

Hydrometeorological Design Studies Center

Progress Report for Period

April 2021 to June 2021

Office of Water Prediction

National Weather Service

National Oceanic and Atmospheric Administration

U.S. Department of Commerce

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DISCLAIMER

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

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I. INTRODUCTION

The Hydrometeorological Design Studies Center (HDSC) within the Office of Water Prediction (OWP) of the National Oceanic and Atmospheric Administration’s (NOAA) National Weather Service (NWS) updates precipitation frequency estimates for parts of the United States and affiliated territories, in coordination with stakeholder requests. Updated precipitation frequency estimates, accompanied by additional relevant information, are published as NOAA Atlas 14 and are available for download from the [Precipitation Frequency Data Server \(PFDS\)](#).

NOAA Atlas 14 is divided into volumes based on geographic sections of the country and affiliated territories. Figure 1 shows the states or territories associated with each of the volumes of the Atlas. To date, precipitation frequency estimates have been updated for AZ, NV, NM, UT (Volume 1, 2004), DC, DE, IL, IN, KY, MD, NC, NJ, OH, PA, SC, TN, VA, WV (Volume 2, 2004), PR and U.S. Virgin Islands (Volume 3, 2006), HI (Volume 4, 2009), Selected Pacific Islands (Volume 5, 2009), CA (Volume 6, 2011), AK (Volume 7, 2011), CO, IA, KS, MI, MN, MO, ND, NE, OK, SD, WI (Volume 8, 2013), AL, AR, FL, GA, LA, MS (Volume 9, 2013), CT, MA, ME, NH, NY, RI, VT (Volume 10, 2015), and TX (Volume 11, 2018).

HDSC recently commenced work on a new NOAA Atlas 14 Volume 12 for a full precipitation frequency analysis covering the states of Idaho and Montana. The NOAA Atlas 14 Volume 12 precipitation frequency estimates are expected to be published by December 2023. No funding is available to extend NOAA Atlas 14 Volume 12 coverage to the remaining three northwestern states: Oregon, Washington and Wyoming. Figure 1 shows the new project area as well as updated project areas included in NOAA Atlas 14, Volumes 1 to 12.

For any inquiries regarding NOAA Atlas 14, please send an email to hdsc.questions@noaa.gov.

