HYDROMETEOROLOGICAL DESIGN STUDIES CENTER
QUARTERLY PROGRESS REPORT

1 October 2009 to 31 December 2009

Office of Hydrologic Development

U.S. National Weather Service

National Oceanic and Atmospheric Administration

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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.

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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. Updated precipitation frequency estimates for durations from 5 minutes to 60 days and selected average recurrence intervals (1-year to 1,000-years) accompanied by additional 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 recently completed updated estimates for selected Pacific Islands (NOAA Atlas 14, Volume 5) and is currently updating estimates for the remainder of California (not included in NOAA Atlas 14, Volume 1), 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. Figure 1 shows new project areas as well as project areas included in NOAA Atlas 14, Volumes 1 to 5.

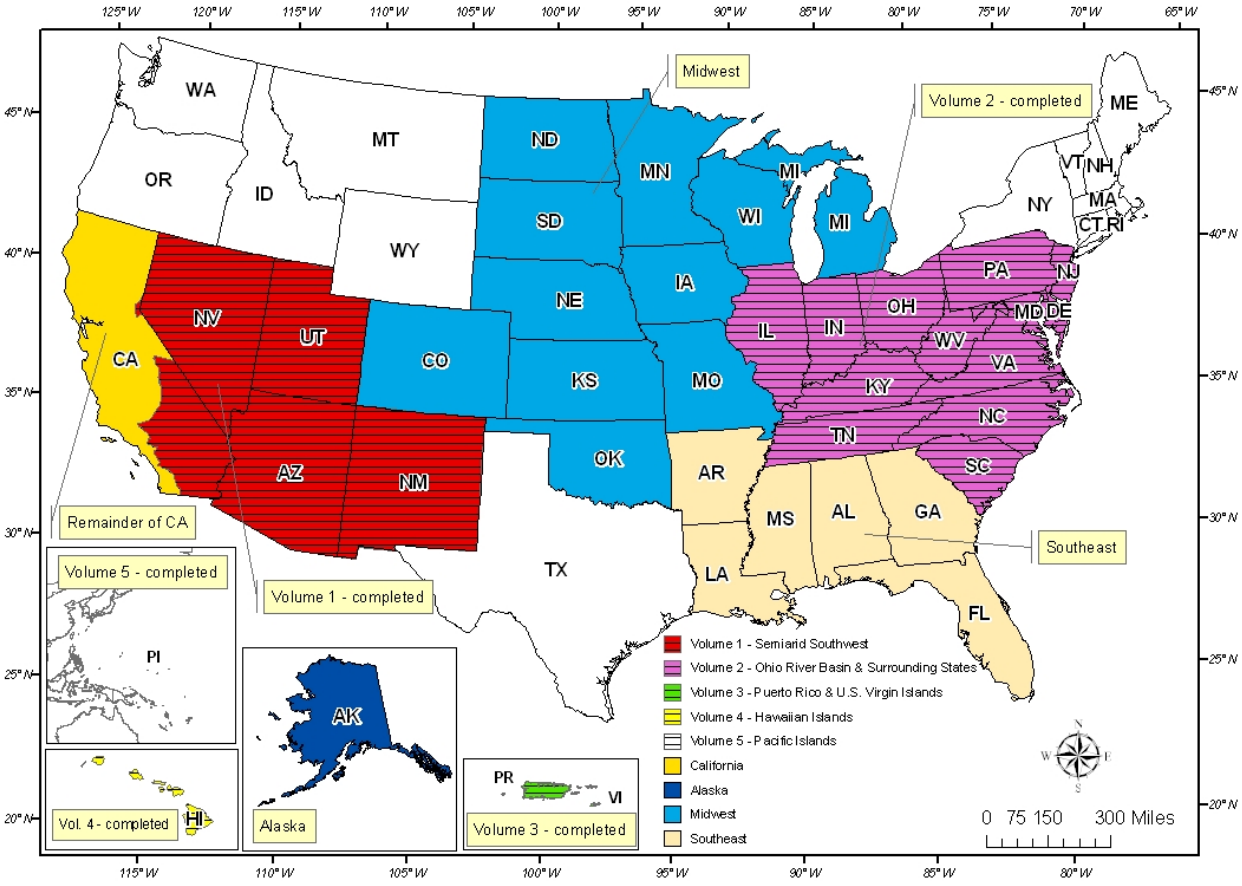

Figure 1. Map showing current project areas and project areas included in NOAA Atlas 14, Volumes 1-5.

