Convection in Earth's Mantle - A Visualization

Team Members	
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1. Overview of the Project:

The project aims to visualize and analyze the time series data of the mid-mantle stagnation and spin transition-induced anomalies in a simulated Earth mantle. The focus will be on understanding the dynamic temperature, velocity, and density anomalies over time.

2. Importance and Interest:

This project is crucial for geophysicists and researchers interested in understanding the complex interactions and anomalies within the Earth's mantle, shedding light on phenomena such as mid-mantle stagnation and spin transitions.

It's interesting due to its potential to uncover insights into the mechanisms influencing mantle dynamics and the associated geological implications.

3. Objectives and Questions:

Objectives:

- Develop visualizations illustrating the mantle's temporal evolution of temperature, velocity, and density anomalies.

- Explore the spatial distribution of spin transition-induced anomalies and their impact on mantle dynamics.

Questions:

- Can we detect spin transition-induced anomalies using this data?

- How does the temperature inside the Earth change over millions of years?

4. Learning Goals:

- Learn ParaView techniques for visualizing and analyzing 3D scalar fields on a spherical grid.

- Gain insights into the relationship between spin transition-induced anomalies and mantle dynamics.

5. Data Used:

Dataset link - SciVis Contest 2021

Utilize the time series dataset containing 3D scalar fields (temperature, velocity components, thermal conductivity anomaly, thermal expansivity anomaly, temperature anomaly, and spin transition-induced density anomaly).

6. Hardware and Software:

Hardware:

1. Laptop 1 - Intel Core i9-11900H, 16GB RAM, Nvidia 3050 laptop GPU

2. Laptop 2 - AMD Ryzen 5900HS, 16GB RAM, Nvidia 3060 laptop GPU

Software:

ParaView for visualization, and any necessary tools for data preprocessing and analysis.

7. Project Schedule:

Completed:

Week 1-2: Data exploration and preprocessing, familiarizing with the structure and content of the dataset.

To-Do:

Week 3-4: Initial visualizations focusing on temperature, velocity, and density anomalies.

Week 5-6: Development of dynamic visualizations illustrating temporal evolution and spatial distribution of anomalies.

Week 7-8: In-depth analysis of spin transition-induced density anomalies and their correlation with mantle dynamics.

Week 9-10: Finalizing the project report, creating an interactive presentation, and discussing potential geological implications.

8. Evaluation of Success:

Success will be evaluated based on the quality of the visualizations that represent the evolution of mid-mantle stagnation and spin transition-induced anomalies.

Assessing the insights gained from the analysis of the simulated data and their alignment with the theoretical predictions and observed seismic tomographic images.

9. Additional Information:

Challenges may include handling the large dataset and understanding the intricacies of spin transition-induced anomalies.