



# EFFECTIVE RECORD LENGTH

Statistics for Hydrology

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US Army Corps  
of Engineers®

## LEARNING OBJECTIVES

- Give a correct definition for effective record length
- Summarize why effective record length is needed
- Describe how effective record length is estimated



## OUTLINE OF TOPICS

- Review Uncertainty Concepts
- Define Effective Record Length
- Demonstrate how effective record length is used
- Calculate Effective Record Length



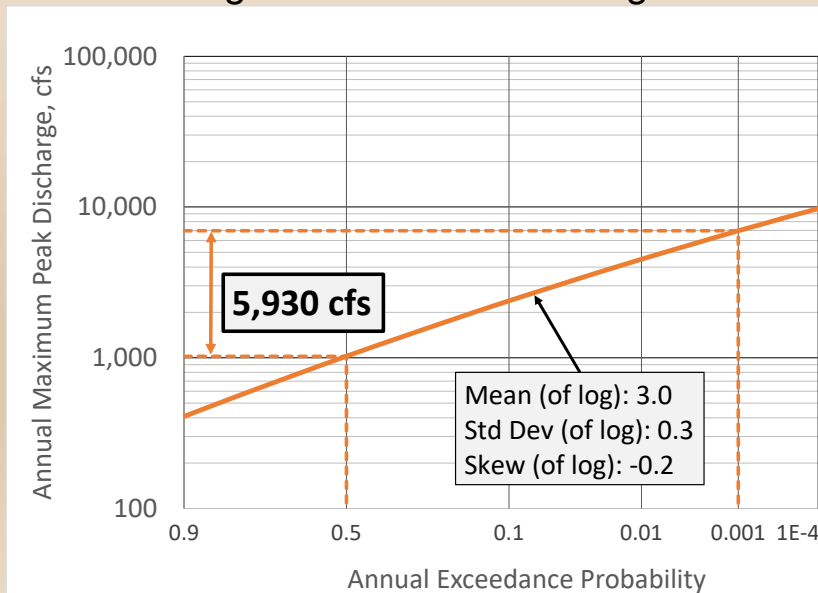
# NATURAL VARIABILITY

- Inherent uncertainty due to randomness
- Irreducible
- Will a major flood occur this year?



