

The V³ Usage Guide

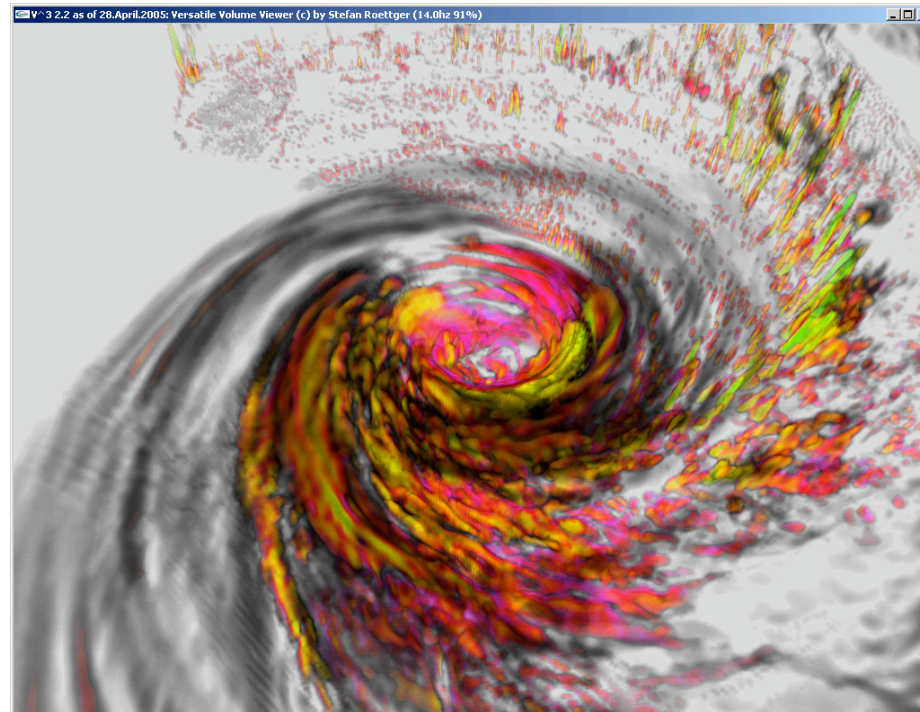
Stefan Roettger, Jan. 2007

Part #3: Hurricane Isabel Showcase

V³ Usage

Step A: The Hurricane Isabel

The Hurricane Isabel is a simulation show case of the National Center for Atmospheric Research. The simulation data was used for the IEEE Vis 2004 Visualization contest. The data is available at <http://vis.computer.org/vis2004contest/data.html>.



V³ Usage

Step B: Data Conversion

The Hurricane data set includes several simulation parameters like precipitation, temperature, cloudiness etc. For our first experiments we download the cloudiness data for step 41 (CLOUDf41.bin.gz) from the data repository and convert the data to the PVM format. We use the raw2pvm utility in the tools folder of the V³ distribution for this task. Compile and apply the utility in the following way:

```
./build.sh tools  
./tools/raw2pvm CLOUDf41.bin 500 500 100 4 4.0 4.0 0.2 CLOUDf41.pvm
```

We have two problems then:

