

Determining Precipitation Frequencies Over the Southern United States

Final Report

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1. PROJECT OBJECTIVES

As a result of the modernization of the National Weather Service (NWS) which began a decade ago, forecasters now are equipped with a variety of new tools and technologies which enable them to provide products and services in ways never before possible. Although the mission of the NWS has not changed, the capabilities of forecasters have been vastly enhanced. The end result is that the public is provided with more accurate forecasts, with higher time and space resolution, and in a gridded-digital form enabling them to utilize the products in new ways.

It is expected that forecasters soon will begin issuing forecasts of the probability of precipitation (PoP) for 3-hourly time periods in the form of high resolution gridded fields. This is a significant increase in resolution over the 12-hourly PoPs that have been issued by the NWS for over 35 years covering much larger areas--county-sized regions or larger. The new software that the NWS will use to prepare these forecasts is called the Interactive Forecast Preparation System (IFPS) which runs in the AWIPS environment. IFPS allows forecasters to develop and communicate products such as high resolution PoPs in gridded, graphical, and text forms.

A knowledge of the climatological likelihood of an event is an excellent starting point for a forecast. Climatological frequencies also provide a basis for assessing forecast skill. The goal of this Partners' Project has been to develop 3-hour precipitation frequencies for a dense network within the NWS Southern Region.

The research was conducted by Mr. Matt Sitkowski, an undergraduate meteorology major at Florida State University. Prof. Henry Fuelberg and Mr. Irv Watson supervised the project. This research is part of the senior honors project for Mr. Sitkowski.

2. PROJECT ACCOMPLISHMENTS

The precipitation frequencies were derived from observed hourly surface data available on CD from the Forecast Systems Laboratory. The format of these data was very complicated, containing many contingencies regarding missing data and other data problems. Mr. Sitkowski spent considerable time writing the FORTRAN code that was needed to read the data. Once that was completed, he was quickly able to write the remaining code to calculate the precipitation frequencies.

The probabilities were calculated for the 30 year period from 1968 – 1997. For each month, we produced probabilities for eight 3-h intervals (01-03 UTC, 04-06 UTC, ... 22-24 UTC). Thus, 96 different sets of computations are made (12 months times 8 periods per month). The calculations were made for 308 stations in the Southern Region. We required that 85% of the hourly data be available (not missing) for a given 3 hour interval. We searched for erroneous data and removed them from the data set. The final data set typically contained about 275 stations for a given time interval. We achieved relatively uniformly spaced coverage within each NWS County Warning Area.

We have displayed the results both in text and graphic form and made them available to NWS forecasters. The completed fields are available on the web at <http://bertha.met.fsu.edu/~sitkow/maps.html>. The procedure also has been documented in a recent issue of NWS *Southern Topics*.

Fig. 1 illustrates precipitation frequencies during July for the period 22-24 GMT. Not all of the ~300 stations used to prepare the graphic were plotted in white to insure legibility. Precipitation maxima are located over the Florida Peninsula, Central Gulf States, and over the mountain ranges of New Mexico. These maxima most likely were caused by both topographic and diurnal mesoscale features. This figure and the 95 others on the web show that precipitation frequencies vary greatly across the Southern Region—both spatially and temporally.

NWS personnel can utilize our completed products as guidance in preparing their forecasts. Mr. Sitkowski will continue to analyze the frequencies, seeking to understand the meteorological processes that lead to the spatial and temporal variations in precipitation occurrence. In summary, we have completed the research tasks outlined in the original proposal.

