

Hydrologic Frequency Analysis Work Group meeting
November 19, 2009
Michael Baker, Jr.
3601 Eisenhower Ave., Alexandria, VA

The Hydrologic Frequency Analysis Work Group (HFAWG) met at the office of Michael Baker, Jr., 3601 Eisenhower Ave., Alexandria, Virginia on November 19, 2009. The purpose of the meeting was to discuss the testing and comparison of Bulletin 17B procedures and the Expected Moments Algorithm (EMA) procedures and to discuss other potential changes to Bulletin 17B. A summary of the Bulletin 17B and EMA test results to date are summarized in an incomplete draft report titled “Expected Moments Algorithm and Bulletin 17B Flood Frequency Comparisons for Evaluating Potential Changes to Bulletin 17B”. This report, which eventually will be published as an U.S. Geological Survey (USGS) Scientific Investigations Report, was distributed to the HFAWG for review on November 12, 2009 and is available at <ftp://ftp.usbr.gov/jengland/HFAWG/testing/B17B-EMA-testing-report-draft-HFAWG-19nov2009.pdf>.

The agenda for the meeting is given in Attachment 1 and the attendee list is given in Attachment 2. Fifteen people attended the meeting in person and six people attended through a Conference Call/Live Meeting.

Will Thomas, Michael Baker, began the meeting by giving a brief history of the HFAWG, the accomplishments to date and the purpose of the HFAWG. The work group first met in January 2000 and all meeting minutes, the work group’s flood frequency research plans and the proposed Bulletin 17B-EMA testing plans are on the work group web site at <http://acwi.gov/hydrology/Frequency>.

Description of EMA and Test Results

Tim Cohn, USGS, gave an overview of the theory and rationale for EMA and discussed the various types of data that EMA can analyze. Bulletin 17B primarily utilizes point data where we assume we know the exact value of the flood peak discharge; however, for some years, historical peaks can be described as being less than a single historical flood threshold. As described by Tim, the EMA procedure can also analyze interval data where we only know a range of values and binomial data where we know the discharge was either greater than or less than a given value. Tim also used a spreadsheet to demonstrate how EMA works.

John England, USBR, presented the Bulletin 17B-EMA testing results to date based on observed data at 82 long-term stations scattered around the country. John presented the results for four categories of gaging stations using tables and graphs in the draft report “Expected Moments Algorithm and Bulletin 17B Flood Frequency Comparisons for Evaluating Potential Changes to Bulletin 17B”, dated November 11, 2009:

- Systematic gaging station data only, no historical data/low outliers: 29 sites
- Historical data, no low outliers: 24 sites
- Low outliers and peaks below a gage base, no historical data: 16 sites
- Historical and low outliers with peaks below a gage base: 13 sites.

There was a lengthy discussion of the results and what they meant. Some of that discussion is captured below.

Action Items and Future Work

Based on a discussion of the test results, the work group developed a list of action items and future work. A brief summary of the action items and the responsible person(s) follows.

1. Perform split-sampling analyses on the observed samples. Split-sampling analyses based on the long-term observed streamgaging records were a part of the original testing plan developed in August 2007. The scope of this effort was reduced to selecting 5 stations with high and low outliers and where the record length exceeds 60 years. The approach is to analyze the first 20 years of record and then continue to add 20 additional years until the full record length is achieved. That is, analyze record lengths of 20, 40, 60, 80 years and the full record. Bulletin 17B and EMA results will be compared for each combination of record lengths.

Nancy Steinberger, FEMA, agreed to perform these analyses.

2. Monte Carlo simulations. For the original testing, Beth Faber, USACE, developed six hypothetical frequency curves some of which were combinations of different frequency distributions with different moments. The scope of this work was reduced to only analyzing curves 4 and 5.

- Curve 4: Mixed distribution of two log Pearson Type III distributions, both with positive skew,
- Curve 5: Concatenation of two log Pearson Type III distributions, both with negative skew.

Tim Cohn and Beth Faber agreed to work together to complete the Monte Carlo simulations of the Bulletin 17B and EMA estimators for the two hypothetical frequency curves.