II. CURRENT PROJECTS

1. PRECIPITATION FREQUENCY PROJECT FOR THE REMAINDER OF CALIFORNIA

1.1. PROGRESS IN THIS REPORTING PERIOD (Oct - Dec 2009)

1.1.1. Data collection and formatting

Remaining data from Riverside County was converted into 15-minute time-steps and compared with previously received hourly data. This closes out the data formatting task.

1.1.2. Data quality control

a. **Station screening**

Some areas, such as Los Angeles County, have a high density of stations from a number of sources. In order to eliminate duplicate or highly correlated data recorded at different stations, stations within 2 miles of each other were reviewed. This review was concluded during the past reporting period and resulted in 258 deletions, 101 merges, and the extension of 18 records using co-located data with shorter reporting intervals. In addition, stations from different sources that have the same or similar names but were not located within 2 miles were screened for duplicate data and/or incorrect coordinates.

Lastly, stations from different data sources with different reporting intervals (i.e., 15-minute, hourly, or daily) that were located within 0.5 miles of each other were identified. The 66 cases were reviewed to confirm data consistency to be treated as co-located. Methods were put in place to track co-located stations for data quality control, data smoothing, and spatial interpolation processes. Where appropriate, station records were deleted, merged, or extended.

b. **Quality control of AMS**

Annual maximum series (AMS) were extracted for a range of durations varying from 15-minute to 60-day. AMS for the 1-day through 60-day durations were compiled from daily, hourly and 15-minute records. Hourly and 15-minute data were aggregated to constrained 1-day (0 to 24 hour) values before extracting 1-day and longer duration annual maxima. Hourly and 15-minute data were also used to compile AMS for 1-hour through 12-hour durations. Again, 15-minute data were aggregated to constrained 1-hour (0 to 60 minute) values before extracting AMS. 15-minute data were also used to compile AMS for 15-minute and 30-minute durations.

High and low outliers and other suspicious values were identified in the distribution of the AMS at all stations for each duration. Questionable maxima were flagged and investigated by reviewing spatial plots, raw data, scanned observation forms found on NCDC's Environmental Document Access and Display System (EDADS), and other storm information from various resources. During this reporting period, 350 stations with 15-minute and 30-minute data, 667 stations with 1-hour, 2-hour, 3-hour, 6-hour and 12-hour data, and 1,681 stations with 1-day, 2-day, 4-day, 7-day, 10-day, 20-day, 30-day, 45-day and 60-day data were checked. 1-day data from daily stations and 1-hour data from hourly stations were checked and corrected for

erroneous values during the previous reporting period. Examination of low outliers indicated that almost all of them were from years with a significant percent of missing and/or accumulated data. They were presumed untrue maxima and were removed from the datasets.

1.1.3. Regionalization

Work began on modification of code that performs the regional frequency analysis and computes associated statistical measures to accommodate new data formats and various data types.

1.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Jan - Mar 2010)

During the next quarter, quality control tasks will be concluded and data reliability testing for the AMS data across all durations will be completed including analysis of trends in AMS data. Correction factors for constrained to unconstrained observations for various durations will be computed.

The regionalization of all data for frequency analysis will be completed. This will include an investigation of spatial patterns in mean annual maxima for selected durations and the frequency analysis of station-specific AMS data to investigate station and regional statistical measures at various durations. Initial precipitation frequency estimates will be computed and the initial spatial interpolation of precipitation frequency estimates will be completed.

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) [January 2010]

Regionalization and frequency analysis [February 2010]

Initial spatial interpolation of PF estimates and consistency checks across durations [March 2010]

Peer review [April 2010]

Revision of PF estimates [July 2010]

Remaining tasks (e.g., development of precipitation frequency estimates for PD series, seasonality, temporal distributions, documentation) [August 2010]

Web publication [September 2010]

2. PRECIPITATION FREQUENCY PROJECT FOR SELECTED PACIFIC ISLANDS

2.1. PROGRESS IN THIS REPORTING PERIOD (Oct - Dec 2009)

2.1.1. Spatial interpolation and final review of precipitation frequency estimates

At-station mean annual maximum (MAM) estimates were spatially interpolated to produce MAM grids for selected durations. First, grids of 1-day MAM were developed using a method specific to the region. In regions where reliable relationships were found between MAM and mean annual precipitation (MAP) and where PRISM MAP grids were available, regression equations were used to create MAM grids from MAP grids. For regions where no relationships between MAM and MAP or MAM and elevation existed at-station MAM estimates were interpolated using biharmonic spline interpolation method.

MAM grids at hourly and daily durations were then derived from 1-day MAM grids by taking advantage of simple relationships that were established for each region between at-station MAM ratios and durations. To produce spatially interpolated precipitation frequency estimates for a given duration, gridded MAM estimates and regional estimates of L-CV and L-skewness, obtained through regional analysis of station data and smoothed across durations, were used to calculate GEV-distribution quantiles for selected frequencies for each grid cell.

