HYDROMETEOROLOGICAL DESIGN STUDIES CENTER QUARTERLY PROGRESS REPORT

1 January 2011 to 31 March 2011

Office of Hydrologic Development

U.S. National Weather Service

National Oceanic and Atmospheric Administration

Silver Spring, Maryland

April 2011

DISCLAIMER

The data and information presented in this report are provided only to demonstrate current progress on the various technical 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.

TABLE OF CONTENTS

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. 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 (http://hdsc.nws.noaa.gov/hdsc/pfds/index.html).

HDSC is currently updating estimates for Alaska, 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. California precipitation frequency estimates were published on April 8th, 2011 as NOAA Atlas 14, Volume 6. Figure 1 shows new project areas as well as updated project areas included in NOAA Atlas 14, Volumes 1 to 6.

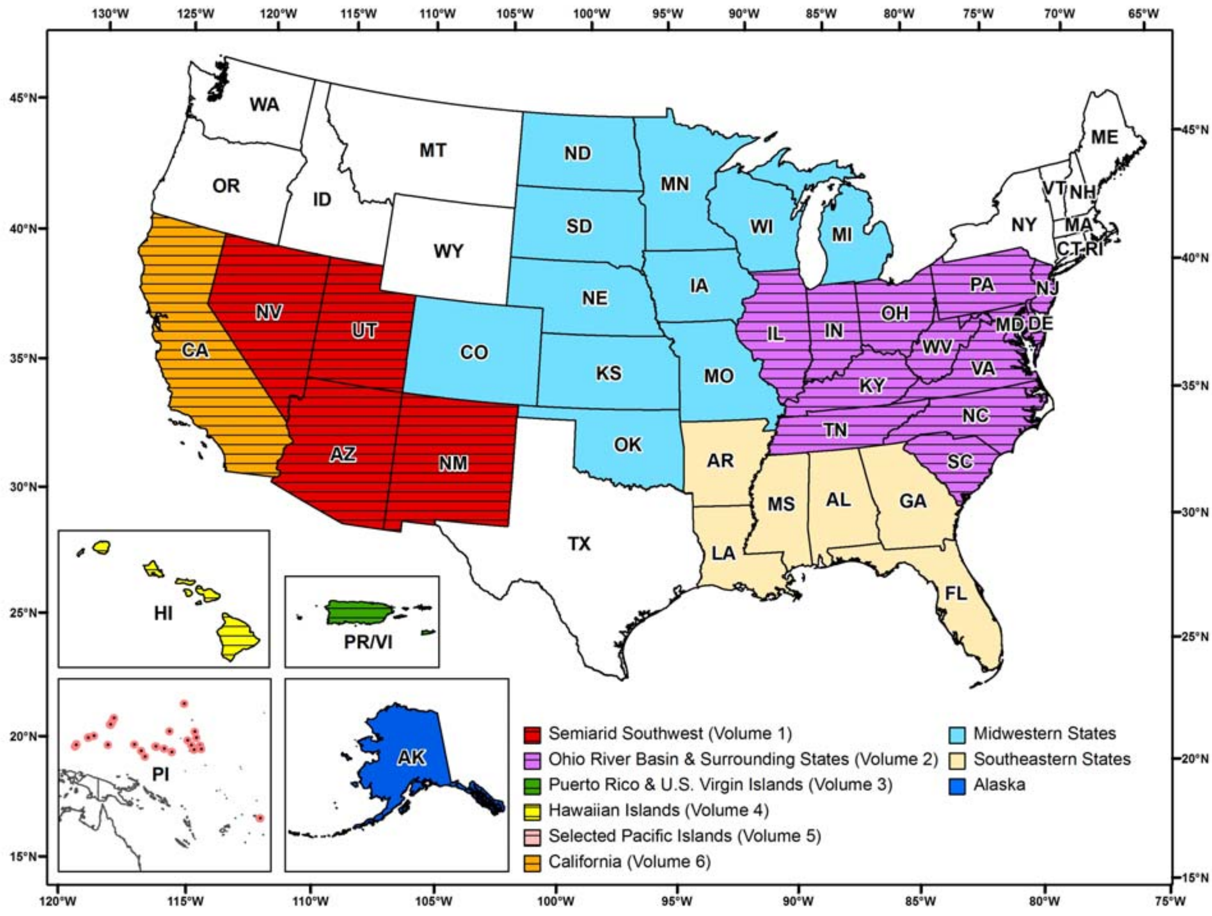

Figure 1. Map showing current project areas and project areas included in published NOAA Atlas 14, Volumes 1-6.

