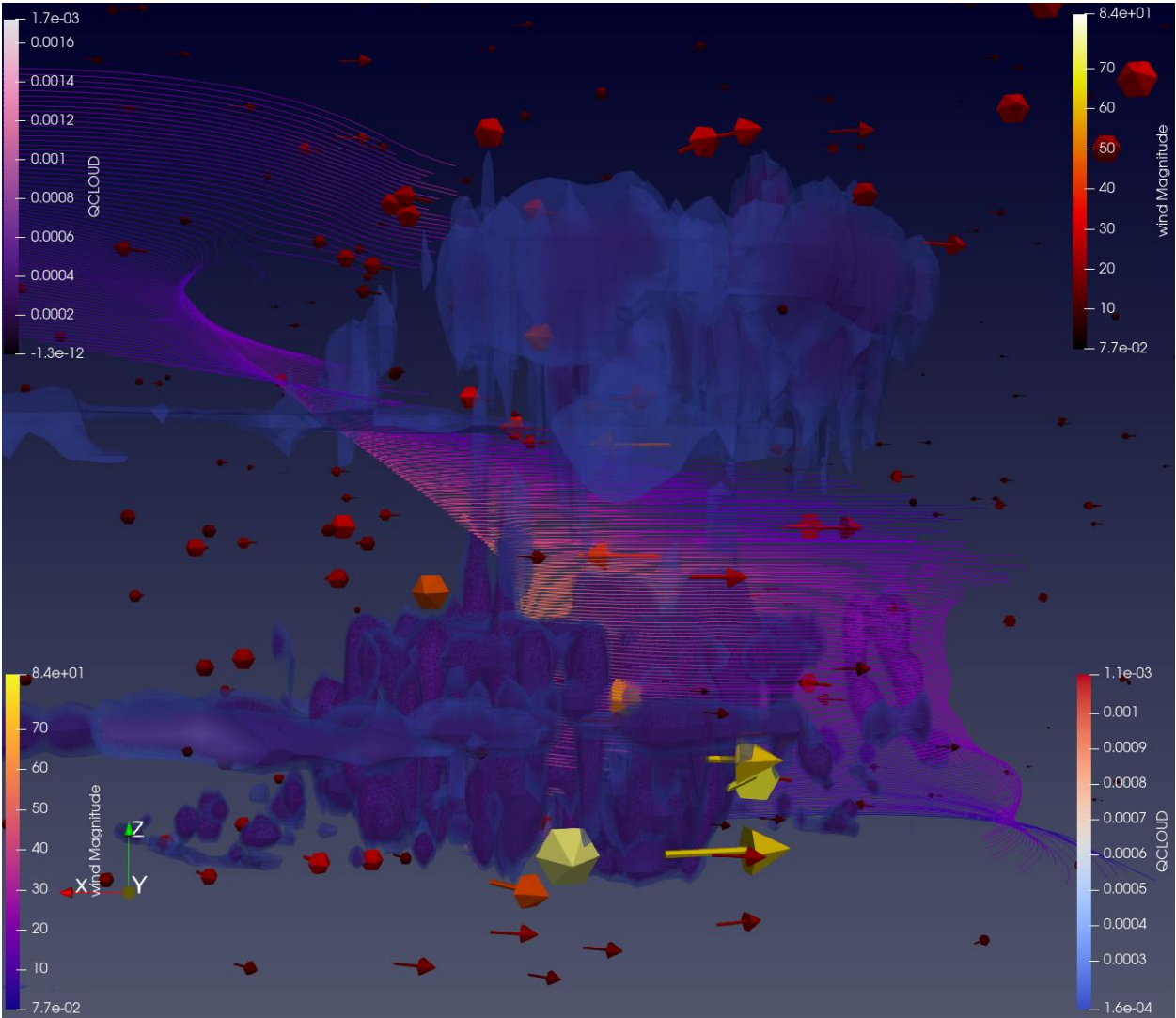


Michael Swenson

Assignment 5

#1 Multi-Field Visualization



Note this is the back side of the data so that the larger glyphs could be more easily seen.

