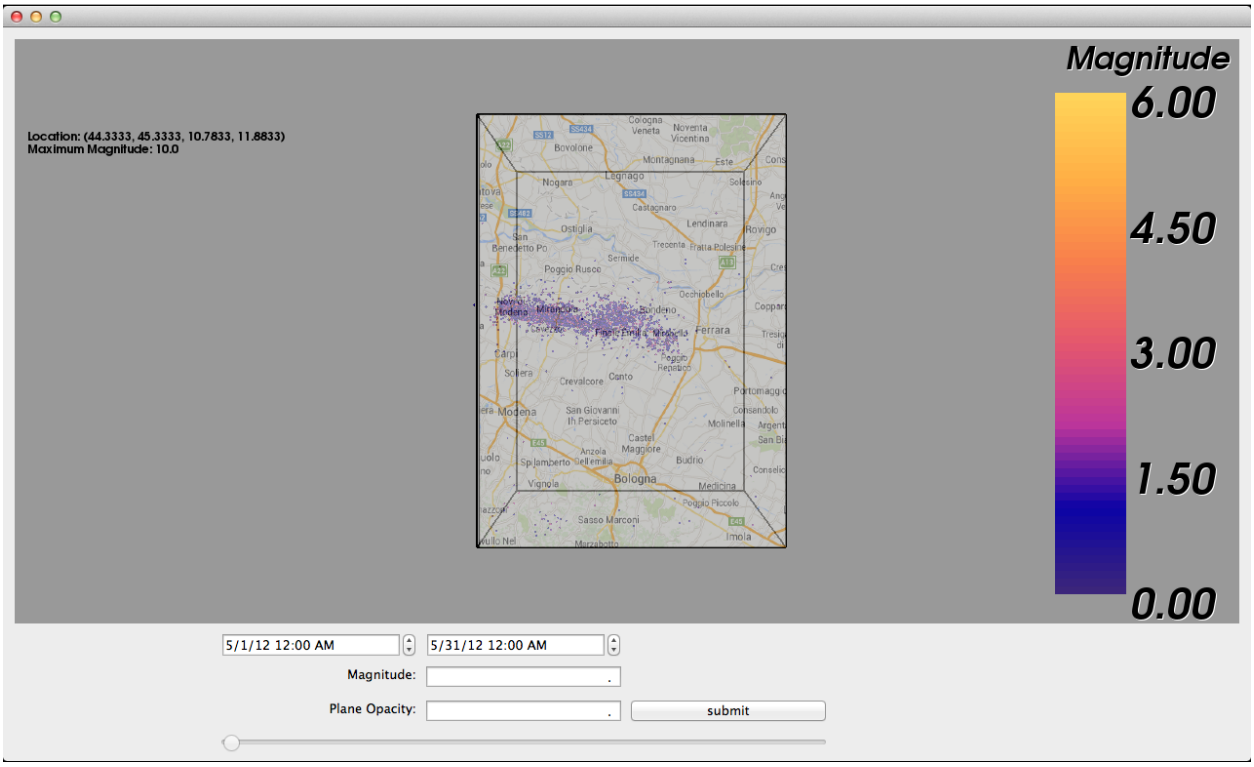
Scientific Visualization Project



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1. Introduction

The purpose of this project is to visualize earthquake data from italian geological surveys in order to improve the current 2D-Visualization provided. The 2D-Visualization is functional but results in a muddled interface making it difficult to distinguish the depth and intensity of each epicenter. We used VTK and python in order to show this data.

2. Solution

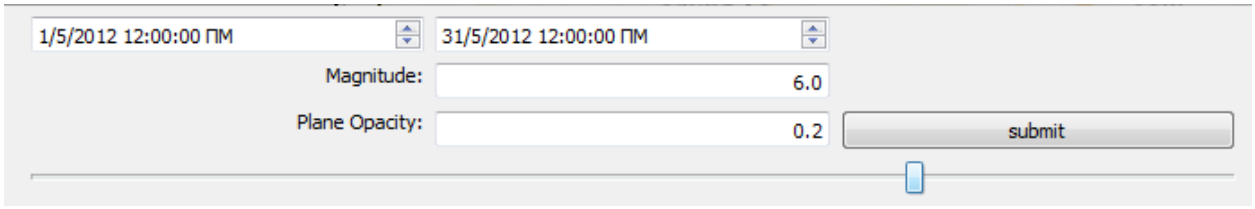
2.1. Visualization of earthquakes

We began by using simple sphere glyphs in order to represent each epicenter of the quake. We stayed with the spheres largely because it was important to understand where these points were in space - and it did not make sense to use other types of glyphs such as arrows which showed direction, or to differ the glyphs in size or shape.