II. CURRENT PROJECTS

1. PRECIPITATION FREQUENCY PROJECT FOR CALIFORNIA

1.1. PROGRESS IN THIS REPORTING PERIOD (Jan - Mar 2011)

1.1.1. Publication announcement

Precipitation frequency estimates were published on April 8th, 2011. The estimates have been published through our newly re-designed Precipitation Frequency Data Server at http://hdsc.nws.noaa.gov/hdsc/pfds/. Volume 6 covers the entire state of California. Estimates for the southeast part of the state published in Volume 1 have been updated. Volume 6 supersedes information in Volume 1.

The release 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 (including 3-day)
- Cartographic maps of precipitation frequency estimates for selected ARIs and durations
- Rainfall (i.e., liquid 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 60-minutes through 24-hours
- Seasonality analysis for heavy precipitation
- Temporal distributions of heavy precipitation for 6-hour, 12-hour, 24-hour, and 96-hour durations
- Annual maximum series data used in the analysis.

Accompanying documentation describing the data, metadata and methodology will be released in May 2011.

1.1.2. Computing environment issues

During this report period, the Office of Hydrologic Development (OHD) has been experiencing a number of issues with its computing storage cluster which has delayed progress. Network outages happened frequently, sometimes multiple times per day, and required constant interaction with the Information Technology Systems Group (ITSG) to get things back up and running. The cause of the outages lay with the active/passive configuration of the two computers that provide the front end interface for the network. Some recent updates to the hardware and software of both seem to have helped stabilize the storage cluster.

In addition, several issues with the web servers, including insufficient storage space and failure of the sync process between the internal and the public web servers, also contributed in a delay in publishing results.

1.1.3. Quality control of annual maximum series (AMS)

Final inspection of data used in the analysis identified gross errors in the pre-1930 daily NCDC data where months with zero precipitation were erroneously recorded as missing data. Because of this, annual maxima were not being extracted since the percentage of missing data for a year was exceeding the maximum allowable threshold (20%). The error was corrected by substituting missing data with zero precipitation for months of data before 1930 that occurred in the "dry" season when annual maxima were less likely to occur (April to September).

1.1.4. Mean annual maxima analysis

The mean annual maxima (MAMs) grids for all durations between 15-minute and 60-day, created by the PRISM Group at Oregon State University by spatially interpolating at-station estimates, were carefully reviewed for any remaining inconsistencies resulting from stations that may have had less reliable sampling (shorter record or missed several heavy events) relative to nearby stations or any inconsistent areas unduly influenced by the interpolation process or a lack of stations. Evident inconsistencies were resolved and data were sent back to the PRISM Group for another run. Three iterations since the peer review were needed to resolve all observed inconsistencies across durations.

1.1.5. At-station precipitation frequency and confidence interval analysis

The regionalization approach used for frequency analysis is described in more detail in the previous quarterly progress report. During this reporting period, the regions were refined based on inspection of maps of spatially interpolated at-station quantiles for selected ARIs and by examination of similarities/dissimilarities in L-moment statistics across durations from 15-minute to 60-day. Regional L-moments were further smoothed across durations to reduce the effect of sampling variability on at-station depth-duration-frequency (DDF) curves. A Monte Carlo simulation procedure, described in the documentation of previous NOAA Atlas 14 volumes, was used to construct 5% and 95% confidence limits.

1.1.6. Spatial interpolation of precipitation frequency grids

The grids of quantiles for each successive average recurrence interval for partial duration series based estimates (or annual exceedance probability for annual maximum series) were derived in an iterative, HDSC-developed interpolation procedure termed the Cascade, Residual Add-Back (CRAB). This procedure is described in detail in the documentation of previous NOAA Atlas 14 volumes. The resulting spatial patterns in precipitation frequency estimates across all durations and ARIs were reviewed and obvious problematic areas (bullseyes, steep gradients in estimates, etc.) were resolved. Quantiles were estimated for four locations to anchor the spatial interpolation in areas where the lack of stations unduly influenced expected spatial patterns.

At-station upper and lower confidence limits were standardized by dividing them by corresponding MAMs and then interpolated using biharmonic spline interpolation method. Standardized upper and lower confidence limits grids were then rescaled by related MAM grids to obtain grids of upper and lower confidence limits at all durations.