At-site precipitation frequency estimates as well as resulting spatially interpolated patterns were carefully reviewed for reasonableness and consistency across durations and frequencies. Grids/maps of the precipitation frequency estimates for selected durations and average recurrence intervals were created and reviewed.

2.1.2. Final deliverables

Various deliverables were finalized prior to publication: seasonality plots, cartographic maps, tables for temporal distributions of heavy precipitation, and documentation.

The navigational interface for internet access to HDSC-produced information was refined to allow easier navigation and to accommodate characteristics unique to the Pacific Islands project area, such as the vast amount of ocean relative to the size of the islands.

2.1.3. Publication

On December 30th, HDSC released NOAA Atlas 14, Volume 5: Precipitation-Frequency Atlas of the United States, Selected Pacific Islands. Selected islands and atolls in the Pacific Ocean are part of the following territories or states: the Commonwealth of Northern Mariana Islands, the Territory of Guam, the Republic of Palau, the Federated States of Micronesia, the Republic of the Marshall Islands, Wake Island and the Territory of American Samoa. The results were published through HDSC's Precipitation Frequency Data Server at http://hdsc.nws.noaa.gov/hdsc/pfds/.

The release included:

- partial duration series (PDS)-based precipitation frequency estimates for average recurrence intervals from 1-year through 1,000-years and annual maximum series (AMS)- based precipitation frequency estimates for annual exceedance probabilities from 1/2 to 1/1000 for durations from 5-minutes through 60-days with corresponding 95% confidence limits: http://hdsc.nws.noaa.gov/hdsc/pfds/pi/pi_pfds.html
- AMS and PDS precipitation frequency estimates as ASCII grids: http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_gis.html
- cartographic maps of PDS-based frequency estimates for select durations and average recurrence intervals: http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_maps.html
- annual maximum series data used in the analysis: http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_series.html
- temporal distributions of heavy precipitation for selected durations: http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_temporal.html
- accompanying documentation describing the data, metadata and methodology: http://www.nws.noaa.gov/ohd/hdsc/currentpf.htm

2.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Jan - Mar 2010)

Federal Geographic Data Committee (FGDC) compliant metadata for the grids will be published. However, this is the final update in the Quarterly Progress Reports.

2.3. 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 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 PD series, seasonality, temporal distributions, documentation) [Complete]

Web publication [Complete]

3. PRECIPITATION FREQUENCY PROJECT FOR THE SOUTHEASTERN STATES

3.1. PROGRESS IN THIS REPORTING PERIOD (Oct - Dec 2009)

The project includes the states of Alabama, Arkansas, Florida, Georgia, Louisiana and Mississippi. An approximately 1-degree buffer around the core states was added to the project area to assist in the delineation of homogenous regions with respect to heavy precipitation characteristics (Figure 2).

