SEMIARID PRECIPITATION FREQUENCY PROJECT

Update of *Technical Paper No. 49* and *NOAA Atlas 2*

Twenty-sixth Progress Report
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Hydrometeorological Design Studies Center
Hydrology Laboratory

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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 the Semiarid Southwestern United States. Current precipitation frequency estimates for the Semiarid region are contained in *Technical Paper No. 49* "Two- to ten-day precipitation for return periods of 2 to 100 years in the contiguous United States" (Miller et al 1964), *NOAA Atlas 2* "Precipitation-Frequency Atlas of the Western United States" (Miller et al 1973), "Short Duration Rainfall Frequency Relations for California" (Frederick and Miller, 1979) and "Short Duration Rainfall Relations for the Western United States" (Arkell and Richards, 1986). The new project 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 all-season 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 Semiarid project area and use accepted statistical methods. In particular, the Semiarid Project is the pilot project in which decisions regarding the methods and format are being made that will affect subsequent projects. The project results will be published as Volumes of *NOAA Atlas 14* on the internet using web pages with the additional ability to download digital files.

The Semiarid Project will produce estimates for 4 states completely, Arizona, Nevada, New Mexico, and Utah, and southeastern California. Additional data from 7 bordering states and Mexico (Figure 1) are included for continuity across state borders. The core and border areas and regional groups for long duration (24-hour through 60-day) analyses are shown in Figure 1. Regional groups for short duration (60-minute through 12-hour) analyses are shown in Figure 2.

