2006 IEEE Visualization Design Contest

John van der Zwaag
vanderz@hpc.msstate.edu
Mississippi State University
High Performance Computing Center
2 Research Blvd
Starkville, MS 39759

Introduction

To give scientists the ability to fully analyze the data, I employed two different methods to visualize the data. I used volume visualization of the magnitude of the vector and colorwheel visualization. I will describe the different methods and how they could be used to answer the contest questions in the following sections.

In each of the visualizations, the roads, coastline, and density data were included to give contextual information. The roads are rendered with a tan color and the coastline is rendered with a red color. In the volume visualizations, the outline of the basins are rendered with a black color. In the colorwheel visualizations, the outline of the basins are rendered with a white color.

Volume Visualization

For the volume visualization, the magnitude of the vectors was used to define the volume. By using the magnitude of the vectors, it is easy to determine the direction, size, and relative intensity of the waves. Color was used to differentiate the depths with blue being the deepest and red being the shallowest. Since the waves in the upper depths hid most of the waves from the lower depths, the volume was rendered from below. However, to keep the contextual information recognizable, the orientation of the X and Y dimensions were retained.

Because the volume visualization clearly shows the relative intensity and direction of the waves, it is useful for answering **Question 2** from the contest. *Figure 1* shows how the waves follow the Salton Sea Basin. *Figure 2* shows where the waves are being focused to the center of the Los Angeles Basin in the Whittier-Narrows area. This also relates to **Question 1** since they appear to follow a pronounced sediment channel as shown by the arrow. See the first section of the animation 'terashake.m2v' to see the waves being focused in motion and the second section of the animation to see a close-up of the Whittier-Narrows area.

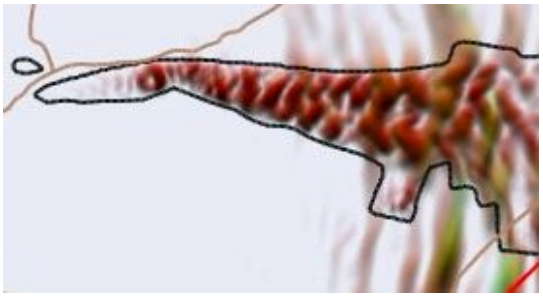

Figure 1 Salton Sea Basin

Figure 2 Whittier-Narrows Area

The volume visualization is also useful for answering **Question 4** from the contest. For example, reflections can be seen in the Los Angeles Basin near the end of the simulation. *Figure 3* shows a still of some of the reflected waves. The reflected waves are more evident in the animation.

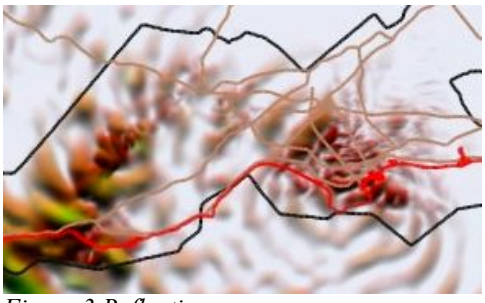

Figure 3 Reflections

Regarding **Question 5**, both the Salton Sea Basin and San Gabriel Basin appear to act as wave sources. *Figure 4* shows new waves originating from the Salton Sea Basin and *Figure 5* shows waves originating from the San Gabriel Basin. Again, the animation more clearly shows the phenomena. In the two images, the new wave sources are shown as white dots. In *Figure 4*, the original epicenter is shown as a red dot.

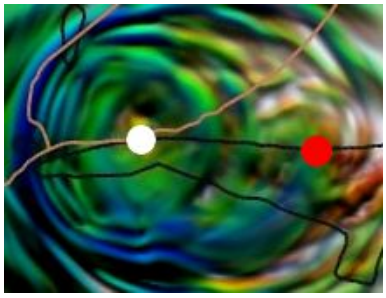

Figure 4 Salton Sea Basin

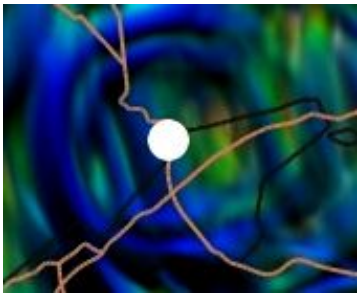

Figure 5 San Gabriel Basin

Colorwheel

The colorwheel visualization was used to attempt to answer **Question 3** from the contest. Since the wave type depends on the direction of the vector, the volume visualization based on the vector magnitude was not going to be able to differentiate between the different wave types.

The colorwheel visualization shows that most of the waves appear to be Love Waves with the vector moving perpendicular to the wave direction as shown in *Figure 6*. However, *Figure 7* appears to show different wave types in the Salton Sea Basin with the vectors moving parallel with the wave motion. This may be the result of reflections in the basin, but it is evident that the waves do not change type outside of the basins. It is harder to see in motion, but an animation is provided in the third section of the video.

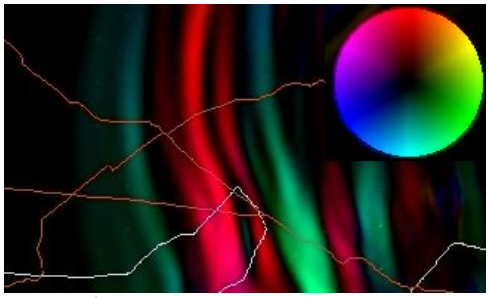

Figure 6 Love Waves

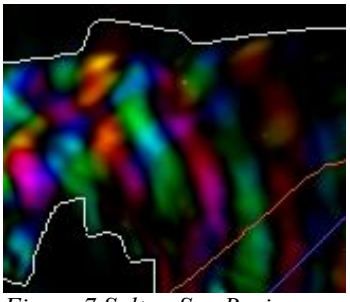

Figure 7 Salton Sea Basin

Software

Specialized software was developed using OpenGL and ImageMagick libraries.