1) The “no-data” value in the data set leads to an incorrect scalar value range

we need to remove all occurrences of 1e35f or greater from the raw data

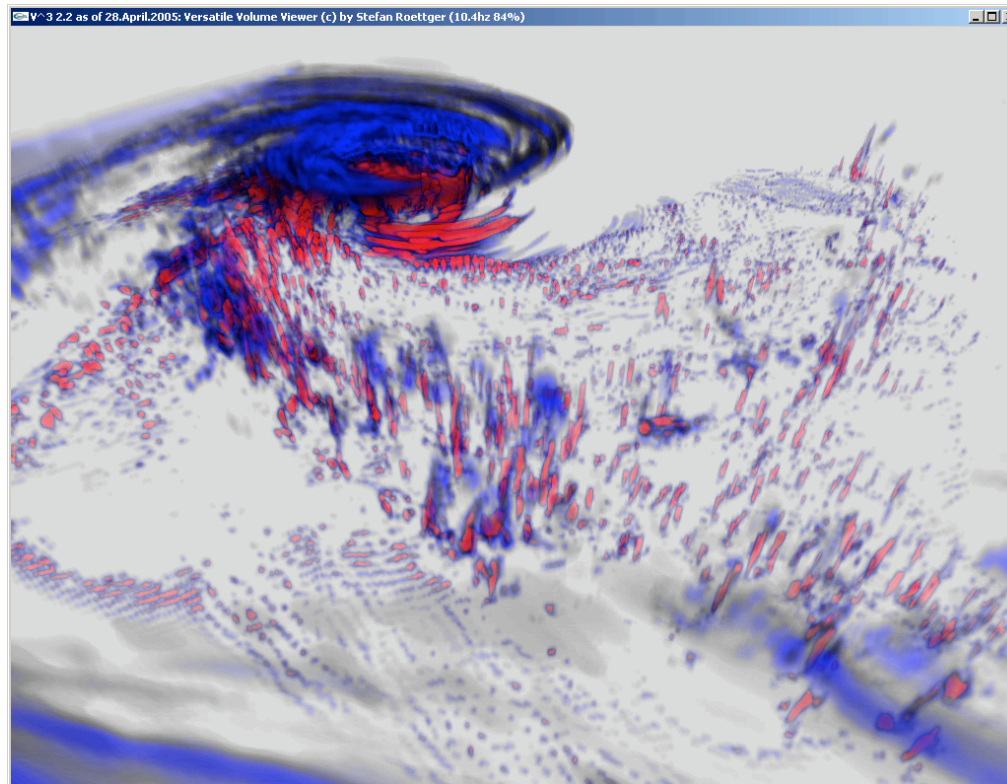
1) The entire data set is very stretched, so that we need to exaggerate the elevation

```
./tools/raw2pvm CLOUDf41.bin 500 500 100 4 1.0 1.0 0.75 CLOUDf41.pvm
```

V³ Usage

Step C: Cloudiness

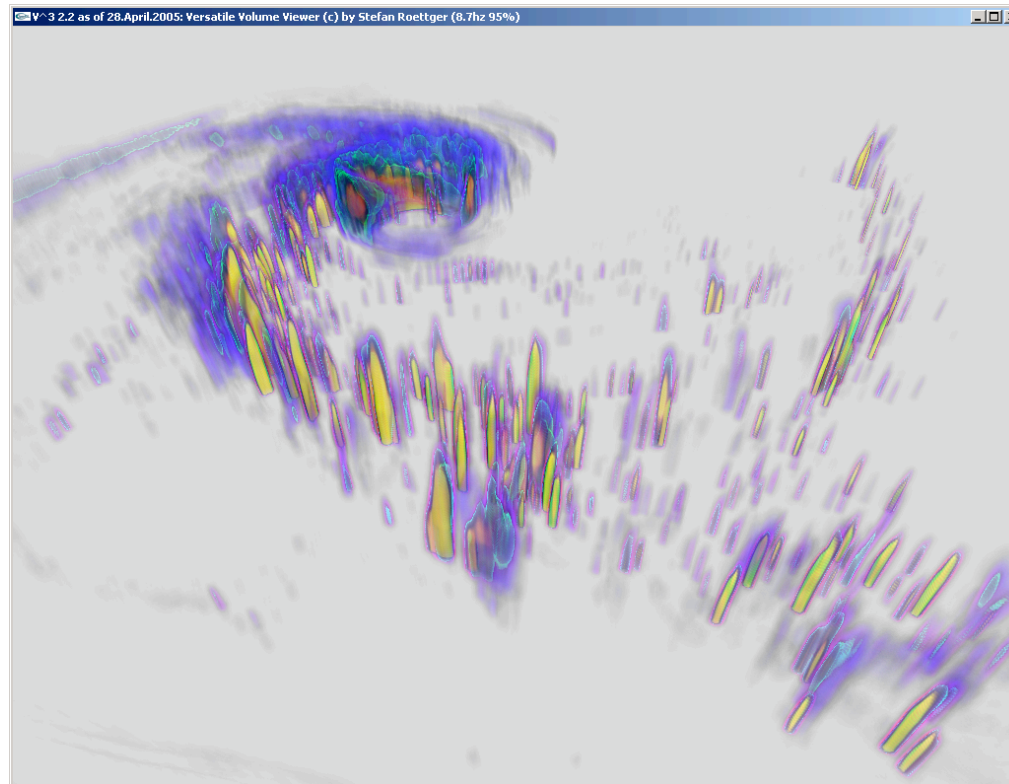
We load the converted data set and adjust the opacity. Then we mark a small range of low cloudiness values in red, a small range of high cloudiness values in blue and finally adjust the emission. The result is depicted below. We see the typical cyclone spiral in the higher atmospheric layer (the Central Dense Overcast, CDO) and a lot of heavy clouds scattered around the center and in the arms of the hurricane.



