HYDROMETEOROLOGICAL DESIGN STUDIES CENTER
QUARTERLY PROGRESS REPORT

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Office of Hydrologic Development

National Weather Service

National Oceanic and Atmospheric Administration

U.S, Department of Commerce

Silver Spring, Maryland

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DISCLAIMER

The data and information presented in this report are provided only to demonstrate current progress on the various tasks associated with these projects. Values presented herein are NOT intended for any other use beyond the scope of this progress report. Anyone using any data or information presented in this report for any other purpose does so at their own risk.

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I. INTRODUCTION

The Hydrometeorological Design Studies Center (HDSC) within the Office of Hydrologic Development of National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) is updating precipitation frequency estimates for various parts of the United States and affiliated territories. Updated precipitation frequency estimates for durations from 5 minutes to 60 days and average recurrence intervals between 1- and 1,000-years, accompanied by additional relevant information (e.g., 95% confidence limits, temporal distributions, seasonality) are published in NOAA Atlas 14. The Atlas is divided into volumes based on geographic sections of the country and affiliated territories. NOAA Atlas 14 is a web-based document available through the Precipitation Frequency Data Server (PFDS; http://hdsc.nws.noaa.gov/hdsc/pfds/index.html).

HDSC recently updated estimates for Alaska and is currently updating estimates for the following southeastern states: Alabama, Arkansas, Georgia, Florida, Louisiana and Mississippi, and the following midwestern states: Colorado, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Wisconsin. The following northeastern states have signed up to update estimates through the Federal Highway Administration's (FHWA) Pooled Fund Program and we are waiting on actual fund transfers: Connecticut, Massachusetts, Maine, New Hampshire, New York, Rhode Island and Vermont. Once the Pooled Fund Program has received the funds from each State, contract documents between FHWA and NWS can be finalized, and we will begin the three year task of updating precipitation frequency estimates for the northeastern states. Figure 1 shows new project areas as well as updated project areas included in NOAA Atlas 14, Volumes 1 to 7.

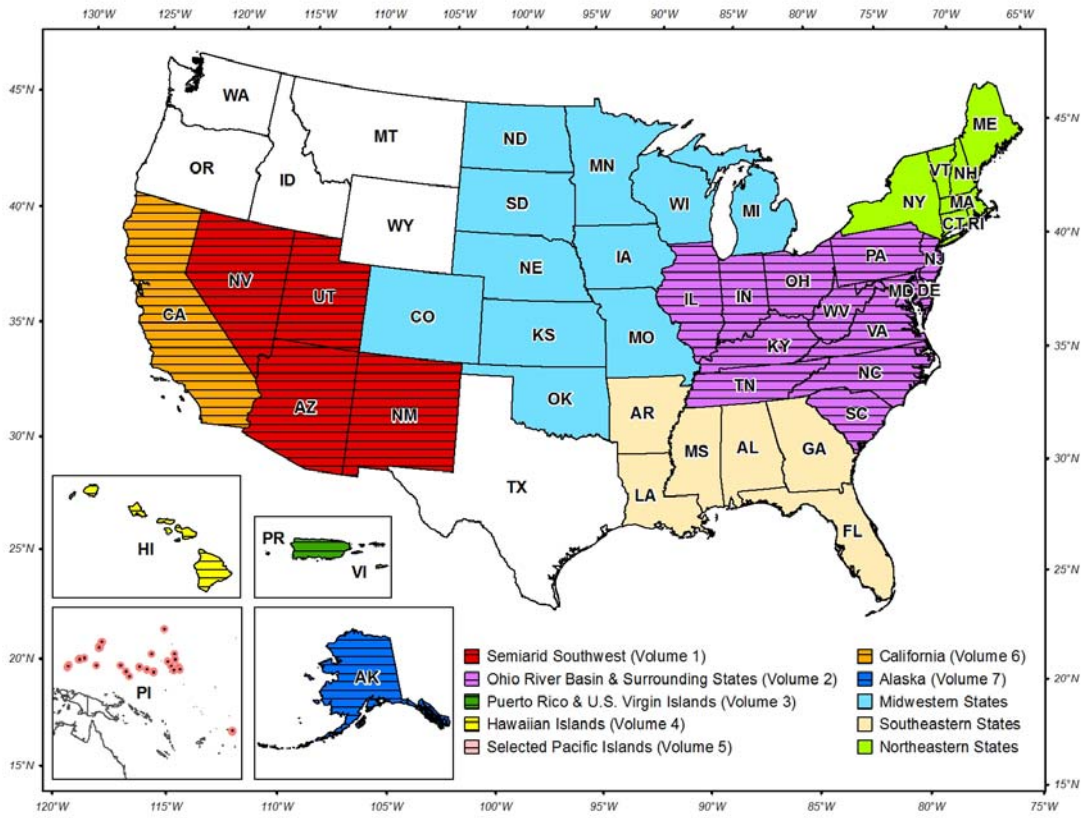

Figure 1. Current project areas and project areas included in published NOAA Atlas 14, Volumes 1-7.

