

HAWAII PRECIPITATION FREQUENCY PROJECT

Update of *Technical Paper No. 43*

Sixteenth Progress Report
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Hydrometeorological Design Studies Center
Hydrology Laboratory

Office of Hydrologic Development
U.S. National Weather Service
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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 of NOAA's National Weather Service plans to update 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 average recurrence intervals from 1 to 1,000 years. The Project will review and process 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 (<http://www.nws.noaa.gov/ohd/hdsc>) 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.

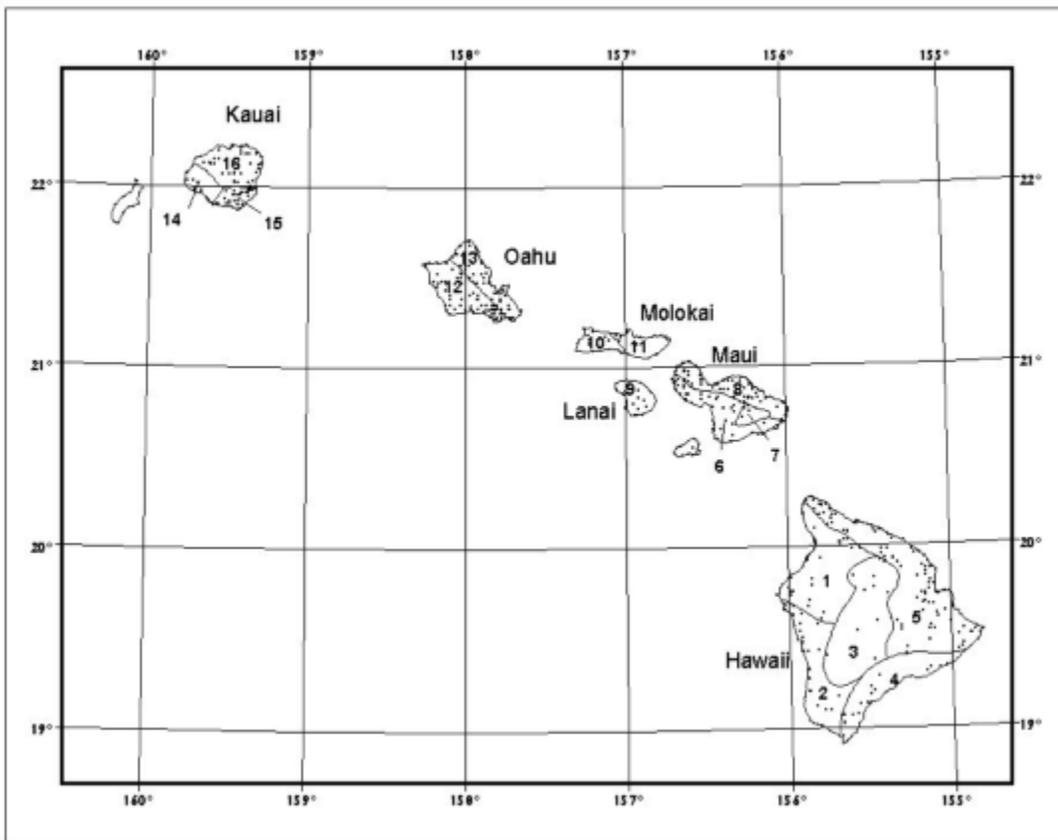


Figure 1. Hawaii Precipitation Frequency Project area, regional divisions and daily station locations.

2. Highlights

Funding has become available for Fiscal Year 2005 (FY05) and therefore it is anticipated that we will be able to start on the Hawaii Precipitation Frequency Project in July/August 2005. Additional information can be found in Section 4.1, Funding Becomes Available for FY05 and Section 5, Projected Schedule and Remaining Tasks.

Some highlights discussed below are lessons learned from the Puerto Rico and Virgin Islands project and the Ohio River Basin and Surrounding States project and therefore are relevant to this project.

Software has been written to improve the data quality control process. Additional information is provided in Section 3.1, Software Updates.

The Precipitation Frequency Data Server (PFDS), the on-line portal for all NOAA Atlas 14 deliverables and information, underwent several important changes. The most noticeable change was the re-organization of the GIS Download page. Additional information is provided in Section 3.2, PFDS.

Progress on the development of areal reduction factors remains slow due to difficulties in completing the analysis software. Development and testing of software from the procedure described in NOAA Technical Report NWS 24 is 95% completed. Modifications have also been made in the ARF sites with respect to which stations are being used. Two statistical procedures have been prepared to test the differences between the ARF curves generated from the various sites. Additional information is provided in Section 3.3, Areal Reduction Factors.