1. Represent the data set as a volume using the resampling to image filter, the blue gas you see above with the color scale in the top left.
2. Add a filter “contour”. I chose the range of values from .0001 - .0017 and generated 100 points in between.
3. Next I added a “StreamTracer” filter to the main data associated with the QCloud, with a line as the seed that was centered on the data bounds. I reduced the resolution to give a transparent feel.
4. Finally, I added a filter again to the main data, of glyphs, using the wind column as orientation and scale, scaled by 2000, with the tip radius larger to emphasize direction. The number of glyphs made is 500 and mapped by the bottom left scale.

From what I see it appears as though the clouds and wind speed are the greatest at the bottom of the cyclone. This is viewed from the glyphs and contour especially. It also appears that the wind seems to travel in a counter clockwise direction.

What is diffusion tensor MRI imaging? State three types of diffusivities and describe each briefly. How a diffusion tensor can be represented mathematically? [Cchapters 15,16] 2) Briefly describe box, ellipsoid, and superquadric glyphs for visualization of tensors field. Compare and contrast the benefits and disadvantages for these glyphs. [Chapter 16]

What is diffusion tensor MRI imaging?

- DT-MRI is the imaging that takes advantage of the different values of water and cell membrane properties to construct different biological structures based on their cellular composition. Properties such as the anisotropy and isotropy of a material can be used to understand the makeup of a tissue and modeling it.

State three types of diffusivities and describe each briefly.

1. Thermal Diffusivity
 - It measures the transfer rate of heat in a material from hot to cold. Formally defined as thermal conductivity / (density + specific heat capacity)
2. Mass Diffusivity
 - Essentially how quickly two substances mix. For instance Carbon dioxide introduced to air.
3. Magnetic diffusivity
 - Describes the permeability of free space relative to electrical conductivity.

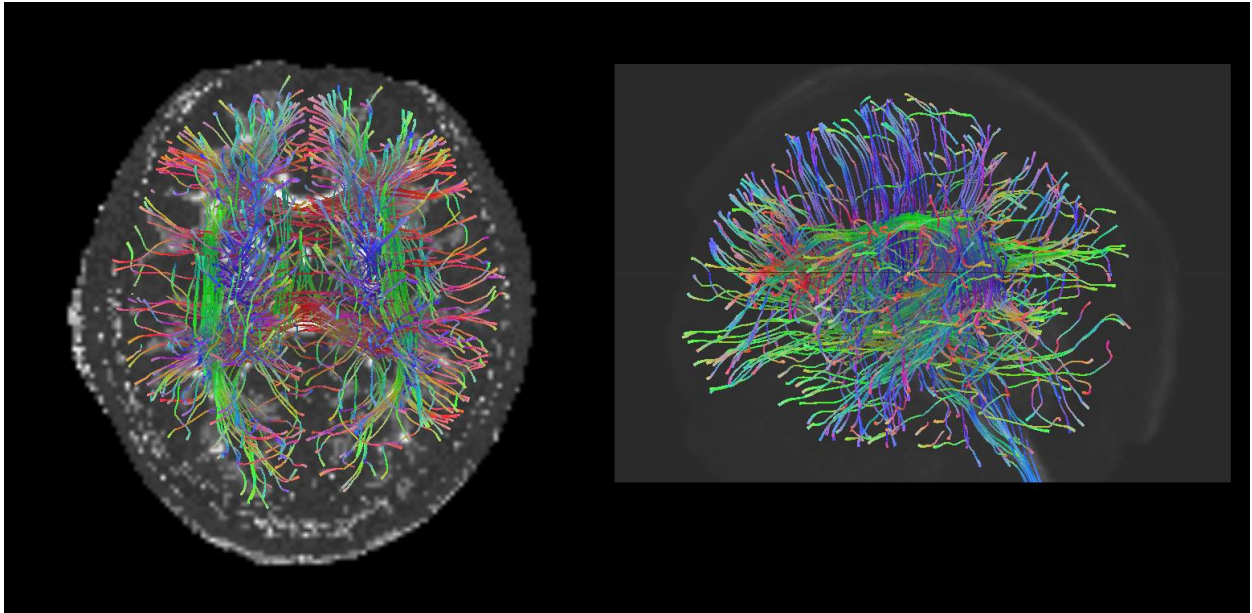
A tensor is described mathematically as a matrix 4x4 or 3x3, where each element is another vector or matrix.

