HAWAII PRECIPITATION FREQUENCY PROJECT

Update of *Technical Paper No. 43*

Eleventh 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 should be considered as preliminary and 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 1000 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.

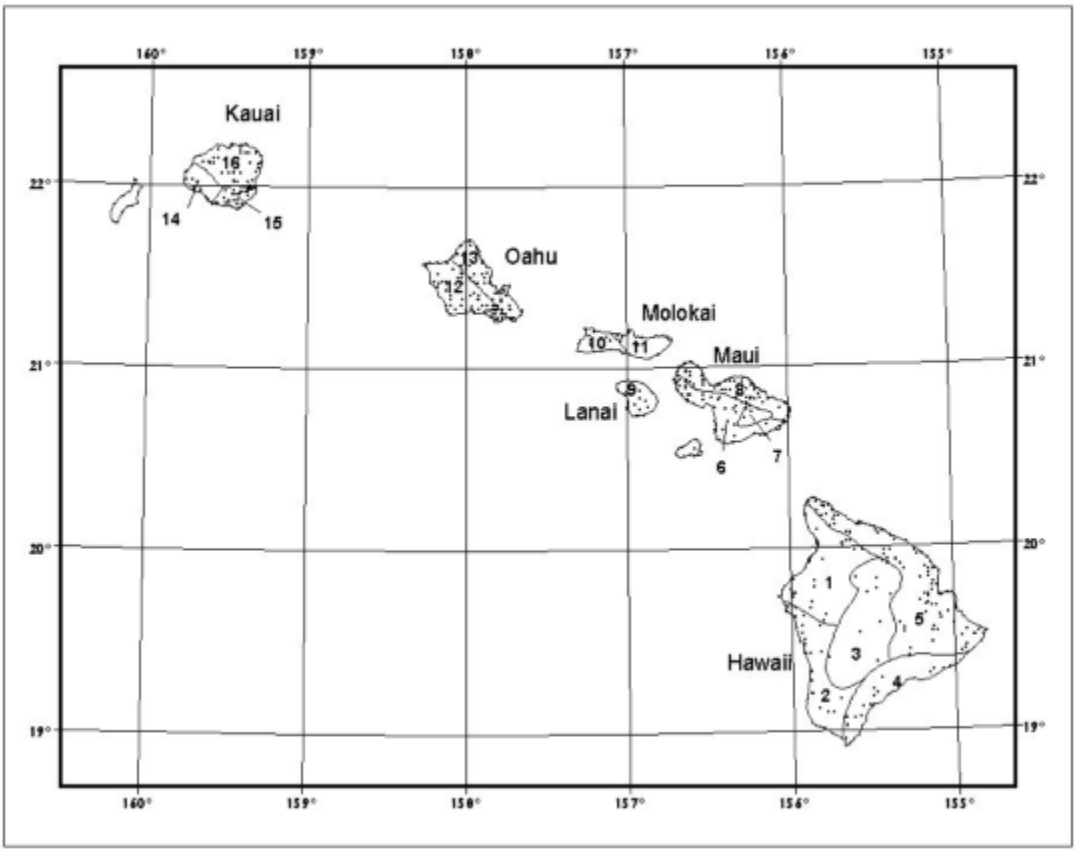

Figure 1. Hawaii Precipitation Frequency Project area, regional divisions and daily station locations.

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.

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

Hawaii Hydronet 15-minute data through 12/2003 has been added to the dataset and quality control has begun. Quality control was also started on the hand entered daily data from the state maintained rain gage network. Additional information is provided in Section 3.1, Data Collection and Quality Control.

A procedure for adjusting mean PRISM grids was developed and tested. The Cascade, Residual Add-back (CRAB) derivation procedure was modified to accommodate a conversion from annual maximum series (AMS)-based results to partial duration series (PDS)-based results. Additional information is provided in Section 3.2, Software Updates/Spatial Interpolation.

The Precipitation Frequency Data Server (PFDS) underwent several modifications. In particular, the results provided by the PFDS will now be in terms of partial duration series as the default, rather than annual maximum series. Additional information is provided in Section 3.3, Precipitation Frequency Data Server.

Study areas to be used and tested in the areal reduction factor (ARF) development have been selected and are being quality controlled. Software development to process the data and ultimately generate the ARF curves is 90% completed. Additional information is provided in Section 3.4, Areal Reduction Factors.