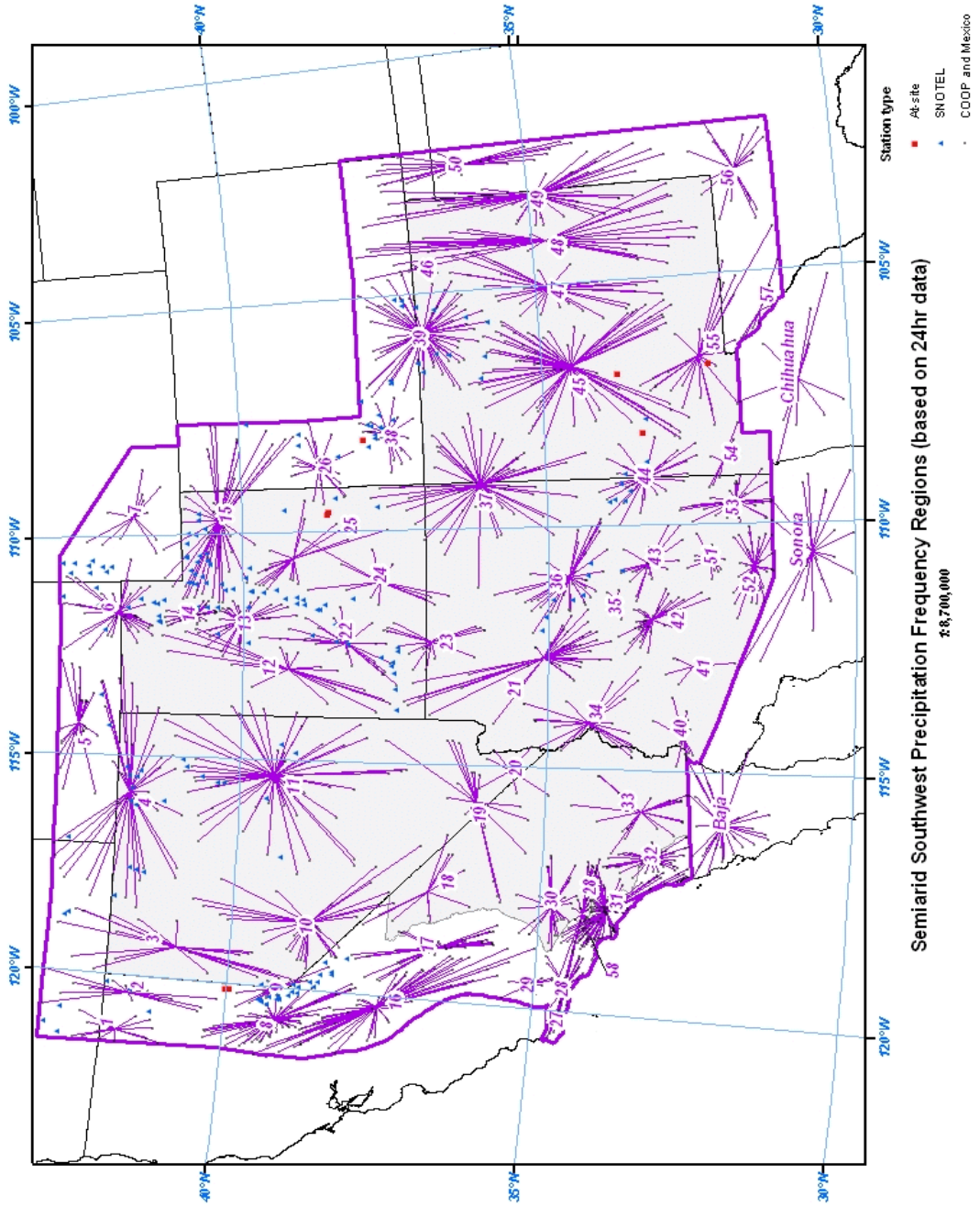

Figure 1. Semiarid Precipitation Frequency project area and 59 regional groups for 24-hour and longer duration values.

