HYDROMETEOROLOGICAL DESIGN STUDIES CENTER
QUARTERLY PROGRESS REPORT

1 July 2009 to 30 September 2009

Office of Hydrologic Development

U.S. National Weather Service

National Oceanic and Atmospheric Administration

Silver Spring, Maryland

October 2009

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., 90% confidence intervals, temporal distributions, seasonality) are published in NOAA Atlas 14. The Atlas is divided into volumes based on geographic sections of the country. 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 the remainder of California (not included in NOAA Atlas 14, Volume 1), selected Pacific Islands, 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 4.

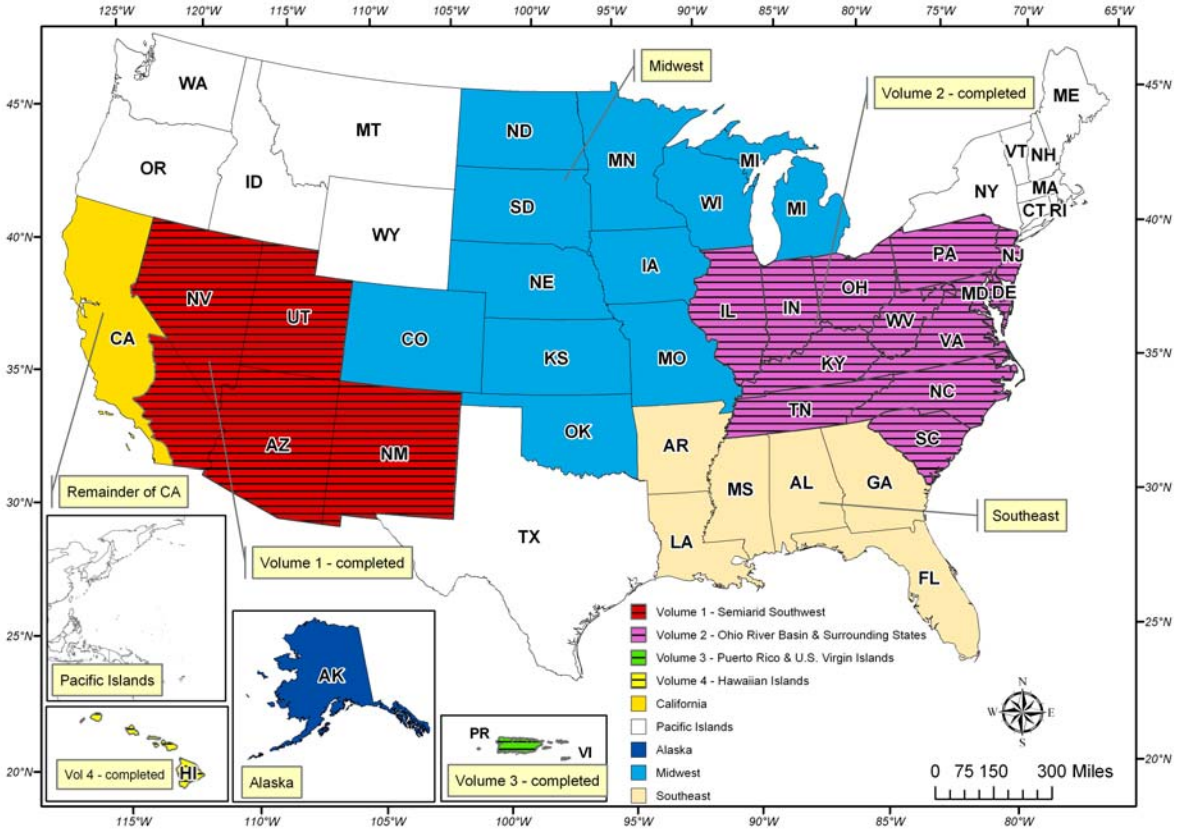

Figure 1. Map showing current project areas and project areas included in NOAA Atlas 14, Volumes 1-4.

II. CURRENT PROJECTS

1. PRECIPITATION FREQUENCY PROJECT FOR THE REMAINDER OF CALIFORNIA

1.1. PROGRESS IN THIS REPORTING PERIOD (Jul - Sep 2009)

1.1.1. Data collection and formatting

Table 1 provides basic information on all datasets, including data type, data source, number of stations in each processed dataset, and the number of stations retained after initial screening. The number of stations after screening represents those that meet several requirements, including minimum number of data years. Daily and hourly stations were retained for further review if they had: a) at least 30 years of data, or b) between 10 and 30 years of data and no station with more than 30 years within 5 miles, or c) at least 10 years of data at elevations above 2,500 feet. These numbers also account for stations that were merged to produce longer records, initial deletions based on data quality assessments, and stations that were screened for co-located data, which is described in the next section. They are subject to change as we further review and screen the data. Since the last progress report, all datasets have been formatted, but 5-minute and ALERT data have not yet been screened. Hourly SNOTEL data, although did not pass initial screening requirements and will not be directly used in frequency analysis, are kept, because they are the primary source of information in high elevation areas.