Grids from Volume 1 were shifted by 15 seconds in both horizontal and vertical directions to align them with the Volume 6 grids. This shift was coupled with interpolation where the new grid cell value was assigned the average of the original surrounding grid cells. As a result, there may be a slight difference in Volume 1 values; however, the difference is negligible for locations in flat terrain and noticeable, but still small, in mountainous areas. Two methods for blending estimates and reducing discontinuities in estimates at the boundary of Volume 6 and Volume 1 project areas were investigated. The first one was based on running the CRAB procedures on combined Volumes 1 and 6 areas; this approach had to be abandoned since the original input files for Volume 1 hourly durations could not be located. The second approach was based on spreading the difference in estimates at the boundary across a certain distance from the boundary. The method was successful in smoothing the transition for majority of duration/ARI grids, but created unnatural spatial patterns in some. A decision was made not to smooth the estimates across two project areas. Consequently, the difference in estimates from the two volumes at the boundary may be obvious, especially for rarer ARIs.

1.1.7. Rainfall-only frequency grids

Frequency estimates were calculated from updated rainfall-only AMS using similar procedures as for precipitation. Empirical equations that relate precipitation and rainfall frequency estimates were developed in consideration of ARI, duration and elevation. Grids of rainfall-only estimates were generated by applying developed empirical equations to the precipitation frequency grids and accompanying 90% confidence interval bounds for durations between 60-minutes through 24-hours.

1.1.8. Temporal distributions

The project area was divided to 14 regions based on climatology of extreme precipitation. Temporal distributions of heavy rainfall were computed for each region for use with the precipitation frequency estimates for 6-hour, 12-hour, 24-hour, and 96-hour durations. Procedures used to derive temporal distributions are similar to those used in previous NOAA Atlas 14 volumes. The temporal distributions are expressed in probability terms as cumulative percentages of precipitation totals at various time steps. Separate temporal distributions were derived for four precipitation cases defined by the duration quartile in which the greatest percentage of the total precipitation occurred.

1.1.9. Seasonality

To portray the seasonality of extreme precipitation throughout the project area, precipitation amounts that exceeded precipitation frequency estimates (quantiles) with selected annual exceedance probabilities (AEPs) for chosen durations were examined for each region delineated for temporal analysis. Graphs showing the monthly variation of the exceedances for a region are provided for each location in the project area via the Precipitation Frequency Data Server (PFDS).

1.1.10. 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.

1.1.11. Documentation

Work began on the final documentation to accompany the estimates. The document will be published online in May 2011.

1.1.12. Web page enhancements

The web interface for the Precipitation Frequency Data Server (PFDS) has been redesigned and enhanced to use custom created Google Maps. All grids were converted to HDF5 file formats to facilitate a faster download speed.

1.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Apr - Jun 2011)

Accompanying documentation will be completed and published online in May 2011.

1.3. PROJECT SCHEDULE

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) [Complete]

Regionalization and frequency analysis [Complete]

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

Peer review [Complete]

Revision of PF estimates [Complete]

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

Web publication of PF estimates [complete]

Web publication of documentation [May 2011]

2. PRECIPITATION FREQUENCY PROJECT FOR THE SOUTHEASTERN STATES

2.1. PROGRESS IN THIS REPORTING PERIOD (Jan - Mar 2011)

The project includes the states of Alabama, Arkansas, Florida, Georgia, Louisiana and Mississippi and an approximately 1-degree buffer around the core states included to assist in the delineation of homogenous regions with respect to heavy precipitation characteristics (Figure 2). To facilitate a more efficient process, Southeastern and Midwestern (see Section 3) precipitation frequency projects are being done simultaneously. Because of that, some of the results shown in this report apply for the both projects.

