

Rainfall Distributions for Ohio Valley and Neighboring States based on NOAA Atlas 14 Data

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Background

It has been 7 years since the National Weather Service published NOAA Atlas 14 for the Ohio Valley and Neighboring States (Volume 2). Since that time, guidance on rainfall distributions has not been generally distributed or formally accepted for use with NRCS hydrology computer programs. Since the Type II and Type III rainfall distributions were developed based on data more than 35 years old, these distributions were tested against distributions developed based on the new NOAA 14 data. The Type II and Type III distributions, though they are reasonable in certain areas, are not generally applicable for the locations where they have been used in the past. WinTR-20 has been released with the capability of importing a text file of NOAA 14 rainfall data and developing rainfall distributions on a site-by-site basis. Generalized distribution regions for use in EFH-2 and WinTR-55 have not been developed or distributed prior to this time. Recent release of rainfall-frequency data for New York and the New England States by the Northeast Regional Climate Center has provided the impetus to develop regional distributions for those states. Since the region covered by NOAA Atlas 14 Volume 2 adjoins the northeast, proposed rainfall distributions for the Ohio Valley and neighboring states are now being released for testing and comments.

Earlier in 2011, the National Weather Service made significant changes in their NOAA 14 web site, changed some of the rainfall-frequency values, and changed GIS data which may be downloaded. The changes to the rainfall values and GIS files have created the need to download the rainfall data for all the representative county locations again. The rainfall distributions and county rainfall databases released with this notice are derived from the most recent NOAA 14 web site.

Development of rainfall distributions

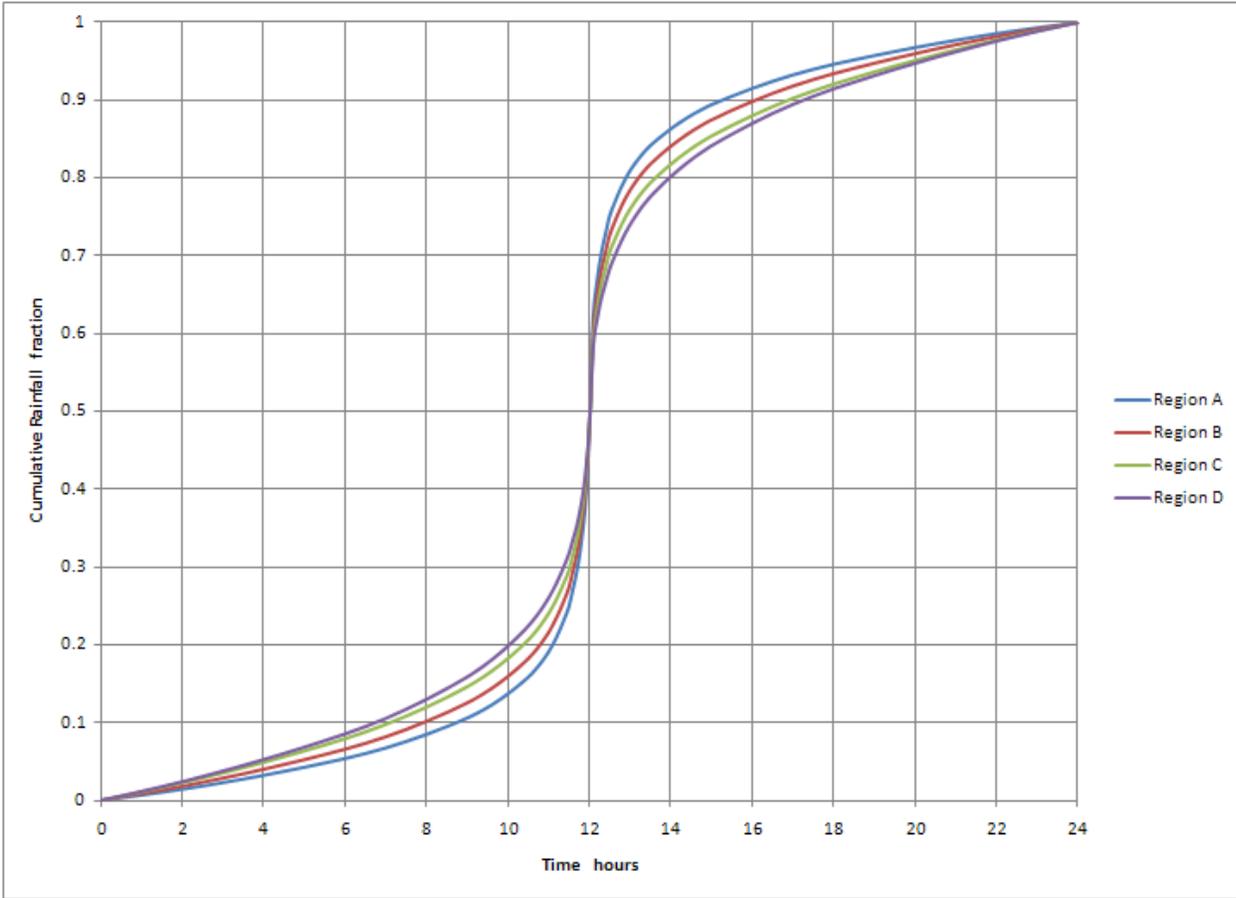
Testing of rainfall distributions developed for NOAA 14 data show that the rainfall distribution can vary significantly with return period. In other words, the 1-year through 100-year storms may have different ratios of 5-minute to 24-hour, 10-minute to 24-hour, etc. The 25-year storm has been chosen to represent the regional distribution for two major reasons. One is that many conservation practices are designed for the 25-year storm. The other reason is that the 25-year rainfall distribution reasonably represents the average distribution of all storms from 1-year to 500-year. The ratio of 1-hour 25-year to