Table 1. List of data types, data sources, number of stations in each processed dataset, and number of stations after initial screening (ALERT gauges measure precipitation using tipping buckets in increments of 0.04 in).

Data type	Data source	Number of stations processed	Number of stations after screening
Daily	National Climatic Data Center (NCDC)	1,356	519
	CA Department of Water Resources	382	96
	U.S. Army Corps of Engineers	43	38
	Santa Barbara County Flood Control District	161	85
	LA County Dept. of Public Works	1,180	397
	San Diego County Flood Control District	67	11
	California Nevada River Forecast Center	553	13
	Ventura County Watershed Protection District	104	79
	City of Roseville, Dept. of Public Works	6	2
	Santa Clara Valley Water District	130	47
	U.S. Geological Survey (USGS)	10	1
	Contra Costa Flood Control District and Water Conservation District	15	8

Data type	Data source	Number of stations processed	Number of stations after screening
	SNOTEL	152	51
	NCDC's CLIMVIS Global Summary (Mexico)	33	16
	Alameda County Flood Control District	54	54
Hourly	National Climatic Data Center	540	310
	CA Department of Water Resources	345	0
	U.S. Army Corps of Engineers	43	31
	Metro Flood Control District, Fresno	8	0
	Jim Goodridge, Retired State Climatologist	337	149
	Remote Automatic Weather Station data (RAWS)	250	157
	City of Roseville, Dept. of Public Works	5	1
	USGS	6	3
	SNOTEL	64	TBD
	Alameda County Flood Control District	10	9
15-min	National Climatic Data Center	477	319
	Alameda County Flood Control District	3	2
5-min	National Climatic Data Center	24	TBD
	Santa Barbara County Flood Control District	36	TBD
	LA County Dept. of Public Works	62	TBD
	Contra Costa Flood Control District and Water Conservation District	17	TBD
	Riverside County Flood Control District	38	TBD
ALERT	Orange County California Dept. of Parks & Recreation	45	TBD
	San Diego County Flood Control District	67	TBD
	Marin County Flood Control and Water Conservation District	5	TBD
	Alameda County Flood Control District	TBD	TBD

1.1.2. Data quality control

a. Co-located stations

There are approximately 700 sets of NCDC stations with the same station ID reporting precipitation amounts at different time steps. They were reviewed for consistency and for potential extension of annual maximum series (AMS) data at stations reporting at longer durations from stations reporting at shorter durations. Data from 15-minute stations were aggregated to constrained 1-hour amounts (i.e., 0 to 60 minutes) and compared with corresponding 1-hour amounts recorded at co-located hourly stations. Similarly, hourly and 15-minute data were aggregated to constrained 1-day amounts (i.e., midnight to midnight

aggregations) for comparison with 1-day amounts recorded at co-located daily stations. Cases where high events were recorded in one data type but not another were noted for further quality control. If the annual maximum series of the co-located stations were essentially the same, then only the data from the station with the shorter reporting interval were retained and will be used to extract AMS for the longer durations. Where possible, data records were extended at hourly and daily stations by aggregating the data from the station with the shorter time-step (15-minute or 1-hour, respectively). As a result of this screening, 39 daily and 61 hourly stations were deleted. The records of 29 daily stations were extended.

b. **Quality control of AMS**

High and low outliers were identified and reviewed for consistency relative to data at nearby stations for the 1-day and 1-hour annual maximum series data. 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. Out of the 1-day annual maximum series data from 1,886 daily stations with at least 10 years of data, 284 corrections were made to the raw data resulting from a check of high outliers and 164 low outliers were set to missing in 1-day AMS data. Out of the 1-hour annual maximum series data from 842 hourly stations with at least 10 years of data, more than 156 corrections were made to the raw data based on high outliers and 48 low outliers were set to missing in the 1-hour AMS data. In addition, a significant number of erroneous values were identified in the RAWS data which led to a correction in the formatting of the incremental data. Stations where corrections were made are being re-checked for any additional outliers.