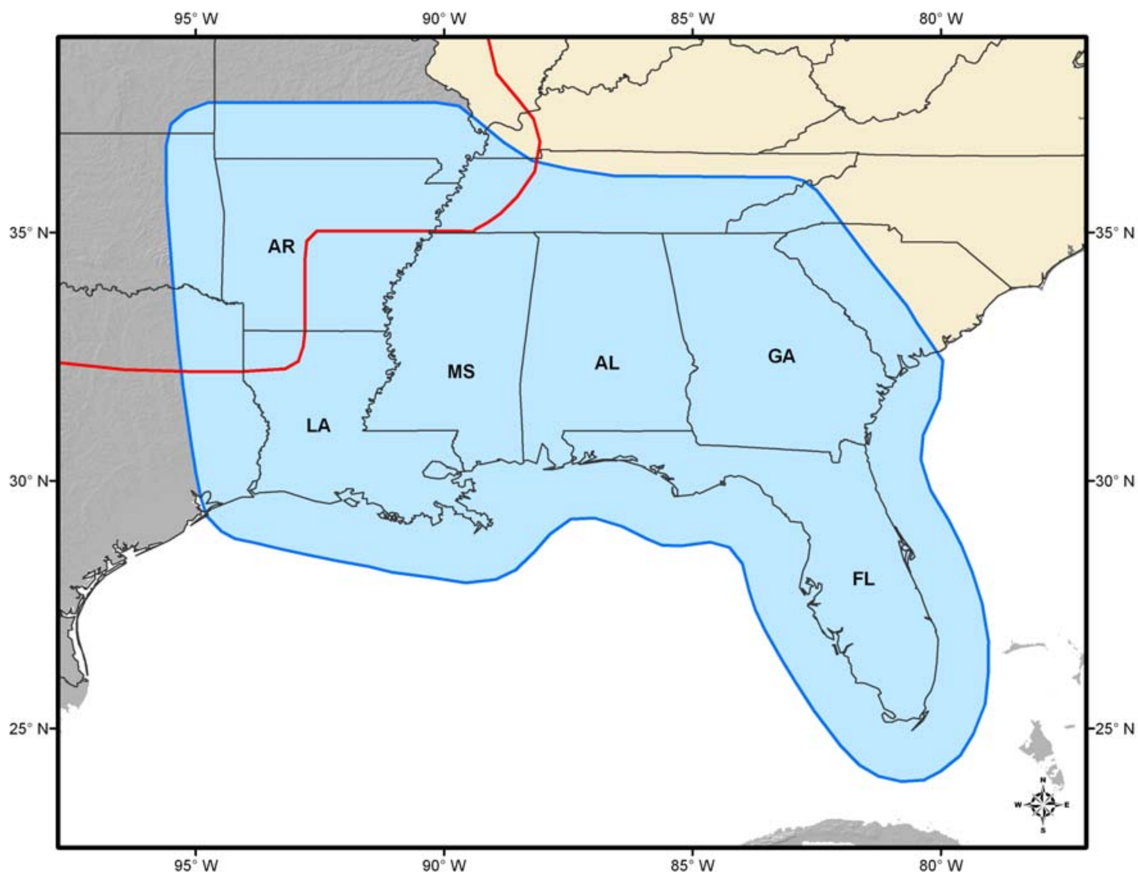

Figure 2. Southeastern precipitation frequency project area (shown in blue). Also shown is the border of the Midwestern precipitation frequency project area (red line).

2.1.1. Computing environment issues

During this report period, the Office of Hydrologic Development (OHD) has been experiencing a number of issues with its computing storage cluster. Network outages have been happening frequently, sometimes multiple times per day, and have required constant interaction with the Information Technology Systems Group (ITSG) to get things back up and running. The cause of the outages laid with the active/passive configuration of the two computers that provide the front end interface for the network. Some recent updates to the hardware and software of both seem to have helped stabilize the storage cluster. This has delayed progress of some tasks. In the interim, some previously completed tasks that did not require the use of that computing environment have been revisited.

2.1.2. Data collection and formatting

a. Data collection

It was observed that the data from Remote Automated Weather Stations (RAWS) was not downloaded for all states. 169 additional hourly stations from this network with at least 10 years of data were downloaded in this reporting period.

Additionally, 15-minute, hourly, and daily data from the National Climatic Data Center (NCDC) and the Natural Resources Conservation Service (NRCS) (SNOTEL) were updated to include any recently archived data since the data were initially downloaded in July 2009.

b. Formatting

It was decided that 15-minutes will be the shortest reporting interval for sub-hourly data because the spatial coverage of 5-minute data is too sparse. Therefore, data from four 5-minute and three ALERT (with variable reporting intervals) datasets were formatted to 15-minute data. For the ALERT datasets, data were also formatted directly to 1-hour and 1-day increments to retain any information that may be lost during the distribution and then aggregation of events into various time intervals.

A final inspection of all formatted datasets was done. Miscellaneous corrections were made to six datasets.

2.1.3. Review of station metadata and station screening

Final review of station metadata has been done. Through this check it was identified that SNOTEL and RAWS metadata were suspicious; therefore, new metadata were obtained for those datasets. In addition, the elevation for any stations for which the source did not provide an elevation will be set to an elevation extracted from a DEM.

