



**UMS**  
UNIVERSITI MALAYSIA SABAH



**UH6461002 MATHEMATICS WITH COMPUTER GRAPHICS**

**FACULTY OF SCIENCE AND NATURAL RESOURCES,**

**SEMESTER 1 SESSION 2023/2024**

**SC40103 SCIENTIFIC DATA VISUALIZATION**

## **MINI PROJECT**

|                                    |  |
|------------------------------------|--|
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## **Introduction**

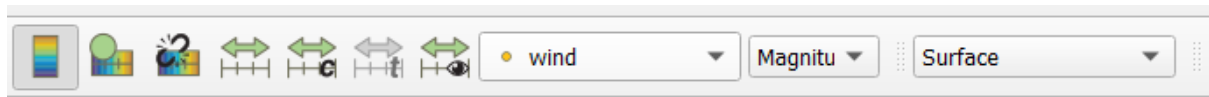
ParaView is a powerful open-source data visualization and analysis tool widely used in scientific and engineering domains. It enables users to explore and interpret complex datasets through interactive 3D visualizations. With support for various data formats and scalable parallel processing, ParaView facilitates the examination of diverse data types, ranging from computational simulations to experimental results. Its user-friendly interface and extensive feature set make it a valuable tool for researchers, engineers, and analysts seeking to gain insights from intricate datasets in fields such as fluid dynamics, climate modelling, and medical imaging.

In this mini project, two different types of datasets will be produced rendered scientific visualisation data. The first dataset is related to Hurricane Katrina, while the second is a DICOM dataset. An isosurface visualisation will be created using the combination of main filters like Contour, Clip, StreamTracer and ect. Afterwards, an animation of Hurricane Katrina's formation and pelvis dataset generation will be created based on the provided datasets.

## Process Taken

### Hurricane Katrina

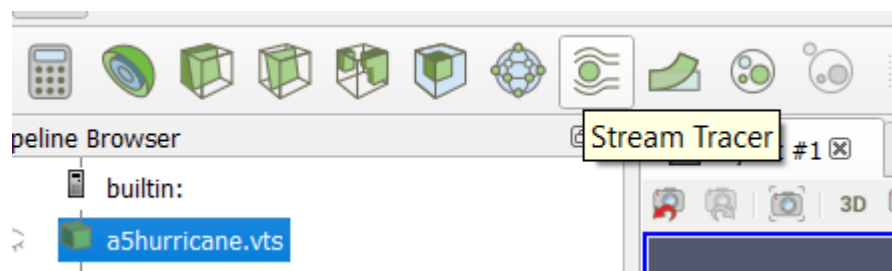
Load the a5hurricane.vts using ParaView, set the display representation as surface:



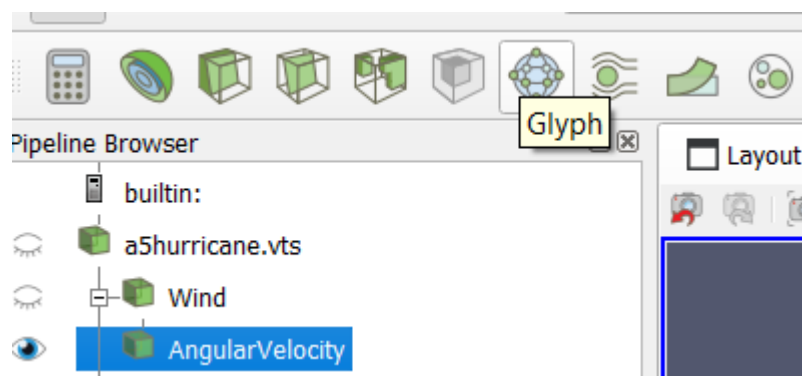
Choose the mapping data to 'Cold and Hot' to provide a better visual for air flow in hurricane:



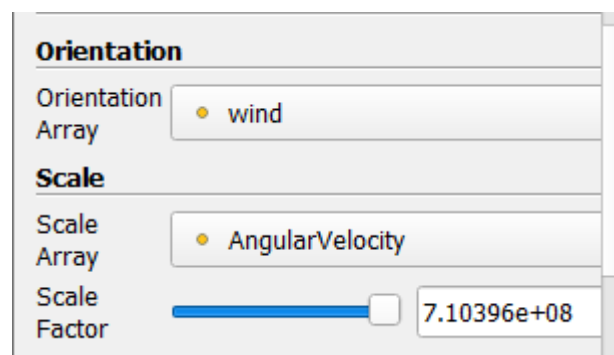
On the a5hurricane.vts, apply the filter Stream Tracer to visualize the hurricane:



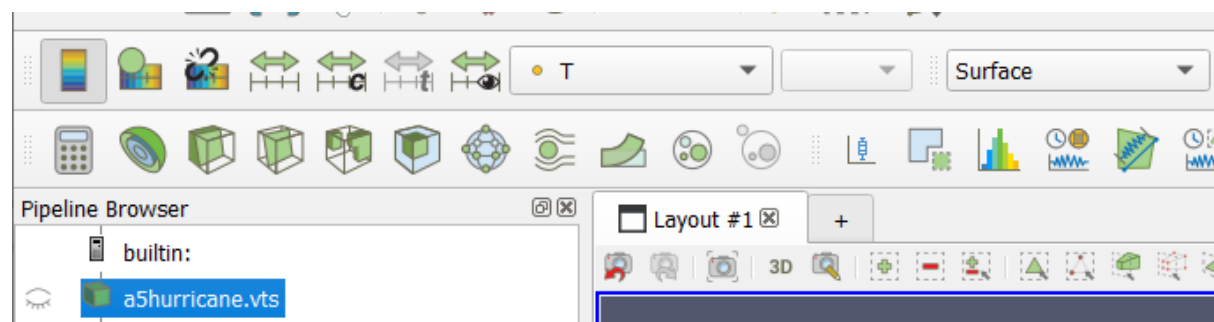
Based on the Stream Tracer, create a glyph filter on:



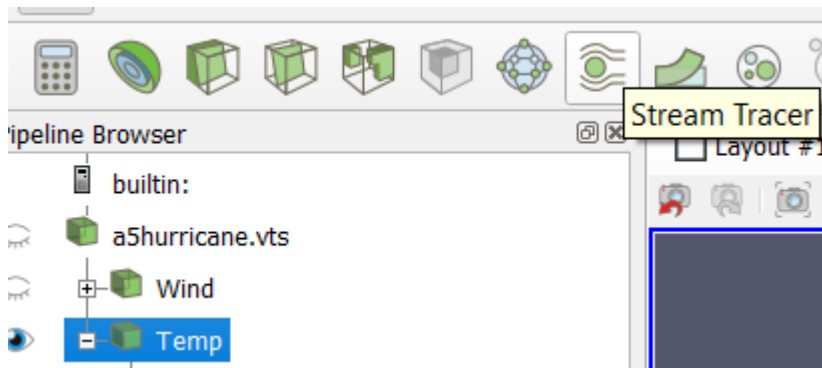
Set the Scale Array to angular velocity, arrow to represent the angular velocity of the hurricane is visualize:



Change the a5hurricane data set to Temperature:

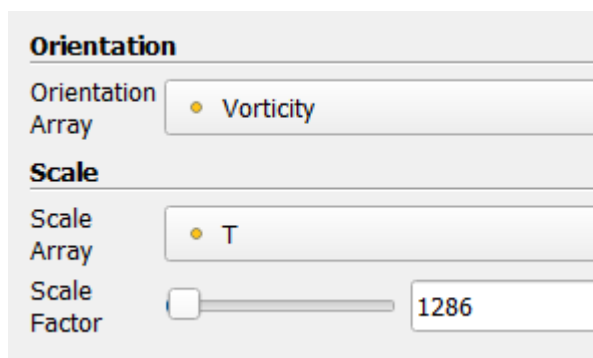


Under the a5hurricane.vts, create a Stream Tracer filter:



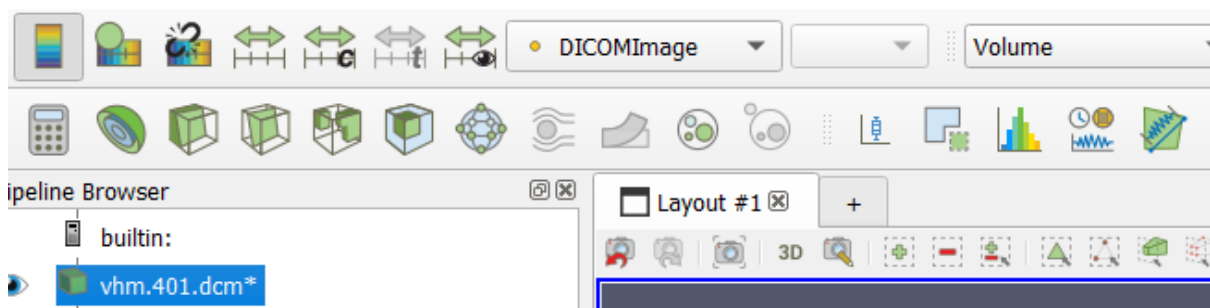
Under the Stream Tracer filter (Temp), set its properties Display representation as wireframe, seed type as line, and tick the 'render line as tubes' under styling properties.