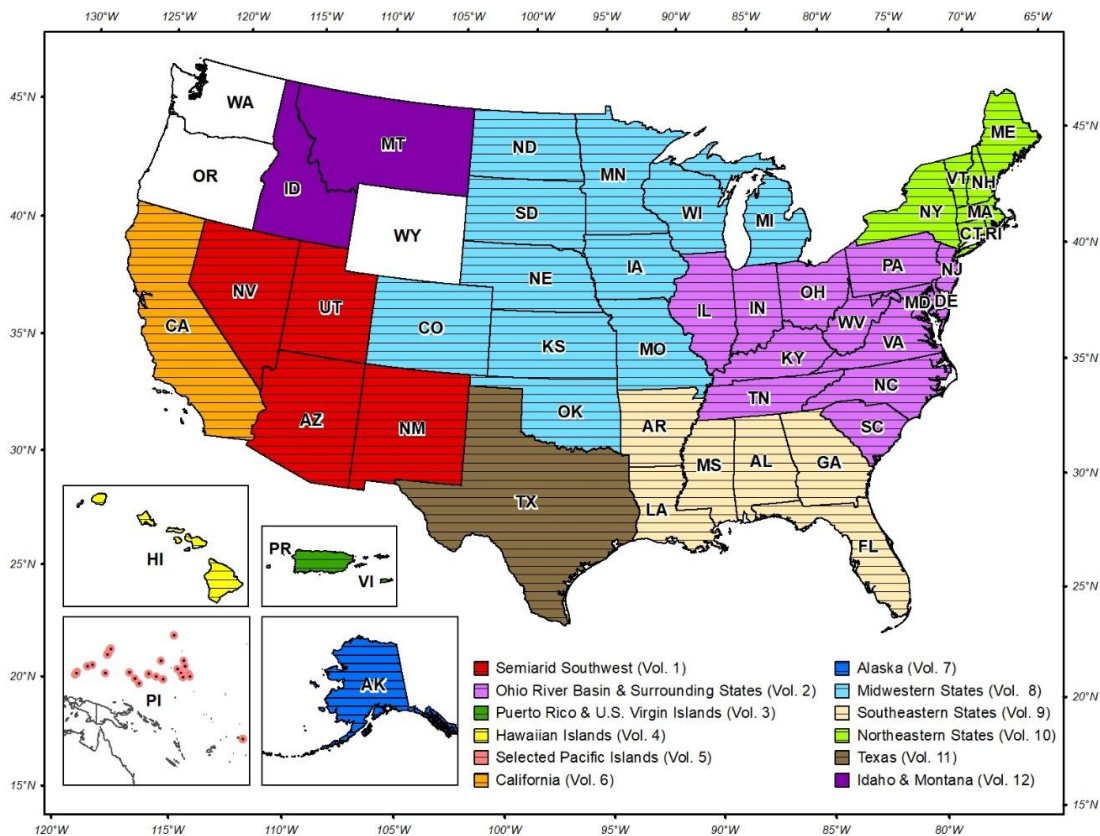


Figure 1. States or territories associated with each of the volumes of the Atlas.

II. CURRENT NOAA ATLAS 14 PROJECTS

1. VOLUME 12: IDAHO AND MONTANA STATES

On May 26, 2021, the HDSC commenced work on a new NOAA Atlas 14 Volume 12. The precipitation frequency estimates for this volume includes the states of Montana and Idaho and approximately a 1-degree buffer around these two states (Figure 2). This project's expected completion date is December of 2023.

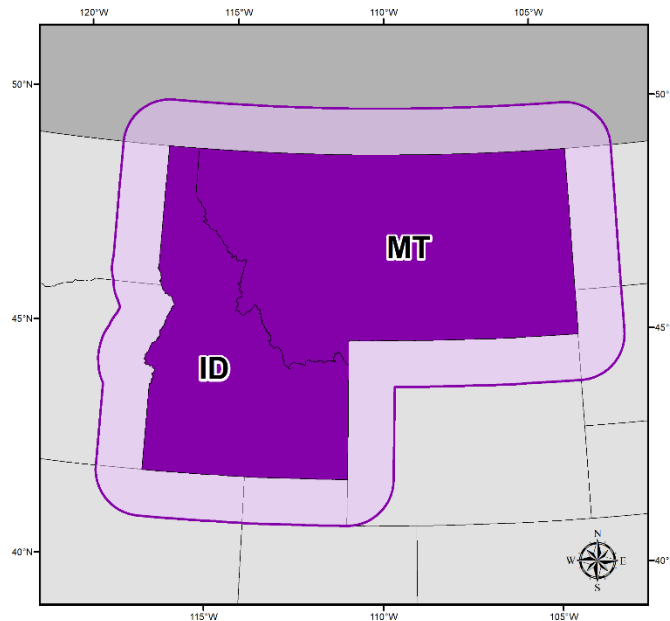


Figure 2. NOAA Atlas 14, Volume 12 extended project area (shown in purple).

1.1. PROGRESS IN THIS REPORTING PERIOD (Apr - June 2021)

1.1.1. Data collection and data screening

The primary source of NOAA Atlas 14 Volumes data is the NOAA's National Centers for Environmental Information (NCEI). The NCEI is the most reliable data source network in the United States. The NCEI's precipitation data alone may not be sufficient to support the objectives of NOAA Atlas 14. Since the NOAA Atlas 14 estimates are based on the statistical analysis of the historical record of the observed precipitation data, denser spatial coverage may be needed to compute the robust and reliable precipitation frequency estimates. Therefore, for each project area, we also collect digitized data measured at 1-day or shorter reporting intervals from other Federal, State and local agencies.