As a result of the additional and corrected data and metadata, any station screening previously done is being re-visited.

2.1.4. Web page enhancements

The web interface for the Precipitation Frequency Data Server (PFDS) has been redesigned and enhanced to use custom created Google Maps and to increase file download speed (http://hdsc.nws.noaa.gov/hdsc/pfds/index.html).

2.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Apr - Jun 2011)

In the next reporting period, investigation of high and low outliers in the AMS will be completed. Work will continue or start on investigation of spatial patterns in mean annual maxima, trend analysis in AMS, delineation of homogeneous regions, and preliminary analysis of L-moment statistics.

2.3. PROJECT SCHEDULE

Completion date is revised for some tasks but will not impact the final publication date.

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) [July 2010; revised to June 2011]

Regionalization and frequency analysis [November 2010; revised to August 2011]

Initial spatial interpolation of precipitation frequency (PF) estimates and consistency checks across durations [August 2011]

Peer review [September 2011]

Revision of PF estimates [December 2011]

Remaining tasks (e.g., development of precipitation frequency estimates for partial duration series, seasonality, temporal distributions, documentation) [April 2012]

Web publication [May 2012]

3. PRECIPITATION FREQUENCY PROJECT FOR THE MIDWESTERN STATES

3.1. PROGRESS IN THIS REPORTING PERIOD (Jan - Mar 2011)

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 the core states is included to assist in the delineation of homogenous regions with respect to heavy precipitation characteristics (Figure 3). To facilitate a more efficient process, Southeastern and Midwestern (see Section 3) precipitation frequency projects are being done simultaneously. Because of that, some of the results shown in this report apply for the both projects.

