

HAWAII PRECIPITATION FREQUENCY PROJECT

Update of *Technical Paper No. 43*

Twelfth Progress Report
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Hydrometeorological Design Studies Center
Hydrology Laboratory

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 this project. 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 purpose other than for what it was intended does so at their own risk.

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1. Introduction

The Hydrometeorological Design Studies Center (HDSC), Hydrology Laboratory, Office of Hydrologic Development, U.S. National Weather Service is updating its precipitation frequency estimates for Hawaii. Current precipitation frequency estimates for Hawaii are contained in *Technical Paper No. 43*, "Rainfall-Frequency Atlas of the Hawaiian Islands for Areas to 200 Square Miles, Durations to 24 Hours, and Return Periods from 1 to 100 Years" (U.S. Weather Bureau 1962). The update includes collecting data and performing quality control, compiling and formatting datasets for analyses, selecting applicable frequency distributions and fitting techniques, analyzing data, mapping and preparing reports and other documentation.

The Project will determine annual precipitation frequencies for durations from 5 minutes to 60 days, for return periods from 2 to 1,000 years. The Project will review and process all available rainfall data for the Project area and use accepted statistical methods. The Project results will be published as a Volume of NOAA Atlas 14 on the internet using web pages with the ability to download digital files.

The Project area covers the Hawaiian Islands including Hawaii, Maui, Lanai, Molokai, Oahu, and Kauai. The Project area including preliminary regions is shown in Figure 1.

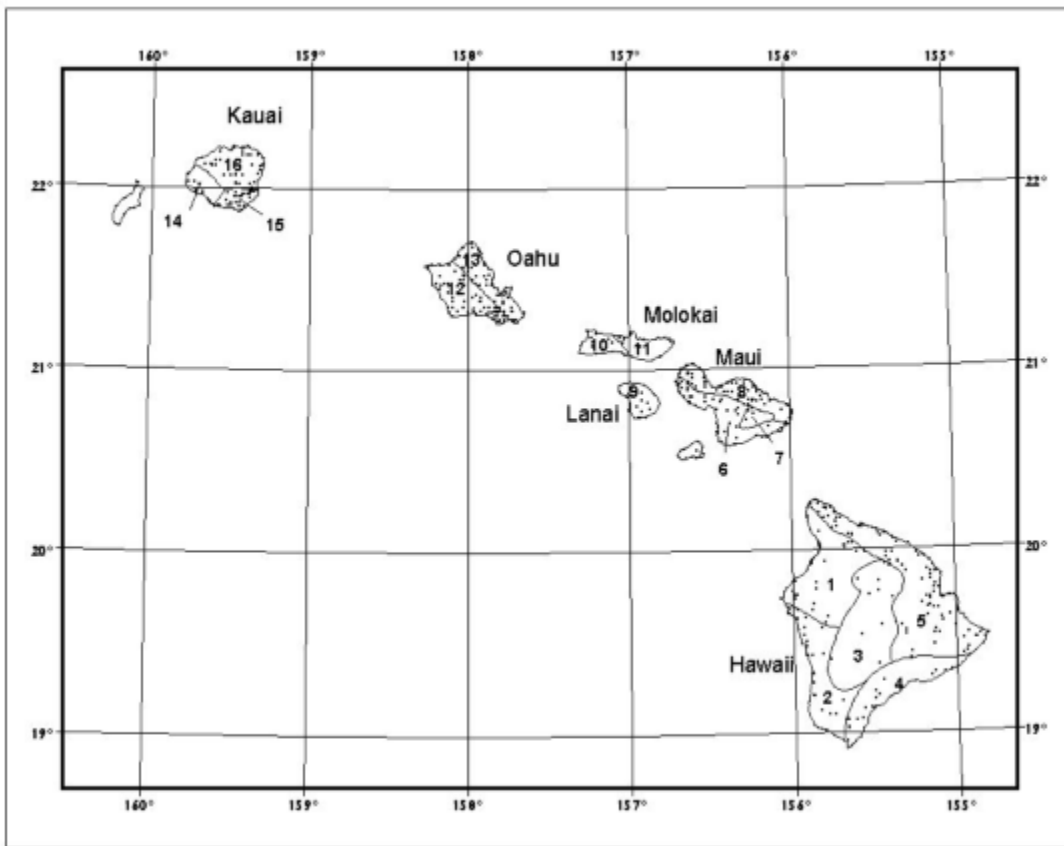


Figure 1. Hawaii Precipitation Frequency Project area, regional divisions and daily station locations.