I think to think of crystal structures where the tensor describes which plane a vector may be traveling through and then the element of the tensor represents the coefficients that affect the wave.

1. Ellipsoid Glyph
 - a. It is an ellipsoid where the 3 radii match the 3 principle component axes. It is a natural approach for this reason. Some of the drawbacks are occlusion and when rotated an ellipsoid isn't as defining as some of the other glyphs.
2. Box Glyph
 - a. More clearly defined in a projected view but it isn't symmetric as the values move from $cl = 1$ to $cp = 1$. Don't ascribe direction as well.
3. Superquadrics
 - a. They have good symmetry and when compared to ellipsoid that also have the symmetry superquadrics are easier to see differences of when projected and rotated.

#3 Part 1

High Contrast, 1000 tracts, and a “bow tie” region.



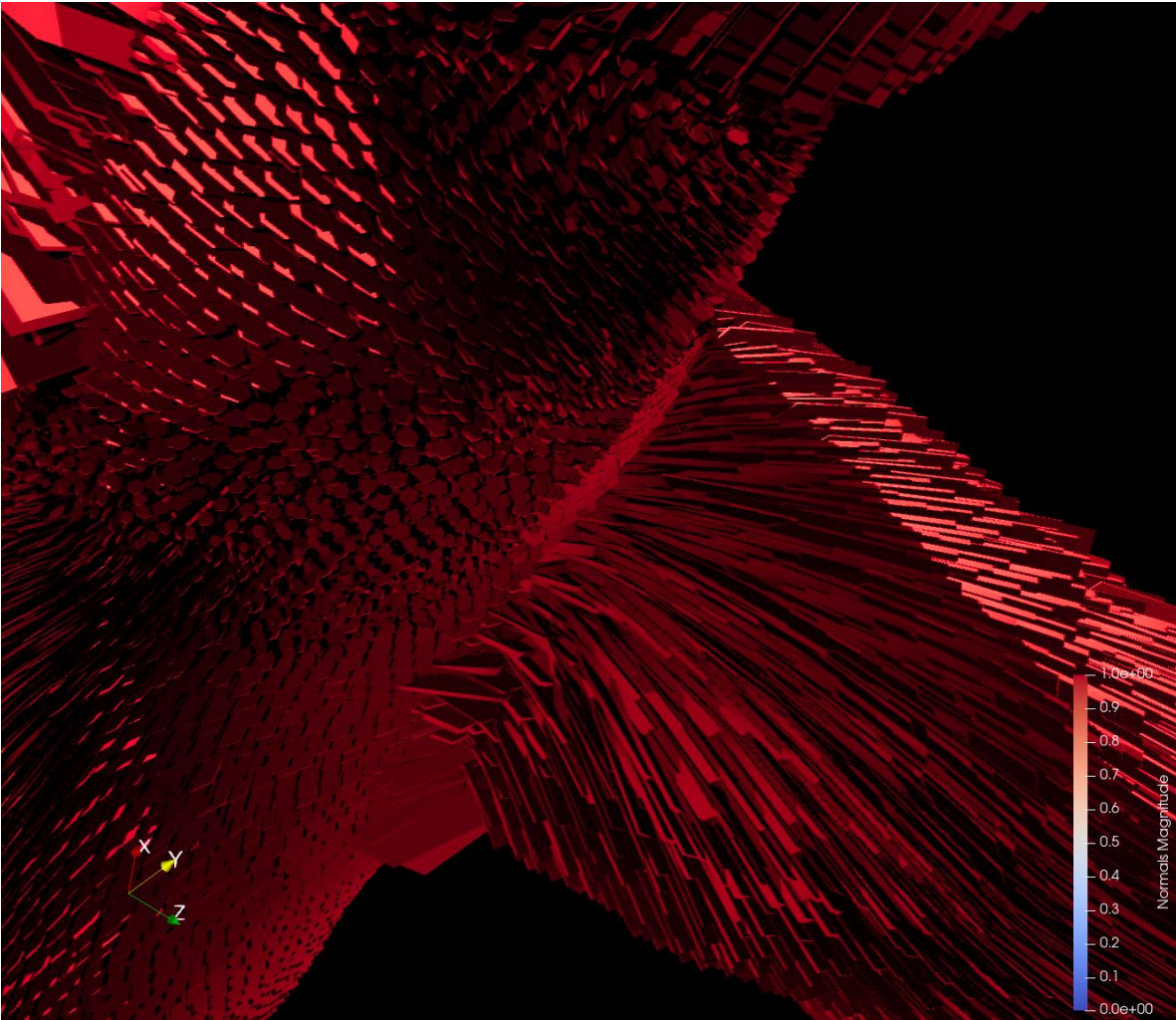
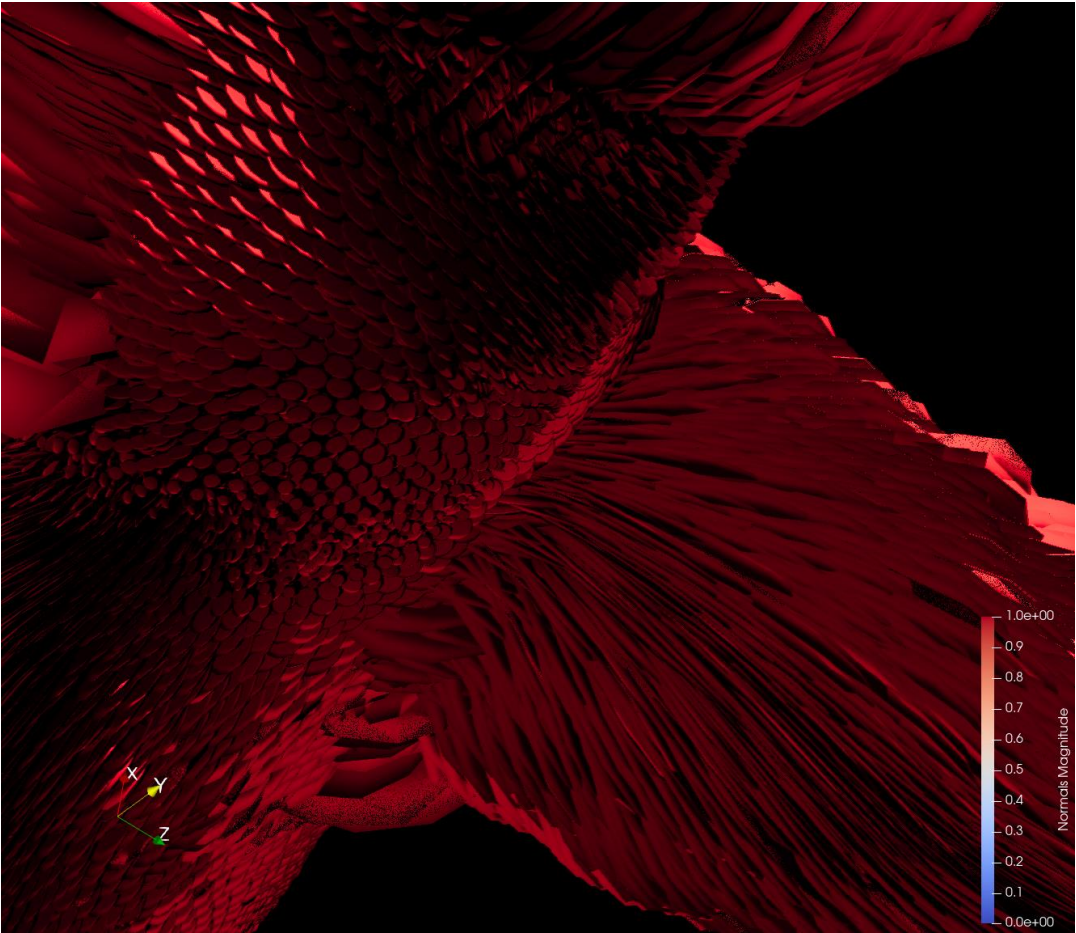
#3 Part 2

Tensor slice associated with part 1.