Then, apply glyph filter to the Temp stream tracer and set its orientation array as vorticity and scale array as T, arrows represent the temperature flow is visualize:



## Pelvis

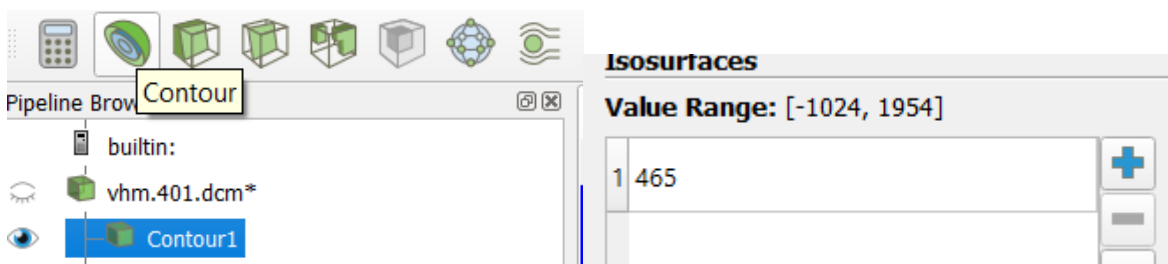
Load the DICOM datasets as directory and set the display representation as volume:



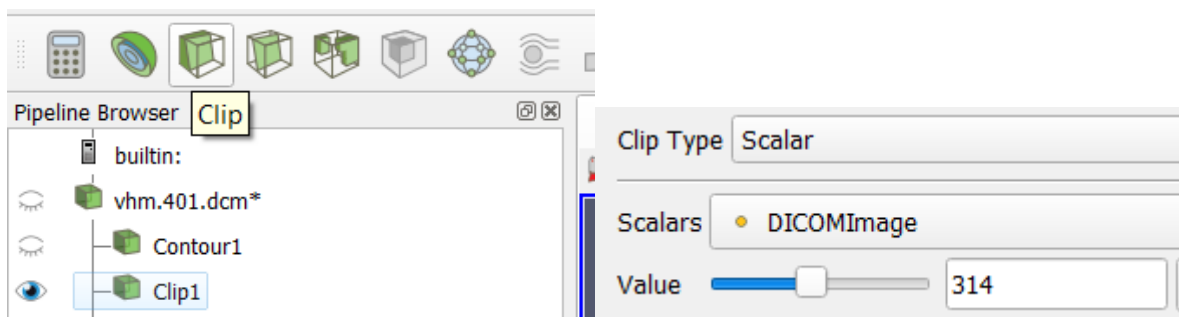
Set the mapping data to 'Rainbow Uniform':



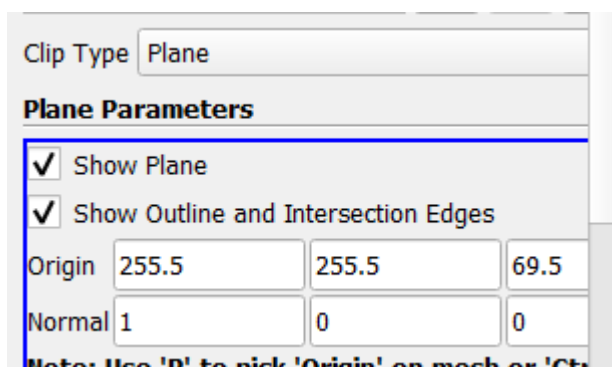
Apply the contour filter, set the value range as 465, bone of the DICOM data is visualize:



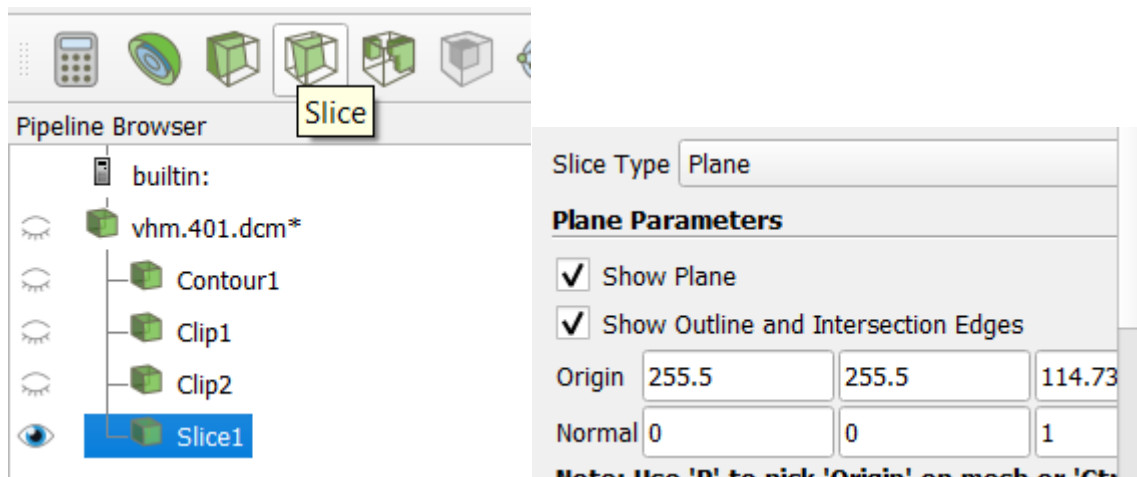
By using clip function choose clip type to scalar, set the value to 314, bone of the DICOM data is visualize:



Using clip filter, clip type as plane, a plane view of the DICOM datasets is visualize:



Using the slice filter, a slice from the DICOM datasets is visualize:



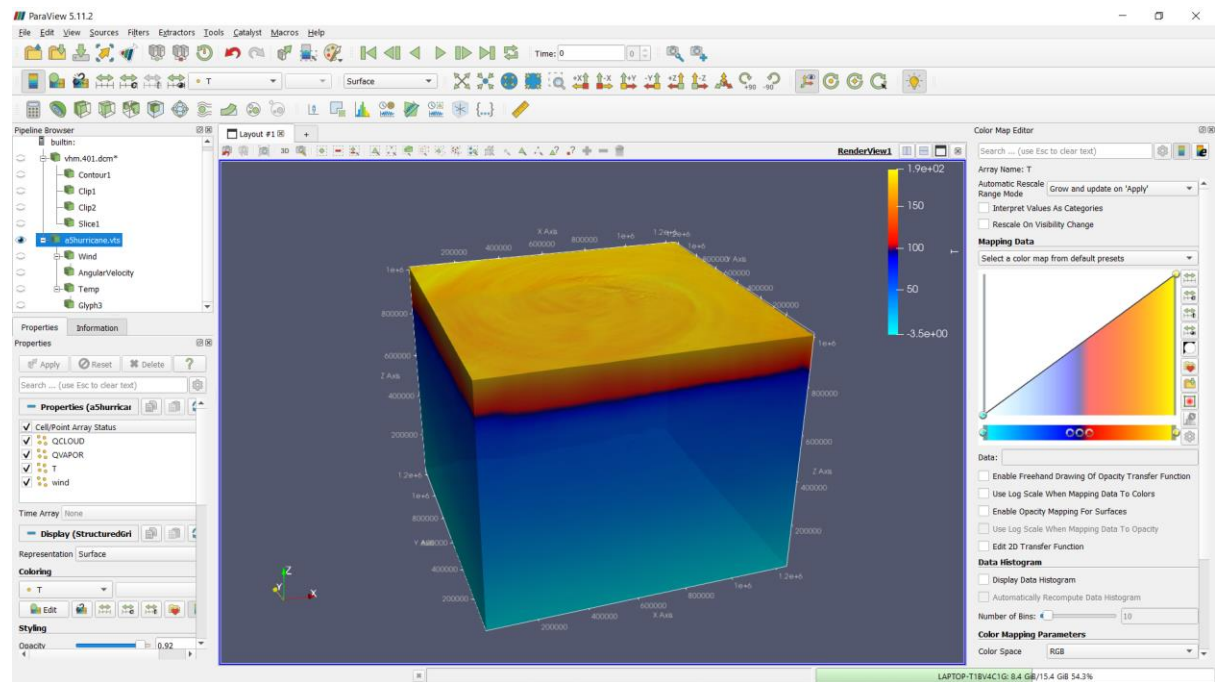
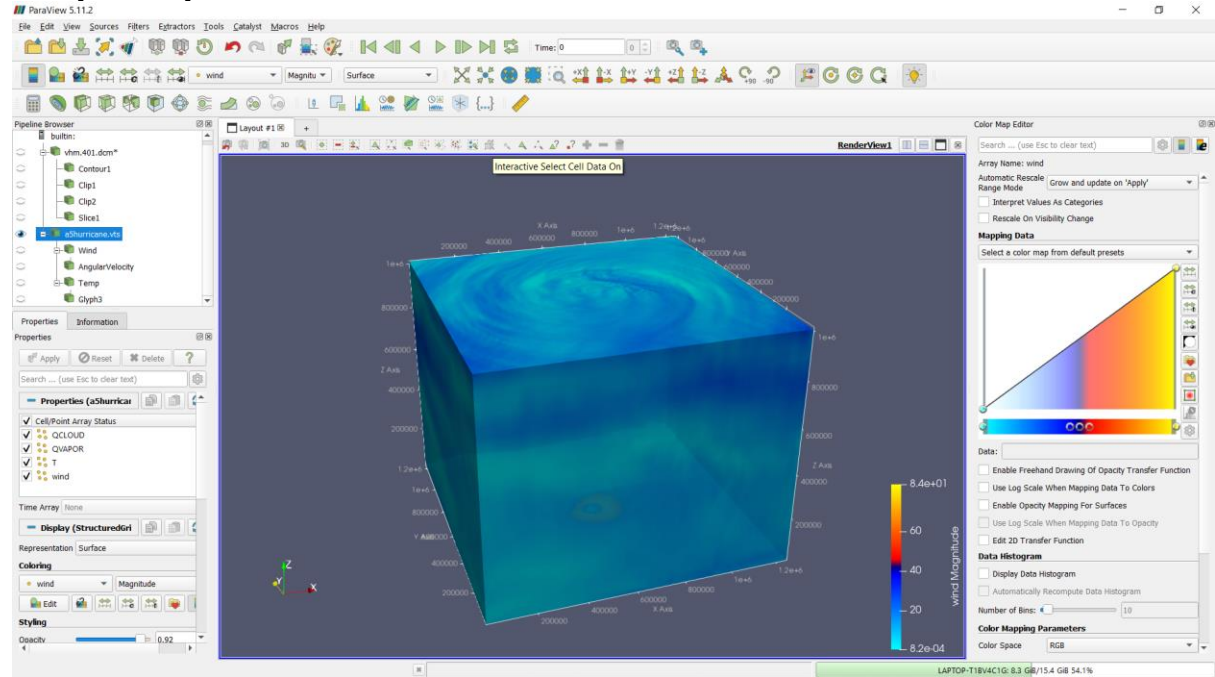