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. Annual maximum series data at relevant stations were compared and decisions were made on what stations to delete or merge.

1.1.3. Regionalization

To support a regional frequency analysis approach, homogeneous regions (groups of stations) must be developed and tested for homogeneity/heterogeneity using statistical measures. Preliminary regions were developed using a nonhierarchical cluster K-mean clustering algorithm with latitude, longitude, and 1-day mean annual maximum as attribute variables. In addition, independent regional delineation has been done by two meteorologists, based on their assessment of local climate, topography and extreme precipitation characteristics. A composite of three will be used to develop an initial set of 16-20 regions. They will be further refined into smaller regions based on 1-day statistical measures and physical considerations.

1.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct - Dec 2009)

During the next quarter, the quality control and data reliability testing for the AMS data across all durations will be completed. Correction factors for constrained to unconstrained observations for 1-day to 24-hour, 2-day to 48-hour, 1-hour to 60-minute and 2-hour to 120-minute will be computed.

Initial regionalization of 1-day and 1-hour data will be completed and work will start on refinement of those regions. This will include frequency analysis of station specific AMS data to investigate station and regional statistical measures.

1.3. PROJECT SCHEDULE

Data collection, formatting and initial quality control [July 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) [September 2009]

Regionalization and frequency analysis [January 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 (Jul - Sep 2009)

2.1.1. Peer review

After an internal review, preliminary precipitation frequency estimates were finalized and released for a public peer review. A temporary web interface and cartographic maps were created for this purpose. HDSC conducted the peer review of the preliminary results during the period July 21, 2009 to August 15, 2009. The review included the following items:

1. AMS-based depth-duration-frequency and intensity-duration-frequency curves at gauged locations (Table 2 provides basic information on the number of stations available in each territory/nation/state per duration that were used in the frequency analysis);
2. mean annual maximum precipitation maps for 60-minute, 24-hour, and 10-day durations;
3. 100-year precipitation frequency maps for 60-minute, 24-hour, and 10-day durations;
4. map showing regional groupings of stations used in frequency analysis .

HDSC received comments from two parties. A summary of the comments and HDSC's responses will be provided in the final documentation for the project.

Table 2. Number of stations available in each territory/nation/state per duration.

Territory or nation/state		Island/atoll	Number of stations (after merge) with at least 10 years of data per duration			
			≥1 day	≥1 hr	≥ 15 min	< 15 min
Territory of American Samoa		Tutuila	12	4	2	1
		Ta'u	1	0	0	0
Commonwealth of the Northern Mariana Islands		Rota	2	1	1	0
		Saipan	4	2	2	0
		Tinian	1	0	0	0
Federated States of Micronesia	State of Chuuk	Lukunoch	1	0	0	0
		Polowat	1	0	0	0
		Weno	1	1	0	1
	State of Kosrae	Kosrae	4	0	0	0
	State of Pohnpei	Mokil Atoll	1	0	0	0
		Nukuoro Atoll	1	0	0	0
		Pingelap Atoll	1	0	0	0
		Pohnpei	6	1	1	1
	State of Yap	Gagil-Tamil	1	0	0	0
		Maap	1	0	0	0
		Rumung	1	0	0	0
		Ulithi Atoll	1	0	0	0
		Woleai Atolls	1	0	0	0

	Yap	4	1	0	1
Territory of Guam	Cocos Island	1	0	0	0
	Guam	17	7	3	1
Republic of Palau	Angaur	1	0	0	0
	Babelthuap	3	0	0	0
	Koror	1	1	0	1
	Malakal	1	0	0	0
	Peleliu	1	0	0	0
Republic of Marshall Islands	Majuro Atoll	2	1	0	0
	Mili Atoll	1	0	0	0
	Utirik Atoll	1	0	0	0
	Wotje Atoll	1	0	0	0
	Ailinglapalap Atoll	1	0	0	0
	Enewetak Atoll	1	0	0	0
	Kwajalein Island	1	0	0	0
	Jaluit Atoll	1	0	0	0
U.S. Minor Outlying Islands	Wake Island	1	1	0	0
TOTAL		80	20	9	6

2.1.2. Revisions to at-site depth-duration-frequency curves

All tasks completed before the peer review were revisited. Additional work was done to confirm station metadata. Homogeneous regions for computing precipitation frequency estimates were slightly refined. The effects of regionalization and smoothing on original precipitation frequency estimates were investigated.

