

DATA, STUDENTS, AND VISUALIZATION

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How do we derive meaning from data?

➤ Data collection and analysis is fundamental to the practice of science, and is therefore an important part of any science curriculum.

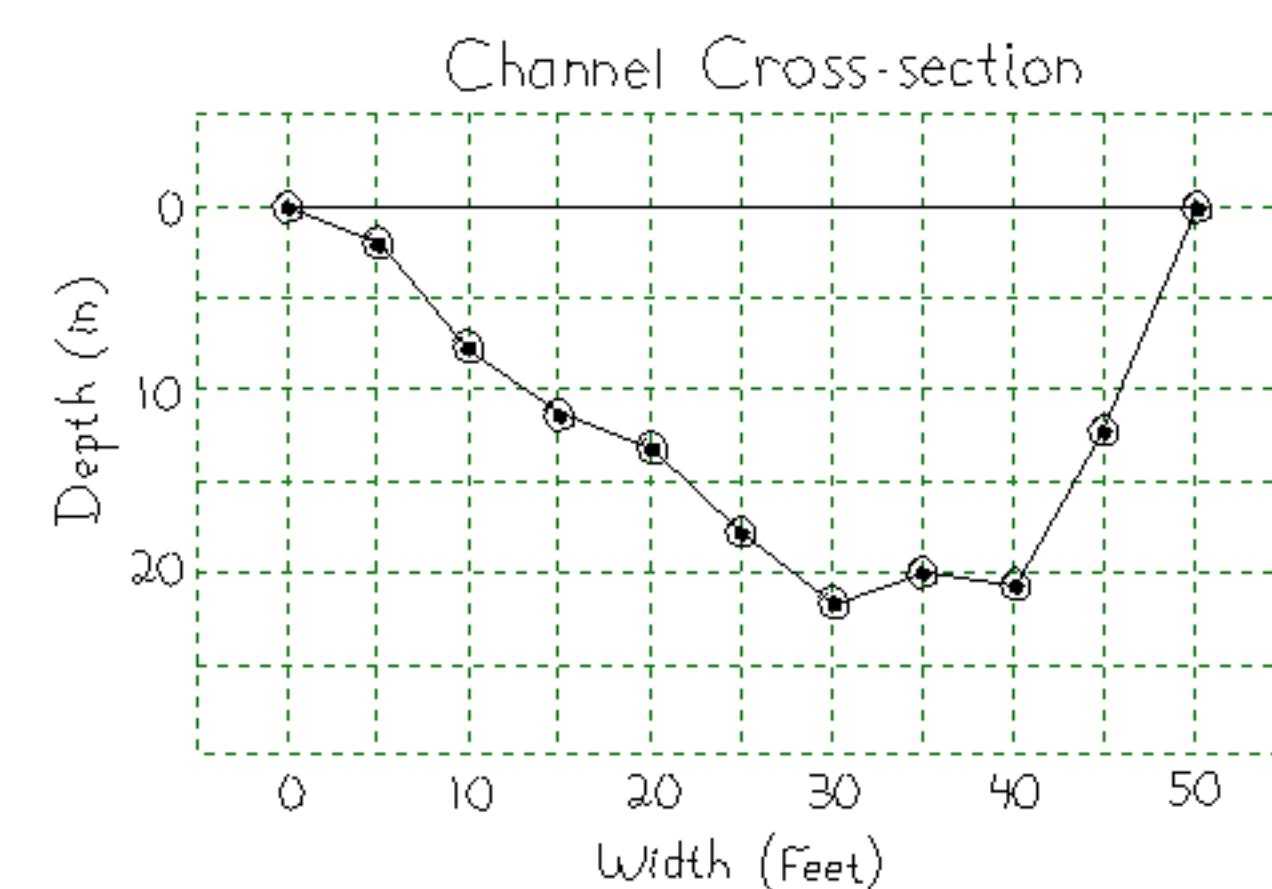
➤ Data by itself, however, is not very informative.