II. CURRENT PROJECTS

1. PRECIPITATION FREQUENCY PROJECT FOR THE SOUTHEASTERN STATES

1.1. PROGRESS IN THIS REPORTING PERIOD (Jan - Mar 2012)

The project includes the states of Alabama, Arkansas, Florida, Georgia, Louisiana and Mississippi and an approximately 1-degree buffer around these core states (Figure 2). To facilitate a more efficient process, Southeastern and Midwestern (see Section 2) precipitation frequency projects are being done simultaneously. Because of that, some of the results shown in this report apply for both projects.

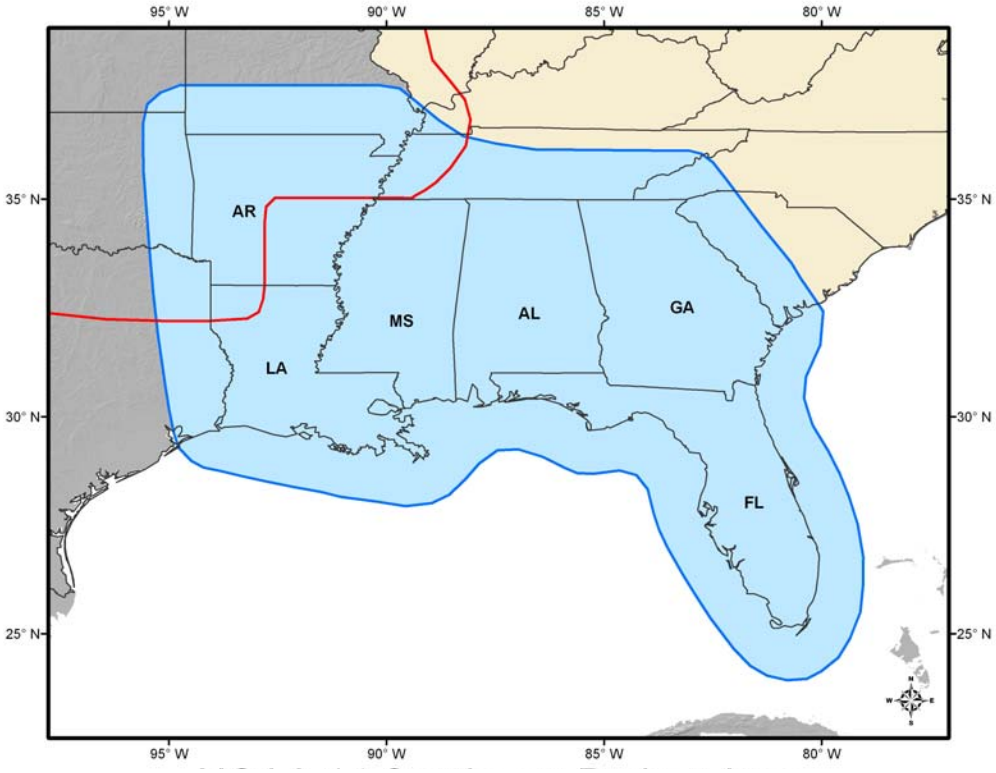

Figure 2. Southeastern precipitation frequency project area (shown in blue). Also shown is the border of the Midwestern precipitation frequency project area (red line).

1.1.1. Data collection and formatting

It was found that some stations in the NWS Cooperative Data Network stations have longer periods of record than the data obtained through the NCDC. For these long-term records, data were downloaded from other on-line sources or else manually entered from original observation forms. Data were added to about 100 stations.

Errors were found in the location of some NCDC stations. Therefore, extracted NCDC metadata were checked against NCDC's original metadata file for location accuracy. In the original file, NCDC lists a station multiple times if a station was moved during its history. Cases where there was a large discrepancy between the last (i.e., most recent) entry and the previous entry were used to identify and correct mis-located stations.