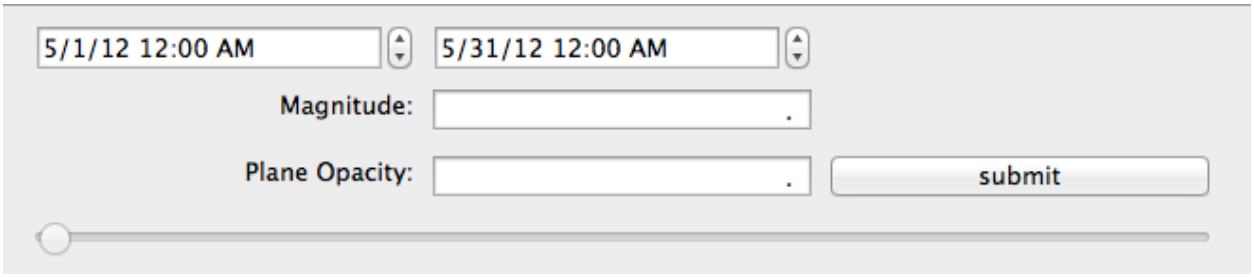
In order to show the strength of each earthquake, we used a color. We defined the colormap to easily distinguish different magnitudes. It was designed according to luminance, which allows differences to be easily seen. The color is not meant to be used to get an absolute reading of the data - but instead to understand the differences between the quakes, and to have those with relatively higher magnitudes be more easily seen. Thus we employed the “Heated Iron” color map, which allowed for both a clean and understandable visualization of the data.

After the configuration of the glyphs, we decided to filter our initial data. We chose to work around the area of Bologna (a region in Emilia-Romagna in the Po valley in Italy) because of the sizable quakes in 2012. The filtering was implemented by initially choosing the coordinates of the area. The user can then further filter the data via the GUI.

3. Examples of how do you use QT gui



(Figure 1. PC Interface)



(Figure 2. Mac Interface)

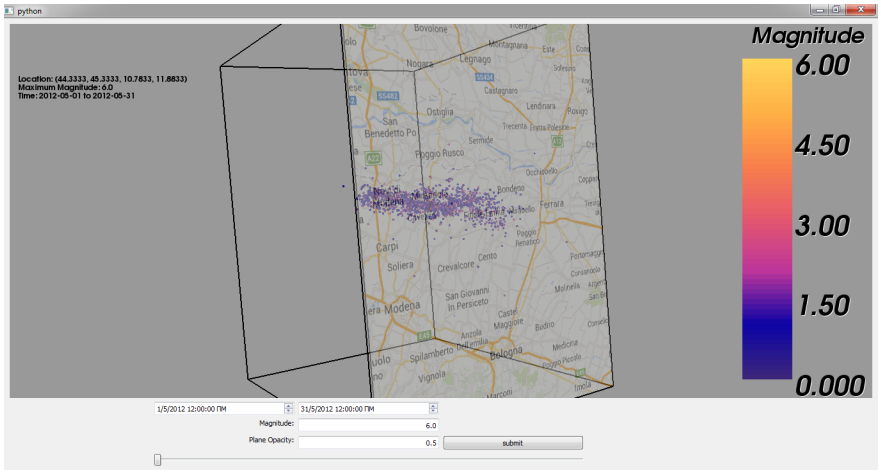
Before the program is initialized, a filter is run to get our location subset, and the time slider is deactivated. Once the program is loaded, the view above the GUI shows our VTK Window which has its own interactor and allows for rotation and zoom. The GUI can filter based on time, on maximum magnitude, and can also affect the plane opacity.

Once initial values are submitted, the time bar is activated and the user can specify what “slice” of time they would like to see. The slider works by dividing the time between the points specified in the GUI and showing 10% of the time from where the slider is set. For example, if the two times specified are ten days apart and the slider is set to 10%, then the data would show day one to two. One problem we found with this approach is that if the slider is set above 90% it shows dates higher than those given.

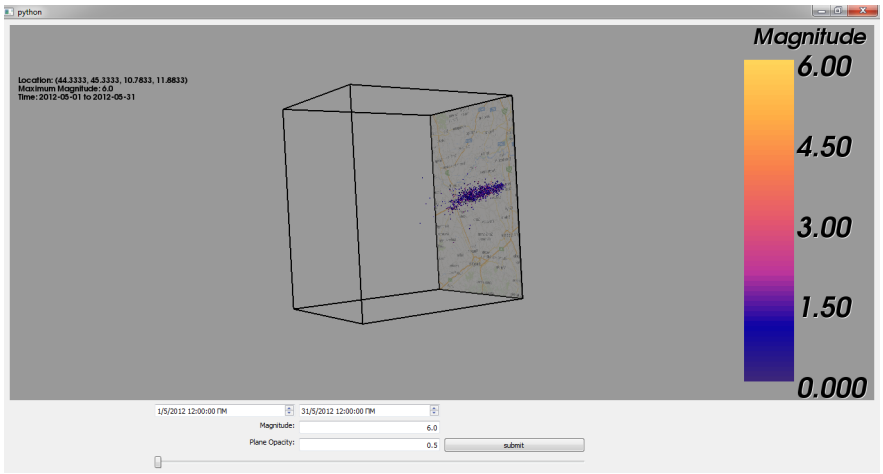
If the user presses the letter “a”, then the animation begins. It moves the slider from the initial position all the way to the final position.