| | | | | | | | |
|---|-------|-------|-------|-------|-------|------|-------|
| 0 | 0 | 0 | 0 | 0 | 0 | -488 | -0.07 |
| 1 | 0.017 | 0.016 | 0.014 | 0.014 | 0.014 | -488 | -0.01 |
| 2 | 0.033 | 0.032 | 0.032 | 0.032 | 0.032 | -488 | 0.07 |
| 3 | 0.05 | 0.051 | 0.051 | 0.051 | 0.051 | -488 | 0.07 |
| 4 | 0.065 | 0.07 | 0.069 | 0.069 | 0.069 | -488 | 0.02 |
| 5 | 0.083 | 0.089 | 0.089 | 0.089 | 0.089 | -488 | -0.02 |
| 6 | 0.069 | 0.109 | 0.108 | 0.108 | 0.108 | -488 | -0.06 |
| 7 | 0.116 | 0.129 | 0.128 | 0.128 | 0.128 | -488 | -0.1 |

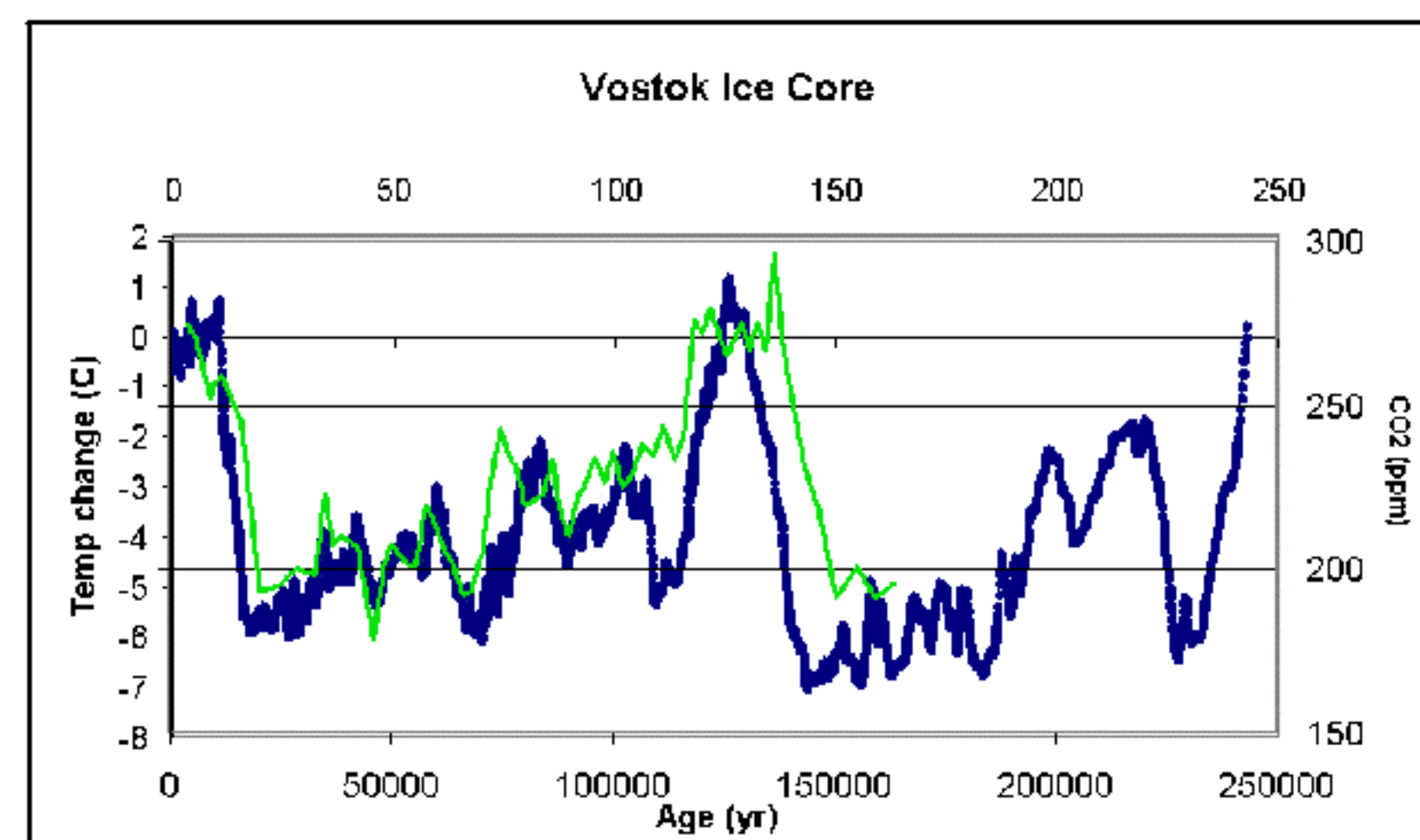


➤ While there are many important lessons to be learned in working with data, one key aspect of data analysis is its graphical representation. Students need to learn techniques of data display