Lastly, the annual maximum series obtained from the South Florida Water Management District's DBHYDRO database were carefully reviewed. Accumulated data were prevalent throughout the dataset, but reasonable annual maxima could still be extracted. Therefore, it was decided to relax the criteria that limit the amount of allowable accumulated data during the year and rainy season so that more annual maxima could be extracted. The resulting data will be checked against nearby stations during the mean annual maxima analysis (Section 1.1.4)

1.1.2. Station screening

Hourly and 15-minute stations with less than 20 years of data and daily stations with less than 30 years will not be used in the analysis. Initially, these stations are retained in case they could be merged with nearby stations to increase record lengths and to aid in the QC process. In this reporting period, all stations not meeting the minimum number of years criteria were removed from the dataset. Instances where an hourly station with more than 20 years of data was co-located with a daily station with less than 30 years were reviewed and decisions were made to keep or delete stations on a case by case basis. 2,022 15-minute, 1,619 hourly, and 7,832 daily stations were removed based on these criteria.

1.1.3. Quality control of AMS

All high outliers in annual maximum series (AMS) are being verified, corrected, or removed from the dataset for all durations between 15-minutes and 60-days for stations that meet the minimum number of data years criteria. Recall that base durations (15-minute, 1-hour and 1-day) have already been quality controlled.

Plots of at-station AMS distributions were checked for

- 703 stations for durations 30-minute through 120-minute (691 events were flagged as high outliers),
- 1,488 stations for 2-hour through 48-hour (3,006 high outliers),
- 5,439 stations for 2-day through 60-day (12,299 high outliers).

All high outliers and any other questionable values were reviewed relative to nearby stations. Any that could not be confirmed were investigated further using climatological observation forms, monthly storm data reports and other historical weather event publications. The 15-minute and hourly datasets are complete. Work continues on the daily durations.

1.1.4. Mean annual maxima analysis

Spatial analysis of at-station mean annual maxima estimates (MAMs) for 1-hour, 1-day and 10-day durations continues. During the analysis, station MAMs are reviewed for spatial consistency. Stations may have a different period of record or may have missed several heavy events relative to nearby stations. Decisions are made on a case by case basis to keep, edit, or delete certain data/stations.

1.1.5. Correction for constrained observations

Work began on developing factors to convert constrained observations (e.g., 1-day) to unconstrained values (e.g., 24-hour). Quality-controlled, concurrent constrained and unconstrained annual maxima from hourly stations will be used in a zero-intercept regression model to develop the daily correction factors, while co-located hourly (constrained) and n-minute (unconstrained) concurrent annual maxima will be used for hourly factors (e.g., 1-hour to 60-minute).

1.1.6. Peer review preparation

Initial web pages for the peer review of preliminary results have been developed. The project area is being divided into manageable sections for the cartographic review maps. We expect the peer review to begin in July 2012.

1.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Apr - Jun 2012)

In the next reporting period, the following tasks will be completed: analysis of spatial patterns in mean annual maxima and resolution of any inconsistencies, trend analysis of 1-hour and 1-day AMS, regionalization and derivation of depth-duration-frequency curves at gauged locations, and the spatial interpolation of precipitation frequency estimates at base durations for peer review.

1.3. REVISED PROJECT SCHEDULE

Completion dates for remaining tasks are revised to reflect the continued impact of loss of personnel and issues with computing resources. As a result, the publication date is revised to March 2013.

Data collection, formatting, and initial quality control [Complete]

Extraction of annual maximum series (AMS); additional quality control and data reliability tests (e.g., outliers, trend analysis, independence, consistency across durations, duplicate stations, candidates for merging) [Near completion]

Regionalization and frequency analysis [May 2012]

Initial spatial interpolation of precipitation frequency (PF) estimates and consistency checks across durations [June 2012]

Peer review [July 2012]

Revision of PF estimates [November 2012]

Remaining tasks (e.g., development of precipitation frequency estimates for partial duration series, seasonality, temporal distributions, documentation) [January 2013]

Web publication [March 2013]

2. PRECIPITATION FREQUENCY PROJECT FOR THE MIDWESTERN STATES

2.1. PROGRESS IN THIS REPORTING PERIOD (Jan - Mar 2012)

The project area includes the states of Colorado, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Wisconsin and an approximately 1-degree buffer around these core states (Figure 3). To facilitate a more efficient process, Southeastern (see Section 1) and Midwestern precipitation frequency projects are being done simultaneously. Because of that, some of the results shown in this report apply for both projects.