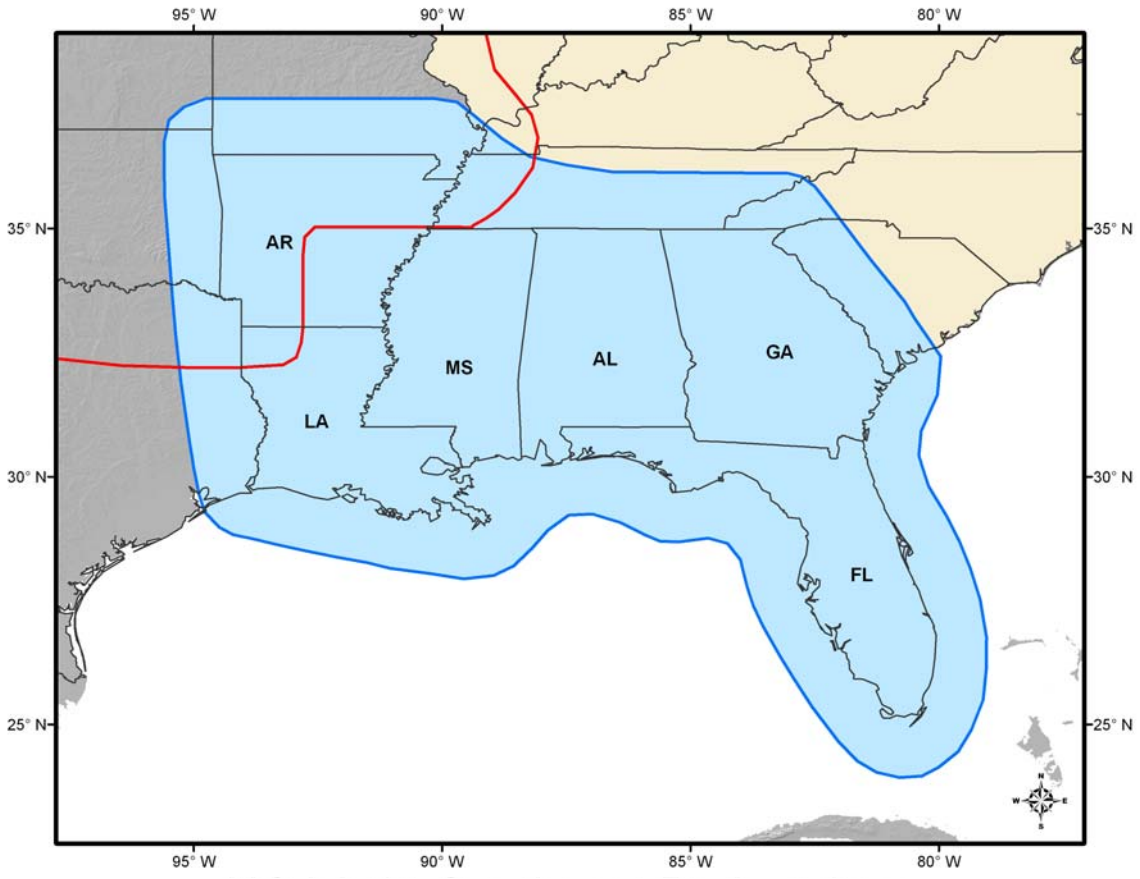

Figure 2. Southeastern precipitation frequency project area (shown in blue). Also shown is the border of the Midwestern precipitation frequency project area (red line).

The main activities in this period were focused on data reformatting, initial data quality control, and extraction of annual maximum series. Table 3 provides a current list of potential data sources and their status. A total of 39 potential datasets were identified during the data collection stage. After a preliminary evaluation, decisions were made not to use data from 24 datasets (highlighted in gray) either because they had no stations with more than 10 years of data, duplicated data from another data source, or did not respond our data solicitation. Among the remaining datasets, eight datasets were reformatted into the HDSC standard format. If you

have any questions about the data sources that will be used in the project, please contact us at HDSC.Questions@noaa.gov.

Table 3. Current list of potential precipitation data sources and status of formatting work.

Formatting status	Source of data and dataset name	Data reporting interval	Number of stations formatted or comment
Data formatted	National Climatic Data Center (NCDC)	daily	3235
	NCDC	hourly	963
	NCDC	15-min	478
	U.S. Geological Survey (USGS)	daily	710
	National Atmospheric Deposition Program (NADP)	daily	23
	St. Johns River Water Management District (SJRWMD)	daily	54
	City of Vero Beach, Florida	daily	1
	Georgia Forestry Commission Weather Station Network	hourly	19
Formatting in progress	Natural Resources Conservation Service: SCAN network	hourly	13
To be formatted	Remote Automated Weather Stations (RAWS)	hourly	TBD
	TRMM Satellite Validation Office, Florida site	TBD	TBD
	South Florida Water Management District (SFWMD)	5-min	TBD
	Southwest Florida Water Management District (SWFWMD)	15-min	TBD
	Florida Automated Weather Network (FAWN), University of Florida	15-min	35
Collecting data	Natural Resources Management Office, Brevard County, Florida	daily	Waiting for metadata
Datasets that will not be used	U.S. Climate Reference Network (NCDC)	5-min	Established in 2003
	USGS, Georgia Water Science Center	daily	Same as USGS
	Road Weather Information System (RWIS) network	–	Real-time obs.; insufficient length
	Alabama Office of the State Climatologist	–	Data from NOAA
	Alabama Mesonet/NRCS Soil Climate Analysis Network (SCAN)	daily	Established in 2002
	Auburn University Mesonet	daily	Fee for data
	Cooperative Huntsville Area Rainfall Measurements (CHARM), Alabama	daily	Established in 2001
	Arkansas Red Basin River Forecast Center	daily	Same as NCDC
	Florida Climate Center	–	Same as NCDC
	Northwest Florida Water Management District (NWFWMD)	5-min	Contacted but did not receive data
	Suwannee River Water Management District (SRWMD)	hourly	Insufficient data length
	Lake Okeechobee Lakewatch Rainfall Monitoring Program, Florida	daily	Part of SFWMD
	Capital Area Flood Warning Network, Florida	5-min	Established in 2005
	Brevard County Utility Services Department, Florida	daily	Same as NRMO, Brevard County, FL
	Department of Barefoot Bay Water and Sewer	monthly	Same as NRMO,