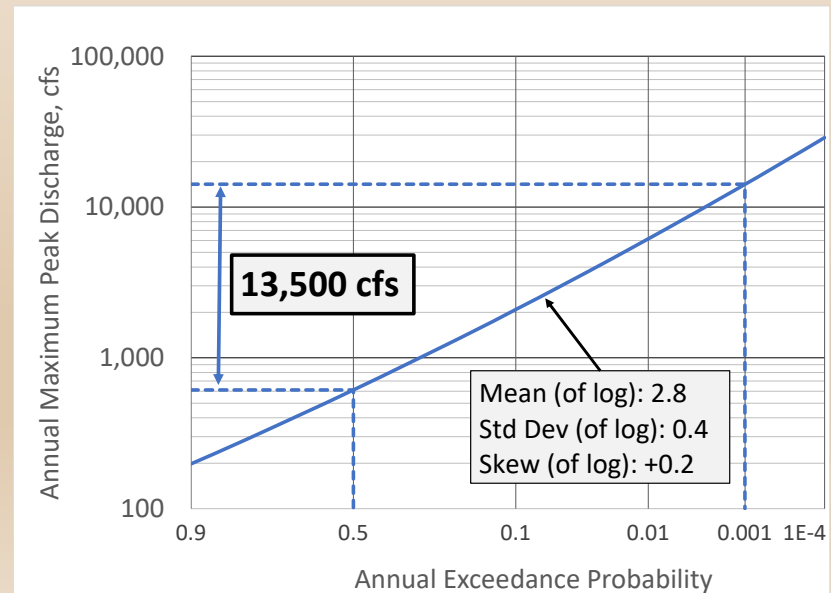
## LESS NATURAL VARIABILITY

Smaller range of flow for same range of AEP



## MORE NATURAL VARIABILITY

Larger range of flow for same range of AEP

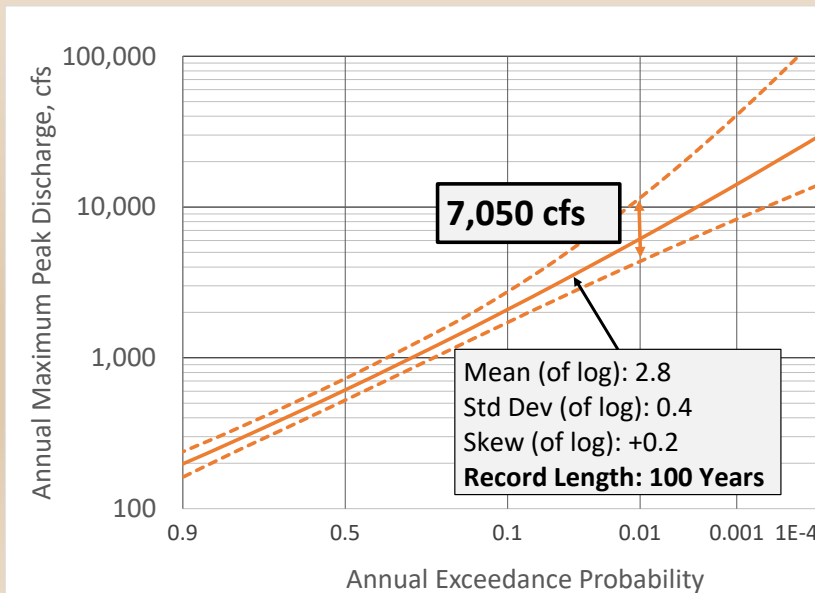


# KNOWLEDGE UNCERTAINTY

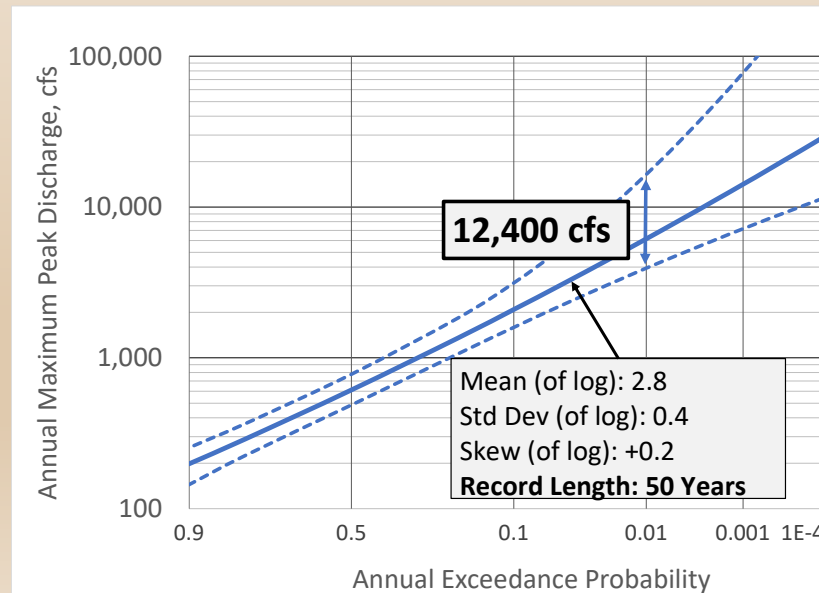
- Uncertainty due to limited data
- Reducible with more data
- How big is the 500-year flood?