3. Progress in this Reporting Period

3.1 Software Updates

Additional software has been written to improve the efficiency and effectiveness of the data quality control process. Data will be quality controlled using a new spatially-based quality control procedure (*QCseries*) that screens annual maximum series (AMS) and partial duration series (PDS) to identify maximum precipitation values that are suspect relative to concurrent data at nearby stations.

The *QCseries* software is undergoing testing and implementation. Most importantly, an objective process is being developed to establish the criteria for computing the quality control flag for each of the annual maximum and/or partial duration series. The quality control flags range from 0 to 10, with 0 being highly suspect. The flags are based on concurrent precipitation at nearby stations and the deviation from spatially distributed values of percent of mean annual precipitation. Although a fully optimized and proven flagging algorithm has not yet been completed, a significant portion of the logic has been determined and the software is currently functional as a quality control tool. Look for more details in future Quarterly Progress Reports.

3.2 PFDS

The Precipitation Frequency Data Server (PFDS), the on-line portal for all NOAA Atlas 14 deliverables and information, underwent several important changes. The most noticeable change was the re-organization of the GIS Download page. To ease confusion and increase usability, this page, which was originally multiple pages long, was split into four separate web pages titled: Time Series, Maps, GIS Data and Version Numbers. As a result, the left sidebar items changed accordingly. Furthermore, buttons to these pages were added to the header of the state specific pages to allow easier navigation.

Other changes include:

1. Continued to update the PFDS Performance and Stats page on a monthly basis (see below).
2. Added a link to Customer Survey results so users could view the categorical feedback we're getting.
3. A few frequently asked questions (FAQ) were added to the FAQ page.

HDSC continuously monitors the hits, integrity and performance of the PFDS, which continues to receive an increasing number of hits per month. The graph (Figure 2) below summarizes the number of individual data inquires made since January 2004, while the map (Figure 3) indicates the locations of inquires during the past quarter.

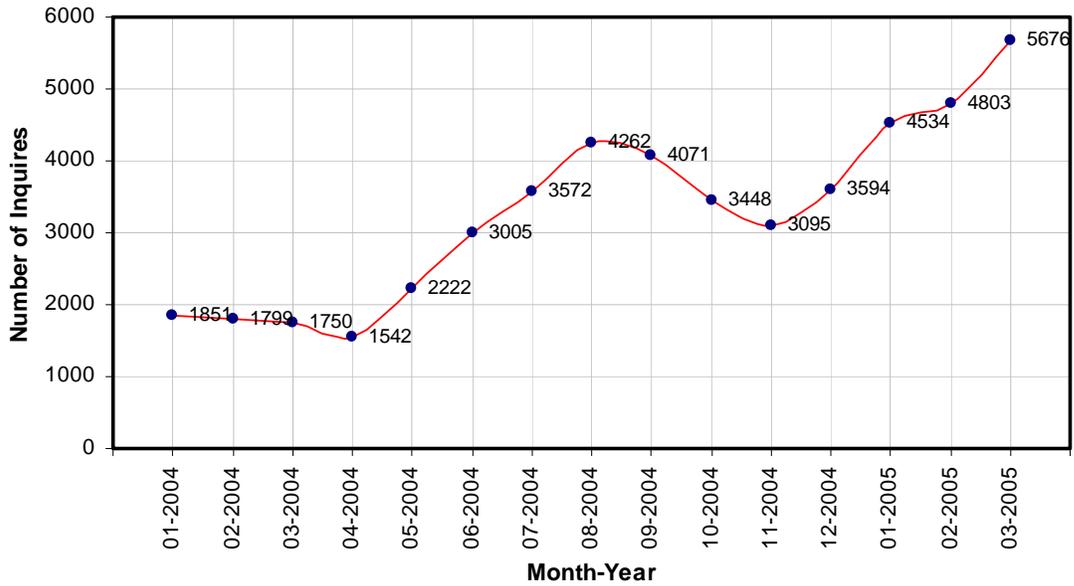


Figure 2: Number of individual PFDS data inquiries per month.