Formatting status	Source of data and dataset name	Data reporting interval	Number of stations formatted or comment
	District, Florida		Brevard County, FL
	Public Waters and Utilities Administration, City of Melbourne, Florida	daily	No metadata available
	Stormwater Management Academy, University of Central Florida	–	Not collecting raingauge data
	WEAR WeatherNet, Florida	5-min	Real-time obs.; insufficient data length
	Georgia State Climatology Office	–	Same as NCDC
	Georgia Automated Environmental Monitoring Network (GAEMN)	15-min	Fee for data
	GeorgiaWx.net Mesonet System	–	Real-time obs.; insufficient data length
	Mississippi State Climatology Office	–	Same as NCDC
	Delta Research and Extension Center (DREC) Network, Mississippi	–	Data forwarded to NOAA
	Mississippi Mesonet	hourly	Established in 2004

A few datasets were found without elevation information. HDSC may use a digital elevation model (DEM) or Google Earth to fill in the missing elevation information.

While working on the data formatting, initial data quality control was applied to pre-screen data with abnormal (extremely large or negative) values and gaps. A few datasets were identified with data quality issues (e.g., suspicious data and/or large amounts of missing data) during this procedure. The agencies that provided the data were contacted to resolve some of the issues. Some provided further internal data quality control measures and flags. In addition, we began examining co-located 15-minute, hourly and daily stations primarily to eliminate data that are actually aggregations of the 15-minute (or hourly) data.

A wet season analysis was started to delineate regions with similar extreme climatology to assist in extracting meaningful annual maxima for frequency analysis. The wet season for extraction purposes is assigned by inspecting histograms of annual maxima for the 1-day and 1-hour durations and by assessing the periods in which two-thirds of annual maxima occurred at each station.

3.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Jan - Mar 2010)

The main focus for the next reporting period will be data reformatting, initial data quality control and extraction of annual maximum series.

3.3. PROJECT SCHEDULE

Data collection, formatting, and initial quality control [August 2009]

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]

Regionalization and frequency analysis [November 2010]

Initial spatial interpolation of PF estimates and consistency checks across durations [May 2011]

Peer review [July 2011]

Revision of PF estimates [October 2011]

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

Web publication [May 2012]

4. PRECIPITATION FREQUENCY PROJECT FOR THE MIDWESTERN STATES

4.1. PROGRESS IN THIS REPORTING PERIOD (Oct - Dec 2009)

The project area includes the states of Colorado, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Wisconsin. An approximately 1-degree buffer around the core states was added to the project area to assist in the delineation of homogenous regions with respect to heavy precipitation characteristics (Figure 3).