and visualization in order to derive meaning from data sets. This is true whether the data have been gathered by the students themselves, or has been downloaded via the Internet.

Technique #1: Hand graphing field data
Graph construction and interpretation is a fundamental skill for all students!

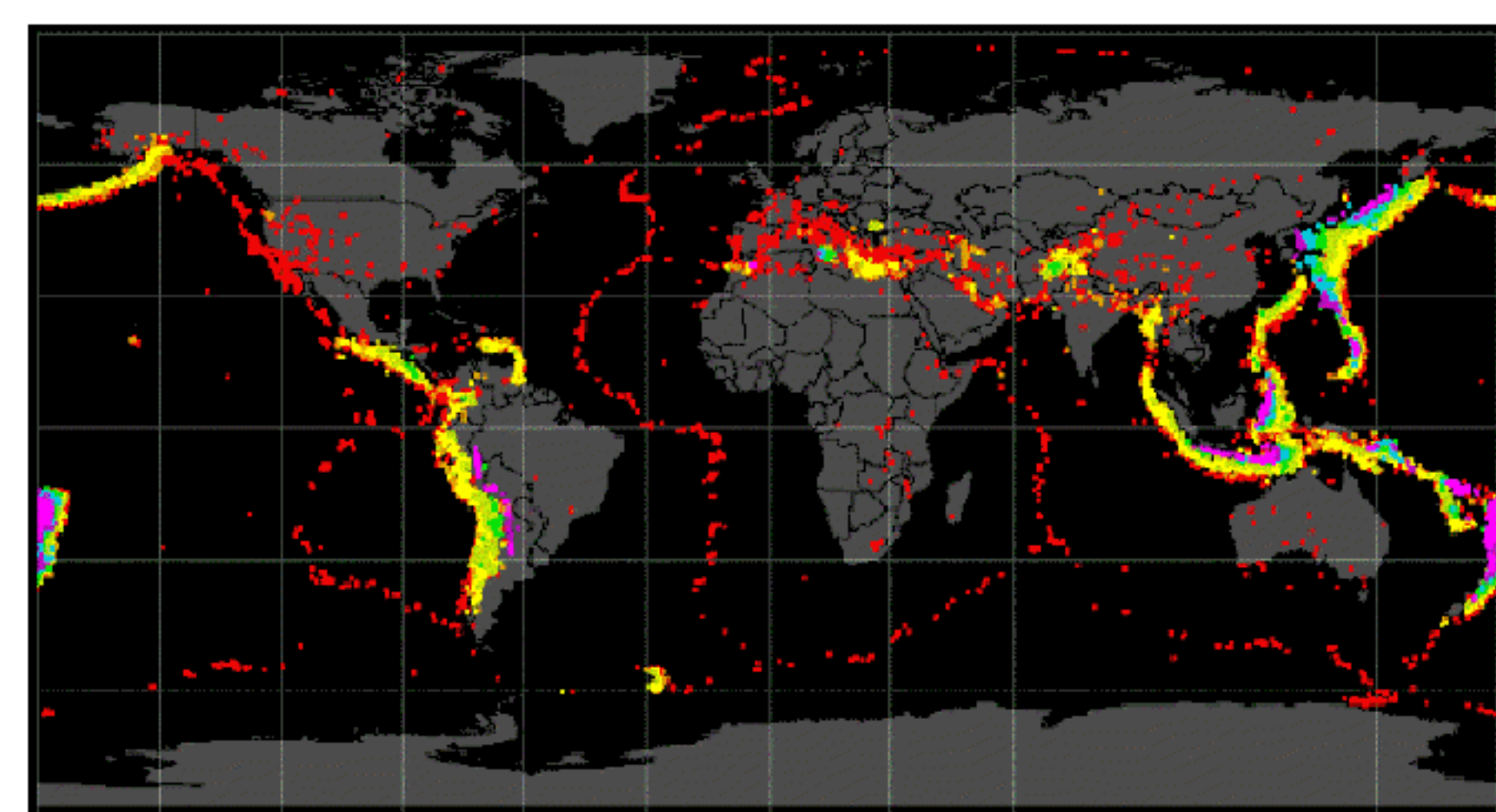
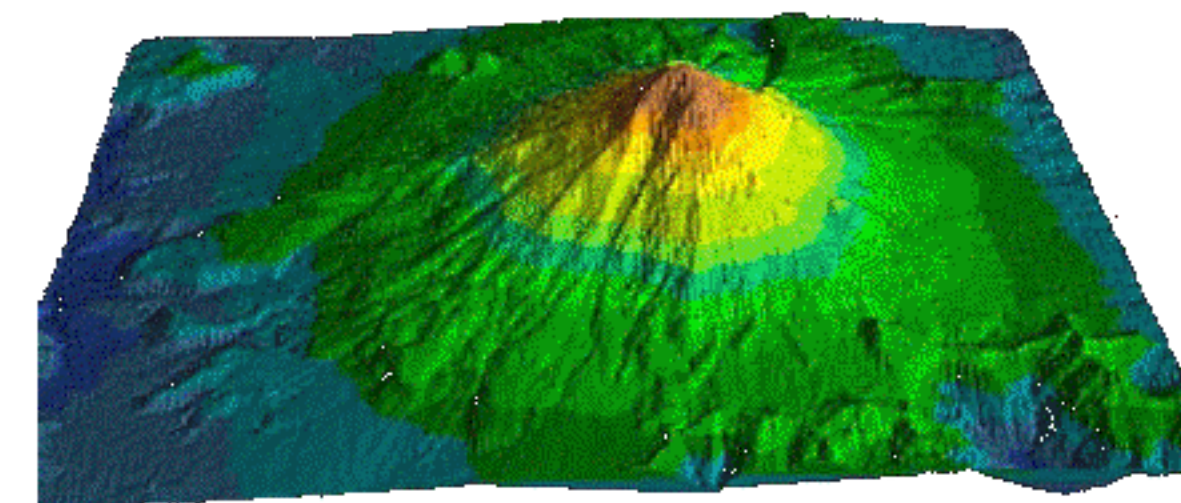