V³ Usage

Step D: Precipitation

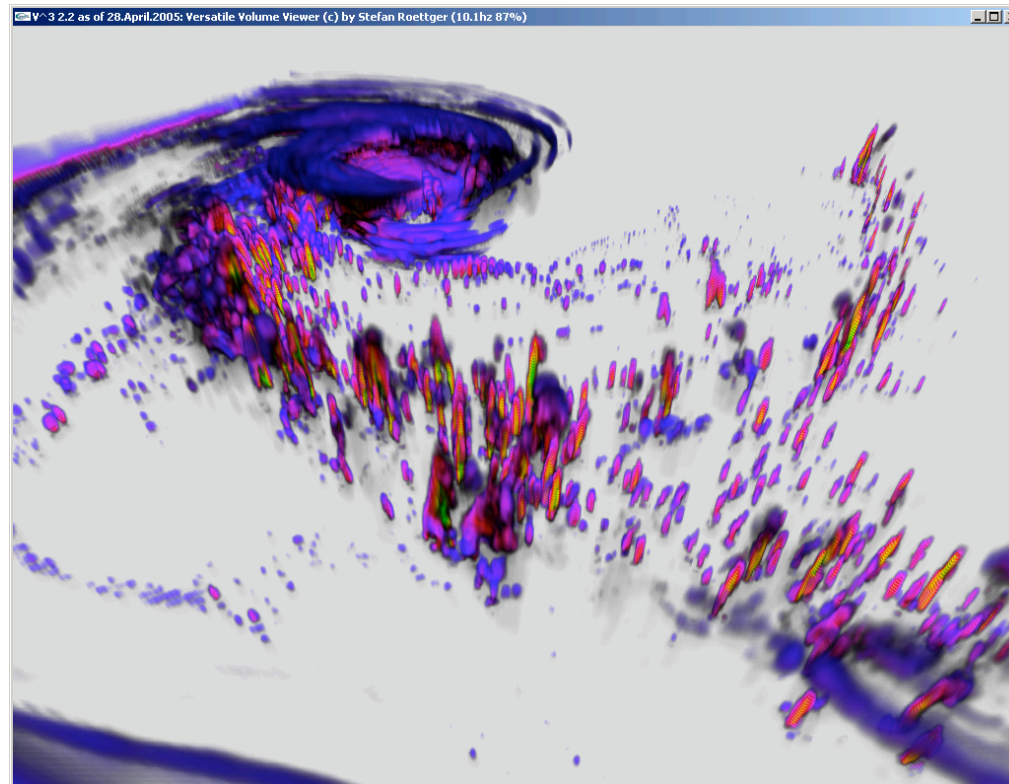
Precipitation: Intensities range from blue (low) to yellow (high). There is heavy precipitation around the eye of the hurricane (the eye wall) and scattered rain clouds with heavy downpour in the spiral arms (the rain bands). Interestingly, the eye wall is asymmetric. It exhibits a gap in the direction of backward movement.