LESS KNOWLEDGE UNCERTAINTY  
Smaller confidence interval with more data



MORE KNOWLEDGE UNCERTAINTY  
Larger confidence interval with less data



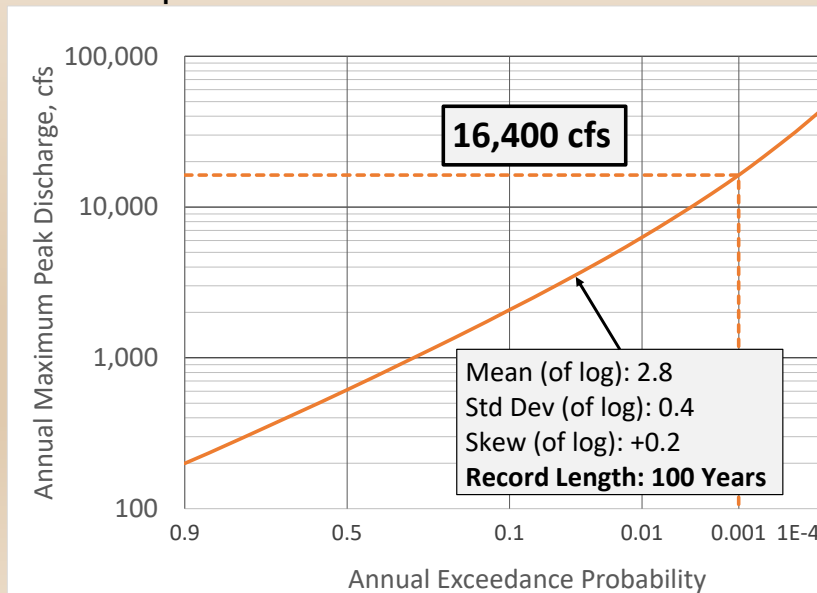
# KNOWLEDGE UNCERTAINTY

- Effect on expected (or mean) hazard



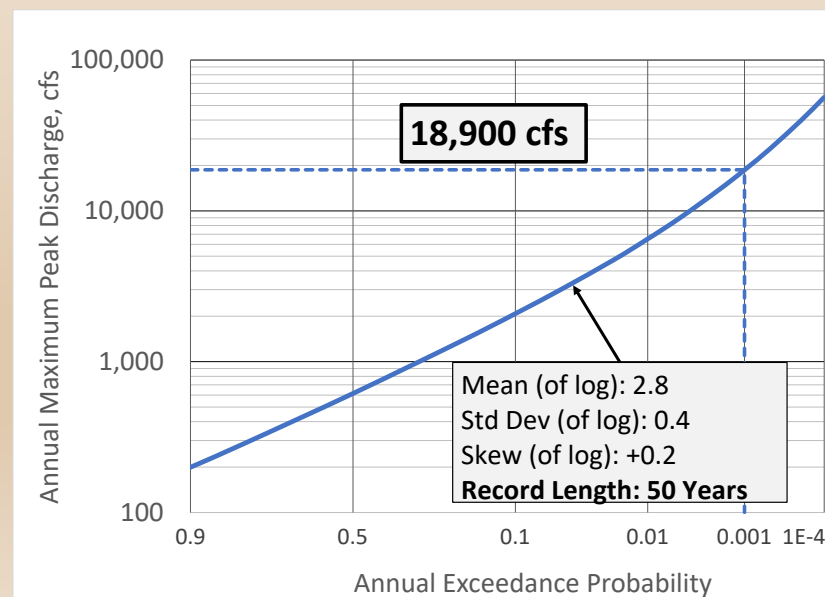
## LESS KNOWLEDGE UNCERTAINTY

Less frequent mean hazard with more data



## MORE KNOWLEDGE UNCERTAINTY

More frequent mean hazard with less data

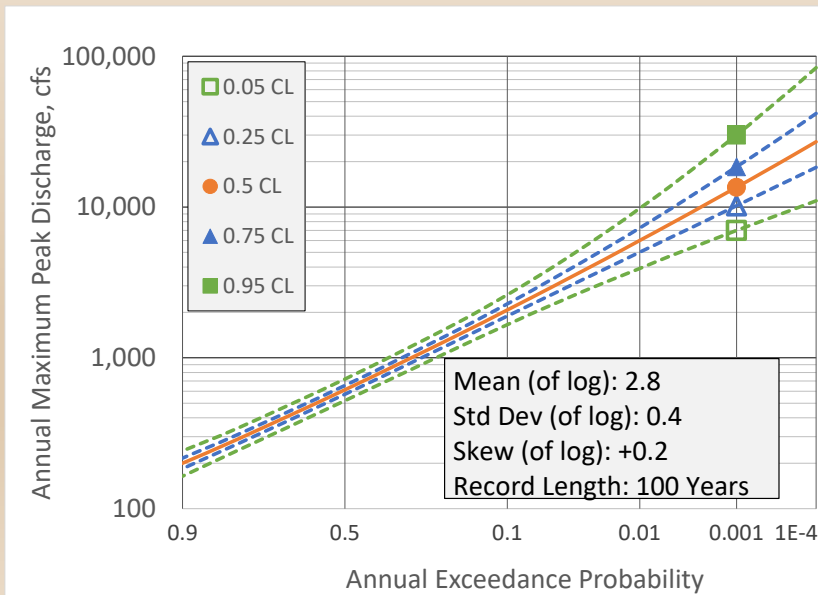


# QUANTILE VARIANCE

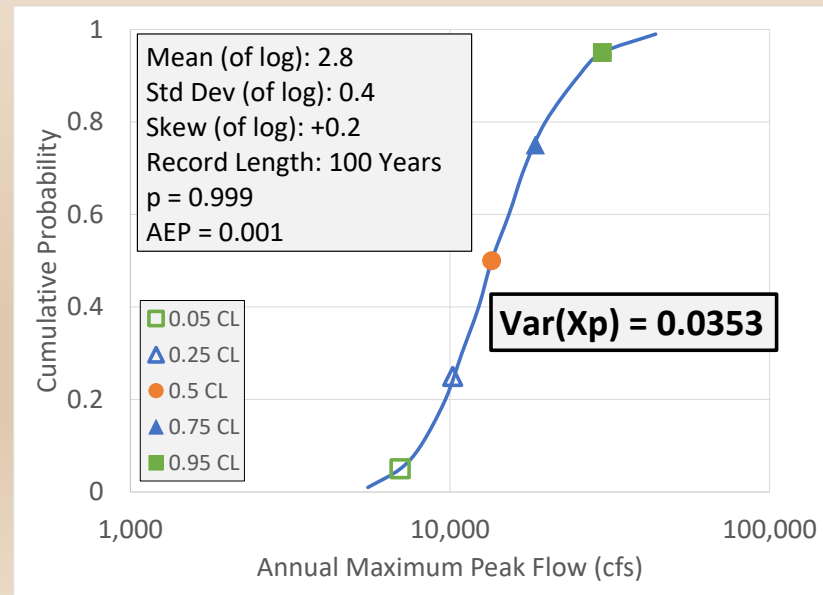


- Uncertainty in flow for a given annual exceedance probability
- Related to the confidence intervals
- Quantile (p) means non-exceedance probability ( $p = 1 - AEP$ )
- Variance measures dispersion or uncertainty