While exploring the data with our GUI, we were able to more accurately find when the biggest quakes hit, and could further narrow down the time to find any points of interest.

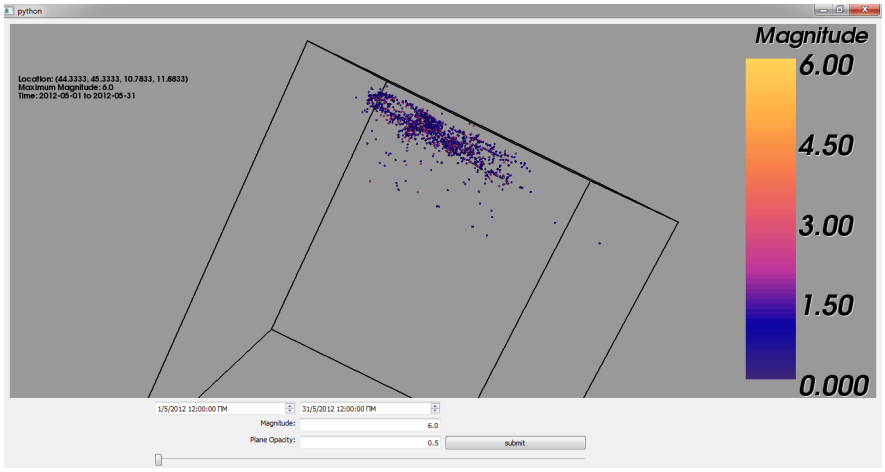
4. Representative images of the results



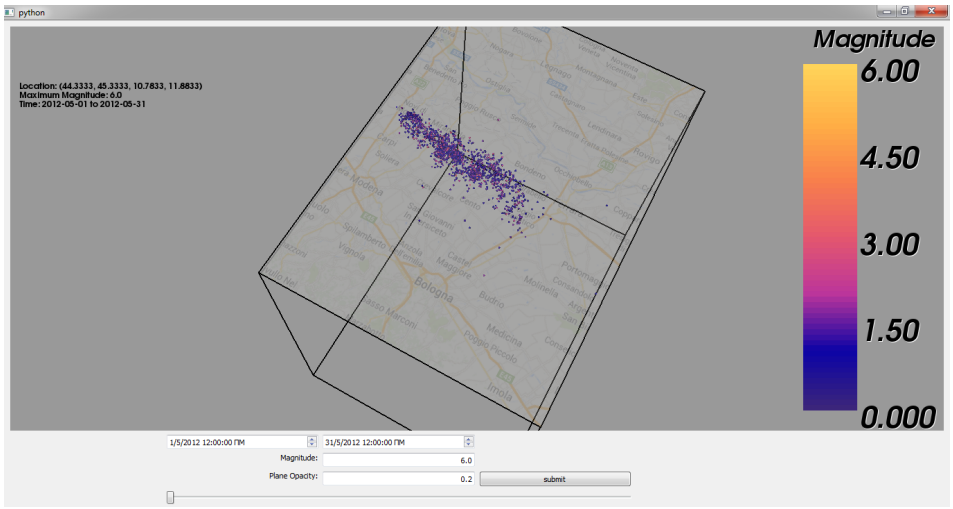
(Figure 3. Slightly rotated model after initialization)



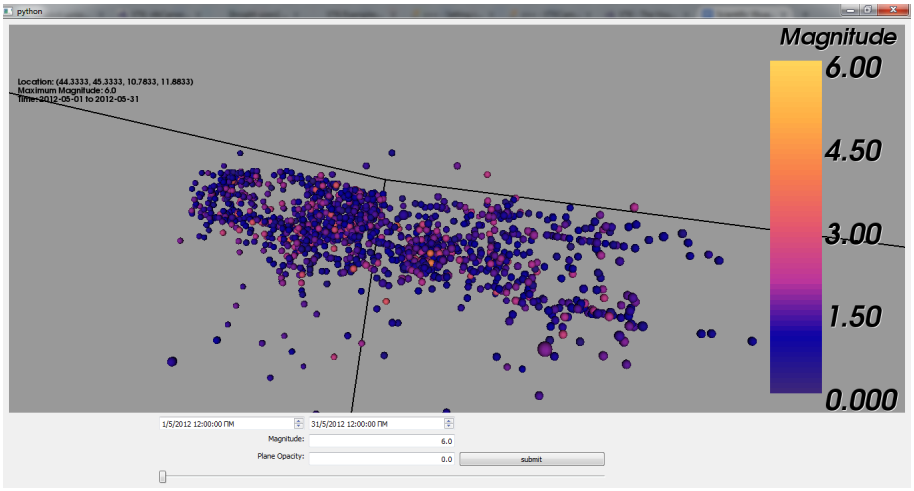
(Figure 4. Rotated model after initialization)



