University: College of Charleston

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Partners or Cooperative Project: Partners

Project Title: Synoptic Climatology for High Impact Events in Southern South Carolina and Northeast Coastal Georgia

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SECTION 1: PROJECT OBJECTIVES AND ACCOMPLISHMENTS

1.1 Completed work

A database of many high impact events in the Charleston, SC NWS Forecast Office(CHS) County Warning Area(CWA) since 1950 was created. These events include F2 or greater tornadoes, 1 3/4 inch or larger hail, one day rainfall accumulations of 5 inches or greater, measurable snowfall, days with maximum temperatures 100F or greater, days with maximum temperature 32F or lower, and landfalling hurricanes. The data has been quality controlled to avoid duplicate event dates and events that extend into more than one day.

Next, graphics of means and anomalies of vector wind, temperature, and geopotential heights at 250, 300, 500, 700, and 850 mb were produced using the NCEP/NCAR reanalysis database at http://www.cdc.noaa.gov/Composites/Day/. The graphics were created for the day of the high-impact event in question as well as the 3 days leading up to the event. Maps were created on two different domains; United States and North America (see example in figure 1).

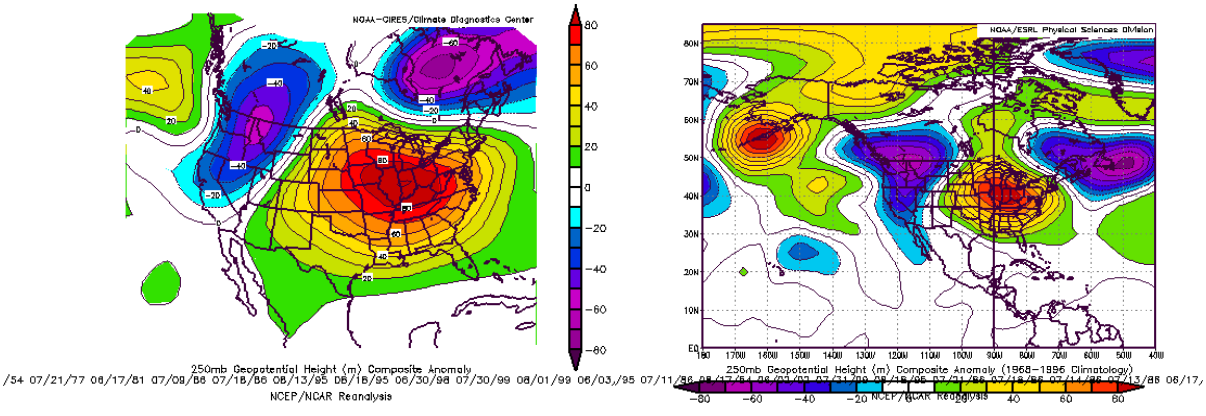

Fig. 1: Geopotential Height Anomalies at the 250hPa level on the day of extreme heat events in the Charleston CWA. The left figure is on the United States scale while the right figure is on the North America scale.

Summaries of the methodologies employed to create the United States scale maps as well as preliminary findings have been written by two graduate students, Janet Johnson and Danielle Timmons, as part of their Master's Theses. Similar work is underway on the North American scale maps.

1.2 Division of Labor

Under the direction of Frank Alsheimer, the students from the College of Charleston involved in the project mined the raw event information from the NCDC Storm Data publications as well as the online Applied Climate Information Database (xmACIS). They then created graphics from the NCEP/NCAR reanalysis and did some post analysis.

Lee Lindner recruited the students, helped with the logistical side of student involvement and managed the budget.

SECTION 2: RELATED ACCOMPLISHMENTS

Frank Alsheimer hosted a group of students in the NWS conference room in February to prepare them for potential involvement in this research. As part of this process, Frank took the students on a tour of the facilities, which significantly enhanced their education.

Two graduate students (Janet Johnson and Danielle Timmons) used this research to partially fulfill their masters degree thesis requirements (both successfully defended in May 2007), and have received grant funds in salary. Additionally, five undergraduate students (Anne Chalmers, Daniel Johnson, Brittney Marshall, Tom Rolfson and Cameron Self) received course credit (course title 'Meteorology Laboratory', ENVT390, 3 credit hours, taught Maymester 2007), in addition to grant funds, for their involvement in this project. Thus, many students received educational benefits as a result of this project.