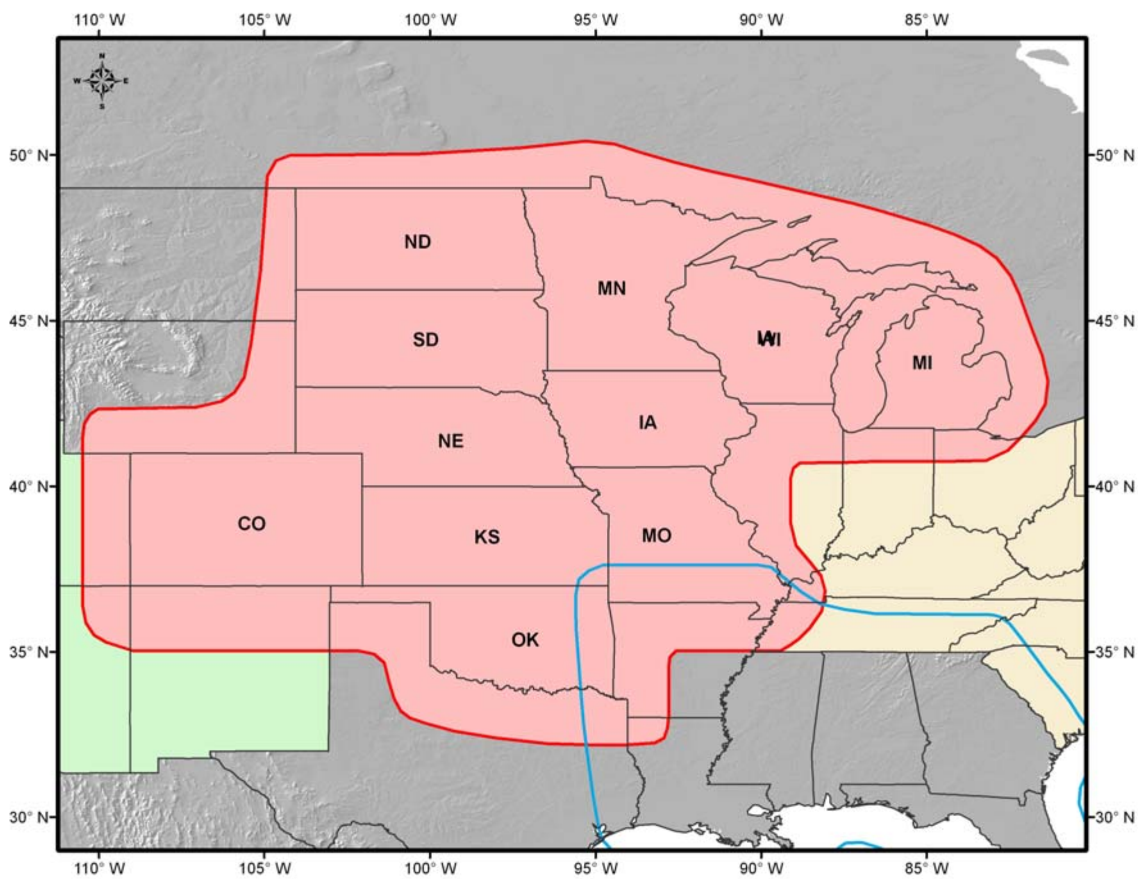

Figure 3. Midwestern precipitation frequency project area (shown in red). Also shown is the border of the Southeastern precipitation frequency project area (blue line).

3.1.1. Computing environment issues

During this report period, the Office of Hydrologic Development (OHD) has been experiencing a number of issues with its computing storage cluster. Network outages have been happening frequently, sometimes multiple times per day, and required constant interaction with the Information Technology Systems Group (ITSG) to get things back up and running. The cause of the outages laid with the active/passive configuration of the two computers that provide the front end interface for the network. Some recent updates to the hardware and software of both seem to have helped stabilize the storage cluster. This has delayed progress of some tasks. In the interim, some previously completed tasks that did not require the use of that computing environment have been revisited.

3.1.2. Data collection and formatting

a. Data collection

Investigation into responses from the National Hydrologic Warning Council's request for data, led to the addition of 123 15-minute stations from the USGS South Dakota Water Science Center. Two additional datasets: hourly data from the Colorado Springs Fountain Creek Watershed District, and 15-minute/hourly data from USGS Colorado Water Science Center (in collaboration with OneRain) were received during this quarter.

It was observed that the data from Remote Automated Weather Stations (RAWS) was not downloaded for all states. 169 additional hourly stations from this network with at least 10 years of data were downloaded in this reporting period.

Additionally, 15-minute, hourly, and daily data from the National Climatic Data Center (NCDC) and the Natural Resources Conservation Service (NRCS) (SNOTEL) were updated to include any recently archived data since the data were initially downloaded in July 2009.

b. Formatting

It was decided that 15-minutes will be the shortest reporting interval for sub-hourly data because the spatial coverage of 5-minute data is too sparse. Therefore, data from four 5-minute and three ALERT (with variable reporting intervals) datasets were formatted to 15-minute data. For the ALERT datasets, data were also formatted directly to 1-hour and 1-day increments to retain any information that may be lost during the distribution and then aggregation of events into various time intervals.

A final inspection of all formatted datasets was done. Miscellaneous corrections were made to six datasets.

3.1.3. Review of station metadata and station screening

Final review of station metadata has been done. Through this check it was identified that SNOTEL and RAWS metadata were suspicious; therefore, new metadata were obtained for those datasets. In addition, the elevation for any stations for which the source did not provide an elevation will be set to an elevation extracted from a DEM.

As a result of the additional and corrected data and metadata, any station screening previously done is being re-visited.

3.1.4. Web page enhancements

The web interface for the Precipitation Frequency Data Server (PFDS) has been redesigned and enhanced to use custom created Google Maps and to increase file download speed (http://hdsc.nws.noaa.gov/hdsc/pfds/index.html).

3.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Apr - Jun 2011)

In the next reporting period, investigation of high and low outliers in the AMS will be completed. Work will continue or start on investigation of spatial patterns in mean annual maxima, trend analysis in AMS, delineation of homogeneous regions, and preliminary analysis of L-moment statistics.

3.3. PROJECT SCHEDULE

Completion date is revised for some tasks but will not impact the final publication date.

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) [July 2010; revised to June 2011]

Regionalization and frequency analysis [November 2010; revised to August 2011]

Initial spatial interpolation of precipitation frequency (PF) estimates and consistency checks across durations [August 2011]

Peer review [September 2011]

Revision of PF estimates [December 2011]

Remaining tasks (e.g., development of precipitation frequency estimates for partial duration series, seasonality, temporal distributions, documentation) [April 2012]

Web publication [May 2012]

4. PRECIPITATION FREQUENCY PROJECT FOR ALASKA

4.1. PROGRESS IN THIS REPORTING PERIOD (Jan - Mar 2011)

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

4.1.1. Computing environment issues

During this report period, the Office of Hydrologic Development has been experiencing a number of issues with its computing storage cluster. Network outages have been happening frequently, sometimes multiple times per day. Some recent updates to the hardware and software of both seem to have helped stabilize the storage cluster. This has delayed progress of some tasks. In the interim, some previously completed tasks that did not require the use of that computing environment have been revisited.

