

Final Outreach Report

An Interactive Climate System for Predicting Significant Weather Events

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1. SUMMARY OF PROJECT OBJECTIVES:

A major objective of this project was to build a significant weather events database for 10-12 different important (warning/advisory criteria) phenomena for the Middle Atlantic River domain for the period 1950-2004. Another objective was the development of algorithms that would relate significant climatic-based anomalies from relevant analysis fields from the NCEP reanalysis data set to the occurrences of the significant weather events. The planned outcome is a prediction system that would connect known configuration of anomalies to model forecasts of anomalies and assess the risk of significant weather based on the robustness of the relationship established from past events.

2. PROJECT ACCOMPLISHMENTS AND FINDINGS:

2.1 University related

The relational database continues to be refined so that it can be updated easily and accessed more readily by other users. Most recently, fog was included in the event database. The development of the algorithms took us down seldom-traveled paths (by synoptic meteorologists) including cluster analysis and early analog techniques to pattern recognition. The operational component is still being developed (thus the 6-month extension) and should be available for testing during the early spring. This project brought to our attention the need for the North American Regional Reanalysis database, which we are in the process of placing on a jointly accessed data server so that the pattern recognition can be better defined by a finer scale data set.

2.2 NWS related

The NWS had the opportunity to participate in the course from which the original database was produced. This facilitated the interaction between students and NWS personnel and led to the formation of a working group to improve forecasting hazardous weather events. This working group is composed of both PSU and NWS meteorologists. The primary goal of this group is to exploit these data sets and improve forecasting of hazardous weather events. The knowledge and expertise shared in this group has been beneficial to the NWS office and its understanding of a wide range of hazardous weather events.

The database events database is now being used to develop forecast concepts and products to facilitate anticipating future hazardous weather events. A recent study on heat waves has been implemented to demonstrate the use of this database in and to better anticipate future heat waves in the eastern United States.

This study has led to the need to develop a more robust database. To this end the high resolution North American Regional Reanalysis (NARR) database is being constructed with the Pennsylvania State Climatologist's office. This database offers potential to improve the forecasting of many hazardous weather events, including the large-scale conditions associated with severe weather outbreaks.

The NWS has worked with the PSU to improve products displaying both deterministic model and ensemble model output related to key predictors of hazardous weather. These web-pages serve as the cornerstone of forecasting many hazardous weather events including non-convective high wind, heavy snow, heavy rain, and episodes of both extreme warm and cold weather.

The strong association and relationship with the PSU meteorology department has led to better access to real-time data and case data. The interactive website (<http://hart.met.psu.edu/meteo497/mapper.html>) has allowed many NWS forecasters and NWS offices the ability to classify and determine the patterns associated with a wide range of hazardous weather events. This page is widely used and is leading to a better understanding of these concepts in the forecast process.

3. BENEFITS AND LESSONS LEARNED: Partners Perspectives

3.1 University Partner

The jointly taught course designed by the partners will likely be offered again with a focus on testing and refining the prediction scheme. This course also introduces students to the world of relational databases as applied to operational meteorology. The project has led the university partner to consider methods of down-scaling the assessed risks so that sub-basin areas can be alerted to pending significant weather events.

3.2 NWS Partner

The overall benefits have been considerable. The interaction with students was and always is a big plus. The access to talented and energetic people has been a big benefit. The PSU now hosts the database and has provided access to these data. The dataset is now in 6-hourly rather than 12-hourly increments. Finally, due to the initial success of the larger-scale dataset in identifying anomalies associated with hazardous weather, the PSU has provided space to develop and implement the high resolution NARR data for follow-on research. The potential benefits in forecasting more mesoscale severe weather events will likely be the biggest benefit of all these efforts over the next 6-12 months.

4. PUBLICATIONS AND PRESENTATIONS:

The findings of this project were presented at the Artificial Intelligence conference of the AMS annual meeting in San Diego, CA during January 2005. An article to be submitted to an appropriate journal is being planned. Several abstracts have been prepared and are being submitted to the AMS for inclusion at the Weather Analysis and Forecasting Conference in August 2005.

5. SUMMARY OF PARTNERS INTERACTIONS AND ROLES:

Despite the constant schedule challenges and the activation of one of the PI's to military duty for more than 6 months, the commitment of the partners made this project succeed. Regular communications and a very talented undergraduate summer assistant helped push along the project. Guidance from interested parties outside the project also added to scientific integrity of this new approach to prediction. Each partner understood their role and worked well together.