Novel Visualizations of Global Climate Simulation Using WebGL

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Abstract

The Global Modeling and Assimilation Office at Goddard created a two-year simulation of the world climate at a very high global resolution. This generates an extremely large amount of data, on the order of 4 Petabytes of data from a resolution of 7k globally. The specific task is to create novel visualizations of large-scale climate models using this data to create an engaging and approachable format without having to understand the raw data formats. The global climate simulation is created in a web-based, 3D interactive format and designed to make this data easy to understand and follow. Transforming the climate data from native format into a powerful visualization and aesthetically appealing interface allows the information to be more accessible and meaningful to the world.

Methods/Approach

The base of the visualization is built on the WebGL Globe, an open platform for geographic data visualization; WebGL is a web technology based on OpenGL that brings hardware-accelerated 3D graphics to the browser. The project uses a blend of HTML/CSS, Javascript (THREE.js API), and IDL to ultimately create the final product. By generating many images of the climate data and compressing them into a WEBM video format, it is possible to create a continually progressing view and timeline of weather data on the interactive globe.

Discussion/Conclusion

In its most basic form, this model provides a working visual representation of global climate data at any selected point in time. Looking into the future, it is possible to build on top of this to further provide information about certain weather patterns, such as storm and hurricane tracking. By pipelining the original data and/or filtering the colors of the images, trackers can be programmed to trace certain patterns. The user currently can control the time, zoom in and out, as well as rotate the globe as they wish. This allows for the study of both large scale and focused local climate change effects.

Background

The climate data is generated in NetCDF format and stored in the NCCS Discover file systems. By running a shell script that calls IDL processes (developed by Dr. William Putman), full color infrared (IR) images of the simulated climate are generated. Using this method, images for each time step of the simulation were created.

Results

By wrapping the compressed, generated visual data around the globe object, the virtual, 3D, interactive environment is completed and users can then work with the visualized data as they see fit.

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