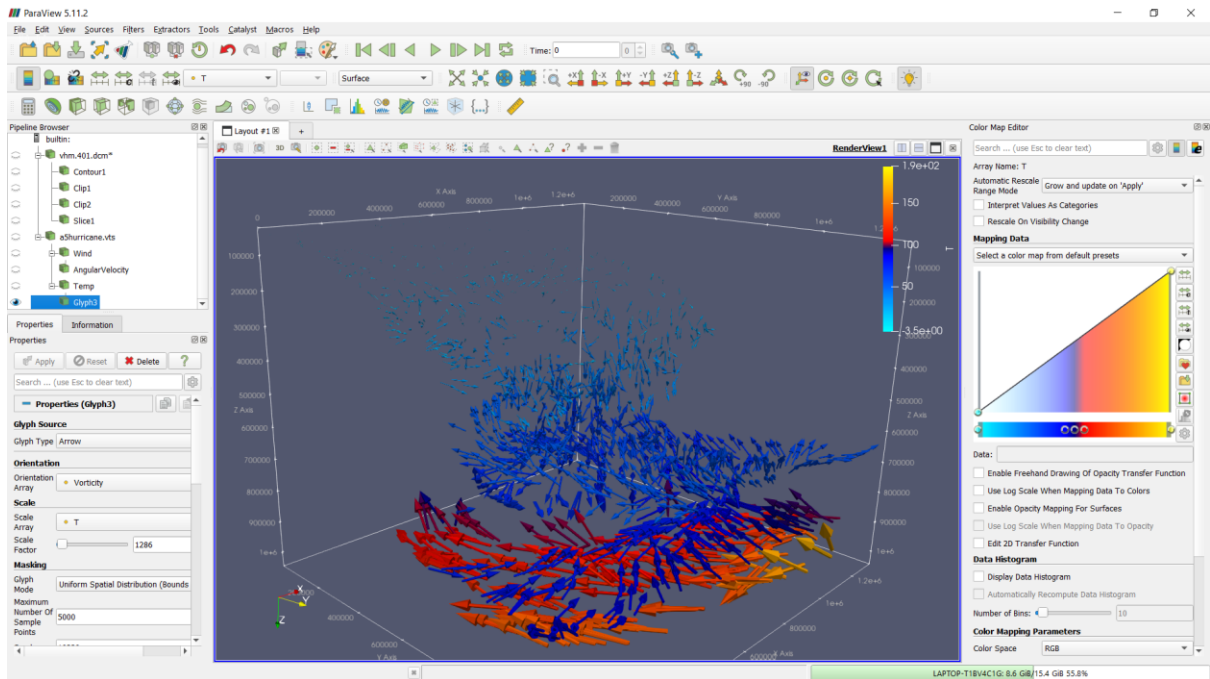
## **Strength and Uniqueness**

The data visualization by using ParaView has the following strength and uniqueness.

1. Shape of hurricane is visualized.
2. The temperature of hurricane is visualized.
3. Angular velocity of hurricane is visualized.
4. Direction of air flow/temperature flow is visualized.
5. 3D volume of DICOM datasets is visualized.
6. Bone shape of DICOM datasets is visualized.
7. Multiplanar of DICOM datasets is visualized.
8. Slice of DICOM datasets is visualized.