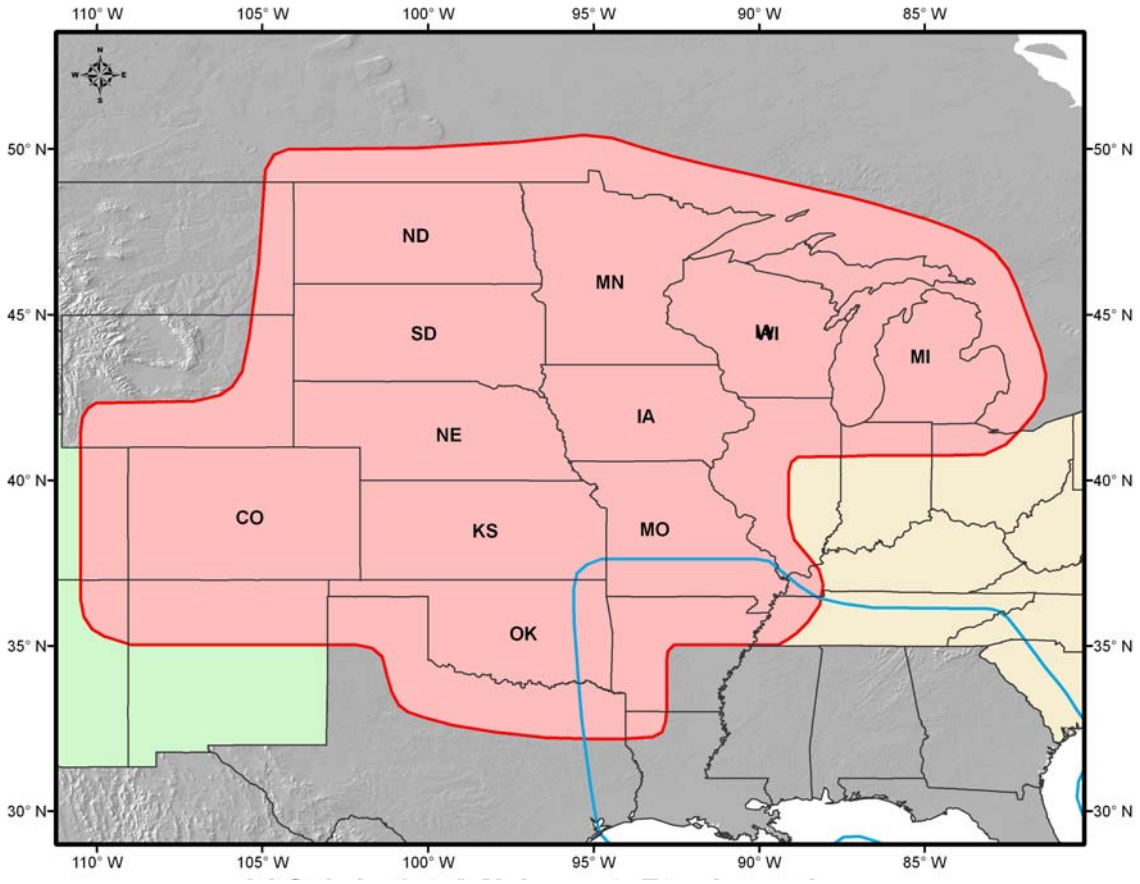

Figure 3. Midwestern precipitation frequency project area (shown in red). Also shown is the border of the Southeastern precipitation frequency project area (blue line).

The main activities in this period were focused on data reformatting, initial data quality control, and extraction of annual maximum series. Table 4 provides a current list of potential data sources and their status. A total of 49 potential datasets were identified during the data collection stage. After a preliminary evaluation, decisions were made not to use data from 11 datasets (highlighted in gray) either because they had no stations with more than 10 years of data, duplicated data from another data source, or did not respond our data solicitation. Among the remaining datasets, 17 were reformatted into the HDSC standard format. If you have any questions about the data sources that will be used in the project, please contact us at HDSC.Questions@noaa.gov.

Table 4. Current list of potential precipitation data sources and status of formatting work.

Status	Source of data and dataset name	Data reporting interval	Number of stations or comment
Data formatted	National Climatic Data Center (NCDC)	daily	6668
	NCDC	hourly	1757
	NCDC	15-min	1017
	Environment Canada	daily	284
	Environment Canada	hourly	35
	U.S. Geological Survey (USGS)	daily	531
	National Atmospheric Deposition Program (NADP)	daily	58
	Natural Resource Conservation Service (NRCS): SNOTEL dataset	daily	106
	NRCS: SNOTEL	hourly	79
	High Plains Regional Climate Center (HPRCC): Automated Weather Data Network (AWDN)	hourly	167
	Bureau of Reclamation, Colorado, Kansas, Nebraska, North Dakota and South Dakota (USBR)	daily	41
	Community Collaborative Rain, Hail and Snow Network (CoCoRaHS), Colorado	daily	71
	Missouri Commercial Agriculture Weather Station (CAWS) Network	hourly	17
	North Dakota State Water Commission (NDSWC) Precipitation Network	daily	2890
	North Dakota Agricultural Weather Network (NDAWN), North Dakota State University	daily	70
	NDAWN	hourly	70
	Minnesota State Climatology Office, Department of Natural Resources	daily	344
Formatting in progress	Natural Resources Conservation Service: SCAN network	hourly	7
	US Army Corps of Engineers, Omaha District Office	hourly	60
	US Army Corps of Engineers, St. Louis District Office	hourly	86
	Colorado Agricultural Meteorological Network (CoAgMet)	hourly	69
	Oklahoma Mesonet	daily	134
	Northern Colorado Water Conservancy District	daily	23
	Atmospheric Radiation measurement (ARM) Southern Great Plains (SGP) Surface Meteorological Obs.System (SMOS) Network	1-min	21
To be formatted	Oklahoma Mesonet	hourly	TBD
	Oklahoma Mesonet	5-min	TBD
	Remote Automated Weather Stations (RAWS)	hourly	86
	Michigan Automated Weather Network (MAWN)	5-min	3
	Urban Drainage Flood Control District (UDFCD): ALERT Weather Station Network, Denver, CO	daily	131
	UDFCD: ALERT Weather Station Network, Denver, CO	5-min	TBD
	Fort Collins Utilities Department: ALERT System	daily	TBD
	Fort Collins Utilities Department: ALERT System	2-hour	TBD