For this project area, we are interested in collecting all available precipitation datasets (daily, hourly, 5-minute, etc.) for stations in Idaho and Montana, as well as in adjacent portions of neighboring states (Nevada, North Dakota, Oregon, South Dakota, Utah, Washington and Wyoming) and also in Canada.

We have downloaded and formatted the following 15-minute, hourly and daily data from NCEI: DSI 3260, DSI 23240, Global Historical Climatology Network (GHCN) Daily, Integrated Surface Data (Lite), Quality Controlled Local Climatological Data (QCLCD), Raw Hourly Precipitation Data (RHP), and Unedited Local Climatological Data (ULCD). We have also downloaded 1-minute Automated Surface Observing System (ASOS) data.

In addition to NCEI, we have downloaded or received the following datasets: Snowpack Telemetry (SNOTEL) Network, United States Bureau of Reclamation (USBR) Hydromet, United States Bureau of Reclamation (USBR) Agricultural Weather Networks (AgriMet), Soil Climate Analysis Network (SCAN), High Plains Regional Climate Center (HPRCC), Idaho National Laboratory (INL) Air Resources Laboratory (ARL) Mesonet, Ada County Highway District and Northwest Watershed Research Center (NWRC). We have begun work on formatting the data and metadata from these datasets into our common format.

We identified additional datasets from other agencies as additional sources of potentially useful data. We have reached out to dataset providers or identified the most efficient ways of downloading the following data: Midwestern Regional Climate Center, CDMP 19th Century Forts and Voluntary Observers Database, Automated Weather Data Network (AWDN), National Weather Service Hydrometeorological Automated Data System (HADS), National Atmospheric Deposition Program (NADP), Remote Automatic Weather Stations (RAWS), U.S. Department of Agriculture (USDA), Agricultural Research Service (ARS), United States Geological Survey (USGS) National Water Information System (NWIS) dataset, Montana Department of Transportation Road Weather Information System (RWIS), and Environmental Canada.

During this reporting period, we also contacted our network of users and stakeholders to help us identify the data sources in the project area. We would like to thank all of those who responded to our inquiry and/or provided the data. We welcome any information on the data for this project area. If you have any relevant information, please contact us at hdsc.questions@noaa.gov.

1.1.2. Metadata quality control

We completed screening NCEI's stations' metadata (which make up the majority of the data for the project) for errors. Stations with potential errors were identified by reviewing published coordinates and elevations for large changes over the course of the station's lifetime. Stations with assigned elevations that were more than 10% different from elevations extracted from a 1 arcsecond (approx 30 meters) digital elevation model (DEM) are being investigated. Such stations may be re-located based on inspection of satellite images, maps and records of the station's history. Misplacements were typically the result of latitude and longitude data having inadequate precision. Original and revised coordinates for all stations used in the analysis will be provided in Appendix 1 of the accompanying NOAA Atlas 14 Volume 12 document. Stations with no elevation information were assigned DEM elevations and also investigated for possible location errors.

An example metadata correction for Volume 12 is the one for the NCEI daily station Huntley (GHCND:USC00244343). This station was flagged since the difference between the metadata elevation (3037 feet) and the gridded DEM elevation (4190 feet) showed a difference of 38 percent. Further investigation revealed that this station had incorrect longitude and latitude information, and as a result was plotting 48 miles away from its correct location. According to the [U.S Department of Commerce. Substation History: Montana, report, 1956: Washington D.C.](#), between April 19, 1906 and December 30, 1918 the station was located at a Bureau of Reclamation (USBR) camp located one

block west of the post office in Huntley, MT at an elevation of 3037 feet. The latitude longitude information in the same document is reported as 45.9°, -108.316667°, which is off by exactly one degree longitude from the current metadata of 45.9°, -109.316667° from NCEI. Based on this information, the station was moved to 45.8957° -108.3088° to match the approximate described location and elevation.