2.1.3. Revisions to spatially interpolated precipitation frequency grids

Since for this project PRISM (Parameter-elevation Regressions on Independent Slopes Model) mean annual maximum grids were not available, the HDSC-developed spatial interpolation technique (termed the Cascade, Residual Add-Back - CRAB) technique could not be used to convert mean annual maximum grids into precipitation frequency grids for various frequencies and durations. Alternative interpolation methods based on elevation and mean annual precipitation grids were used instead. HDSC continues to evaluate various interpolation methods to minimize the error and ensure consistency across all durations.

2.1.4. Miscellaneous tasks

90% confidence intervals on precipitation frequency curves have been computed for all durations. Temporal distributions of heavy precipitation for use with the precipitation frequency estimates were also computed for selected durations (6, 12, 24, and 96 hours). Work on accompanying documentation and related web pages is also in progress.

2.1.5. Public outreach

In an effort to make the Pacific Island communities aware of the upcoming release of precipitation frequency estimates, HDSC notified via email relevant government agencies. If you would like more information, please contact HDSC at HDSC.Questions@noaa.gov.

2.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct - Dec 2009)

Final precipitation frequency estimates with accompanying information will be released during this reporting period.

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) [Near completion]

Web publication [October 2009]

3. PRECIPITATION FREQUENCY PROJECT FOR THE SOUTHEASTERN STATES

3.1. PROGRESS IN THIS REPORTING PERIOD (Jul - Sep 2009)

The project covers 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 help homogeneous region delineation for frequency analysis (Figure 2).

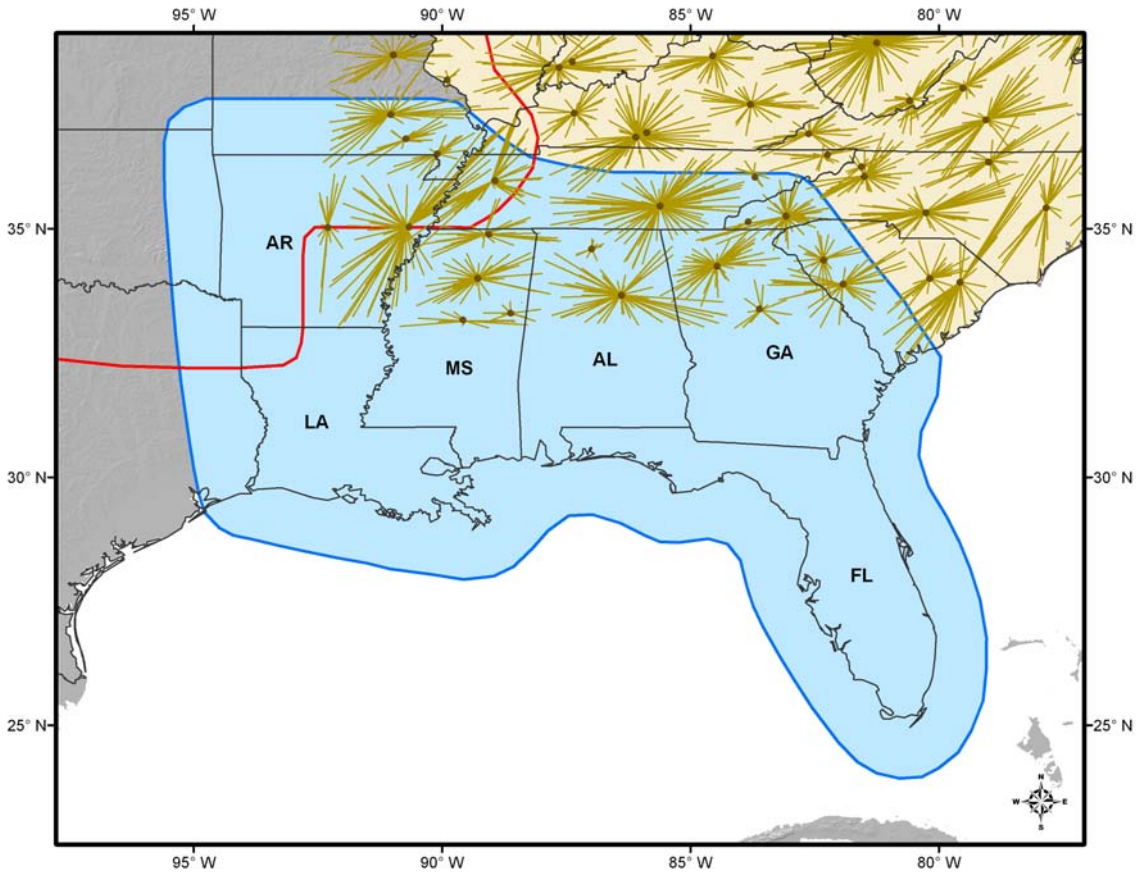

Figure 2. Southeastern precipitation frequency project area (shown in blue). Also shown are regional groupings of stations from NOAA Atlas 14, Volume 2 (brown spider lines) and border of Midwestern precipitation frequency project area (red line).

