

(a) contour map generated over the data interpolated by shepard method

(b) contour map generated over the data interpolated by n -phase interpolation technique ($n=2$)

Figure 2 Comparison between interpolation method

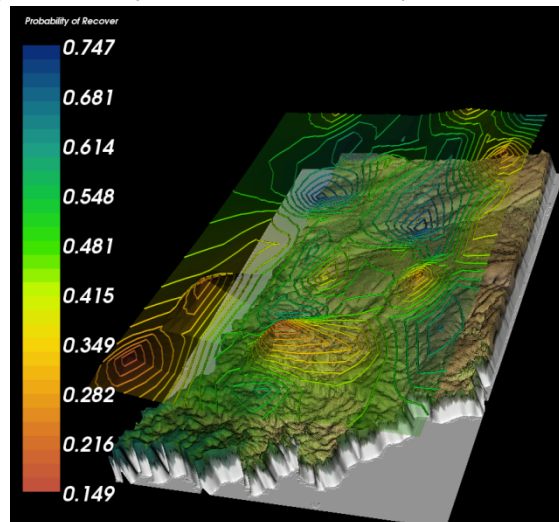


Figure 3 3D contour map

3.3 Glyphs

Although 3D isocontour map shown in Figure 3 gives a good overview on the current status, it is hard to figure out exact values on each point. To achieve this, a 3D glyphs are employed to give a feel on how high values are on each point to users. A 3D cube was located on each data point and its height is modified with respect to the scalar value on the point. The glyph view shows the required precipitation and the probability of recovery by changing the geometrical feature of the glyph on a region. The height of inner cube penetrating the outer represents the required precipitation and its color is corresponding to the probability of recovery. A glyph with deeper blue means it has higher probability of recovery. The color of outer cube represents the required precipitation while its height represents the expected precipitation. Figure 4 shows different types of glyphs. At the first time, I tried to show the glyphs on every data points based on the thought that it will be able to carry more information to users. However, the resulting image was far from what I was expecting. In order to prevent the resulting image from being cluttered by lots of glyphs, only data points corresponding to 75 weather stations are sampled by using vtkProbeFilter. The height of each glyphs h computed as follows:

$$height = zScaleFactor * precipitation$$

Since the given precipitation is relatively bigger than the other scalar values, $zScaleFactor$ was multiplied to standardize the height of each glyph.

3.4 GUI

The program provides controls over all components used in the visualization. For example, user can change the opacity of contour lines, surfaces and underlying maps. Also can determine how many contour lines will be

generated through GUI. The functionalities provide with GUI are listed below:

- Changing opacity
- Changing the number of contour lines being generated
- Change the type of map (Plane map or warped image)
- Saving the current view
- Capture current visualization as an image
- Changing color map dynamically

The GUI created for this project is shown in Figure 5.

3.5 Development Environment

The program for this project was implemented by active TCL/TK 8.5.7 and VTK 5.4.

The program used for pre-processing was implemented with C++ using MS Visual studio 2008.