24-hour 25-year rainfall values has been used to determine the boundaries of the rainfall distribution regions. Using GIS analysis, those locations with a ratio of more than 0.48 have been placed in Region A, ratios between 0.43 and 0.48 have been placed in Region B, ratios between 0.38 and 0.43 have been placed in Region C, and ratios less than 0.38 have been placed in Region D. For reference, the ratio of 1-hour to 24-hour rainfall for the Type II is 0.45 and the ratio for the Type III is 0.40.

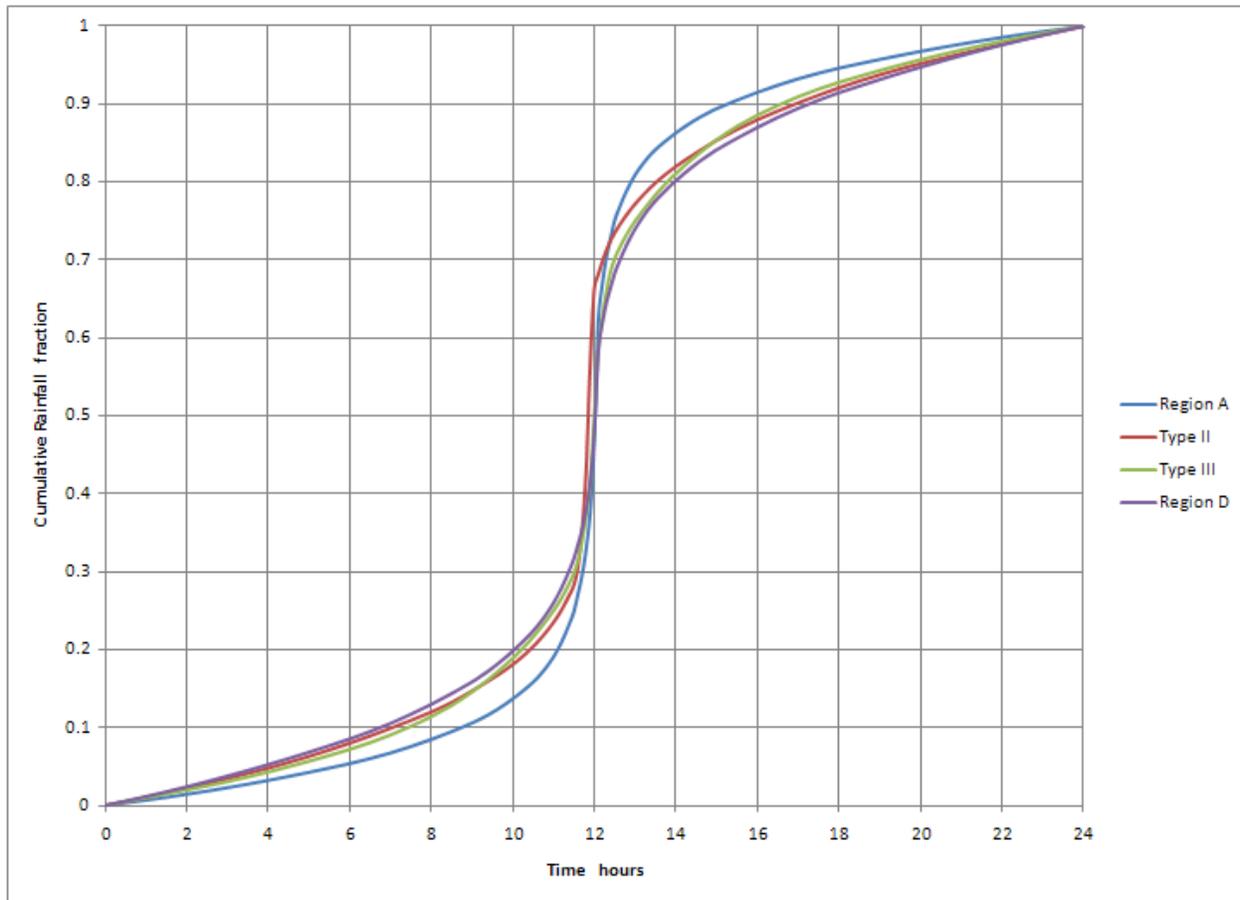
Once the boundaries were determined, the average 5-minute to 24-hour ratio, the average 10-minute to 24-hour ratio, etc were determined for each of the four regions. These average ratios were then used to develop the 24-hour rainfall distribution for each region. The concept used to develop the rainfall distribution was to maximize the rainfall for all durations by putting the 5-minute duration in the middle at 12 hours and centering each succeeding duration on 12 hours. For example, the 1-hour rainfall is placed from 11.5 to 12.5 hours, the 2-hour rainfall is placed from 11 to 13 hours, etc.