SECTION 3: SUMMARY OF BENEFITS AND LESSONS LEARNED: OPERATIONAL PARTNER PERSPECTIVE

3.1 Benefits

The initial images of the upper level means and anomalies proved a useful tool for forecasters trying to determine the threat for snow from a February 2007 event in the CHS CWA. While the Global Forecast System (GFS) model was indicating accumulating snow (which is relatively unusual in the CHS CWA), the synoptic climatology indicated that the upper levels from the GFS were not supportive of snow. It turned out to be a null event as the climatology suggested.

Another benefit realized so far is the forecaster's ability to compare the results with mean and anomaly charts produced by the GFS ensemble system. While the ensembles are a powerful tool, it can be difficult for forecasters to understand the results. This is especially true when looking at ensemble means which produce a relatively smooth representation of the atmosphere compared to a single deterministic model. However, because this study looked at composites of many days, it also gives a 'smoothed' representation of the atmosphere prior to significant events. This will give the forecasters an additional context for interpreting ensemble solutions.

3.2 Lessons Learned

There have been a few minor issues during the project. First, the College of Charleston students participated in the study at different times of the year, so the mentor had to repeat some of the training more than once. In the future, all the necessary training will be done at one time for the group.

Additionally, some of the historical data used to determine the dates of the events was only available without charge on the network at the NWS, so all of the students had to spend some time initially at the NWS office to gather the initial data. This caused some minor slow downs of progress due to the occasional conflict of schedules between the mentor and the students. However, the CDC website could be accessed from anywhere allowing the students to get more done remotely once the initial database was complete.

Finally, the shear volume of maps produced (more than 1000) has made the task of organizing all the results larger than expected. It is therefore taking longer to come up with an organized manuscript for the NWS forecasters to reference for the survey as well as for presentation at a conference.

Despite these issues, the results generated thus far have already been used (as mentioned above) in the operational forecast process.

3.3 Future Work

An organized manuscript and/or web page will be developed this fall so NWS CHS forecasters can make the best use of the analog study. After a period of 6 months, the forecasters will be surveyed to determine cases where the study proved beneficial in the forecast process, and where it was misleading.

Further into the future, another similar study using the higher resolution North American Regional Reanalysis (NARR) may be useful. However, as that data only goes back until 1979, a different set of high-impact criteria may be needed to determine a meaningful number of events.

SECTION 4: SUMMARY OF BENEFITS AND LESSONS LEARNED: UNIVERSITY PARTNER PERSPECTIVE

4.1 Benefits

In addition to the science being conducted, this project has made a significant impact on the education of various undergraduate and graduate students, not only in terms of providing financial support, but more significantly in terms of providing a laboratory and research complement to their coursework.

4.2 Lessons Learned

Funding for this project did not actually start until almost three months after the start date, which resulted in some delays. The inability to get any no-cost extensions (due to the COMET office moving to a new grant) did not allow us to complete as much as we had hoped, and did not allow us to present the research at any conferences as we had planned. Also, arranging undergraduate students to assist in this project required more time than originally anticipated. Nonetheless, these issues did not cause serious problems, and we are pleased with the final results.

SECTION 5: PRESENTATIONS AND PUBLICATIONS

Johnson, Janet, 2007. Storm surge simulator project. M.S. in Environ. Stud. Internship report. 122 pp., College of Charleston, Charleston, SC.

Timmons, Danielle, 2007. Hurricane storm surge simulator. M.S. in Environ. Stud. Internship report. 128 pp., College of Charleston, Charleston, SC.

Some of the initial charts of means and anomalies for tornado and hail events were presented by Frank Alsheimer at the WFO CHS Spring Severe Weather Workshop on March 27th, 2007. Additional findings will be presented at a similar workshop in the Spring of 2008.

Additionally, a conference manuscript and presentation of the results will be made at the AMS Climate Prediction Applications Science Workshop in Chapel Hill, NC during March, 2008.

SECTION 6: SUMMARY OF UNIVERSITY/OPERATIONAL PARTNER INTERACTION AND ROLES

Due to the structure of the project, several opportunities for communication between the students at the College of Charleston and the staff at the NWS office were realized. It was also an opportunity for the NWS mentor to be directly involved in the development of two graduate students by participating on the Master's Committee for the students.

The partnership also gave the NWS mentor an opportunity to interact with faculty at the College of Charleston in the academic areas of Physics and Environmental Science. This exchange promoted the concept of multi-disciplinary studies and potential relationships in the future.