3. Progress in this Reporting Period

3.1 Data Collection and Quality Control

Hawaii Hydronet 15-minute rainfall data through 12/2003 has been added to the dataset and quality control on this dataset has begun. Quality control was also started on the hand entered daily data from the state maintained network that we received from the University of Hawaii.

3.2 Software Updates/Spatial Interpolation

In the Semiarid Southwest Precipitation Frequency Project, we learned that slight changes may occur in the mean annual maximum values at stations due to data quality corrections. Since it is not always cost effective to have the Spatial Climate Analysis Service at Oregon State University re-run the grids with our updated data, we have developed a process to adjust the PRISM mean annual maxima grids.

The procedure starts with the calculation of an adjustment factor: new mean divided by old mean at each station. Here the old mean is the mean that was used in creating the original PRISM mean grid. Both means are from the database and not interpolated from the PRISM mean grid. These point adjustment factors are then spatially distributed using an inverse-distance-weighting (IDW) algorithm. The resulting grid is then filtered to remove extraneous noise in the adjustment grid. The filtered adjustment grid is then multiplied by the original mean annual maxima grid to produce an adjusted PRISM mean annual maxima grid.

This simple approach allows fine-tuning of the PRISM mean annual maxima grid cell values, but it is not robust enough to accommodate new data points (i.e., stations not used in the original PRISM gridding), omissions of stations, or any major changes in the mean values. During the procedure, the software produces percent difference grids to evaluate differences between the previous grids and the adjusted grids.

During the last quarter, the Cascade, Residual Add-back (CRAB) derivation procedure was modified to accommodate a conversion from AMS-based results to PDS-based results. AMS to PDS conversion factors will be calculated from the data for the final publication.

Finally, the software used to create vector (contour) shapefiles from the precipitation frequency grids was made more robust by incorporating logic to determine the best contour interval for the given grid. The software forces the number of contour intervals to be less than or equal to 30 and greater than 10. The contour intervals are forced to fall at convenient break points, yet provide as much spatial detail as possible.

3.3 Precipitation Frequency Data Server (PFDS)

The Precipitation Frequency Data Server (PFDS) underwent several modifications. In particular, the results provided by the PFDS will now be in terms of partial duration series, rather than annual maximum series, as the default. Results based on either series can be selected as a criterion from the state-specific web-page of the PFDS.

The state-specific input pages have been simplified by eliminating the radio buttons. The PFDS interface now detects which input type (via a click on the map, a click on a station, the pull-down list, static location, or by area) without the user having to indicate it.

In addition, reference information pages have recently been added. And we have also resolved legend color issues on the maps that we will be providing. A new color ramp was built to mimic the transparency color on maps.

3.4 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. We have successfully completed testing and evaluation of the software through Chapter 5 of TR-24 by looking at the statistical results for Chicago, IL data. We are now working on the remaining chapters.

We have completed quality control on the data for Chicago, IL; Walnut Gulch, AZ; Tifton, GA; North Danville, VT; and Hastings, NE. Quality control work is continuing on the remaining study areas including Hawaii. We have added Riverside, CA and Maricopa, AZ to the list of areas we are studying. It is anticipated that a total of 15 study areas throughout the United States will be used in the study. 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.

4. Issues

4.1 Upcoming Presentations

Interest in the new estimates is increasing. As a result, Geoff Bonnin, representing HDSC, will give a presentation entitled "Temporal Distributions of Heavy Rainfall Associated with Updated Precipitation Frequency Estimates" at the Transportation Research Board Conference in Washington DC on January 15, 2004.

Geoff Bonnin will present "Recent Updates to NOAA/NWS Rainfall Frequency Atlases" at the American Association of Geographers Annual Meeting in Philadelphia, PA on March 18, 2004 and at the Southeast Region meeting of the Association of State Dam Safety Officers in Norfolk, VA on April 19, 2004.

He will also present a paper, "Statistics of Recent Updates to NOAA/NWS Rainfall Frequency Atlases," at the World Water and Environmental Resources Congress 2004 to be held June 28-July 1, 2004 by the American Society of Civil Engineers.

5. Projected Schedule and Remaining Tasks

The following list provides a tentative schedule with completion dates. Brief descriptions of tasks being worked on next two quarters are also included in this section.

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

5.1 Data Collection and Quality Control.

We expect to be able to obtain NCDC 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)

Software for the ARF computations will be completed in the next quarter and the computations will be performed 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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