There are diagonal regions of green along the “Butterfly Wings” region in the upper left and right. It is interesting that similar tracts are in similar regions and also that the majority of them tend to travel in perpendicular directions. There is also an interesting connective area between the two hemispheres near the middle of the image approximately 1/3 and 2/3 of the way up the image.

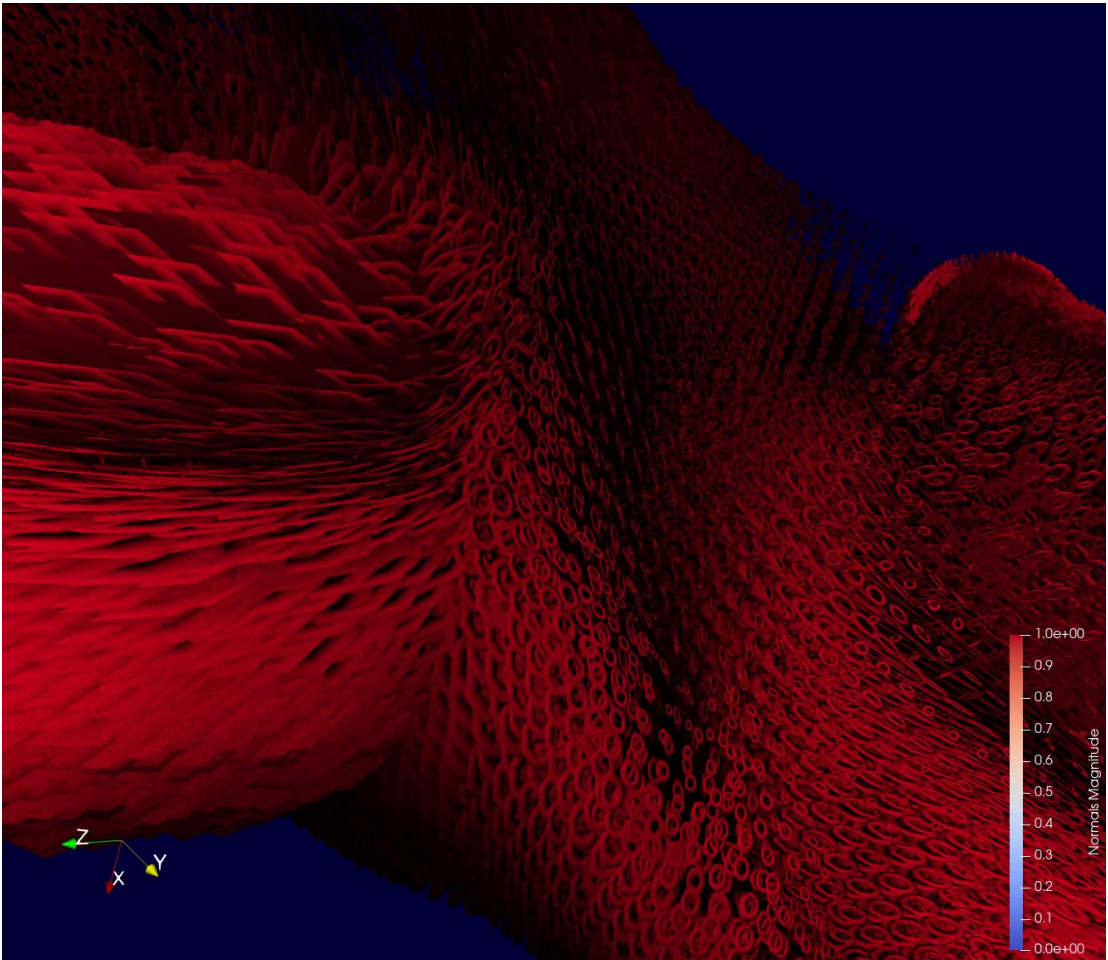
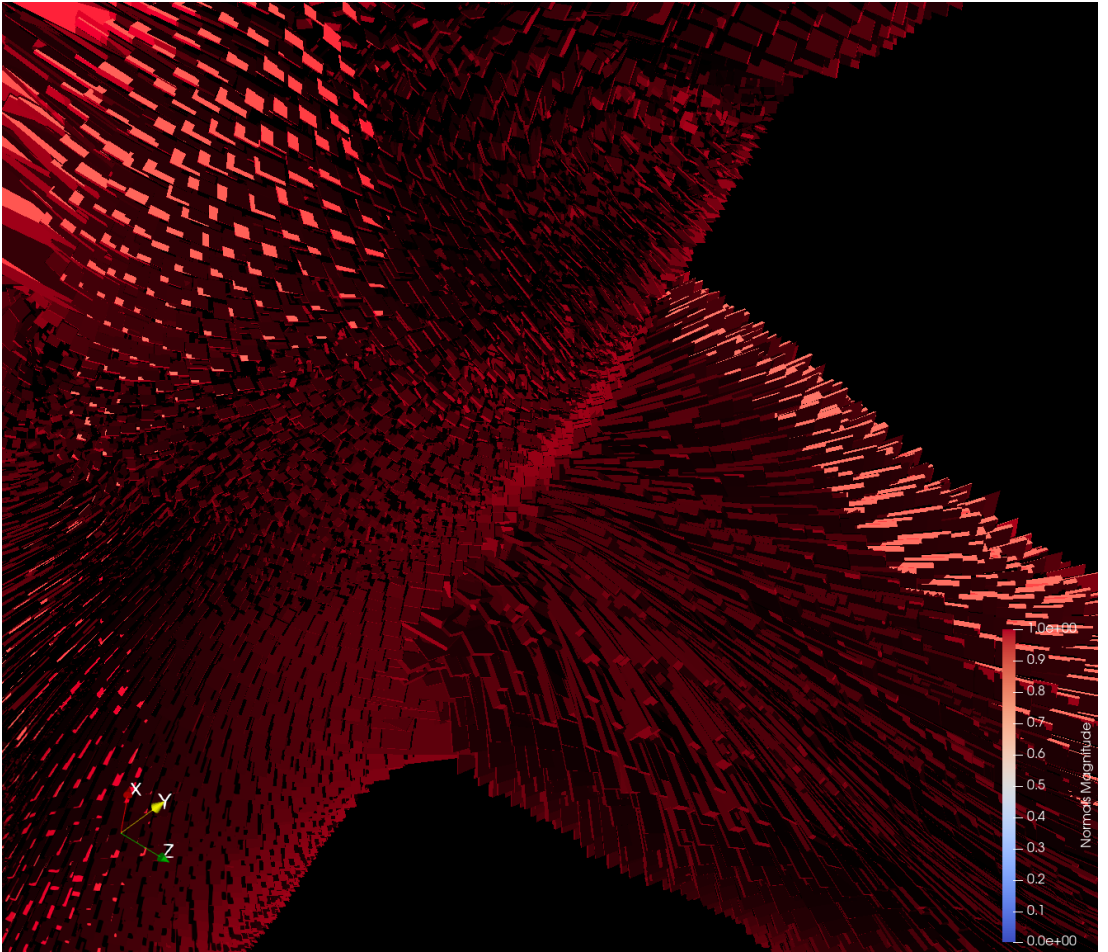
Sphere radius 1. This is at the joint of the main branch to the other two. I changed the background color to increase contrast between the figure and the back. I also used tone exposure and luminent lighting to achieve this visual. This is true for all of part 4.



Cylinder r = .8

Box 1x1x1

Didn't change anything on this because my computer was huffing and puffing after doing the superquadrics.



Superquadric: Reduced resolution

#4 I found the superquadric glyphs the most informative. The reason being that it is much easier to distinguish different shapes rather than a transformed shape. I didn't get to play around much with it due to computational problems I was having but you can easily see where the two "branches" meet there is drastically different effects happening.

Discussion:

I struggled initially just figuring out how to input the B-table for the DSI studio because I hadn't gone far enough in the steps. I also struggled on number one with the known bug and had to email instructor staff about it. I learned that there are extremely powerful visualization software for free! Also, it makes me want to track down other interesting data sets and visualizations just to have a greater understanding of the tools and complex data sets.