V³ Usage

Step E: Rain Clouds

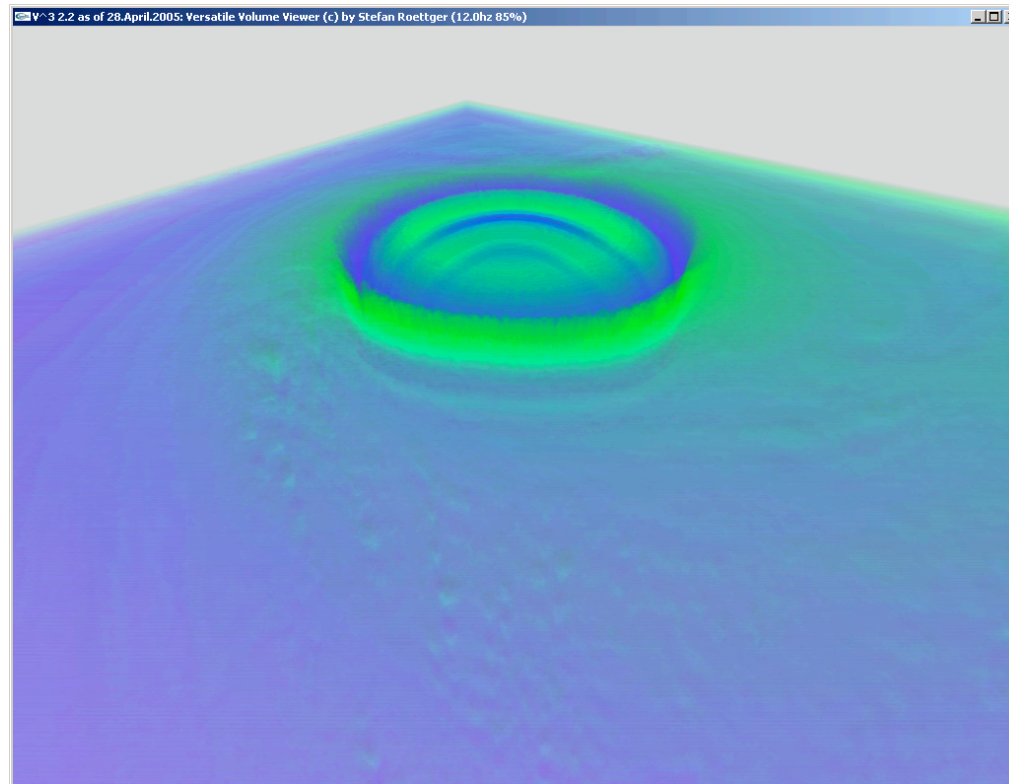
The visualization shows cloudiness vs. precipitation. The opacity maps to cloudiness whereas the color maps to precipitation. Intensities range from blue (low precipitation) to red and yellow (high precipitation). The CDO, the eye wall and the rain bands are clearly distinguishable.



V³ Usage

Step F: The Eye of Isabel

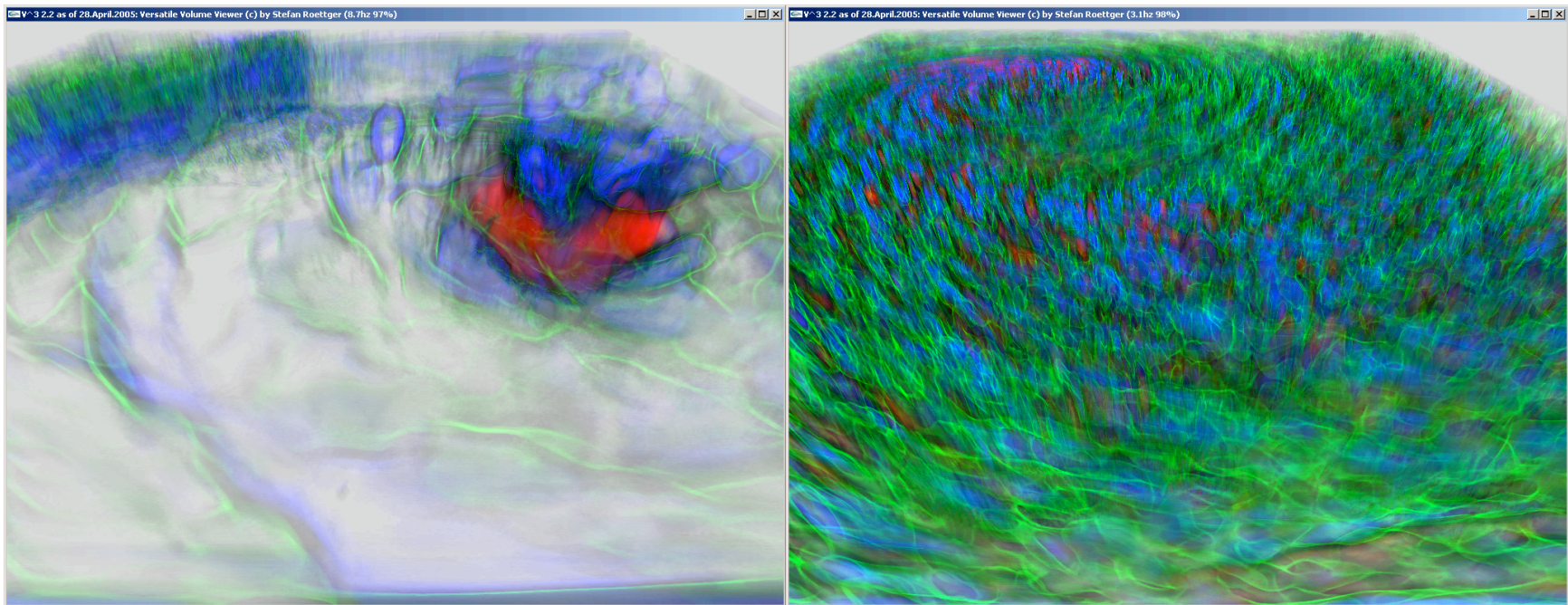
The visualization shows the pressure simulation parameter. It reveals the large depression in the eye of the hurricane. A couple of alternating blue and green color ranges were used. The outmost green ring depicts the eye wall.



