def547eb5&extent=-146.2334,13.1913,-46.3896,56.5319>

Air Emission Resources EPA-Where You Live

<https://www3.epa.gov/air/emissions/where.htm>

California Air Resources Board Maps

<https://ww3.arb.ca.gov/maps/maps.htm>

Real-Time Air Quality Monitoring Data-USA

<https://files.airnowtech.org/airnow/today/airnow.kml>

Canada National Pollution Release Inventory (NPRI) [https://www.ec.gc.ca/inrp-](https://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=1D892B9F-1&wbdisable=true)

[nri/default.asp?lang=En&n=1D892B9F-1&wbdisable=true](https://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=1D892B9F-1&wbdisable=true)

Air Quality-Google Outreach

<https://www.google.com/earth/outreach/special-projects/air-quality/>

AirNow-Current Air Quality Conditions (Map Tool)

<https://www.airnow.gov>

Google Earth Tool for Studying Air Quality <https://www.enviroware.com/the-google-earth-tool-for-studying-air-quality/>

Europe Air Quality KMZ/KML files (Drag/Import into Google Earth) <https://www.enviroware.com/google-earth-environmental-data-files/>

Environmental Defense Fund-Sensors and Air Quality

<https://www.edf.org/airqualitymaps>

EDF Air quality Oakland California-interactive map <https://www.edf.org/airqualitymaps/oakland/pollution-and-health-concerns-west-oakland>

World Health Organization

<https://www.who.int/airpollution/en/>