3. Provide data sets and information on EMA to practicing engineers to see if reasonable results can be obtained. The objective here is to test the usability; reproducibility, and reasonableness of the EMA approach for persons that have no prior knowledge of the technique but who are knowledgeable about the computational aspects of flood frequency analysis.

Tim Cohn will provide instructions for implementing EMA and the software for these analyses.

Bruce Rindahl, Ventura County, CA, offered to perform the tests on gaging station data in Ventura County.

A key point discussed during the meeting was that selecting the thresholds for the EMA method was very critical and often a difficult task. The analyst should rely authoritative data, rather than anecdotal, for selecting the thresholds.

4. Summarize Monte Carlo simulations from published papers by England, Cohn, Stedinger, Griffis and others. The emphasis should be on those papers that deal with low outliers and mixed distributions.

John England agreed to summarize these results and include them in the draft report.

5. Summarize frequency results for Bulletin 17B and EMA analyses for gaging stations with many nonexceedances, measurement error, multiple thresholds and interval data. These gaging stations are in addition to the 82 stations discussed above.

John England offered to summarize results for 5-10 stations that he has previously analyzed for various studies and/or papers.

6. All HFAWG members are to review the results of the Bulletin 17B-EMA testing described in the draft report “Expected Moments Algorithm and Bulletin 17B Flood Frequency Comparisons for Evaluating Potential Changes to Bulletin 17B” and provide comments to John England.

The purpose of the draft report is to describe the EMA procedure and compare EMA to the Bulletin 17B procedure. This report, to be published by USGS, will not make any recommendations regarding the adoption of EMA. Martin Becker commented that the HFAWG is providing unofficial comments on the USGS report and that the HFAWG should not be cited in the report as colleague reviewers. This does not prevent USGS from using a HFAWG member as a colleague reviewer but this person would not be representing the HFAWG. The intent of this approach is to make it clear that the HFAWG is not approving the USGS report or adopting the EMA procedure. The HFAWG comments are intended to improve the USGS report with respect to describing the Bulletin 17B-EMA test results and presenting a balanced and objective evaluation of the two methods.

Note: Martin Becker does not agree that a member of the HFAWG should be a colleague reviewer of the USGS report because this does not maintain independence between the USGS report and the HFAWG.

General Discussions

Various points and questions were discussed throughout the day and some of those thoughts are captured below.

Is it possible to identify conditions under which Bulletin 17B or EMA is a better approach to use? Based on the testing to date, it is not possible to answer this question.

The HFAWG agreed that there are still several topics or issues for which the testing and improved methods will not address at this time:

- Frequency analyses for ungaged sites,
- Techniques for analyzing data for watersheds undergoing land use change, nonstationarity and climatic variability (or climate change),
- Techniques for analyzing data at regulated watersheds.

The above issues should be addressed in the future but will not be addressed in the next revision of Bulletin 17B.

Gary Estes mentioned the need for dedicated funding to complete the Bulletin 17B-EMA testing.

Other Improvements in Bulletin 17B

The HFAWG generally agreed that there are other areas where Bulletin 17B can be improved. Suggested improvements include:

- Implementation of a new historical plotting position,
- Improved procedures for estimating confidence limits that take into consideration the uncertainty in the skew coefficient,
- Improved procedures for defining generalized or regional skew such as the Bayesian Generalized Least Square approach being used by USGS in selected studies.

Although these new procedures were not discussed in detail at the meeting, it was agreed that these procedures are described in the literature and are consistent with our research plans as described in “Flood Frequency Research Needs and Bulletin 17B Possible Improvement Plans” that is posted on the HFAWG web site (<http://acwi.gov/hydrology/Frequency>).

Next Meeting

The HFAWG agreed to meet again in March 2010 at Michael Baker’s office in Alexandria, VA. All action items described above should be completed a couple of weeks prior to the proposed March 2010 meeting. John England will provide a revised

version of the USGS report “Expected Moments Algorithm and Bulletin 17B Flood Frequency Comparisons for Evaluating Potential Changes to Bulletin 17B” at least two weeks prior to the March 2010 meeting.