V³ Usage

Step G: Early and Late Up Winds

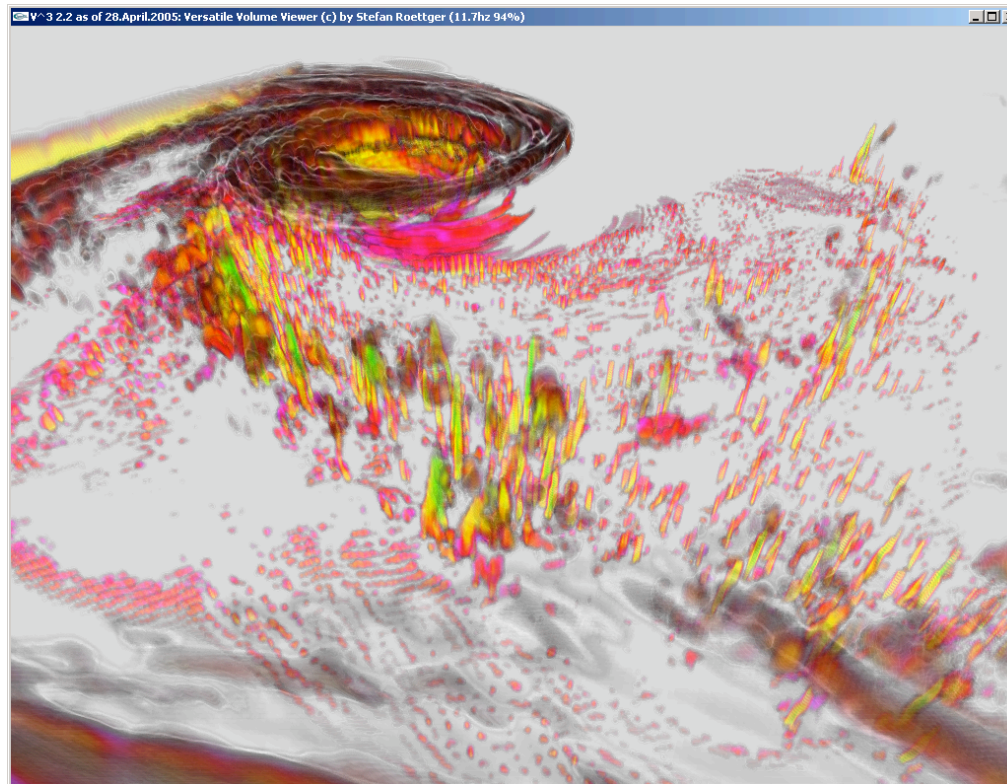
In these visualizations the z-velocity is shown in a very early (left) and a late phase (right) where the alternating up (red) and down (blue) winds have spread from the center in the beginning to the entire range of the hurricane in the final stage. The iso-surface of zero z-velocity is depicted in green. The falling winds in the storm center are characteristic for a hurricane.