The main activities in this period were focused on data acquisition, evaluation, and reformatting. A total of 35 potential data sources have been identified. Table 3 provides a current list of potential data sources and their status. Ten datasets were downloaded from the internet or received after contacting the data sources. Two datasets (NCDC and USGS data) were reformatted into the HDSC standard format. After a preliminary evaluation, decisions were made not to use data from 18 data sources (highlighted in gray) either because they had no stations with more than 10 years of data or duplicated data from another data source. We are still waiting to hear back from a few data sources, but have otherwise completed the data collection effort. If you have any questions about the data sources that will be used in the project, please let us know by email to HDSC.Questions@noaa.gov.

Table 3. Current list of potential precipitation data sources and data types.

Data source	Data type	Preliminary number of stations	Data received so far	Decision	Comments
National Climatic Data Center (NCDC)	15-min; hourly; daily	478; 963; 3235	Metadata and data	Will use	Formatted
U.S. Climate Reference Network (NCDC)	5-min	–	–	Will not use	Established in 2003
U.S. Geological Survey (USGS)	daily	710	Metadata and data	Will use	Formatted
USGS, Georgia Water Science Center	daily	212	Metadata and data	TBD	Received
Remote Automated Weather Stations (RAWS)	hourly	TBD	Metadata and data	TBD	Downloaded
National Atmospheric Deposition Program (NADP)	daily	89	Metadata and data	Will use	Downloaded
Natural Resources Conservation Service SCAN network	15-min	8	Metadata and data	Will use	Downloaded
Road Weather Information System (RWIS) network	–	–	–	Will not use	Real-time observations; insufficient data length
Alabama Office of the State Climatologist	–	–	–	Will not use	Data from NOAA
Alabama Mesonet/NRCS Soil Climate Analysis Network (SCAN)	daily	14	Metadata and data	Will not use	Established in 2002
Auburn University Mesonet	daily	21	Metadata	Will not use	Fee for Data
Cooperative Huntsville Area Rainfall Measurements (CHARM), Alabama	daily	170	–	Will not use	Established in 2001
Arkansas Red Basin River Forecast Center	daily	1200	Sample data	Will not use	Same as NCDC
Florida Climate Center	hourly; daily	111		TBD	Same as NCDC; Contacted
Northwest Florida Water Management District (NWFWMD)	5-min	30-40		TBD	Contacted
South Florida Water Management District (SFWMD)	5-min; daily	TBD	Metadata and data	Will use	Received
St. Johns River Water Management District (SJRWMD)	daily	54	Metadata and data	Will use	Received
Lake Okeechobee Lakewatch Rainfall Monitoring Program, Florida	daily	10	–	Will not use	Part of SFWMD
Capital Area Flood Warning Network, Florida	5-min	20	–	Will not use	Established in 2005
Natural Resources Management Office, Brevard County, Florida	daily	2	Data	Will use	Received

Data source	Data type	Preliminary number of stations	Data received so far	Decision	Comments
Brevard County Utility Services Department, Florida	daily	2	Data	Remove	Same as above
Department of Barefoot Bay Water and Sewer District, Florida	monthly	2	Data	Remove	Same as above
Public Waters and Utilities Administration, City of Melbourne, Florida	daily	1	Data	Will not use	No metadata available
City of Vero Beach, Florida	daily	1	Metadata and data	Will use	Received
TRMM Satellite Validation Office, Florida site	TBD	TBD	Metadata and data	Will use	Downloaded
Florida Automated Weather Network (FAWN), University of Florida	15-min	35	Metadata and data	Will use	Downloaded
Stormwater Management Academy, University of Central Florida	–	–	–	Will not use	Not collecting raingauge data
WEAR WeatherNet, Florida	5-min	71	–	Will not use	Real-time observations; insufficient data length
Georgia State Climatology Office	TBD	TBD		TBD	Contacted
Georgia Automated Environmental Monitoring Network (GAEMN)	15-min	78	Metadata	Will not use	Fee for data
Georgia Forestry Commission Weather Station Network	hourly	19	Metadata and data	Will use	Received
GeorgiaWx.net Mesonet System	–	–	–	Will not use	Real-time observations; insufficient data length
Mississippi State Climatologist	TBD	TBD		TBD	Contacted
Delta Research and Extension Center (DREC) Network, Mississippi	–	–	–	Will not use	Data forwarded to NOAA
Mississippi Mesonet	hourly	15	–	Will not use	Established in 2004

3.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct - Dec 2009)

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

3.3. PROJECTED 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 (Jul - Sep 2009)

The project covers 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 help homogeneous region delineation for frequency analysis (Figure 3).