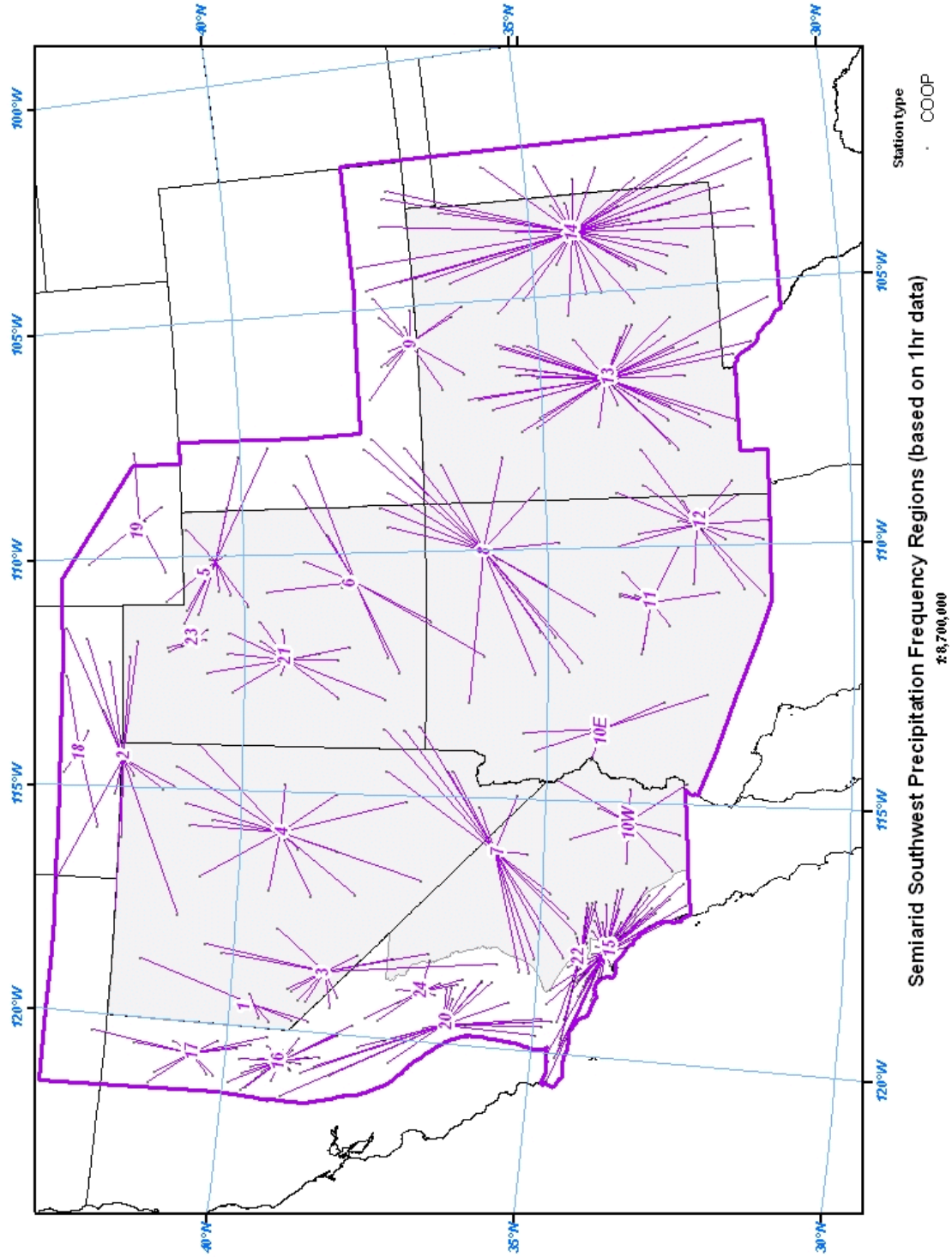

Figure 2. Semiarid Precipitation Frequency regional groups for 12-hour and shorter duration values.

2. Highlights

NWS published NOAA Atlas 14 Volume 1 precipitation frequency estimates for the Semiarid Southwestern United States on August 6. They were made available via the Precipitation Frequency Data Server at http://hdsc.nws.noaa.gov/hdsc/pfds/.

Since publication, we have found a small number of errors which will be corrected in the immediate future. We will establish versions of the data using the Precipitation Frequency Data Server to distinguish between updates. Additional information is provided in Section 3.1, Data Quality Control.

Software was written to conduct an annual maxima consistency check and adjustment and a check for intersite dependency. Additional information is provided in Section 3.2, Software Updates.

The Precipitation Frequency Data Server underwent a few modifications in our continuing effort to make it as user friendly as possible. Additional information is provided in Section 3.3, Precipitation Frequency Data Server.

Temporal distributions have been recomputed using only data that is greater than the 2-year return period. Additional information is provided in Section 3.4, Temporal Distributions.

Quality control continues on data from study areas to be used in the areal reduction factor (ARF) curve development, and software development to process the data and ultimately generate the ARF curves is nearly complete. The name of this project, formerly Depth Area Reduction (DAR), has been officially changed to reflect new nomenclature. Additional information is provided in Section 3.5, Areal Reduction Factors.

3. Progress in this Reporting Period

3.1 Data Quality Control

We are correcting a small number of errors in the published results. The PFDS contains a version-stamping feature that allows changes in the data to be associated with a version number. The data published on August 6 is designated as Version 2. The new estimates will be incorporated with the release of Version 3 in the next week.

Because of concerns with station data at MOAB radio, UT (42-5733), we asked former Utah State Climatologist, Don Jensen, for assistance. With Don's help we have corrected the data. The resulting changes in the 100-year estimates are less than 4% and for the 1000-year less than 15%. The new estimates will reduce the spatial bulls-eye apparent around Moab Radio.

We found inconsistencies in the annual maximum series in a number of cases and developed new quality control software to test for the problem. The problem manifests itself as an annual maximum of a shorter duration that is greater than longer durations in a given year. This can happen when the data has too many missing values immediately adjacent to the accumulation period of the shorter duration for the accumulation of the longer duration to be acceptable. In these cases we were rejecting the accumulation completely rather than accepting the shorter duration accumulation as a minimum value for the longer duration. It can also happen when average adjustment factors that account for different sampling intervals are applied (e.g. 24-hour vs. 1-day data.)

