Numerical Weather Prediction- Maryland

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Introduction

Numerical Weather Prediction – Maryland began in 2016 as a project named TerpWRF designed to provide weather forecasts and information for the state of Maryland. The project was maintained until 2018, when it fell dormant. In 2019, Dr. Jonathan Poterjoy inherited TerpWRF and recruited students to revitalize it as a student led project. This semester, TerpWRF was rebranded to Numerical Weather Prediction – Maryland or NWP-MD. The goal of this project is to give interested students experience working with weather models and plotting software in a real-world scenario.

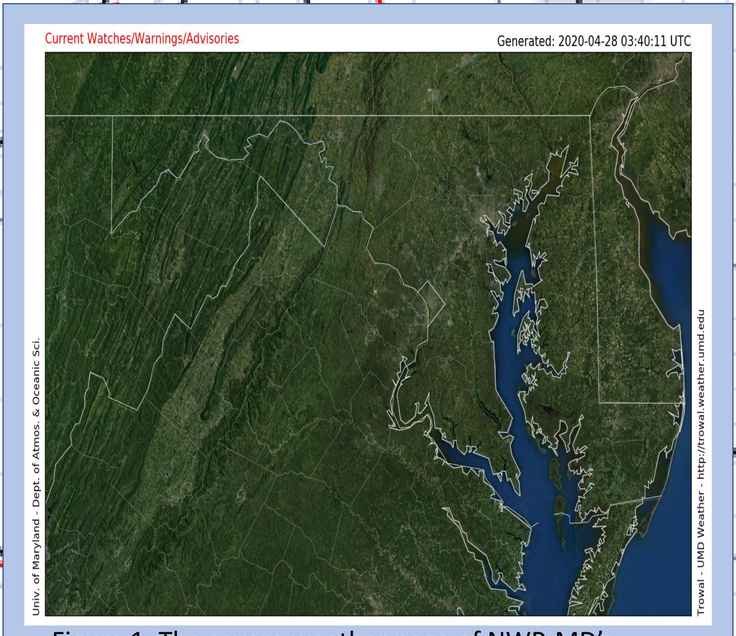

Figure 1: The severe weather page of NWP-MD's website.

Web Development

All forecasts are made available on our website which is maintained by the student web development team. The site uses PHP scripts to grab the most recent model outputs and display them. Our site also displays products from other weather models and institutions, such as the Storm Prediction Centre's Severe Weather Outlook and model output statistics from the Global Forecast System. Currently, I am working on redesigning and modernizing the website to make it more appealing and to reduce bloat. Additionally, I am working on a model information page that will describe our model's configuration in order to improve transparency.

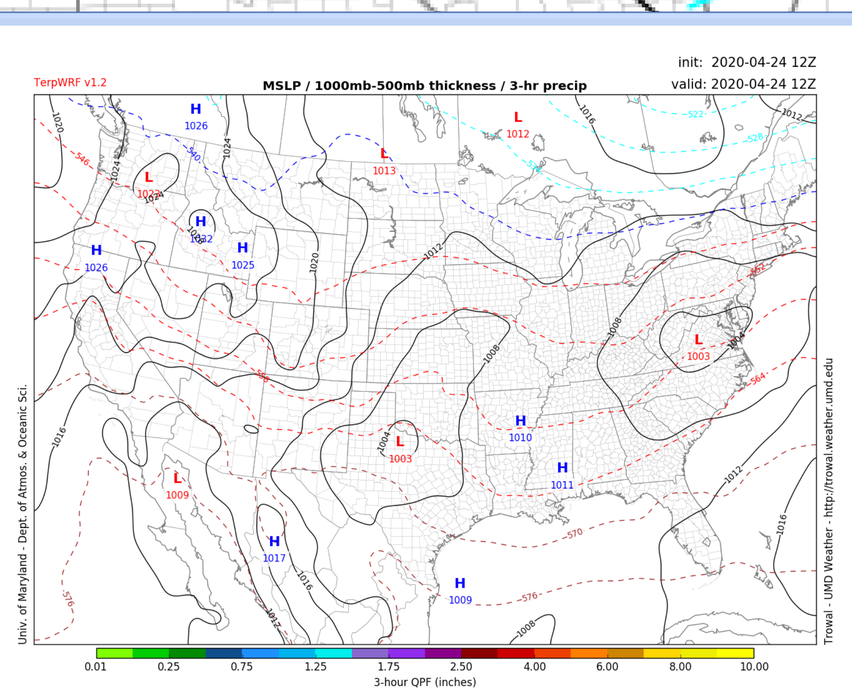

Figure 2: The output of the Weather Research and Forecasting model for April 24, 2020.