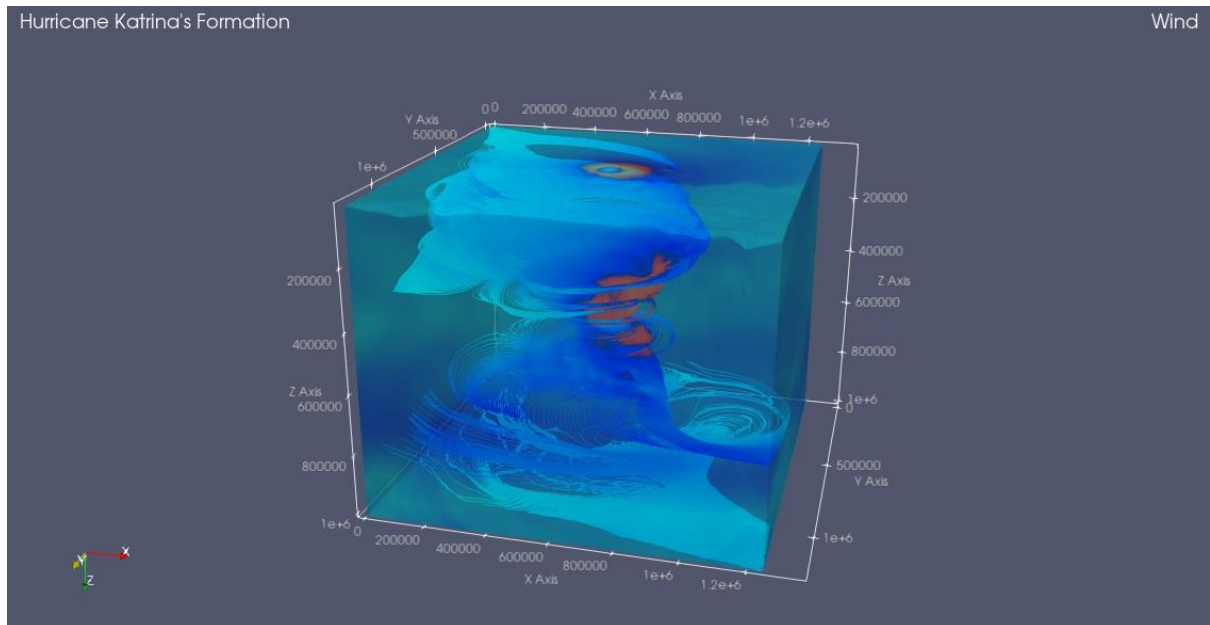
# Sample Output





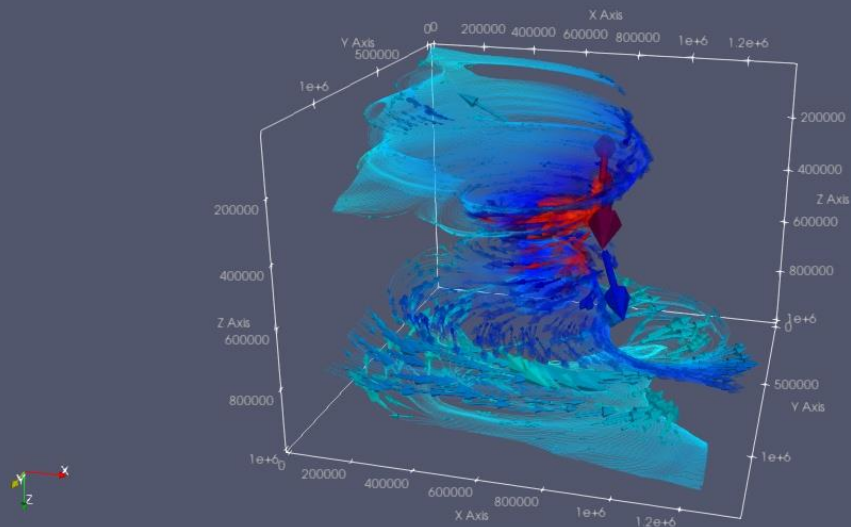
Hurricane Katrina's Formation

Wind