Status	Source of data and dataset name	Data reporting interval	Number of stations or comment
	Fort Collins Utilities Department: ALERT System	30-min	TBD
	Overland Park: ALERT Precipitation Network (Kansas)	daily	58
	Minnesota Department of Transportation	15-min	TBD
	Metropolitan Council Environmental Services, Minnesota	15-min	TBD
	Southeastern Wisconsin Regional Planning Commission, Milwaukee Metropolitan Sewerage District (MMSD)	hourly	21
	Colorado Springs Utilities Department Network	daily	TBD
Datasets that will not be used	Meteorological Assimilation Data Ingest System (MADIS)	5-min	Established in 2001
	Road Weather Information System (RWIS) network	–	Real-time obs.; insufficient length
	Colorado Climate Center, Colorado State University	–	Fee for data; same as the CoAgMet
	MesoWest Colorado	–	Data from other data sources; does not operate any raingauges
	Denver Water Network	weekly	Established in 2003
	Iowa AgClimate Network	hourly	Removed the data based on manager's recommendation
	Kansas State University, State Climate Office	–	Same as NCDC
	Southwest Kansas Mesonet	hourly	Established in 2002
	Michigan State University Climatology Program	daily	Established in 2003
	Minnesota Climatology Group/High Spatial Density Precipitation Network (HIDEN)	daily	Same as MN DNR
	University of Missouri, State Climate Office	hourly	Same as CAWS

A few datasets were found without elevation information. HDSC may use a digital elevation model (DEM) or Google Earth to fill in the missing elevation information.

While working on the data formatting, initial data quality control was applied to pre-screen data with abnormal (extremely large or negative) values and gaps. A few datasets were identified with data quality issues (e.g., suspicious data and/or large amounts of missing data) during this procedure. The agencies that provided the data were contacted to resolve some of the issues. Some provided further internal data quality control measures and flags. In addition, we began examining co-located 15-minute, hourly and daily stations primarily to eliminate data that are actually aggregations of the 15-minute (or hourly) data.

A wet season analysis was started to delineate regions with similar extreme climatology to assist in extracting meaningful annual maxima for frequency analysis. The wet season for extraction purposes is assigned by inspecting histograms of annual maxima for the 1-day and 1-hour durations and by assessing the periods in which two-thirds of annual maxima occurred at each station.

4.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Jan - Mar 2010)

The main focus for the next reporting period will be data reformatting, initial data quality control and extraction of annual maximum series.

4.3. PROJECT SCHEDULE

Data collection, formatting, and initial quality control [August 2009]

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]

Regionalization and frequency analysis [November 2010]

Initial spatial interpolation of PF estimates and consistency checks across durations [May 2011]

Peer review [July 2011]

Revision of PF estimates [October 2011]

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

Web publication [May 2012]

5. PRECIPITATION FREQUENCY PROJECT FOR ALASKA

5.1. PROGRESS IN THIS REPORTING PERIOD (Oct - Dec 2009)

The University of Alaska, Fairbanks (UAF) is moving forward on the joint effort with NWS to update precipitation frequency estimates for Alaska. UAF continues with data collection, formatting, and quality control.

5.1.1. Data collection and formatting

Data from all major reporting agencies have been collected. However, there are a few small outstanding datasets that UAF continues to pursue. The collected data have been reformatted to the NWS specifications and a NWS format-checking program has been used to review data file consistency. Systematic errors occurring as a result of the reformatting process have been corrected. During the review process some errors in the original source data were identified that are being investigated for two datasets. Table 5 provides basic information on datasets: current status of data formatting, data source, data type, number of stations in each dataset, and comments. This table is subject to change as a result of the quality control process to be performed after all data are collected.

Table 5. List of data sources, number of stations in each dataset, data reporting intervals, and their current status of formatting or collection

Formatting status	Source of data and dataset name	Data reporting interval	Number of stations	Formatting and other comments
Data formatted	Arctic-Long Term Ecological Research Site (LTER)	daily	3	
	Environment Canada	daily	132	Duplication issues within source dataset.
	Natural Resources Conservation Service (NRCS) SNOTEL (SNOwpack TELemetry)	daily	63	
	Road Weather Information System (RWIS) - Alaska Department of Transportation	daily	15	Errors in source dataset.
	National Climate Data Center (NCDC)	daily	606	Leap-year issue (pre-1900).
	Bonanza Creek LTER	hourly	11	
	NCDC – TD3240	hourly	92	
	NCDC – Integrated Surface Hourly (ISH) Database	hourly	378	Errors in source dataset (values too large).
	Environment Canada	hourly	45	
	Arctic-Long Term Ecological Research Site (LTER)	hourly	3	
	Road Weather Information System (RWIS) - Alaska Department of Transportation	hourly	15	
	Water & Environmental Research Center (WERC) - North Slope	hourly	11	
	Remote Automated Weather Station (RAWS)	hourly	129	Errors in source dataset (values too large).