In some cases, station metadata information is inaccurate even if the difference between metadata elevation and DEM information is negligent. For example, the Montana station Springbrook (GHCND: USC00247796) has an elevation of 2580 feet and a DEM gridded value of 2694 feet, a difference of 4 percent. This station metadata was investigated since it measured the [Montana state record 24-hour precipitation](#) of 11.5 inches on June 20, 1921. The current NCEI metadata are 47.366667°, -105.75°, plotting this station about 8 miles west-southwest of Circle, MT. This metadata information is confirmed by substation history document for Montana; however, three documents listed below confirm that this station should be moved to "SE 6 miles of Circle."

1. For the substation history for Springbrook it notes that the "Station relocated 12 miles NNW of this location" and "Circle (near) 7 North of Circle Post Office", " ([U.S Department of Commerce. Substation History: Montana, report, 1956; Washington D.C](#))
2. "4 miles east and 9 miles south of Circle (near)" ([The Climatic Summary of the United States: Climatic Data Herein from the Establishment of Stations to 1930, Inclusive](#))
3. "Springbrook is located in a large rolling flat, surrounded by low hills and groves of trees" ([The Summaries of Climatological Data by Sections: Sections 1 to 30, inclusive, embracing the area from the Rocky mountain states to the Pacific coast, including southern and western Texas](#))

Based on all this information, this station was moved to 47.3838° -105.4797°, which is a move of about 13 miles. This location almost matches the 2580 feet elevation and is also along the West Fork Buffalo Springs Creek.

1.2. PROJECTED ACTIVITIES FOR THE NEXT REPORTING PERIOD (July - Sep 2021)

We will continue with data collection, reformatting, and station metadata checks for non-NCEI stations. All collected data will be examined and formatted into a common format, where appropriate.

The large portion of the work in the next reporting period will be on NCEI co-located station cleanup. Co-located station cleanup investigation involves reviewing time series plots of annual maxima at 1-hour and 1-day co-located stations. If the station with a shorter reporting interval provides the same information as a longer reporting interval, then the station with the shorter reporting interval is removed. If the station with the longer reporting interval has a longer period of record, then it was retained in the dataset in addition to the co-located station with the shorter reporting interval. Where appropriate, we identify data from stations recording at shorter intervals to extend records or to fill in gaps in records for collocated stations recording at longer intervals.

1.3. PROJECT SCHEDULE

- Data collection, formatting, and initial quality control [March 2022]
- Extraction of annual maximum series (AMS); additional quality control and data reliability tests (e.g., outliers, independence, consistency across durations, duplicate stations, candidates for merging) [May 2022]
- Regionalization and frequency analysis [August 2022]

- Initial spatial interpolation of precipitation frequency (PF) estimates and consistency checks across durations [November 2022]
- Peer review [January 2023]
- Revision of PF estimates [March 2023]
- Remaining tasks (e.g., development of precipitation frequency estimates for partial duration series, seasonality, temporal distributions, documentation) [September 2023]
- Web publication [December 2023]

III. OTHER

1. ANALYSIS OF IMPACTS OF NON-STATIONARY CLIMATE ON NOAA ATLAS 14 ESTIMATES

The work on the project to assess the impact of a non-stationary climate on the NOAA Atlas 14 method was put on hold from May, 2020 until May, 2021. Since late May 2021, the HDSC resumed the work on the non-stationary analysis and is currently in the process of summarizing the work performed by the academic partners in the two project phases. For more information on this project, please review the Progress Report from [October 2018 - March 2019](#).

2. CONFERENCES, MEETINGS

On May 11, HDSC group member Michael StLaurent and HDSC Mission Lead Mark Glaudemans gave a presentation at the Mid-Ohio Regional Planning Commission (MORPC) Virtual Regional Forum: Updating Ohio Precipitation Data for Stormwater and Flooding Planning on the NOAA Atlas 14 methodology.