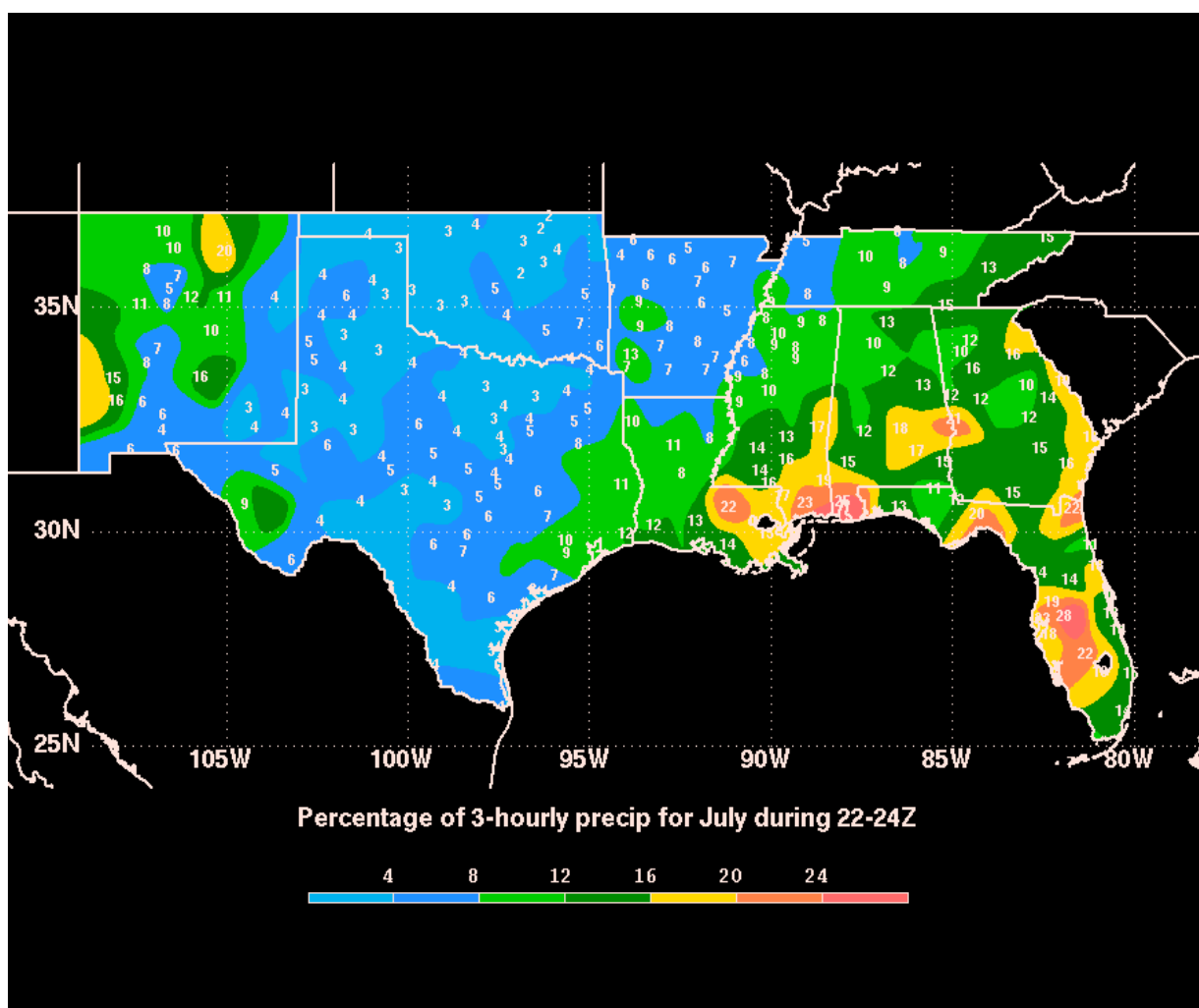


Fig.1. Three-hour precipitation frequencies for July for the period 22-24 GMT

3. RELATED ACCOMPLISHMENTS

The NWS Tallahassee Office is located in the same building as the Florida State University Department of Meteorology. Thus, interactions between the two groups are convenient and many.

The reader is referred to the recently submitted Annual Report for Cooperative Project Number S00-19127 for an extensive discussion of additional funded collaborations. In addition, since our many un-funded efforts truly are collaborative, we submit them below as one section rather than separate NWS and University sections.

1. Prof. Fuelberg and students are working closely with Joel Lanier (NWS-TLH) and Judi Bradberry (SERFC) to produce a high resolution precipitation data base for Florida using a combination of radar and gage data. This project is sponsored by the Florida Dept. of Environmental Protection.
2. Prof. Fuelberg is collaborating with Pat Welsh (NWS-JAX), Irv Watson (NWS-TLH), the University of North Florida, and others to install meteorological sensors along Florida's interstate highways. These data will be provided to the public via the web, "intelligent signage", and kiosks at rest stops. The data also will be used by the NWS in their local mesoscale models. The project is sponsored by the Florida Dept. of Transportation. Prof. Fuelberg is working to develop a new algorithm for fog prediction that will incorporate IFPS data as input.
3. NWS employee T. J. Turnage continues to work on his Masters Degree in meteorology at the Florida State University. Prof. Fuelberg serves as his major professor.
4. Prof. Fuelberg has a contract with Florida Power & Light Co. to perform detailed studies of lightning distributions and timing over their service area. The ultimate goal is to produce a statistical tool that can be used to improve the forecasts of late day lightning in Miami-Dade and Broward Counties of their service area. We are collaborating with NWS-MIA in this research.
5. SOO Irv Watson, MIC Paul Duval, WSFO Tallahassee staff, and invited experts continue to offer a 1-h semester course on the National Weather Service each Spring semester to interested juniors and seniors majoring in Meteorology. This course will be taught next during the Spring 2004 semester.

4. SUMMARY OF BENEFITS

4.1 Florida State University

As a result of this project the participants have learned a great deal about IFPS, i.e., how the NWS is preparing forecasts in this "new era". Insights can be passed along to students in our various classes. Mr. Sitkowski, the undergraduate performing the study, has learned much about NWS operations and research methodology. Partly as a result of this project, he has been hired as a summer worker at the Tropical Prediction Center in Miami.

4.2 National Weather Service—Tallahassee

NWS—Tallahassee, as well as the NWS Southern Region, view this project as a unique opportunity to use the resources in the FSU Department of Meteorology to accomplish a necessary task. It is an outstanding example of research and operations working together in a mutually beneficial way. We believe that the rainfall frequency

project will provide a very important and useful tool to understand the notion of probability of precipitation (POP) that is temporally less than 12 hours. Results may be incorporated into the IFPS in the future

5. PRESENTATIONS AND PUBLICATIONS

Sitkowski, M., H.E. Fuelberg, A.I. Watson, and D. Smith, 2003: Climatological probabilities of precipitation for 3-, 6-, 12-, and 24-h periods, Technical Attachment to *Southern Topics*, National Weather Service Southern Region, October 2003 issue.

Sitkowski, M., 2003: Analysis of 3-, 6-, 12-, and 24-hour precipitation frequencies over the southern United States. Prospectus for a senior honors project at Florida State University, 4 pp [Available from H. Fuelberg].

6. PROBLEMS ENCOUNTERED

No problems were encountered by either the National Weather Service or Florida State University.