Confidence Intervals

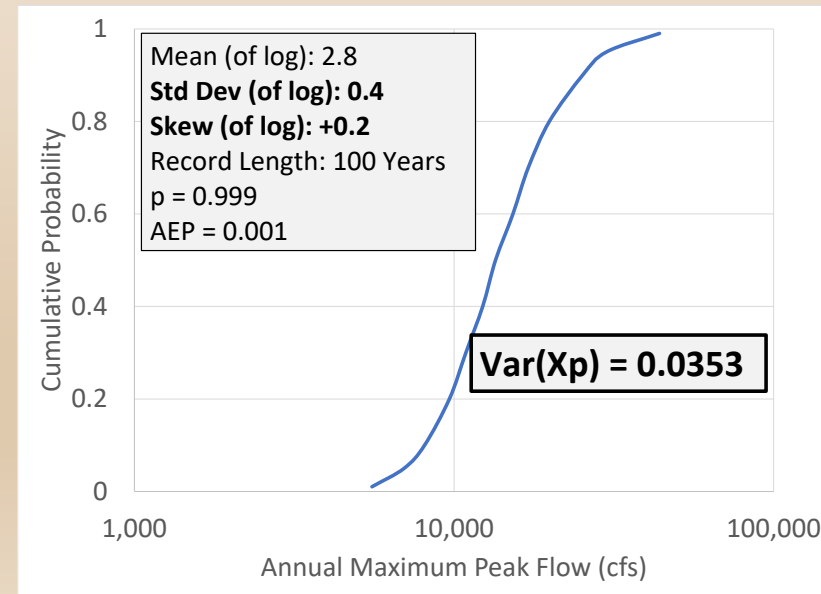
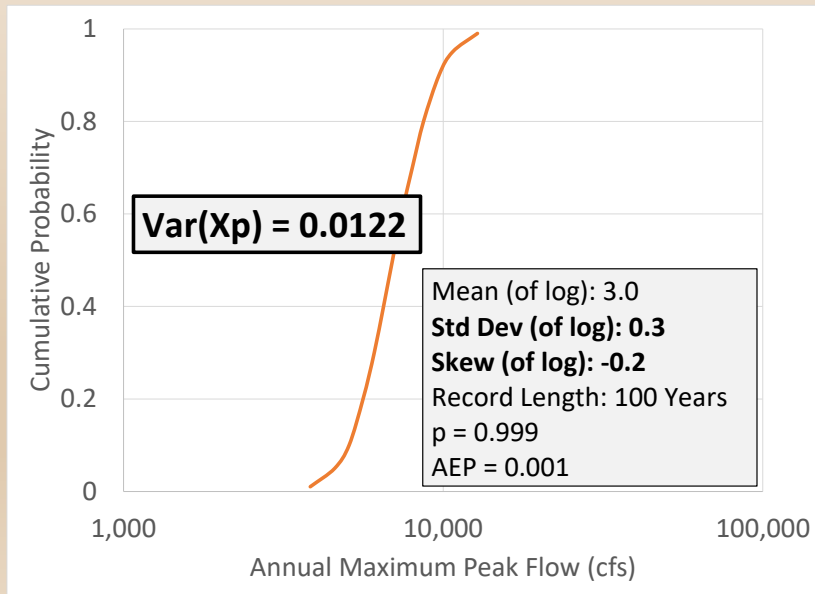


Quantile Variance



# QUANTILE VARIANCE

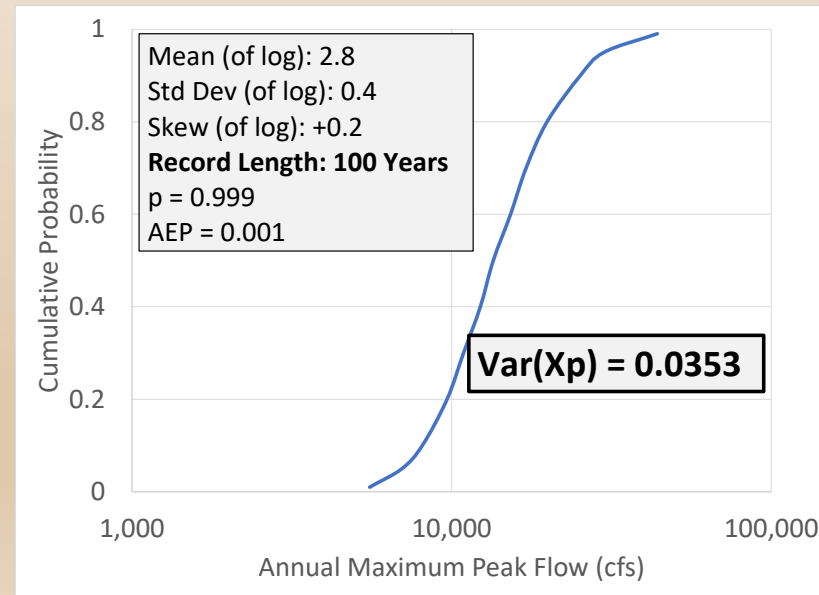
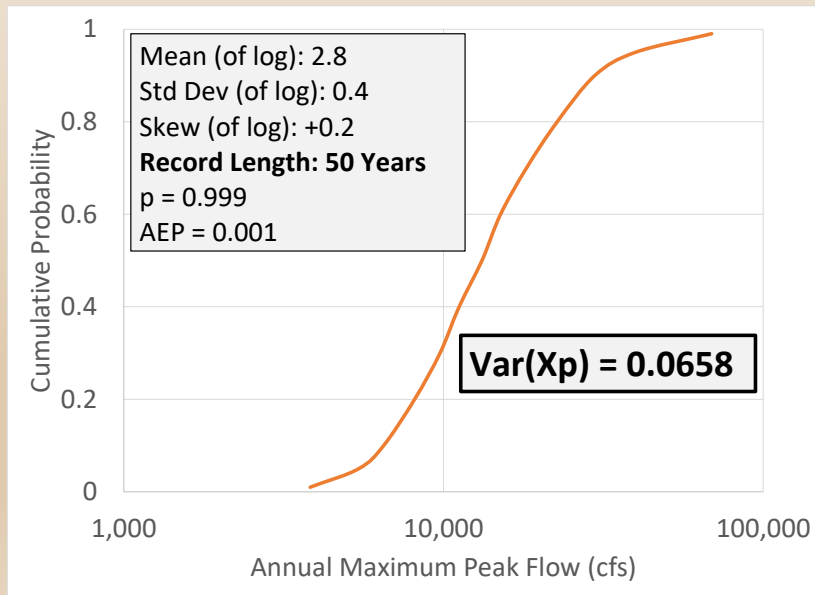
- Depends on both natural variability and knowledge uncertainty
- Increase in standard deviation or skew increases quantile variance