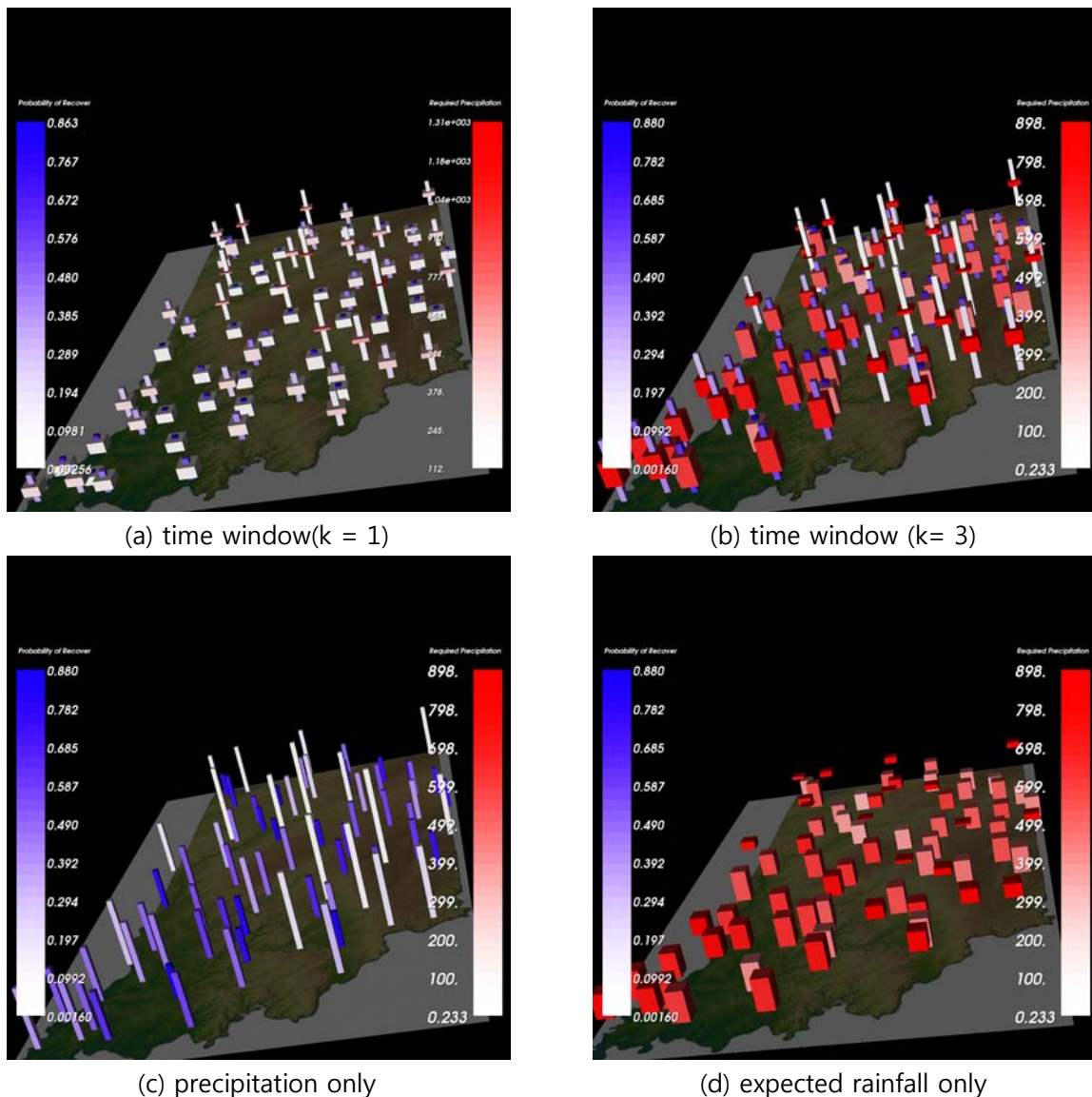


Figure 4 Glyphs

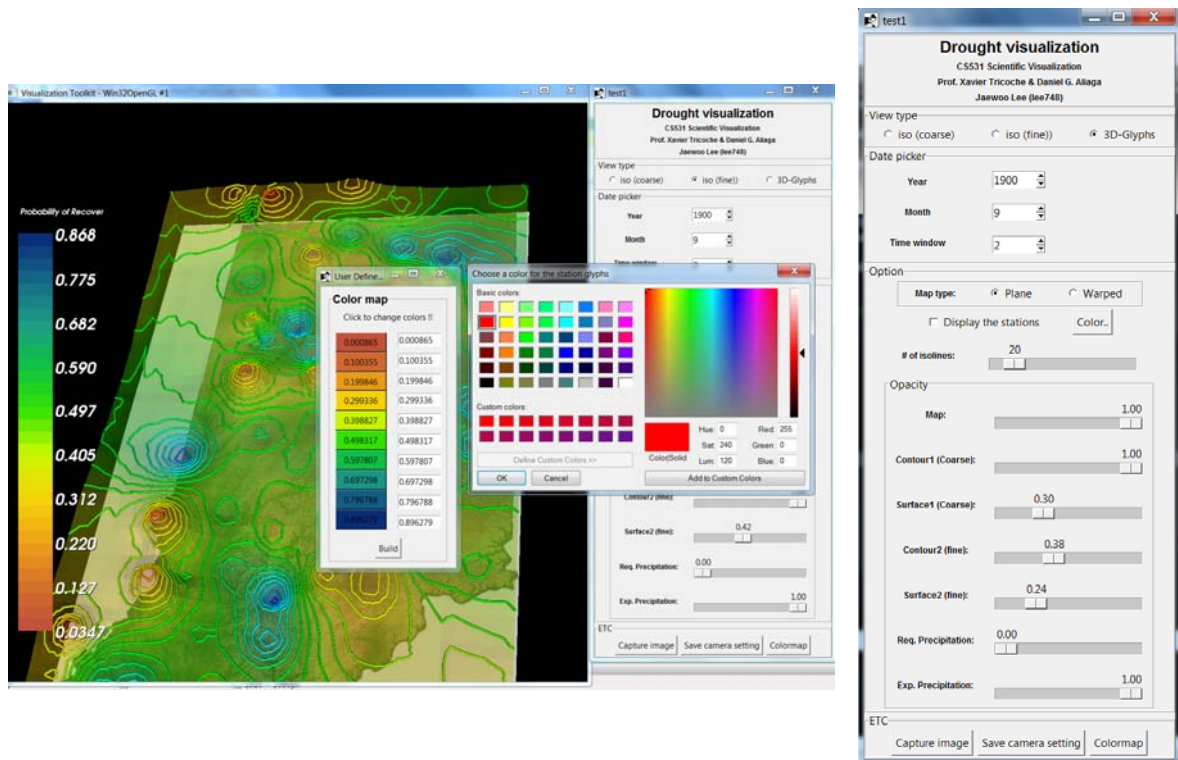
4. Result and Discussion

Since contour map is well known to many people and we are using this technique in our daily lives, it is very intuitive and user can understand it very easily without any further explanation.

In order to build a structured grid from the scattered dataset, an iterative interpolation technique was employed in this project. However, iteratively applying linear interpolation doesn't guarantee that a certain degree of quality can be achieved within a reasonable time. To determine the number of iterations n which can give the best quality of interpolation needs to be done manually by trial-and-error process.

5. Conclusion and Future work

In this project, a 3D isocontour map is created to visualize current drought status over indiana state. Although the resulting visualization is intuitive and easy to understand. However, precipitation represented by height from the ground isn't seem to be effective as I expected because a user has to change the view of angle to compare height of two different points. The will be remained as my future work. Another improvement on this project will be adding a visualization which shows the change of speed on each data points using vector field visualization technique.



(a) Constructing color map on the fly and applying to the image

(b) GUI

Figure 5 GUI

References

- [1] A Spatio-Temporal Drought Analysis for the Midwestern US, Shih-Chieh Kao, Rao S. Govindaraju, and Dev Niyogi, in : World Environmental and Water Resources Congress 2009
- [2] D. Shepard. A two dimensional interpolation function for irregularly-spaced data. ACM National Conference, 517 - 524, 1968.
- [3] Ball, K. M. (1989), Invertibility of Euclidean distance matrices and radial basis interpolation, CAT report no. 201, Texas A & M University, College Station.