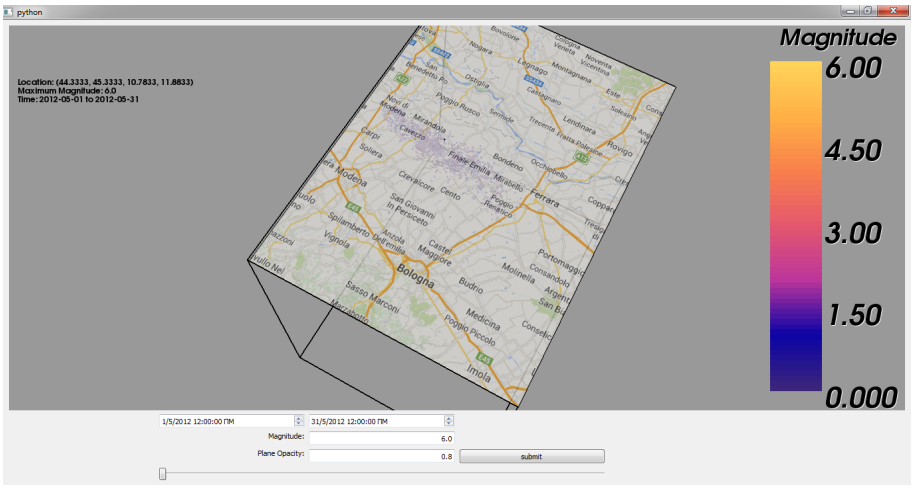
(Figure 5. Side view of data points)



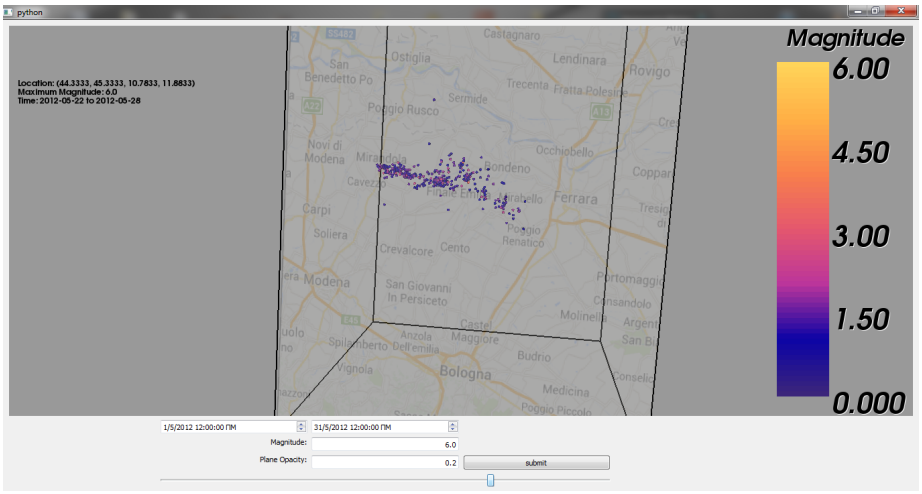
(Figure 6. View with decreased opacity)



(Figure 7. Close view with full transparency of the map)



(Figure 8. View with low transparency of the map)



(Figure 9. Altered results by magnitude filtering)

5. Comments

5.1. Impressions

This project helped us get started with visualizing some real world data. Not only did we get an appreciation for some of the inherent difficulties involved in working with bigger sets of data, but also how to have users understand exactly what you want the data to represent. With more time, we would probably add more functionality to the GUI which could help the user get a better feel for the controls, like a visualization of the orientation via a small cube. We would also try and think a little more about which aspects of the earthquake data are of the most importance. If depth is not such an important factor, for example, we might want to have the data represented differently in our visualization.

5.2. Project Bugs

After animating the scene, the different components of the scene separate and cannot be manipulated at once. We do not yet know why this happens but the glyphs, bounding box, and plane break apart and the interactor interprets them as individual items. This becomes especially problematic when trying to rotate or zoom the scene, as the interactor attempts to enlarge and rotate each separate component rather than the scene itself.