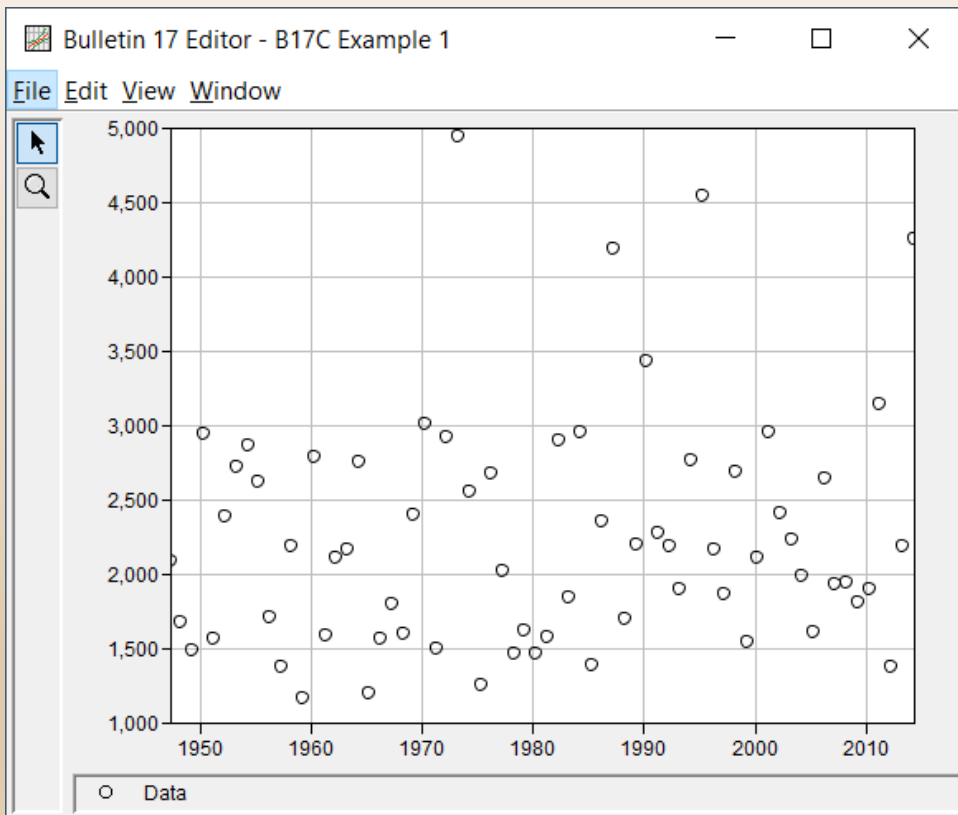


# QUANTILE VARIANCE

- Depends on both natural variability and knowledge uncertainty
- Increase in record length reduces quantile variance