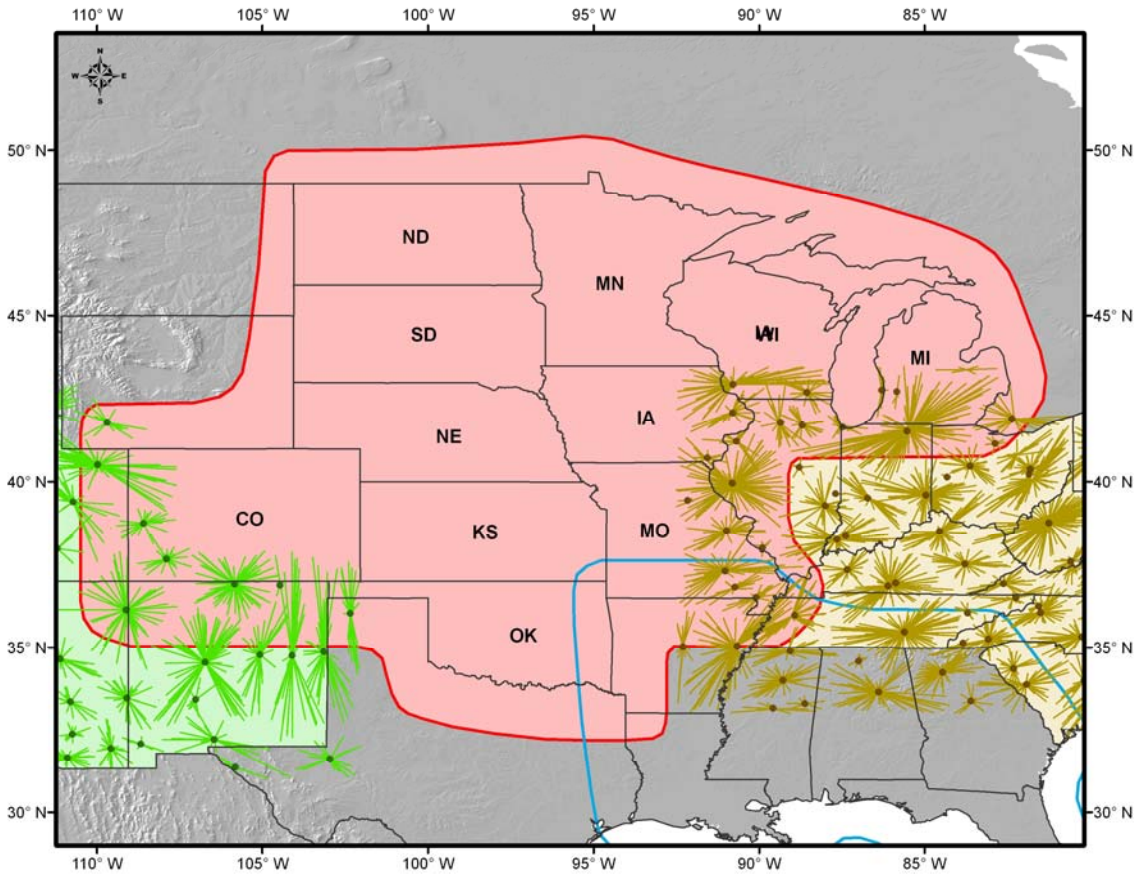

Figure 3. Midwestern precipitation frequency project area (shown in red). Also shown are regional groupings of stations from NOAA Atlas 14, Volume 1 and 2 (green and brown spider lines, respectively) and border of Southeastern precipitation frequency project area (blue line).

The main activities in this period were focused on data acquisition, evaluation, and reformatting. A total of 39 potential data sources have been identified. Table 4 provides a current list of potential data sources and their status. 17 datasets were downloaded from the internet or received after contacting the data sources. Two datasets (NCDC and USGS data) were reformatted into the HDSC standard format. After a preliminary evaluation, decisions were made not to use data from 9 data sources (highlighted in gray) either because they had no stations with more than 10 years of data or duplicated data from another data source.. We are

still waiting to hear back from a few data sources, but have otherwise completed the data collection effort. If you have any questions about the data sources that will be used in the project, please let us know by email to HDSC.Questions@noaa.gov.