4.1.2. Data collection and formatting

Data from the National Climatic Data Center (NCDC) and SNOTEL data from the Natural Resources Conservation Service were updated to include recently archived data. SNOTEL data downloaded from two different databases were combined to produce a larger dataset. Hourly SNOTEL data were investigated for potential use in the analysis, since the data had no quality assurance and short records. Remote Automated Weather Stations (RAWS) data were investigated to remove any suspicious values.

4.1.3. Annual maximum series (AMS) extraction

The criteria for extraction of AMS used in other NOAA Atlas 14 volumes (see for example, NOAA Atlas 14 Volume 5 documentation for more information) were adjusted for this project in order to attain as much data as possible for frequency analysis. Since some stations in Alaska do not collect data during the cold, dry winter months, the yearly criterion was omitted for this project. To determine the allowable amount of missing data during the wet season for each climate region (shown in Figure 4), the impact of various allowable percentages on number of extracted years of data was examined. Results suggested that allowing missing data for up to 1/3 of the wet season (33.33%) was adequate, particularly given that later quality control efforts will screen low outliers in the AMS.

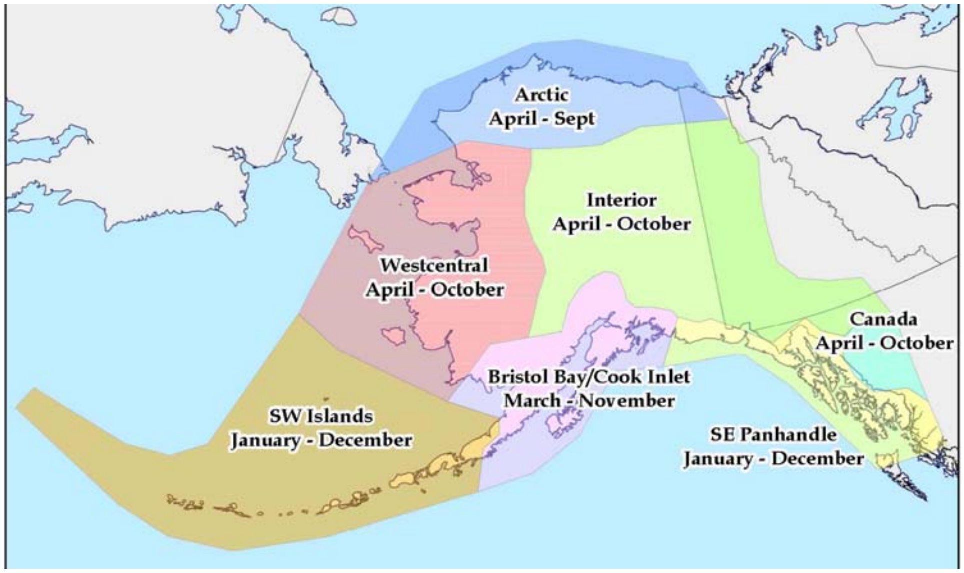

Figure 4. Climate regions and their assigned wet seasons.

4.1.4. Rainfall AMS extraction

Frequency estimates will be calculated from rainfall-only AMS using similar procedures as for precipitation. Empirical equations that relate precipitation and rainfall frequency estimates will then be developed in consideration of ARI, duration and elevation. Temperature data were collected for stations that did not have information on type of precipitation in order to segregate liquid from solid precipitation. Table 1 shows the datasets that have rainfall, snowfall or temperature data available in addition to precipitation data.

Rainfall data were formatted for Environment Canada's daily and hourly datasets, Long-term Ecological Research (LTER) datasets, and NCDC's Integrated Surface Hourly (ISH) dataset. Snowfall was formatted for the daily NCDC dataset. Datasets that report temperature are in the process of being formatted: NCDC (to be used for co-located hourly stations or for periods of time with no snowfall measurements), SNOTEL, and RAWS.

Table 1. Availability of rainfall, snowfall and/or temperature data to be used in rainfall frequency analysis.