Will Thomas
Michael Baker, Jr.
Chair of the HFAWG
December 1, 2009 – revised December 29, 2009

Attachment 1
Subcommittee on Hydrology, Advisory Committee on Water
Information
Hydrologic Frequency Analysis Work Group (HFAWG) Meeting

November 19, 2009
Michael Baker, Jr., Inc., 3601 Eisenhower Ave., Alexandria, VA

Agenda

Meeting Purpose: Present and discuss results completed to date on investigating potential changes to Bulletin 17B in the following areas: historical information; low outlier identification and treatment; confidence limits; and plotting positions. The focus is on EMA and Bulletin 17B comparisons based on theory and using data from 82 sites. Also discuss additional work needs and funding.

<i>Time</i>	<i>Topic</i>	<i>Presenter</i>
9:00 am - 9:15 am	Gathering of Attendees: HFAWG Members, Observers, Introductions	All
9:15 am - 9:30 am	Overview of current investigations, data subgroup and testing subgroup	Will Thomas, HFAWG Chair
9:30 am – 10:00 am	Bulletin 17B and Expected Moments Algorithm Theory Overview	Tim Cohn
10:00 am - 10:30 am	How EMA works: a Practical Demonstration with EMA in a Spreadsheet	Tim Cohn, Nancy Steinberger, John England
10:30 am – 11:00 am	Summary Overview of Testing Methods and Results for 82 sites	John England
11:00 am - 12:00 pm	Details of Testing Results for Categories: Gage; Historical; Low Outliers; Historical and Low Outliers; Confidence Intervals	John England/All
12:00 pm - 1:00 pm	Lunch and Discussion of Testing Results	All
1:00 pm- 2:00 pm	Continue Presentation and Discussion of Testing Results	All
2:00 pm - 2:20 pm	Plotting Positions, Confidence Limits and Generalized Skew Methods	Tim Cohn
2:20 pm - 4:00 pm	Discussions and Decisions on Testing; Discussions on Future Work: additional testing/documentation needs and funding; process on potential changes to Bulletin 17B and recommendations; nonstationarity - land use change, regulated flows, climate variability, etc. other needed studies or additions to Bulletin 17B or potential improvements	All

Attachment 2
Attendees at the November 19, 2009 meeting of the Hydrologic Frequency Analysis
Work Group (HFAWG)
Michael Baker, Jr. office in Alexandria, VA

The following persons attended the November 19, 2009 HFAWG meeting in person:

Name	Affiliation	Email
Tim Cohn	USGS	tacohn@usgs.gov
Robert Mason	USGS	rrmason@usgs.gov
John England	USBR	jengland@usbr.gov
Martin Becker	Self	martin_becker@prodigy.net
Nancy Steinberger	FEMA	nancy.steinberger@dhs.gov
Zhida Song-James	Michael Baker	zsong-james@mbakercorp.com
Beth Faber	USACE	beth.faber@usace.army.mil
Brian Koper	Michael Baker	bkoper@mbakercorp.com
Donald Woodward	American Forests	dew7718@comcast.net
Sanja Perica	HDSC/NWS	sanja.perica@noaa.gov
William Merkel	NRCS	william.merkel@wdc.usda.gov
Jerry Coffey	Retired OMB	drjerrycoffey@cox.net
Mohammad Haque	NRC/NRO	mohammad.haque@nrc.gov
Thomas Nicholson	NRC/RFS	Thomas.nicholson@nrc.gov
Will Thomas	Michael Baker	wthomas@mbakercorp.com

The following persons attended the November 19 meeting by conference call/live meeting:

Name	Affiliation	Email
Ken Eng	USGS	keng@usgs.gov
Jery Stedinger	Cornell University	jrs5@cornell.edu
Mark Bandurraga	Ventura County, CA	mark.bandurraga@ventura.org
Bruce Rindahl	Ventura County, CA	bruce.rindahl@ventura.org
Joseph Kanney	NRC	joseph.kanney@nrc.gov
Gary Estes	Citizen Advocate	gary32@dg4135.us