2. Highlights

As noted in previous progress reports, work on this project has been delayed (see Section 5, Projected Schedule). However, lessons learned from both the Semiarid Southwest project and the Ohio River Basin and Surrounding States project are being applied to the production system that will be used for this project.

Hawaii Hydronet 15-minute precipitation data through 12/2003 and National Climatic Data Center (NCDC) hourly precipitation data through 12/2002 has been added to the dataset. Quality control has been completed on both of these datasets. Additional information is provided in Section 3.1, Data Collection and Quality Control.

Some highlights discussed below are lessons learned are therefore relevant to this project.

Software was written to check for common data errors found in the accumulations of longer durations. Software was written to make hourly-only stations consistent with nearby co-located hourly/daily stations and thereby reduce potential bull's eyes in the hourly results. Additional information is provided in Section 3.2, Software Updates.

Study areas to be used and tested in the areal reduction factor (ARF) development have been selected and all but one has been quality controlled. Three additional study areas were added. Software development to process the data and ultimately generate the ARF curves is complete. Additional information is provided in Section 3.3, Areal Reduction Factors.

3. Progress in this Reporting Period

3.1 Data Collection and Quality Control

Hawaii Hydronet 15-minute precipitation data through 12/2003 and NCDC Hourly precipitation data through 12/2002 has been added to the dataset. The Hydronet data was reformatted to match our format. Quality control has been completed on both of these datasets which will be used in the Areal-Reduction-Factor (ARF) project in addition to the Precipitation Frequency project.

3.2 Software Updates

Software was written to check for data errors commonly found in the accumulations of daily values for longer durations. The software flags the following:

1. Recurring daily precipitation amounts above a user-entered threshold in a month
2. Consecutive recurring daily precipitation amounts above a user-entered threshold in a month
3. Months in which all daily amounts are zero or missing except for a daily amount that is above a user-entered threshold on one of the last 3 days

These flagged occurrences can then be checked for data errors that may impact longer duration accumulations.

Software was written to make hourly-only stations consistent with nearby co-located hourly/daily stations and thereby reduce any potential spatial artifacts, specifically bull's eyes, in the mapped hourly precipitation frequency estimates. The software adjusts hourly quantiles according to their co-located daily station and/or according to the overlapping daily regional characteristics. Specifically, hourly stations that are co-located with a daily station are adjusted using ratios of the 24-hour station means and ratios of the daily and hourly regional growth factors. Hourly-only stations are adjusted using an average ratio of the daily and hourly regional growth factor ratios for all co-located stations within the hourly region.

3.3 Areal Reduction Factors

Progress continues in the development of geographically-fixed Areal-Reduction-Factor (ARF) curves for area sizes of 10 to 400 square miles. Development and testing of software from the procedure described in NOAA Technical Report NWS 24 (TR-24) is complete. A preliminary set of ARF curves for the 2-year return period for the Chicago, IL area study site has been generated (see Figure 2). They are consistent with results published in TR-24.

Three additional study areas (southeast Michigan, Albuquerque, and Seattle) have been identified and added to the list of areas used to develop the final set of ARF curves. Quality control on the Hawaiian hourly reporting data (covering the period 1960 through 2002) and additional Puerto Rico hourly reporting data (covering the period 1998

through 2002) has been performed and completed. Only the Seattle dataset remains to be quality controlled. A total of 15 study areas throughout the United States will be used in the study (see Figure 3). The “not used” study areas indicated in Figure 3 were considered but judged to be inadequate for the study due to poor data, limited or no metadata, or other problems. The set of ARF curves developed for each study area will be tested for differences to determine if a single set of ARF curves can be used for the entire U.S. as is the case today or whether separate curves for different regions of the country are more appropriate.

Figure 2: Preliminary ARF curves based on test data in the Chicago area.