Data type	Data source	Number of stations with rainfall	Number of stations with snowfall	Number of stations with temperature
Daily	Arctic-LTER	3	0	0
	Environment Canada	**151**	**0**	**0**
	SNOTEL	0	0	78
	NCDC – TD3200	0	691	691
Hourly	Bonanza Creek LTER	11	0	0
	NCDC – TD3240	0	0	0
	NCDC – ISH	138	0	0
	Environment Canada	17	0	0
	Arctic_LTER	3	0	0
	WERC - North Slope	26	0	0
	RAWS	0	0	131

4.1.5. Station screening

a. Dataset review

Two datasets were reviewed for overall data quality and ultimately removed from the analysis.

1. The NCDC ISH data were found to have quality issues and since they were co-located with hourly NCDC data from the TD3240 dataset, they were removed from the precipitation frequency analysis. However, they do report rainfall-only information and so potentially useful stations were retained for the rainfall-only frequency analysis.
2. The Alaska Department of Transportation's (ADOT) Road Weather Information System (RWIS) data were reviewed. UAF consulted with ADOT directly regarding the data. Issues with the data reporting were observed - values were consistently too high and different reporting intervals did not sum to consistent values. Given that the data records were also very short, it was decided to remove these data from the analysis.

b. Station cleanup

As a result of the additional and corrected data, it was decided to re-evaluate any station screening previously done. As a result, 91 daily station pairs were merged and 13 daily stations were extended using hourly data. Any station with less than 10 years was removed from the analysis, except for 15-minute stations where only 1 station had more than 10 years.

c. Review of station metadata

Metadata for all stations were reviewed for location accuracy. Through this check it was identified that SNOTEL and RAWS metadata were suspicious; new metadata were obtained for those datasets. The elevation for any stations for which the source did not provide an elevation was set to the elevation extracted from the DEM.

4.1.6. Quality control of AMS

High and low outliers were identified in the distribution of the at-station precipitation AMS for all durations. All identified outliers and other questionable maxima will be verified, corrected, or removed from the data set.

4.1.7. Web page enhancements

The web interface for the Precipitation Frequency Data Server (PFDS) has been redesigned and enhanced to use custom created Google Maps and to increase file download speed (http://hdsc.nws.noaa.gov/hdsc/pfds/index.html).

4.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Apr - Jun 2011)

In the next reporting period, the quality control of precipitation AMS outliers for all durations and a review of mean annual maxima will be completed. The mean annual maxima will be sent to the PRISM Group for spatial interpolation. Extraction of rainfall-only AMS will also be completed. Initial precipitation and rainfall-only frequency estimates will be computed.

4.3. PROJECT SCHEDULE

UAF and HDSC*: data collection, formatting, and initial quality control [Complete]

UAF and HDSC*: extraction of annual maximum series (AMS) for precipitation and rainfall; additional quality control and data reliability tests (e.g., outliers, trend analysis, independence, consistency across durations, duplicate stations, candidates for merging). [February 2010; revised to April 2011]

HDSC: regionalization and frequency analysis [September 2010, revised to May 2011]

HDSC: initial spatial interpolation of PF estimates and consistency checks across durations [January 2011, revised to June 2011]

HDSC: peer review [March 2011, revised to June 2011]

HDSC: revision of PF estimates [May 2011, revised to July 2011]

HDSC and UAF: remaining tasks (e.g., development of precipitation frequency estimates for PD series, seasonality, temporal distributions, documentation) [August 2011]

HDSC: web publication [September 2011]

** The schedule for this task assigned to UAF slipped due to delay in execution of data collection and formatting task. HDSC has joined UAF in execution to speed up the work. This affected deadlines for subsequent tasks, but the project is still expected to be completed on time.*

5. AREAL REDUCTION FACTORS

5.1. PROGRESS IN THIS REPORTING PERIOD (Jan - Mar 2011)

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 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.

No progress has been made during this reporting period. In the past few months, HDSC has been experiencing a number of issues with our computing storage cluster which has delayed progress of many tasks, including the ARF.

5.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Apr - Jun 2011)

In the next quarter, the different methods will be tested using updated quality controlled data.

5.3. PROJECT SCHEDULE

This project began on April 1, 2010. It is expected to take 2 years to complete.

III. OTHER

1. MEETINGS AND PRESENTATIONS

On March 29-31, Debbie Martin presented *Precipitation Frequency Estimates for Puerto Rico and the U.S. Virgin Islands* to professional engineers, planners and scientists. The presentation was given in three locations, Aguadilla, Ponce, and San Juan, and covered all aspects of the project (from data quality control to web publishing). The presentations were sponsored by the Puerto Rican Civil Engineering Institute, College of Engineers and Land Surveyors, as part of their continuing education program.