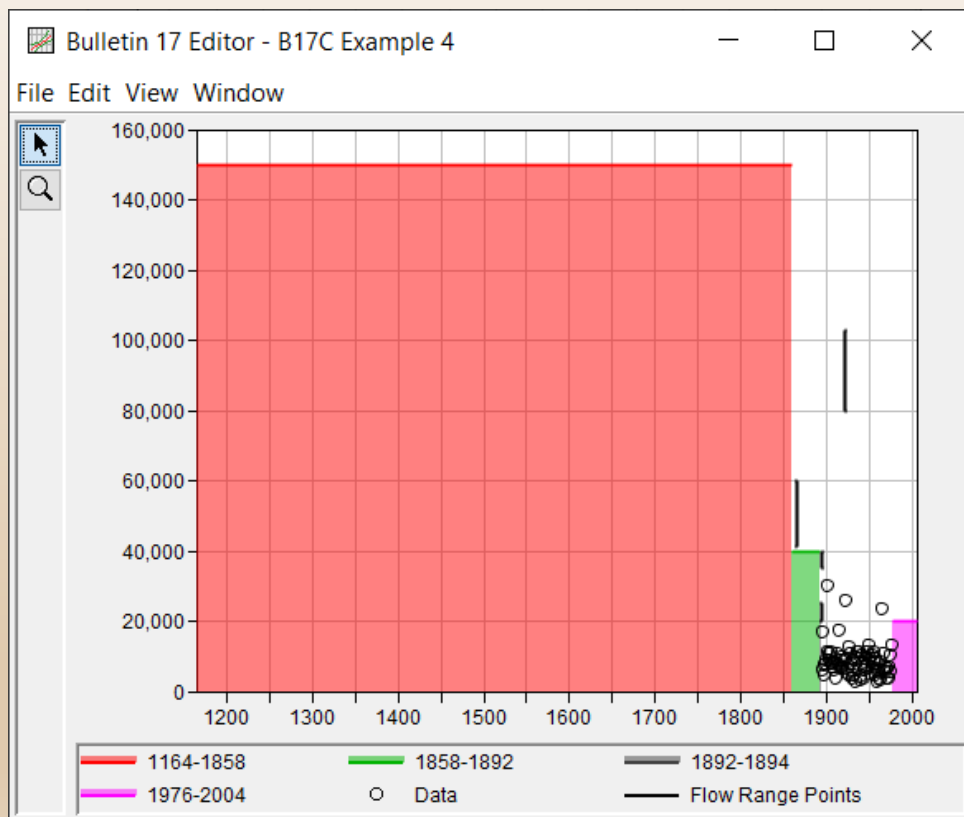
# RECORD LENGTH FOR SYSTEMATIC DATA



- Record length is equal to the number of observed data



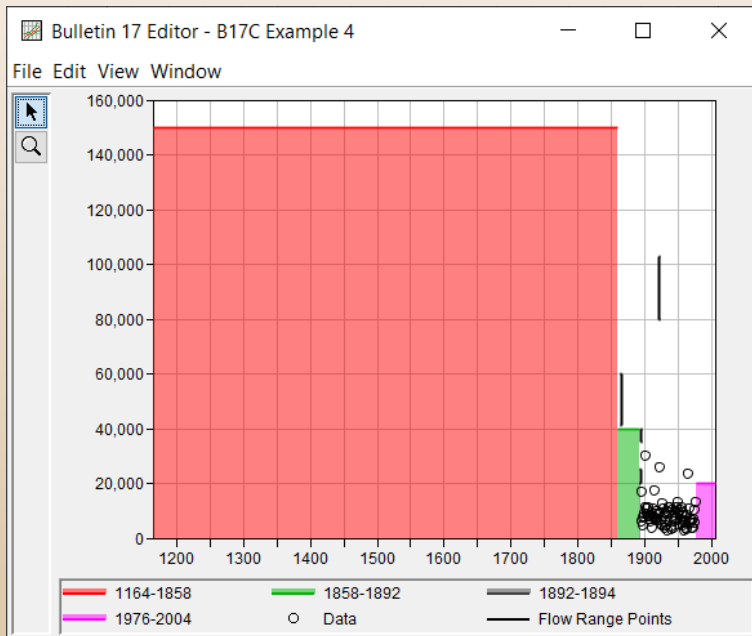
# EFFECTIVE RECORD LENGTH FOR CENSORED DATA



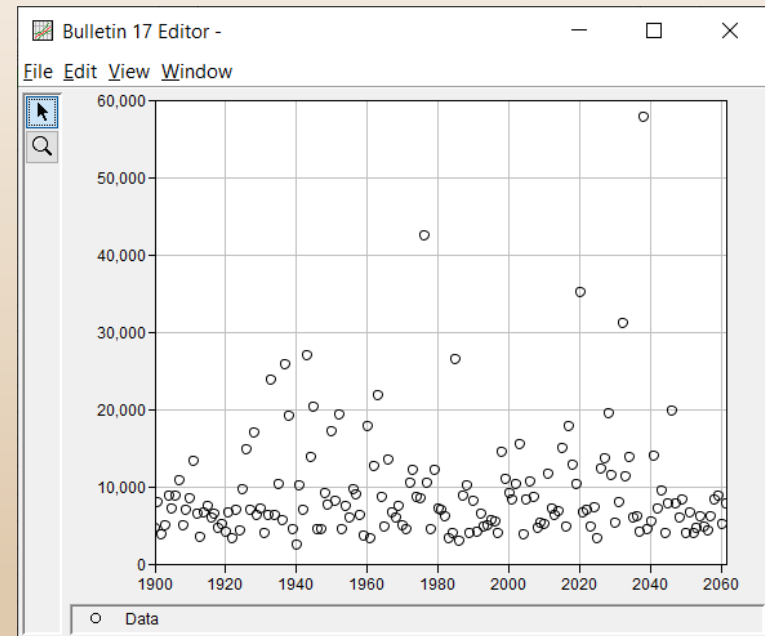
- How many years of information?



