

logPearson Frequency Analysis Spreadsheet for Analyses of Streamgage Records

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April, 2017

INTRODUCTION

Projects along stream corridors require flow frequency estimates. Flow discharge estimates for the 1.25-year (80% chance of occurrence) through 100-year (1% chance of occurrence) discharges are used for projects ranging from stream restoration to culvert and bridge replacements. Where sufficient streamgage data are available, the likely best method for developing flow frequency relationships are from statistical analyses of streamgage data. The standard procedure for developing these estimates use the logPearson frequency analysis, as detailed in Bulletin 17B (Interagency Advisory Committee on Water Data 1982). The addition of the expected moments algorithm (EMA; Cohn et al. 2007; Paretti et al. 2014) and a few other modifications to the Bulletin 17B procedure have been recommended, though have not yet been incorporated into a Bulletin 17C and formally adopted. This spreadsheet tool was developed to implement the analysis procedures detailed in Bulletin 17B, with this Forest Service version initially available in February 2015. The tool (version 3-1) is available for download from the following site:

<https://www.fs.fed.us/biology/nsaec/products-tools.html>

Other tools are available for the computation of flow frequency estimates, such as PKFQWin (Veilleux et al. 2014) and HEC-SSP (Bartles et al. 2016). These tools are standalone applications installed on a personal computer for computing flow frequency relationships. Alternatively, this

spreadsheet tool allows the computation of flow frequency relationships for many streamgages in one file, permits the automation of regional skew coefficient computations, facilitates the deletion of individual data points to assess the impacts of outliers, and does not require administrative computer access for installation.

CAPABILITIES

This spreadsheet tool was developed to perform logPearson frequency analyses of streamgage data using the methods provided in Bulletin 17B of the Interagency Advisory Committee on Water Data (1982). The tool computes peak discharges for the 1.05-year through 500-year events, both without and with the use of a regionally-weighted generalized skew (Figure 1). Results are automatically rounded to three significant figures. Tests for low and high outliers are included, as is a historic peak flow analysis procedure.

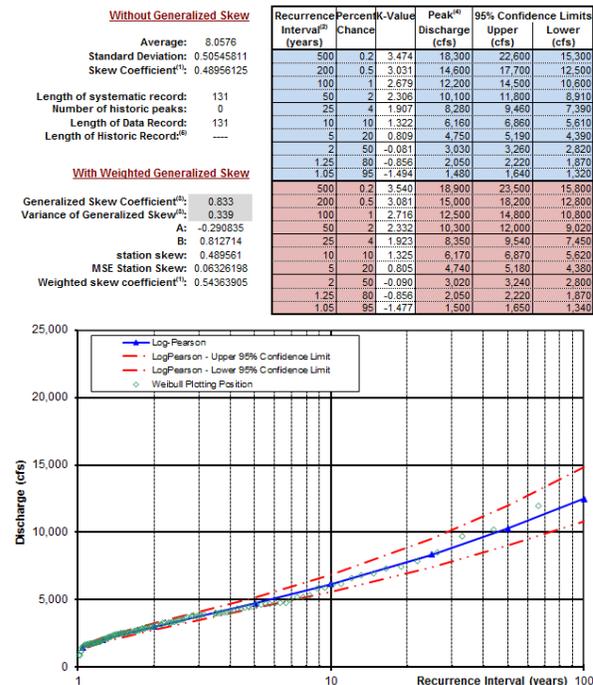


Figure 1: Example flow frequency analysis results for 131 years of systematic record for the Cache la Poudre River (Example Computation Sheet 2, in spreadsheet).

The exclusion of outliers can substantially influence results. The effect of exclusion may or may not be proper for developing the most appropriate frequency analysis; the decision to retain or eliminate a marked outlier needs to be carefully considered, with retention being default.

Data Sources

Streamgage data are available through numerous sources. The U.S. Geological Survey provides the most comprehensive database of streamgage data in the U.S., though state and local agencies, as well as private groups, also collect streamgage data in many areas. A practitioner needs to investigate all potential sources of streamgage data in their area of interest. The reliability of each of these datasets also needs to be assessed.

For USGS data, a spatial tool for finding streamgage data is provided through the USGS station statistics tool on the national Streamstats page:

<https://streamstatsags.cr.usgs.gov/streamstats/>

LIMITATIONS

The computational limitations of this spreadsheet tool are as follows:

- Station and generalized skews must be between -2.00 and +3.00. If this not the case, an “out of bounds” error is obtained.
- The spreadsheet will only work properly for data from 1900 and later, through a workaround for this limitation is illustrated in Example Computation Sheet 2.
- The outlier test is valid for streamgage record lengths ranging from 10 through 149, for an average that excludes zero events and previously-detected outliers.
- Up to two sequential low outliers can be eliminated.
- This tool has not been configured to address zero flood years in arid streams. Such points are simply disregarded.

This spreadsheet tool does not utilize the EMA procedure, which provides what is

considered to be a more accurate flow frequency relationship when historical or paleoflood data are incorporated into an analysis, or where multiple low outliers are present. When the flood record is systematic and where no low outliers are detected, the EMA results should be identical to a standard logPearson analysis as performed using this spreadsheet. The expected moments algorithm is included in the PKFQWin and HEC-SSP programs. A comparison of methods’ results are provided in Paretti et al. (2014).

ACKNOWLEDGEMENTS

Peer review of version 3.1 of this spreadsheet tool was performed by Mohammad Nash, William Wells, and James Snyder, of the U.S. Forest Service. The initial version of this spreadsheet tool (developed in 2002) was peer reviewed by Jon Fripp and Larry Goertz of the USDA NRCS National Design, Construction and Soil Mechanics Center.

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