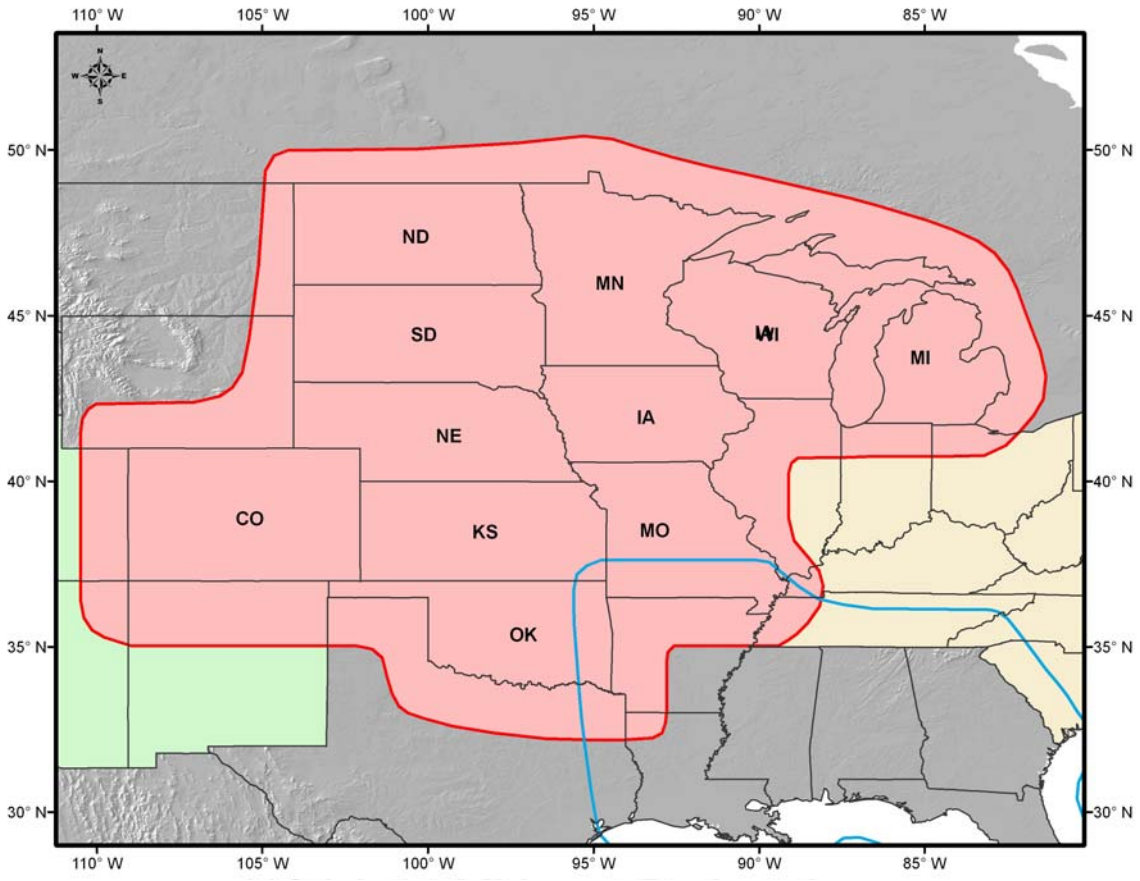

Figure 3. Midwestern precipitation frequency project area (shown in red). Also shown is the border of the Southeastern precipitation frequency project area (blue line).

2.1.1. Data collection and formatting

It was found that some stations in the NWS Cooperative Data Network stations have longer period of records than those obtained through the NCDC. For these long-term records, data were downloaded from other on-line sources or else manually entered from original observation forms. Data were added to about 100 stations.

Errors were found in the location of some NCDC stations. Therefore, extracted NCDC metadata were checked against NCDC's original metadata file for location accuracy. In the original file, NCDC lists a station multiple times if a station was moved during its history. Cases where there was a large discrepancy between the last (i.e., most recent) entry and the previous entry were used to identify and correct mis-located stations.

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Hourly and 15-minute stations with less than 20 years of data and daily stations with less than 30 years will not be used in the analysis. Initially, these stations are retained in case they could be merged with nearby stations to increase record lengths and to aid in the QC process. In this reporting period, all stations not meeting the minimum number of years criteria were removed from the dataset. Instances where an hourly station with more than 20 years of data was co-located with a daily station with less than 30 years were reviewed and decisions were made to keep or delete stations on a case by case basis. 2,022 15-minute, 1,619 hourly, and 7,832 daily stations were removed based on these criteria.