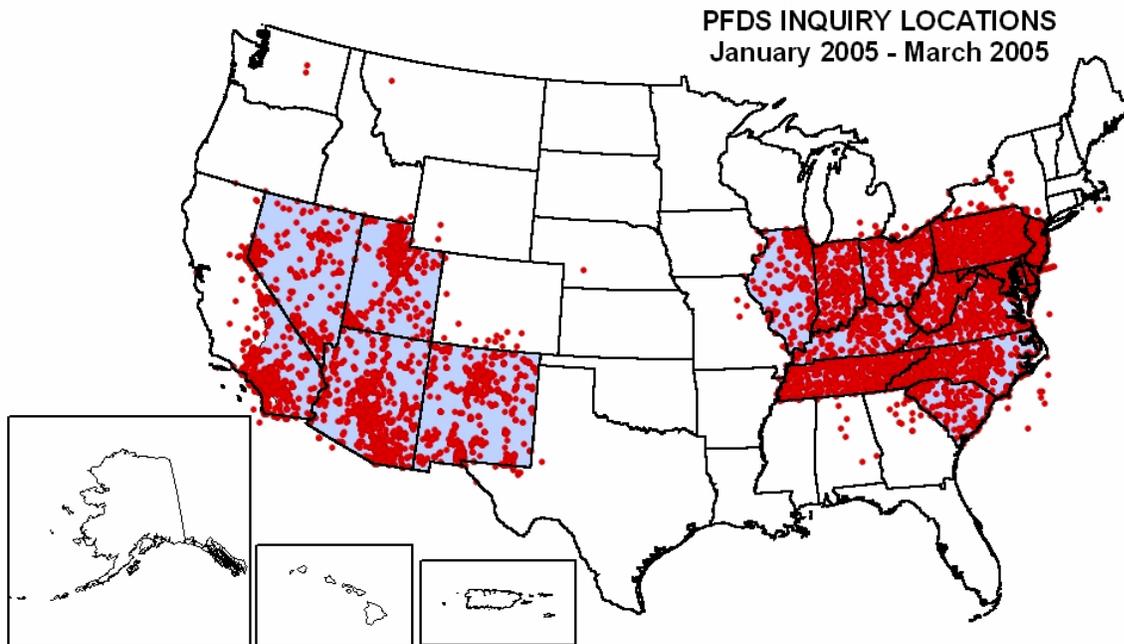


Figure 3: Map of 15,013 PFDS data inquiry locations during the period January-March 2005.

3.3 Areal Reduction Factors

Work continues in the development of geographically-fixed Areal Reduction Factor (ARF) curves for basin area sizes of 10 to 400 square miles. Progress has been slow due to difficulties in completing the analysis software. Development and testing of software from the procedure described in NOAA Technical Report NWS 24 is 90% completed. Modifications have been made in the ARF sites with respect to which stations are being used. This is being done to ensure distances between stations used in the calculations are appropriate. In particular, if a station is more than 80 miles away from any other station for that study site, then that station will not be used in that site's ARF analysis.

Two statistical and objective testing procedures, the sign test (Himmelblau, 1970) and a modified "student t" test (Siegel, 1961) will be used in testing the differences in the ARF curves generated from the various sites. A third objective statistical test for testing differences in the ARF curves is currently being investigated. These procedures were also used in an ARF study performed by Bell (1976).