Table 4. Current list of potential precipitation data sources and data types.

Data source	Data type	Preliminary number of stations	Data received so far	Decision	Comments
National Climatic Data Center (NCDC)	15-min; hourly; daily	1017; 1757; 6668	Metadata and data	Will use	Formatted
Environment Canada	hourly; daily	35; 285	Metadata and data	Will use	Received
U.S. Geological Survey (USGS)	daily	531	Metadata and data	Will use	Formatted
National Atmospheric Deposition Program (NADP)	daily	163	Metadata and data	Will use	Downloaded
Natural Resource Conservation Service (NRCS) SNOTEL data	hourly; daily	111	Metadata and data	Will use	Downloaded
Natural Resources Conservation Service SCAN network	15-min	5	Metadata and data	Will use	Downloaded
Bureau of Reclamation, Colorado, Kansas, Nebraska, North Dakota and South Dakota	daily	41	Metadata and data	Will use	Received
US Army Corps of Engineers, Omaha District Office	hourly	60	Metadata and data	Will use	Received
US Army Corps of Engineers, St. Louis District Office	TBD	86	Metadata and data	Will use	Received
Remote Automated Weather Stations (RAWS)	hourly	86	Metadata and data	TBD	Downloaded
High Plains Regional Climate Center (HPRCC) Automated Weather Data Network (AWDN)	hourly	167	Metadata and data	TBD	Downloaded
Meteorological Assimilation Data Ingest System (MADIS)	5-min	230	–	Will not use	Established in 2001
Road Weather Information System (RWIS) network	–	–	–	Will not use	Real-time obs.; insufficient data length
Colorado Agricultural Meteorological Network (CoAgMet)	hourly	69	Metadata and data	Will use	Downloaded
Colorado Climate Center, Colorado State University	–	–	–	Will not use	Fee for data; same as the CoAgMet data
Community Collaborative Rain, Hail and Snow Network (CoCoRaHS), Colorado	daily	4000	Metadata and data	Will use	Received
MesoWest Colorado	–	–	–	Will not use	Data from other data sources; does not operate any raingauges
Northern Colorado Water Conservancy District	daily	23	Metadata and data	Will use	Downloaded
Urban Drainage Flood Control District (UDFCD) ALERT Weather Station Network, Denver, CO	5-min; daily	131	Metadata and data	Will use	Downloaded
Denver Water Network	weekly	–	–	Will not use	Established in 2003
Fort Collins Utilities Department ALERT System	30-min; 2-hour; daily	55	Metadata and data	Will use	Received
Colorado Springs Utilities Department Network	daily	5	Metadata	TBD	Contacted

Data source	Data type	Preliminary number of stations	Data received so far	Decision	Comments
Iowa AgClimate Network	hourly	13	Metadata and data	Will use	Downloaded
Kansas State University, State Climate Office	daily	500		TBD	Expecting data by August 15, 2009
Southwest Kansas Mesonet	hourly	8	–	Will not use	Established in 2002
Overland Park ALERT Precipitation Network (Kansas)	daily	58	Metadata and data	Will use	Received
Michigan State University Climatology Program	daily	112	–	Will not use	Established in 2003
Michigan Automated Weather Network (MAWN)	5-min	3	Metadata and data	Will use	Downloaded
Minnesota State Climatology Office, Department of Natural Resources	daily	1544	Sample data	TBD	Expecting data by September 14, 2009
Minnesota Climatology Group/High Spatial Density Precipitation Network (HIDEN)	daily	–	–	Will not use	Same as DNR data
Minnesota Department of Transportation	15-min	TBD	Metadata and data	TBD	Received
Metropolitan Council Environmental Services, Minnesota	15-min	TBD	Metadata and data	TBD	Received
University of Missouri, State Climate Office	daily; hourly	28	Metadata	TBD	Contacted
Missouri Commercial Agriculture Weather Station (CAWS) Network	hourly	21	–	Will not use	Established in 2000
North Dakota State Water Commission (NDSWC) Precipitation Network	daily	725	Metadata and data	Will use	Downloaded
North Dakota Agricultural Weather Network (NDAWN), North Dakota State University	10-min; hourly; daily	70	Metadata and data	TBD	Received
Oklahoma Mesonet	5-min; hourly; daily	134	Metadata and data	Will use	Downloaded
Atmospheric Radiation measurement (ARM) Southern Great Plains (SGP) Surface Meteorological Observation System (SMOS) Network	1-min	21	Metadata and data	Will use	Downloaded
Southeastern Wisconsin Regional Planning Commission, Milwaukee Metropolitan Sewerage District	hourly	21	Metadata and data	TBD	Received

4.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct - Dec 2009)

The main focus for the next period will be data reformatting, evaluation, extraction of annual maximum series, and quality control, as well as a review of related literature.