V³ Usage

Step H: Cloud Up Winds

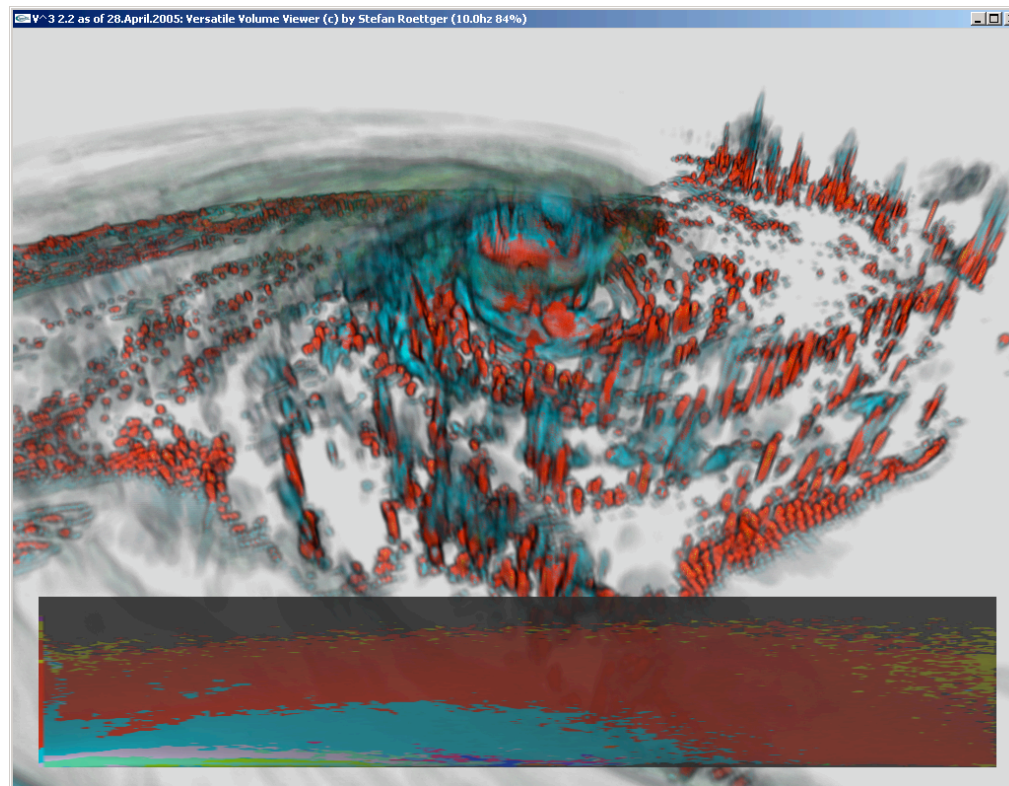
This visualization shows cloudiness vs. z-velocity. Strong up winds are depicted in red, whereas down winds are depicted in yellow and green. The main arm is a weather front where strong winds occur while in between the arms it is relatively calm.



V³ Usage

Step I: Spatialized Clouds

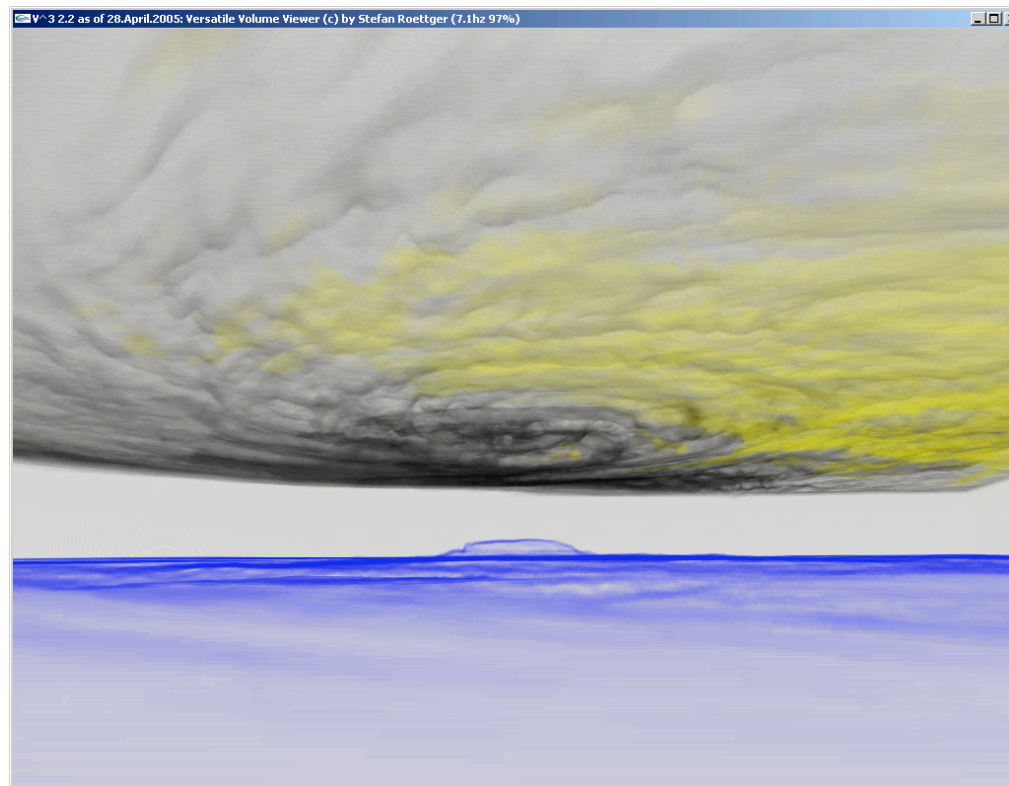
This view shows the cloudiness simulation parameter which was automatically separated into two main classes by applying a spatialized transfer function (depicted at the bottom of the image).