# EFFECTIVE RECORD LENGTH FOR CENSORED DATA



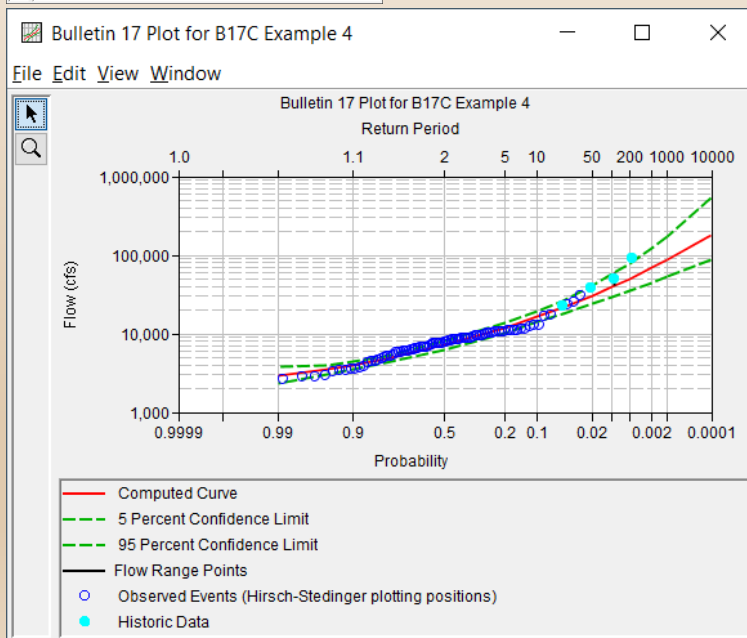
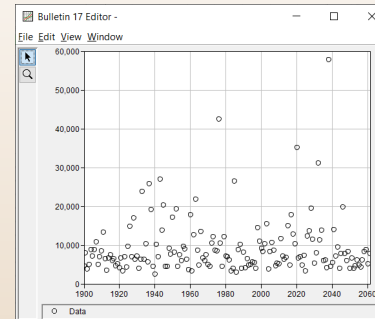
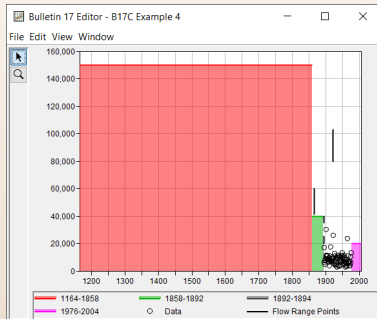
Equivalent?