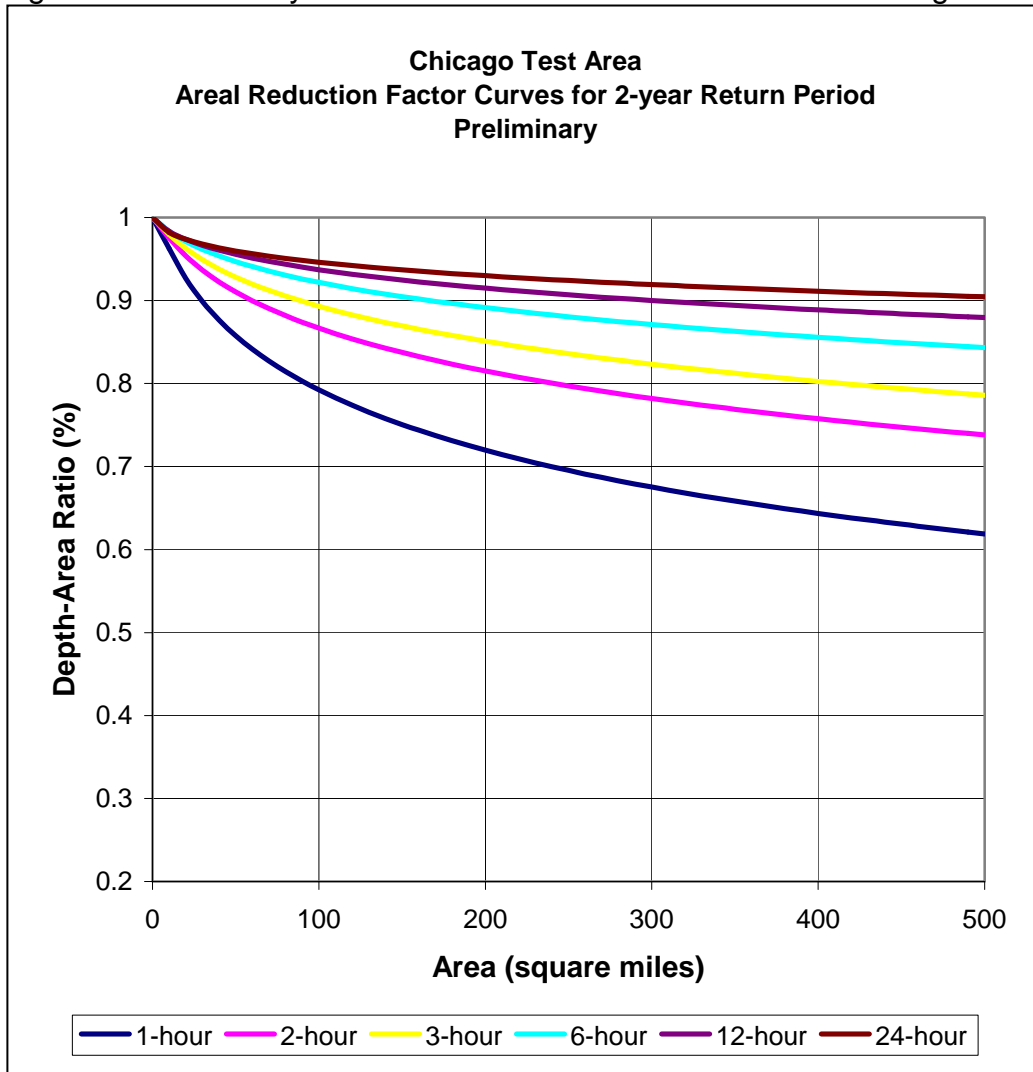
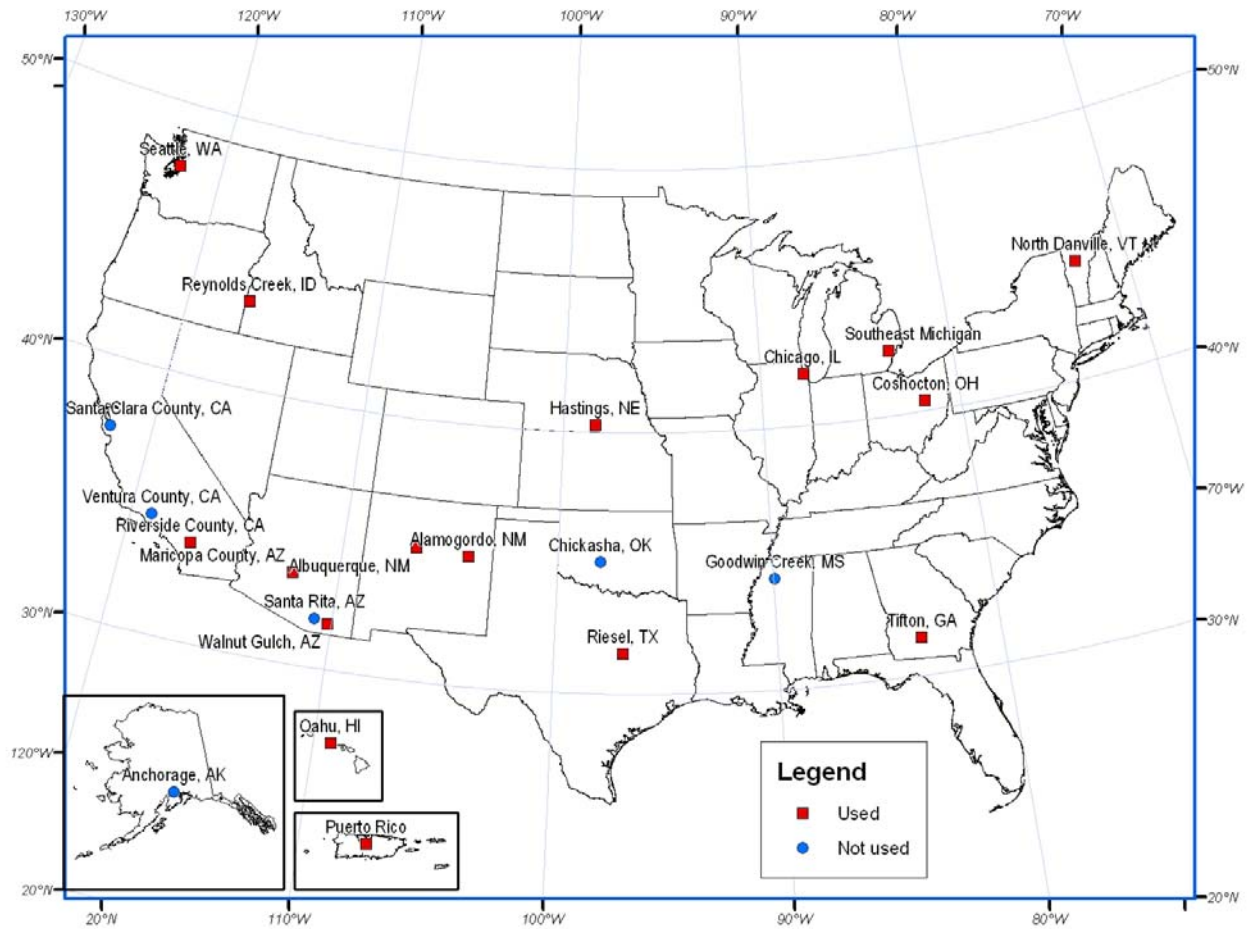