Model Development

The centerpiece of my project is working with a Weather Research and Forecasting model operated by the department of Atmospheric and Oceanic Sciences. Our model initializes using the initial conditions from the GFS. It then produces nationwide forecasts across a 16km grid. Within the 16km grid, a 4km domain is nested over the Eastern seaboard. The refinement of the nested 4km domain allows higher quality forecasts for the DMV area. Once the forecasting process has finished, the model's output is plotted and converted to an image file. This file is then hosted through our website.

The purpose of our work with the WRF model is to produce a version of the model that students and teachers can use without prior programming experience. This simplified model will have a user-interface that will easily allow the user to change forecast duration as well as the parametrization of the model's variables. However, we must improve our own model first. Currently, our model crashes shortly after initialization. This is most likely a result of a change in how the intital conditions are established from the GFS. A large part of our effort is being spent on troubleshooting and mending this routine.

The Future

In the coming semesters, we plan to register as a student organization and create a Student Initiated Course in order to attract more members and reach a broader audience. Additionally, we plan to host our code through GitHub to make it publicly accessible. Once our work with the WRF model is finished, we hope to become one of the first student groups to use the Model for Prediction across Scales or MPAS. Unlike the WRF model, MPAS uses unstructured Voronoi meshes for its domain. This allows the model to efficiently handle issues that WRF and other models face with domain nesting (Tallapragada).

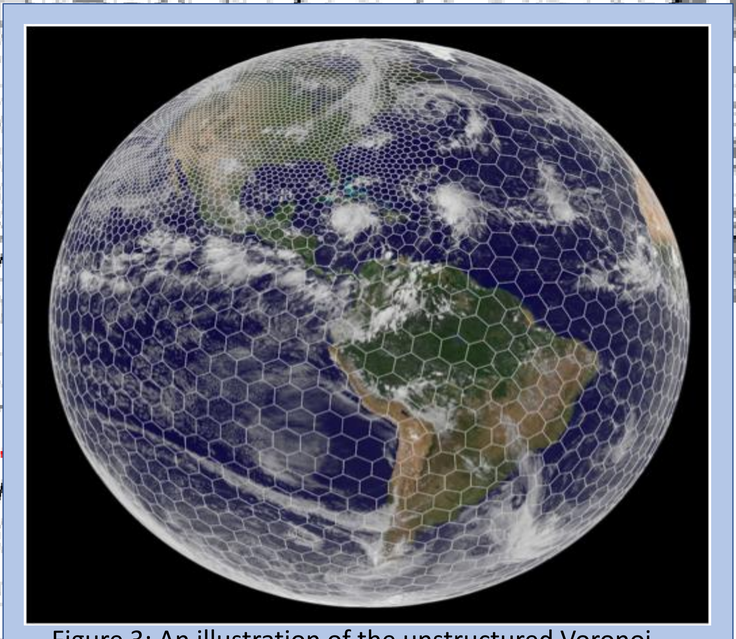

Figure 3: An illustration of the unstructured Voronoi mesh used in MPAS.

Summary

My work with NWP-MD has been an invaluable experience. I have gained a deeper understanding of numerical weather prediction and received hands on experience working with PHP, Python, and the WRF model. In the fall semester, we will become an official student organization. As I have been elected the organization's first president, I plan to continue my involvement for the foreseeable future.

Sources
Figure 1: Trowal Severe Weather page. 28 Apr. 2020. Retrieved from http://trowal.weather.umd.edu/severe
Figure 2: TerpWRF Output. 24 Apr. 2020. Retrieved from http://trowal.weather.umd.edu/TerpWRF/
Figure 3: Visualization of MPAS Mesh. (n.d.). Retrieved from https://mpas-dev.github.io/
Tallapragada, Vijay. "Nesting and Convective Systems." 14 July 2015. Powerpoint file. 15-18.

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