4.3. PROJECTED 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 (Jul - Sep 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.

Reformatting of these datasets has largely been completed. Eight datasets were reformatted during the past quarter. These data are now going through preliminary quality control procedures. Table 5 provides basic information on datasets: data type, data source, number of stations in each dataset, current status of data collection, and current status of data formatting. This table is subject to change as a result of the quality control process to be performed after all data is collected.

Table 5. List of data types, data sources, number of stations in each dataset, current status of collection, and current status of formatting.

Data type	Data source	Number of stations	Status of collection	Status of formatting
Daily	Arctic-Long Term Ecological Research Site (LTER)	3	Complete	Complete
	Environment Canada	59	Complete	Complete
	Natural Resources Conservation Service (NRCS) SNOTEL (SNOwpack TELemetry)	63	Complete	Complete
	National Climate Data Center (NCDC)	674	Complete	Complete
Hourly	Bonanza Creek LTER	2	Complete	Complete
	NCDC	92		Complete
	Environment Canada	29	Complete	Complete
	Arctic Transitions in the Land-Atmosphere System (ATLAS) - UAF	8	Complete	In Progress
	Road Weather Information System (RWIS) - Alaska Department of Transportation	13	Complete	In Progress
	Water & Environmental Research Center (WERC) - North Slope	12	Complete	Complete
	United States Geological Survey (USGS)	TBD		
	Remote Automated Weather Station (RAWS)	142	Complete	Complete
15-min	NCDC	38	Complete	In Progress
Other	Atmospheric Radiation Measurement (ARM) Program	2	In Progress	
	USGS-Benchmark Glaciers	2	In Progress	
	Circumpolar Active Layer Monitoring (CALM)	28	In Progress	

5.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct - Dec 2009)

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

5.3. PROJECTED SCHEDULE

Data collection, formatting, and initial quality control [September 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) [January 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 (Jul - Sep 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.

Insufficient time and resources have prevented this project from moving forward, but that is expected to change as HDSC expands its human resources.

6.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (Oct - Dec 2009)

No progress is expected to be made on this project during the next reporting period. When additional resources become available, HDSC will investigate an approach that utilizes radar-estimated precipitation.

III. OTHER

1. PERSONNEL

1.1. Summer interns

HDSC hosted two student interns during the summer of 2009. Devin Peck joined HDSC through the District of Columbia Metropolitan Consortium (METCON) for Students in Science, Mathematics, and Engineering, Summer Career Orientation Program from June 29 through August 7, 2009. He worked primarily on data collection for the Midwest and Southeast projects. John Yarchoan joined HDSC ultimately through the Student Temporary Employment Program (STEP) from June 30 through August 25, 2009. He assisted with quality control for the California and Pacific Island projects.

1.2. New employees

Five new full-time employees began work with HDSC on September 1, 2009 to assist with the current precipitation frequency projects:

- Sarah Dietz has a bachelor's degree in computer science from Elizabethtown College, Elizabethtown, PA and a minor in Japanese. She has experience in a number of programming languages, operating systems and software relevant to HDSC's work and in particular to HDSC's web pages.
- Sarah Heim has bachelors' degrees in computer science and geography from Minnesota State University. With four years work experience in programming and GIS applications, Sarah's primary responsibility will be to maintain and update HDSC's web pages.
- Ishani Roy has masters' degrees in statistics (environmental track) from University of Maryland and in economics from Rabindra Bharati University, Calcutta, India. She has knowledge and experience in using various statistical techniques and programming languages relevant to HDSC's work.
- Dale Unruh has a master's degree in meteorology from University of Hawaii at Manoa, Hawaii and bachelor's degree in meteorology with a minor in mathematics from Millersville University, PA. He has experience in collecting and analyzing meteorological data and is proficient in several programming languages.
- Tan Zhao has a master's degree in environmental engineering from Michigan State University and a bachelor's degree in environmental engineering from Nanjing University in China. He also has knowledge of various statistical techniques relevant to HDSC work and experience in several programming languages.

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.