Technique # 2: Large data sets
Larger and more complex data sets are best analyzed with the aid of a computer. Here (left) thousands of temperature and CO₂ measurements derived from the Vostok ice core are plotted as a single time sequence using a spread sheet.



While these same data could be pre-formatted and presented to the students as an image without the underlying data, the students are capable of more interesting and sophisticated analyses when they can manipulate the data themselves.

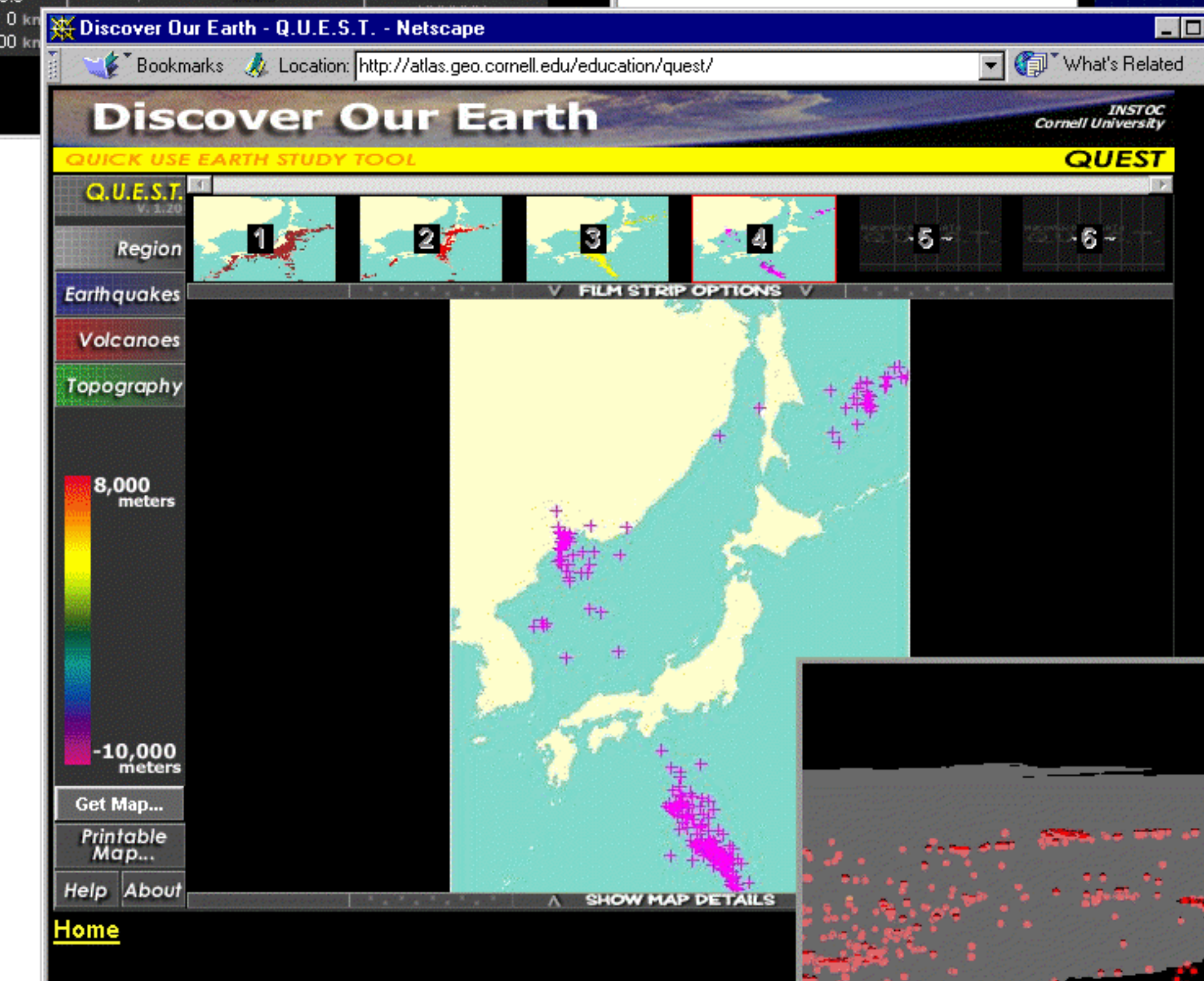
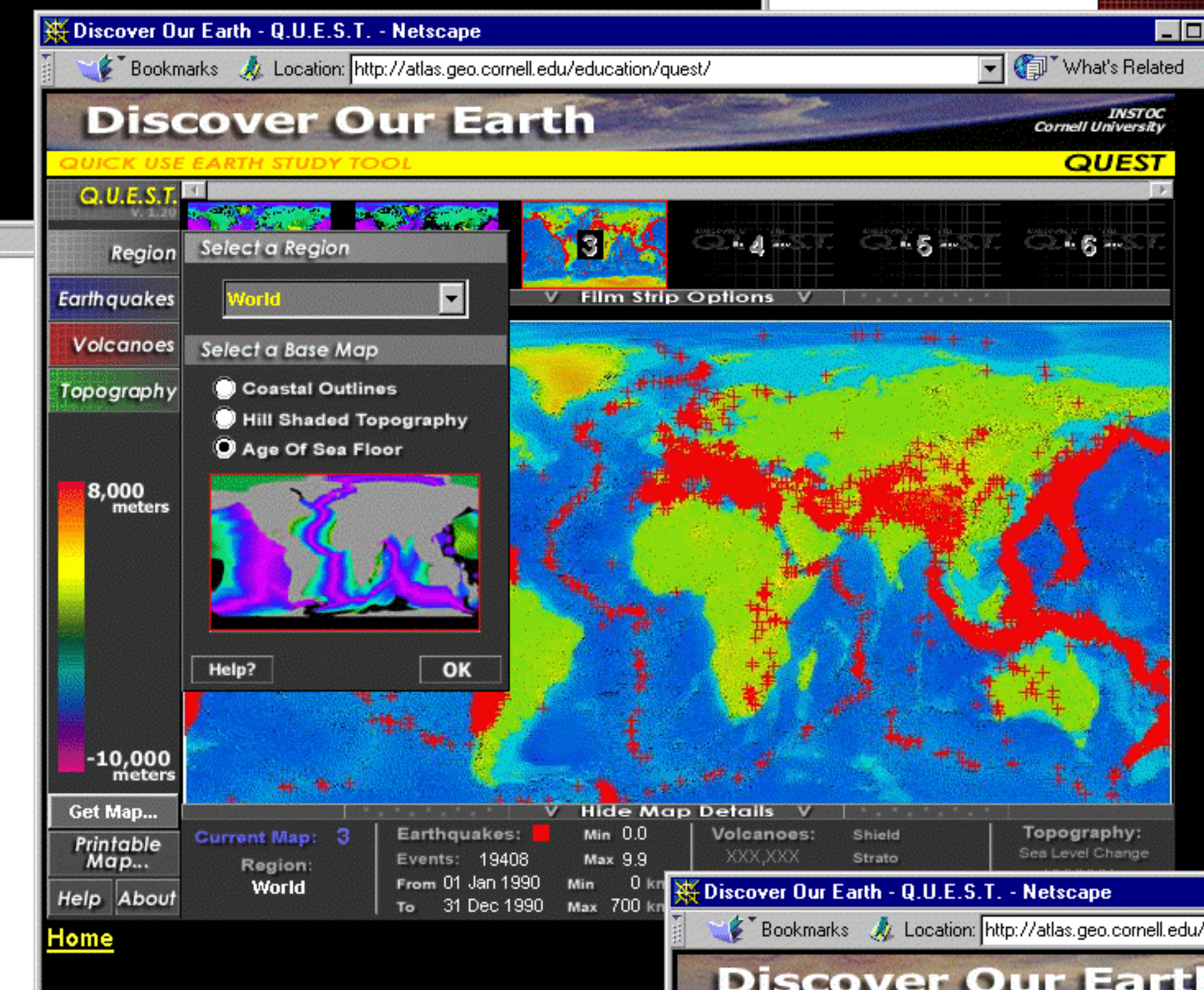
Technique # 3: Geospatial data
Geospatial data is critically important to Earth science, yet it is extremely difficult to work with. How can students best examine spatial data without spending all their time wrestling with software?