Hurricane Katrina's Formation

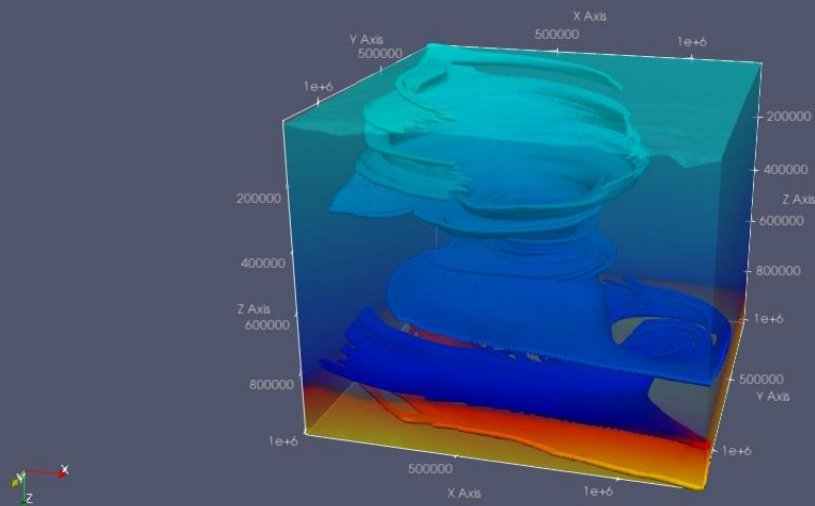
Wind

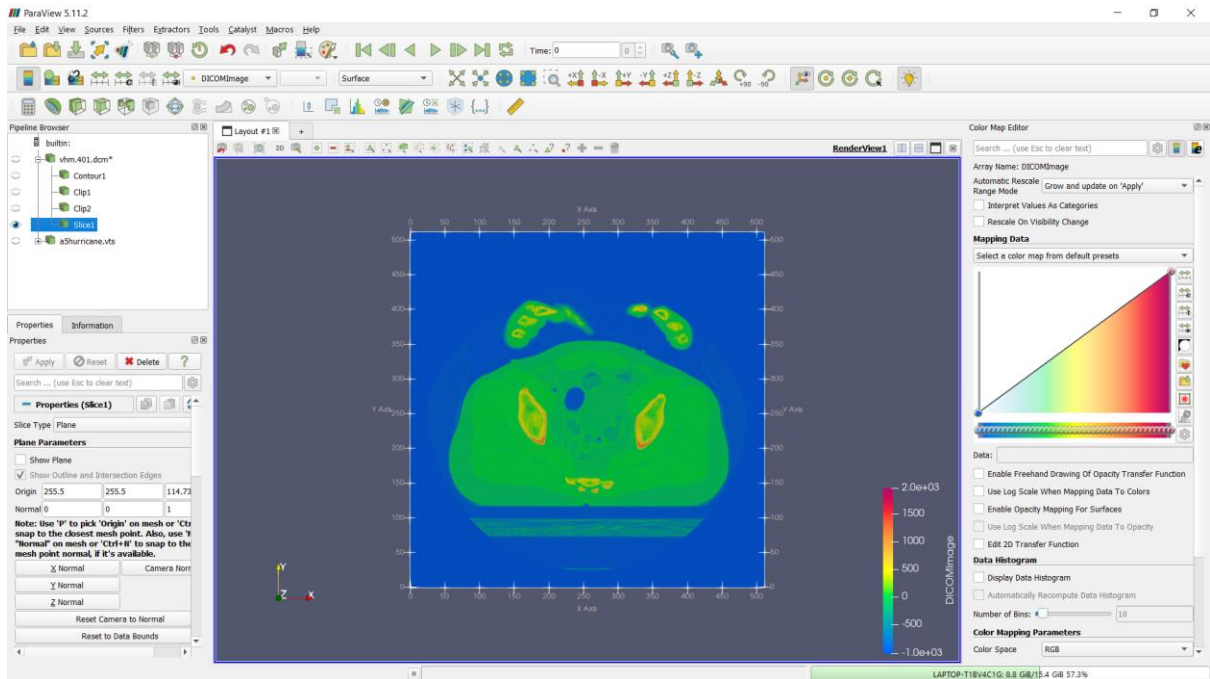
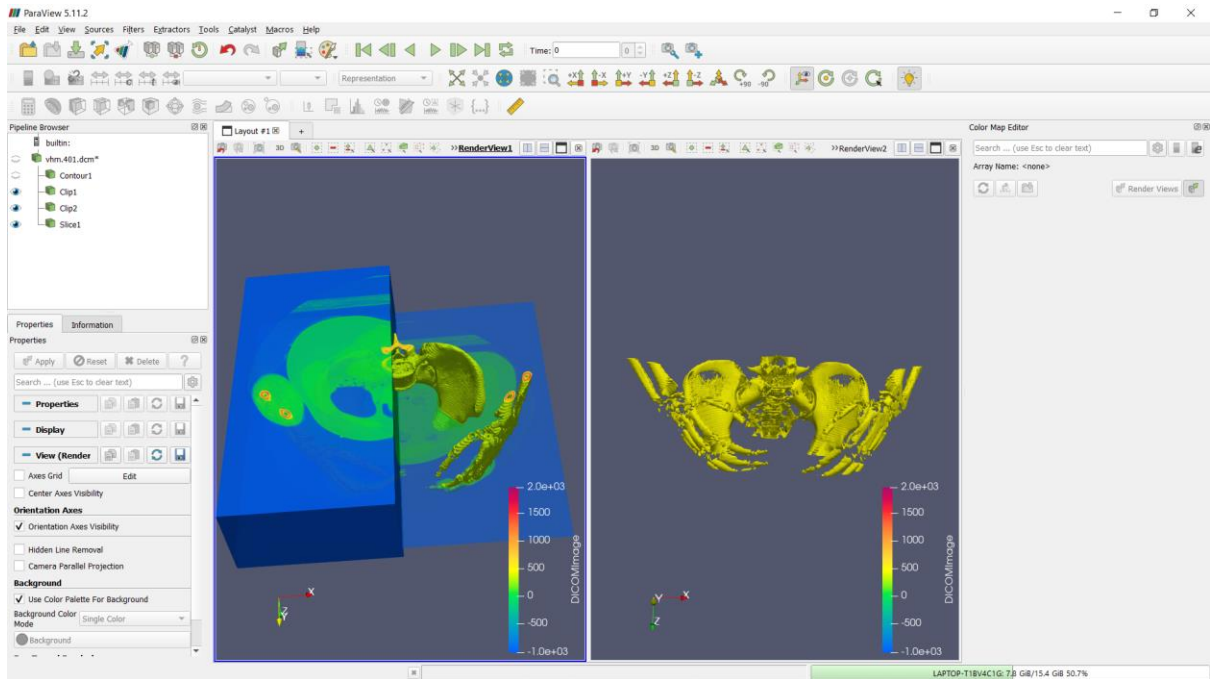