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2.3. REVISED PROJECT SCHEDULE

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Remaining tasks (e.g., development of precipitation frequency estimates for partial duration series, seasonality, temporal distributions, documentation) [January 2013]

Web publication [March 2013]

3. PRECIPITATION FREQUENCY PROJECT FOR ALASKA

3.1. PROGRESS IN THIS REPORTING PERIOD (Jan - Mar 2012)

The University of Alaska, Fairbanks (UAF) and HDSC worked jointly on this project.

3.1.1. Publication announcement

Precipitation frequency estimates for Alaska were published on February 10th, 2012 as Volume 7 of NOAA Atlas 14. The estimates were published through our Precipitation Frequency Data Server at http://hdsc.nws.noaa.gov/hdsc/pfds/. Volume 7 covers the entire state of Alaska and supersedes information in Technical Papers 47 and 52.

Volume 7 includes:

- High resolution grids of precipitation frequency estimates with corresponding bounds of 90% confidence intervals for average recurrence intervals (ARIs) of 1-year through 1,000-years and selected durations from 5-minutes through 60-days
- Cartographic maps of precipitation frequency estimates for selected ARIs and durations
- Seasonality analysis for annual maximum series
- Temporal distributions of heavy precipitation for 6-hour, 12-hour, 24-hour, and 96-hour durations
- Annual maximum series data used in the analysis
- Documentation describing the data, metadata and methodology.

3.1.2. Seasonality

Separate seasonal exceedance graphs were created for two regions in Alaska - the Northern and Southern climate regions (Figure 4). The graphs show the percentage of annual maxima for a given duration from all stations in a region that exceeded corresponding precipitation frequency estimates at selected annual exceedance probabilities (AEPs) in each month. Results are provided for unconstrained 60-minute, 24-hour, 2-day, and 10-day durations and for AEPs of 1/2, 1/5, 1/10, 1/25, 1/50, and 1/100. The regionally-based graphs are provided for any location in the project area via the Precipitation Frequency Data Server (PFDS).

3.1.3. Cartographic maps

Cartographic maps for selected durations and average recurrence intervals were created for the project area. They are available for download through the PFDS. Cartographic maps are meant to serve as visual aids and are not recommended for estimating precipitation frequency estimates.

Figure 4. Climate regions used in NOAA Atlas 14 Volume 7.

3.1.4. Documentation

HDSC completed the documentation describing the project area, data, metadata and methodology for this project. This included a comparison with previously published estimates from Technical Paper 47, all appendices, and metadata for GIS datasets. The University of Alaska, Fairbanks contributed to the documentation by reviewing various sections of text and providing a summary of the under-catch bias correction effort (Appendix A.2).

3.1.5. Web page

The web pages for the Precipitation Frequency Data Server (PFDS) were completed for this project. All grids were converted to HDF5 file formats to facilitate a faster download speed. Given the vastness of the project area, changes were made to various map features including the interactive zooming.

3.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Apr - Jun 2012)

This project is complete.

4. AREAL REDUCTION FACTORS

4.1. PROGRESS IN THIS REPORTING PERIOD (Jan - Mar 2012)

Areal reduction factors (ARFs) are needed to convert average point precipitation frequency estimates to areal estimates with the same recurrence interval for any area of interest. HDSC is testing two existing methods and developing a new copula-based method for calculating ARF. Please see the July – September 2010 Quarterly Report (http://www.nws.noaa.gov/ohd/hdsc/current-projects/pdfs/HDSC_PR_Oct10.pdf) for more information on the methods.

4.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Apr - Jun 2012)

This project continues to be on hold to allow us to focus on precipitation frequency projects.

4.3. PROJECT SCHEDULE

It is expected that this project will be completed by the end of March 2013.

III. OTHER

1. RECENT PRESENTATIONS

HDSC and the University of Alaska, Fairbanks gave a Go-To-Meeting presentation on the precipitation frequency project for Alaska at a seminar organized by the Alaska Center for Climate Assessment and Policy (ACCAP), publicized through the OneNOAA Science Seminars on January 31, 2012 and at the 2012 American Water Resources Association's (AWRA) Alaska Section Annual Conference, March 5-7, Juneau, Alaska.

2. PERSONNEL

On Monday, March 19th, Michael St. Laurent joined HDSC. Mr. St. Laurent received his B.S. degree in Meteorology from Lyndon State College in Lyndonville, VT in 2008 and his M.S. degree from the University of Rhode Island in 2011. He will work on data quality control, trend analysis, seasonality and regionalization tasks for on-going precipitation frequency projects.