Formatting status	Source of data and dataset name	Data reporting interval	Number of stations	Formatting and other comments
	NCDC	15-min	38	
Formatting in progress	Arctic Transitions in the Land-Atmosphere System (ATLAS)-UAF		8	
Collecting data or metadata	Atmospheric Radiation Measurement (ARM) Program		2	Still trying to collect data.
	USGS-Benchmark Glaciers		2	Still trying to collect data. One station received.
	Circumpolar Active Layer Monitoring (CALM)		28	Still trying to collect data.

5.1.2. Data bias correction

The influence of under-catch during extreme events may be mitigated by applying a bias correction to the data. In order to perform the bias correction, the presence of an alter shield at the site needs to be determined. Agencies were contacted to determine whether the gauges for their sites are equipped with alter shields. Some of the stations may have been retrofitted with an alter shield after the time of original site installation. The date of installation of alter shields at stations in this situation may be difficult to determine.

Wind speed data are also needed to perform the bias correction. Two preliminary graphs of wind data for each of three weather stations in different geographic regions of the state were created, one based on hourly wind speed data and one from daily wind speed data for a period of approximately 50 years. These graphs illustrate the differences in wind speed intensity due to the different time increment used for recording the data. As expected, wind speeds measured hourly showed much greater peaks than the daily data.

5.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Jan - Mar 2010)

The main focus during the next reporting period will be quality control of formatted data and subsequent AMS extraction.

5.3. PROJECT SCHEDULE

Data collection, formatting, and initial quality control [January 2010]

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) [February 2010]

Regionalization and frequency analysis [September 2010]

Initial spatial interpolation of PF estimates and consistency checks across durations [January 2011]

Peer review [March 2011]

Revision of PF estimates [May 2011]

Remaining tasks (e.g., development of precipitation frequency estimates for PD series, seasonality, temporal distributions, documentation) [August 2011]

Web publication [September 2011]

6. AREAL REDUCTION FACTORS

6.1. PROGRESS IN THIS REPORTING PERIOD (Oct - Dec 2009)

HDSC is developing geographically-fixed areal reduction factors that can be used to convert point precipitation frequency estimates into corresponding areal estimates in the United States. For a given average recurrence interval, rainfall duration and area size, the areal reduction factor (ARF) is defined as a ratio of average point depth and areal depth with the same recurrence interval.

Although insufficient time and resources have previously prevented it from moving forward, HDSC is now able to devote resources to this project. We have begun a literature review and an assessment of past approaches and collected data.

6.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Jan - Mar 2010)

HDSC will complete a literature review and begin investigating an approach that utilizes radar-estimated precipitation.

III. OTHER

1. RECENT MEETINGS

On November 17th, 2009, Dr. Sanja Perica attended the Hydrology Research Workshop on Revising Regulatory Guide 1.59 “Design Basis Floods for Nuclear Power Plants” at USNRC, Rockville, MD hosted by the Nuclear Regulatory Commission. One of the topics discussed in the workshop was on approaches for updating extreme precipitation records throughout the USA.

On November 19th, 2009, Dr. Perica, attended the meeting of the Hydrologic Frequency Analysis Work Group (HFAWG) at Michael Baker, Jr., Inc. in Alexandria, VA. HFAWG is part of the Advisory Committee on Water Information (ACWI) Subcommittee on Hydrology (SOH). Discussions focused on the comparison of existing Bulletin 17B procedures and the Expected Moments Algorithm (EMA) procedures for estimation of sample moments.

On December 8th, 2009, Dr. Perica attended Extreme Storm Event Work Group teleconference. The Work Group is also part of the ACWI/SOH that focuses on design precipitation estimates up to probable maximum precipitation. The topic of discussion was "Development of Strategy for a National Methodology for Estimating Extreme Storm Precipitation."

2. PERSONNEL

Sandra Pavlovic joined HDSC on December 14, 2009 as a new full-time contractor to HDSC. Ms. Pavlovic has a Bachelor of Science degree and a Master of Science degree in Water Resources Engineering / Hydrology from the Civil and Environmental Engineering Department, University of Maryland, in College Park, MD. She has significant knowledge and experience in using various statistical techniques relevant to HDSC work. She will participate in the evaluation of new statistical approaches and implementation of existing approaches related to various precipitation frequency analysis and data quality control tasks as well as areal reduction factors.

Lastly, HDSC is still actively seeking to fill a Project Scientist II position through University Corporation for Atmospheric Research (UCAR) to lead the research and evaluation of new statistical approaches relevant to HDSC’s work in collaboration with the Office of Hydrology management.