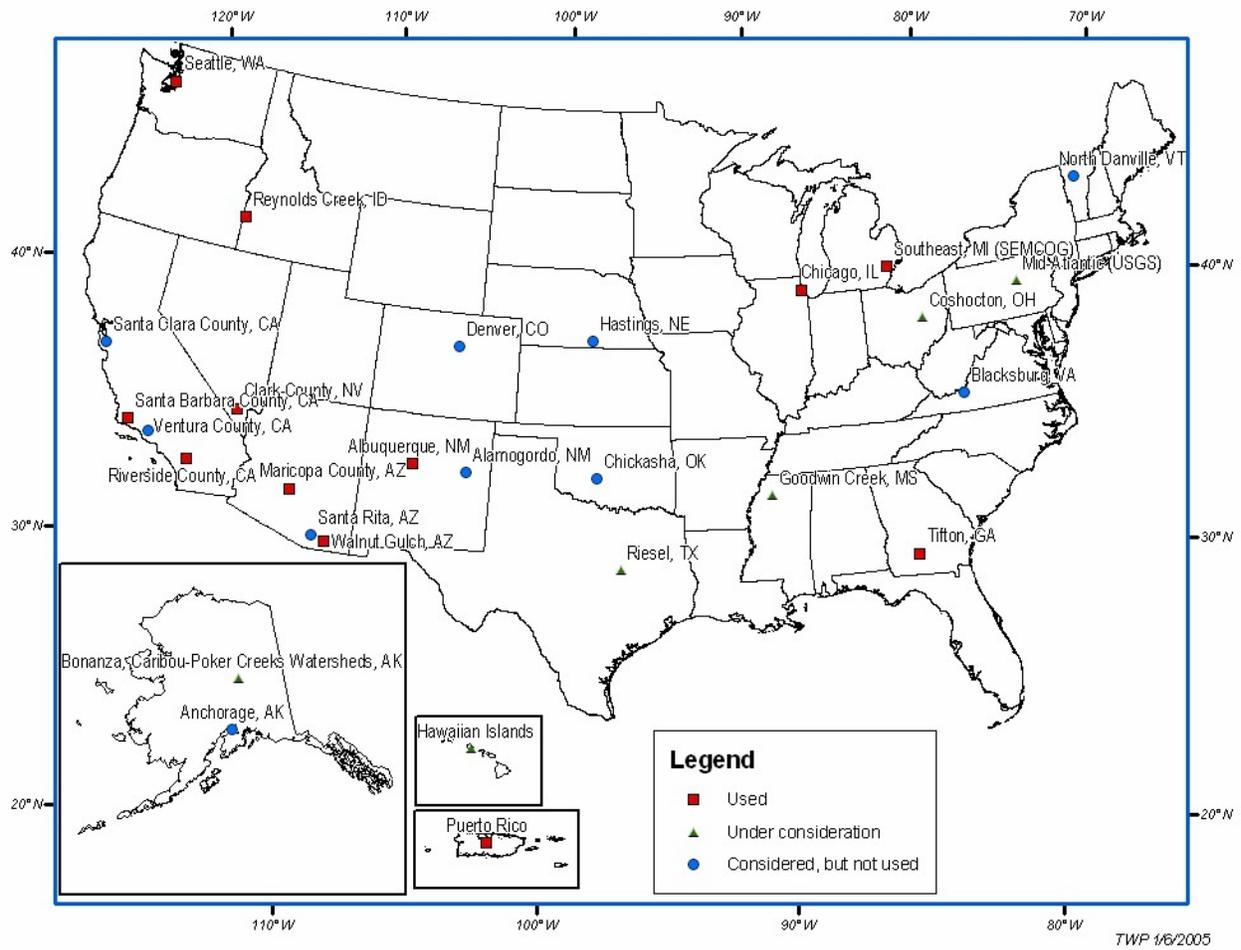


Figure 4: Map of ARF study areas

4. Issues

4.1 Funding Becomes Available for Fiscal Year 2005 (FY05)

Funding has become available for FY05 from the US Army Corps of Engineers (USACE) and NWS sources. However, funding from USACE is less than expected. Therefore, we anticipate work will begin on the Hawaii Precipitation Frequency Project in July or August 2005. However, funding for FY06 must be increased in order to meet the schedule set below.

4.2 Recent and Upcoming Presentations

On March 30 and 31, Geoff Bonnin traveled to Puerto Rico to discuss progress on updating precipitation frequency estimates for Puerto Rico and the U.S. Virgin Islands. In a series of meetings, he met with the NOAA's San Juan Weather Forecast Office (WFO), Puerto Rico and the Commonwealth of Puerto Rico's Department of Natural Resources and Minerals in San Juan. Other interested parties attended such as U.S. Geological Survey, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency and the U.S. Department of Agriculture.

HDSC has submitted a poster paper entitled "NOAA Atlas 14, the new precipitation frequency atlas for the United States" for the European Geosciences Union General Assembly meeting on April 24 – 29, 2005 in Vienna, Austria. Due to funding and schedule constraints, the poster will be presented by others from the Office of Hydrologic Development already attending the meeting.

4.3 1-year Precipitation Frequency

HDSC has been approached by the State of Maryland State Highway Administration (MDSHA) to calculate and include the 1-year average recurrence interval (ARI) precipitation frequency estimates for NOAA Atlas 14 Volume 2. Discussions are being held with MDSHA on funding, contractual mechanisms and the areas to be covered.

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 [October 2005]
- L-Moment Analysis/Frequency Distribution [February 2006]
- Trend Analysis [December 2005]
- Temporal Distributions of Extreme Rainfall [March 2006]
- Spatial Interpolation [May 2006]
- Peer Review of Spatially Distributed Estimates [June 2006]
- Precipitation Frequency Maps [August 2006]
- Web Publication [August 2006]

- Areal Reduction Factors [May 2005]

5.1 Data Collection and Quality Control.

Starting in July 2005 we will obtain appropriate NCDC and other available data and then start the quality control and testing of the regionalization. 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 14 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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