Figure 3: Map of ARF study areas



4. Issues

4.1 Recent and Upcoming Presentations

Past and future presentations by Geoff Bonnin, representing HDSC, include the following:

- “Temporal Distributions of Heavy Rainfall Associated with Updated Precipitation Frequency Estimates” at the Transportation Research Board Conference in Washington DC on January 15, 2004
- “Recent Updates to NOAA/NWS Rainfall Frequency Atlases” at the American Association of Geographers Annual Meeting in Philadelphia, PA on March 18, 2004
- “Recent Updates to NOAA/NWS Rainfall Frequency Atlases” at the Southeast Region meeting of the Association of State Dam Safety Officers in Norfolk, VA on April 19, 2004
- “Statistics of Recent Updates to NOAA/NWS Rainfall Frequency Atlases” at the American Society of Civil Engineers World Water and Environmental Resources Congress on June 28, 2004
- “Recent Updates to NOAA/NWS Rainfall Frequency Atlases” at the California Extreme Precipitation Symposium in Davis, CA on July 1, 2004

5. Projected Schedule and Remaining Tasks

The following list provides a tentative schedule with completion dates. Brief descriptions of tasks that will be worked on during the next few quarters are also included in this section.

Data Collection and Quality Control [July 2004]
L-Moment Analysis/Frequency Distribution [October 2004]
Trend Analysis [August 2004]
Temporal Distributions of Extreme Rainfall [November 2004]
Spatial Interpolation [December 2004]
Peer Review of Spatially Distributed Estimates [February 2005]
Precipitation Frequency Maps [May 2005]
Web Publication [May 2005]
Areal Reduction Factors [June 2004]

5.1 Data Collection and Quality Control.

We will obtain NCDC daily data through 2002 and then start the quality control and testing of the regionalization on an island by island basis as complete data sets are assembled. The estimation of the appropriate probability distribution functions and the

parameterization of these functions as well as the spatial interpolation steps will be done for all islands as a group to ensure consistency in this part of the process.

5.2 Areal Reduction Factors (ARF)

Computations for the ARF curves will be completed in the next quarter for 15 areas. The resulting curves will be tested for differences to determine if a single set of ARF curves is applicable to the entire U.S. or whether curves vary by region.

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