➤ Our solution to the problem of spatial data analysis is to set up a web site that performs most of the ugly manipulations in a way that is transparent to the users. In this way students can concentrate on science questions rather than data formatting questions.

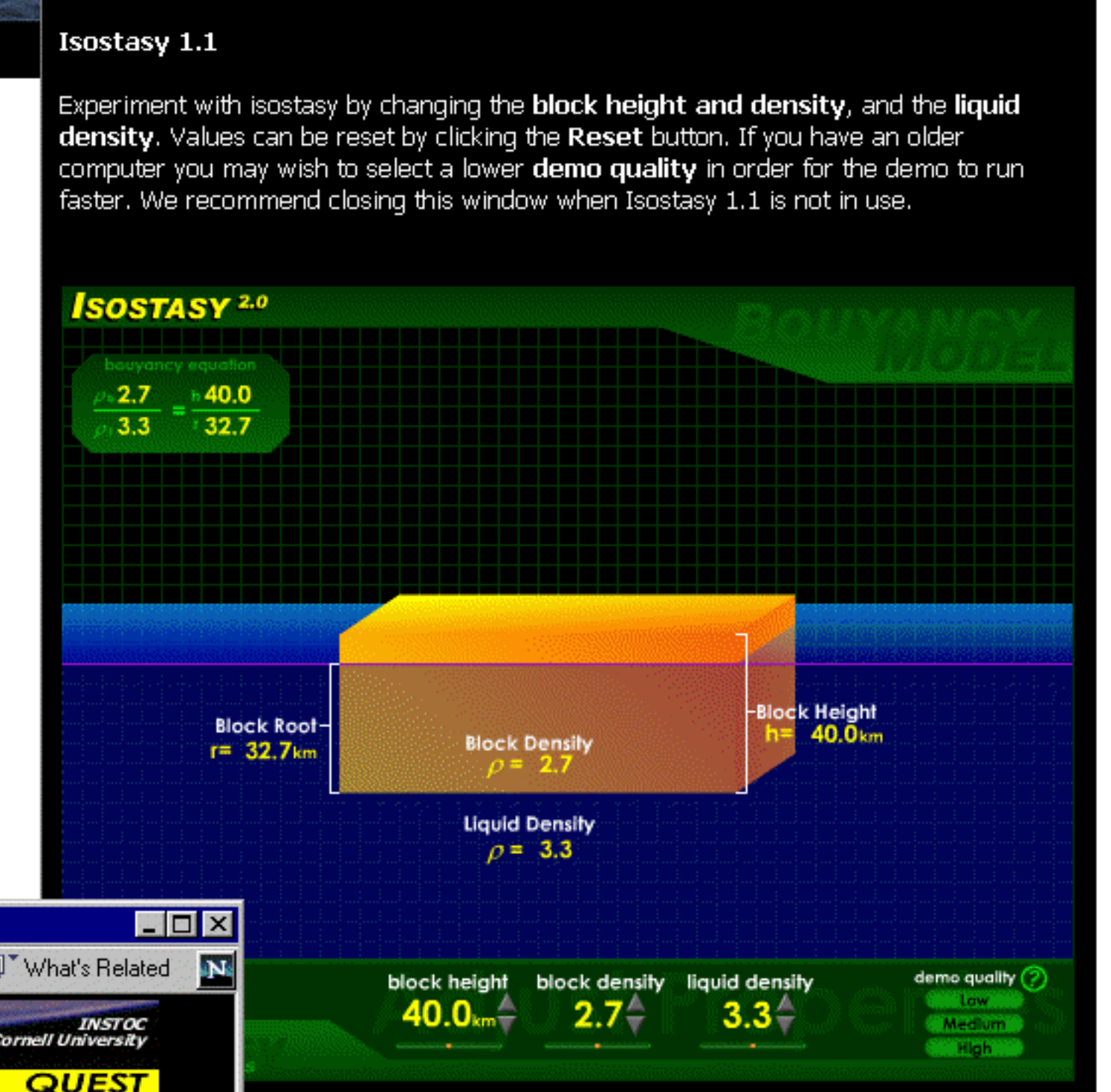
Above: 3D representation of Mt. St. Helens before and after eruption. Above right: global distribution of seismicity. Colors represent earthquakes of different depths.

Discover Our Earth: Web-accessible geospatial data and visualization tools



➤ Background information on each topic is provided for both students and teachers. Each data set has associated activities that allow students to discover important aspects of Earth science.

Virtual experiments help students acquire a deeper understanding of the topic and the significance of the data sets.



➤ Discover Our Earth is a GIS-based application for the Web that allows students to access, query and display spatial data.

➤ Three data sets are currently available; earthquakes, volcanoes and topography. Demographic data is in preparation.

➤ Java-based tools allow students to vary the following parameters:

- Region choice
- Base map choice
- Data set choice
- Data set parameters (EQ depth, time, magnitude etc.)
- Display colors
- Overlays
- Create animated time-series

➤ The data sets are supported by ancillary materials that include:

- Interactive 3D visualizations
- Interactive experiments

➤ History windows allow students to animate image sequences.

VRML images provide interactive flyovers of selected data sets.