V³ Usage

Step J: Temperature

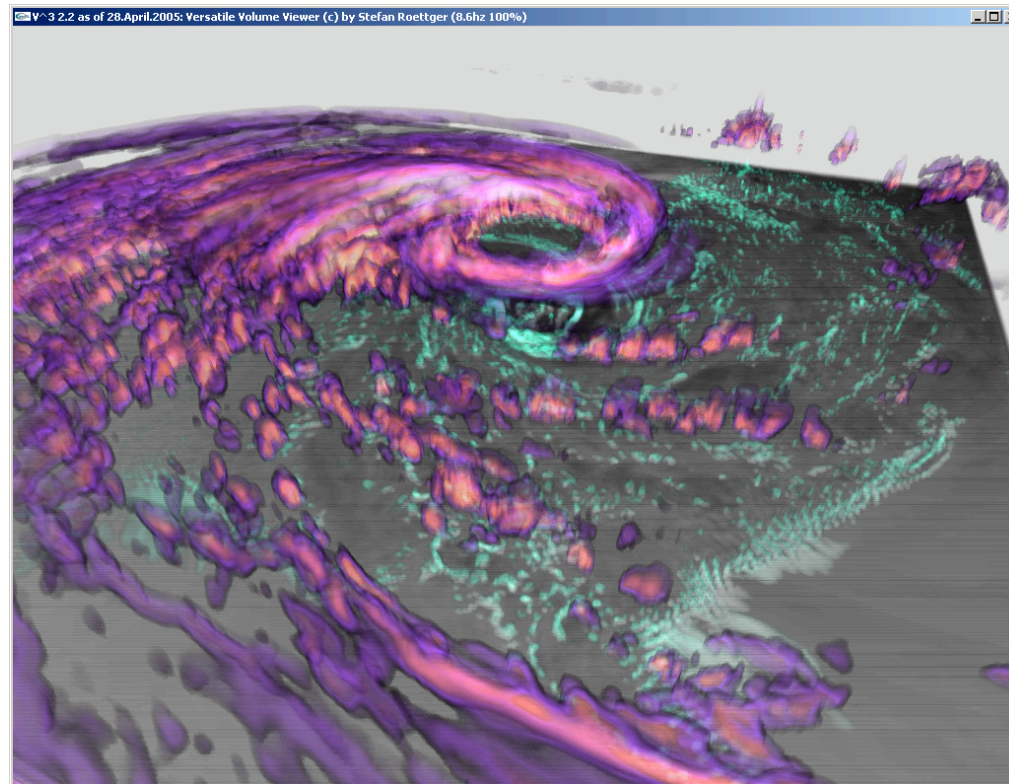
Two iso-surfaces of the temperature simulation parameter. Temperature equal to zero degrees celsius is shown in blue and extremely low temperature in black (ca. -70 degrees) and yellow (below ca. -75 degrees). The warm center of the storm very distinctly rises above the normal isothermal level.



V³ Usage

Step K: Cool Clouds

In this visualization the temperature of the clouds is shown. Extremely warm clouds (above ca. 30 degrees celsius) are shown in green whereas very cool clouds (below zero degrees) are shown in pink.



V³ Usage

Step L: Super-cooled Clouds

Again the temperature of the clouds is shown. On the left green depicts very warm clouds with yellow indicating an extremely warm and cloudy area around the eye wall. On the right super-cooled clouds are shown with purple indicating extremely low temperature. Since super-cooled clouds are regarded as the origin of rain cloud formation, the rain bands and the eye wall are clearly visible on the right.