Maps of each state have been developed which show the boundaries based on analysis of GIS data. For practical use, this map could be revised to follow county boundaries. For example, a single distribution could be chosen for each county (or part of each county if it is divided).

Rainfall distribution A is the most intense of the four distributions. Rainfall distribution D is the least intense. Preliminary comparisons of the four distributions show that Distribution A generates slightly higher peak discharges than the Type II. Distribution D compares generally with the Type III. The comparisons with Types II and III vary for short to long time of concentrations.



Plot of four proposed distributions for Ohio Valley and neighboring states.



Plot of Ohio Valley and neighboring states proposed A and D compared to Type II and Type III.

Testing of EFH-2

Sample **county.VA**, **county.MD**, and **county.DE** rainfall databases have been attached which may be tested with EFH-2. Two files have been attached which are used by EFH-2 to compute peak discharge. These are **type_II.rf** and **type_III.rf**. In order to be selectable in EFH-2, these files must be copied into the directory **C:\Program Files\USDA\EFH2**. Since there is a limit of 5 rainfall distributions in the EFH-2 **type.rf** file, the file **type_II.rf** includes the regional distributions A, B, C, D, and Type II for comparison. The file **type_III.rf** includes the regional distributions A, B, C, D, and Type III for comparison. In order to use these files in EFH-2, one or the other must be renamed to **type.rf**.

Testing of WinTR-55

Four rainfall distribution tables have been prepared in order to test the proposed distributions in WinTR-55. The tables are named **NOAA_A.tbl**, **NOAA_B.tbl**, **NOAA_C.tbl**, and **NOAA_D.tbl**. In order to make

them selectable in WinTR-55, they must be copied into the directory **C:\documents and settings\your name\Application Data\WinTR55\RainfallDistributions**.

The rainfall database for WinTR-55 has not been updated with new NOAA 14 rainfall values. In order to test NOAA 14 data, please enter the values in the Storm Data window. The appropriate rainfall distribution should be selected from the pull-down menu for Rainfall Distribution Type.

Summary

These proposed distributions are considered for interim use until the new field office hydrology tool is completed (which could be 2 or 3 years from now). The field office hydrology tool is being developed to import a NOAA 14 text file with site-specific rainfall data for the project being designed or analyzed (so regional rainfall distributions will not be needed then). Naturally, there is a lot of technical background and testing documentation not included with this release. Chapter 4 of NEH Part 630 is being revised based on the new rainfall-frequency data and techniques for developing a rainfall distribution. If more information is desired please contact us.

A draft EFH-2 supplement is available on request.

If further assistance is desired with respect to development of rainfall databases, rainfall distributions, training on hydrologic computer programs, or development of an EFH-2 supplement, please request it from the Director of the West National Technology Support Center.

List of attachments

1. State maps showing the four regional rainfall distribution boundaries.
2. Test versions of county.VA , county.MD, and county.DE EFH-2 rainfall database. type_II.rf and type_III.rf for use with EFH-2.
3. Rainfall tables for the four distribution regions for use in testing WinTR-55. These are named: NOAA_A.tbl, NOAA_B.tbl, NOAA_C.tbl, and NOAA_D.tbl.