Wind - Angular Velocity

Hurricane Katrina's Formation

Temp

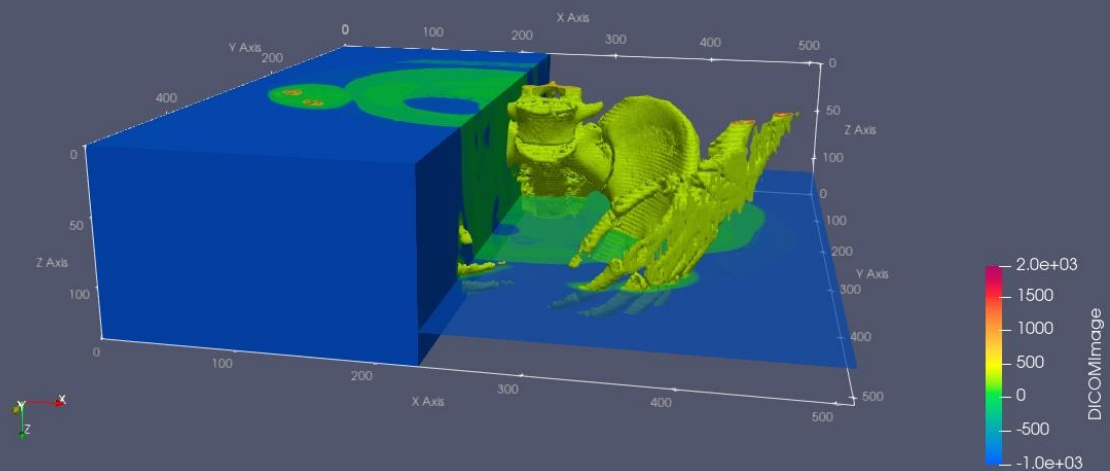






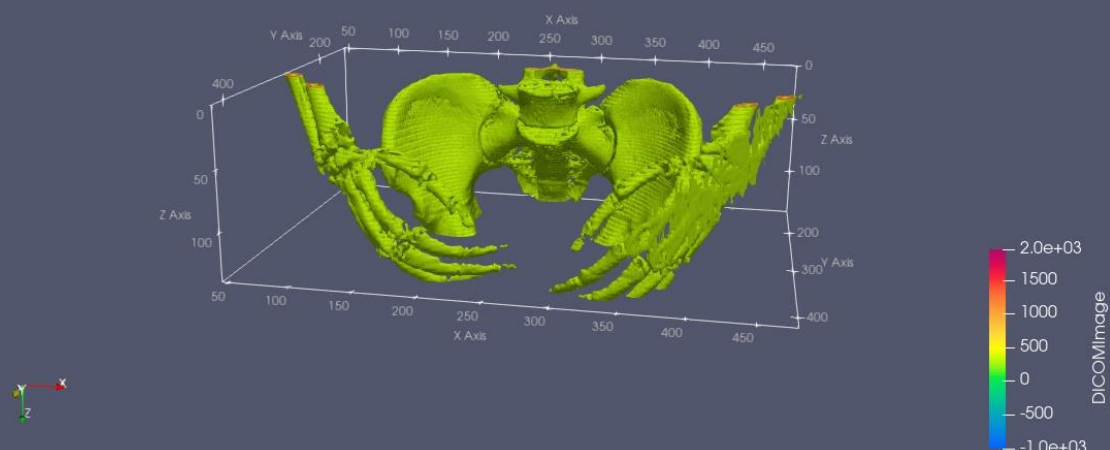
Pelvis Dataset Generation

Surface



Pelvis Dataset Generation

Surface



Pelvis Dataset Generation

Surface