The new annual maximum consistency check identifies occurrences where shorter duration annual maxima are higher than longer duration annual maxima. If the difference is small (<10%), the longer duration annual maxima was set equal to the shorter duration for that year. Differences of 10% or more were flagged and will be examined more closely for data quality issues. The 10% cutoff was chosen as a convenient indicator above which the cause is generally missing data.

There were 16 stations in the Semiarid Project area that had a shorter duration annual maximum that is at least 10% higher than the longer duration annual maximum. In all of these cases, the inconsistencies resulted from erroneous data, for instance, where 0's were entered as missing data. These data were corrected. The corrections impacted the means and 100-year quantiles of these stations by less than 5%.

During a quality control check for cross-correlation between stations, two pairs of stations with duplicate data were found. The inclusion of these duplicate data did not appreciably impact the results. Precipitation frequency estimates changed by less than ±2% for all daily durations in both cases when the station with duplicate data was

deleted. In region 52, stations 02-5921 and 02-5922 had the same data for most of their records; 02-5922 was deleted. In region 54, stations 02-7560 and 02-7563 had duplicate data; 02-7563 was deleted.

3.2 Software Updates

Software was written to conduct an annual maximum consistency check (see Section 3.1 Data Quality Control). This software documents cases where a shorter duration is greater than a longer duration for further investigation. Software has also been written to automatically adjust annual maxima for the offending year in the time series after the investigation is complete.

Software was written to check for intersite dependency by computing cross-correlation between stations. The software identifies cases where stations within 50 miles of each other have appreciable cross-correlation in annual maxima occurring at the same time (see Section 3.1 Data Quality Control).

3.3 Precipitation Frequency Data Server (PFDS)

We modified the Precipitation Frequency Data Server in our continuing effort to make it more user friendly. The modifications include:

a) a greater density of grid lines on the graphs to assist in picking values from the graph,

b) When point estimates are requested for a location by selecting a specific observing location, the station name now appears in the downloadable text table.

We also re-arranged the web pages used for selecting bulk data for downloading. The pages are designed to provide access to huge volumes of data, including spatial (GIS) data, in a clear and organized manner.

3.4 Temporal Distributions

Temporal distributions have been recomputed for the Semiarid project area. Previously we used an average 2-year 24-hour value as the lower limit of values included in the definition of “heavy rainfall” used in the computation, regardless of duration. We realized this may bias the distributions for longer durations by including more frequently occurring events. In the new computation we use the 2-year 24-hour value at that location and for the specific duration as the lower limit. We also decided that the colors on the temporal distribution graphs were difficult to reproduce on a black and white copier. As a result, the temporal distribution graphs will be produced using grayscale.

3.5 Areal Reduction Factors

The name of this project, formerly Depth Area Reduction (DAR), has been officially changed to reflect new nomenclature. 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. 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

No issues.

5. Projected Schedule and Remaining Tasks

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

Precipitation Frequency Maps [November 2003]
Final Report [December 2003]
Spatial Relations (Areal Reduction Factors) [December 2003]

5.1 Spatial Interpolation

We will re-compute the spatial interpolations based on the corrections that have been made and publish the updates as a new version via the Precipitation Frequency Data Server. We will also publish difference maps between Version 2 and the new Version 3 results. In the next quarter, final cartographic maps (as Adobe PDF files) and GIS shapefiles will be produced and published.

5.2 Additional Analyses

Conversion factors from Annual Maximum Series results to Partial Duration Series results will be computed and made publicly available.

5.3 Documentation

Final documentation will be written during the next quarter and published using the Precipitation Frequency Data Server. The documentation will include the new temporal distributions.

5.4 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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