162 years of systematic record

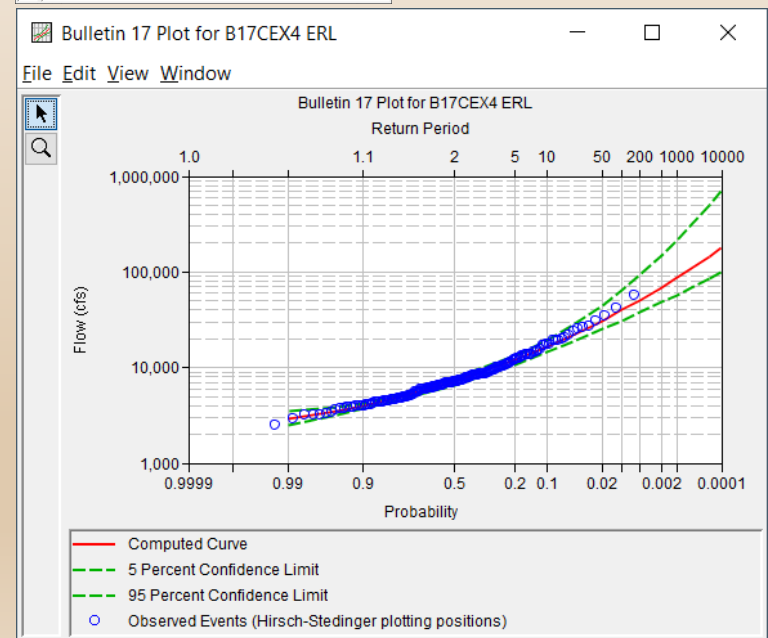


# EFFECTIVE RECORD LENGTH FOR CENSORED DATA

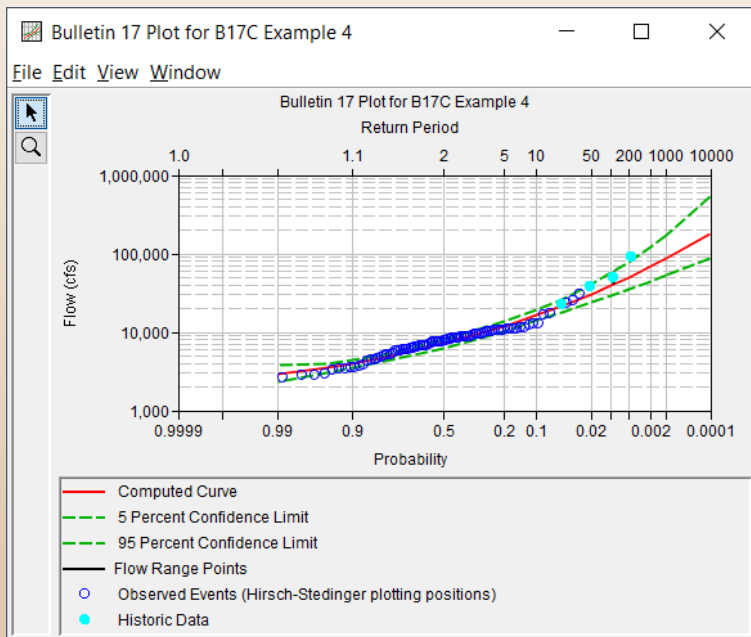


Same computed curve

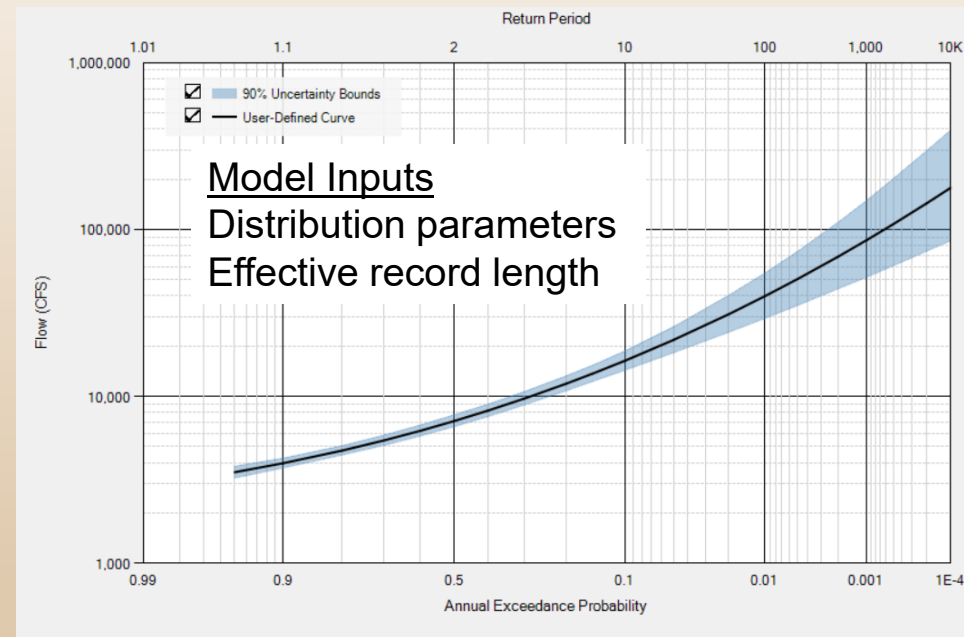
Same uncertainty



# EFFECTIVE RECORD LENGTH FOR CENSORED DATA



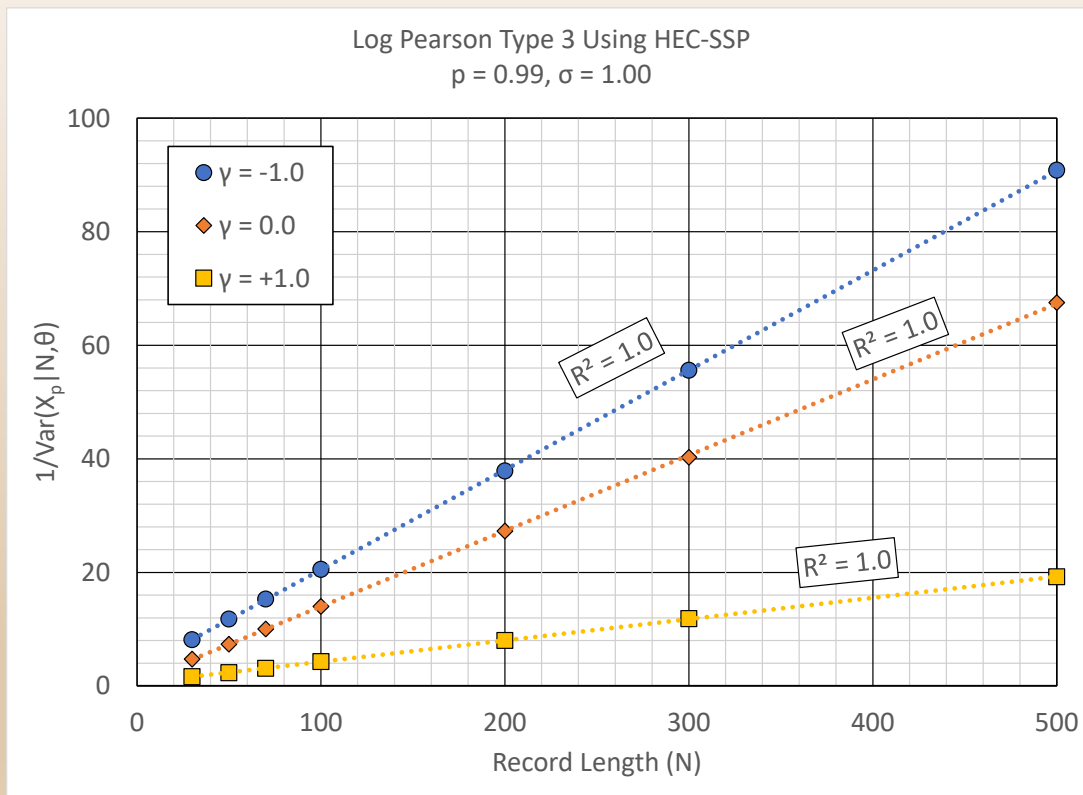
Calculate a frequency curve with uncertainty using the censored data



Model the same frequency curve with the same uncertainty in a flood hazard or risk model



# EFFECTIVE RECORD LENGTH FOR CENSORED DATA



# EFFECTIVE RECORD LENGTH FOR CENSORED DATA



Bulletin 17 Editor - B17C Example 4

Name: B17C Example 4

Description: Example 4: Historical Data - Arkansas River at Pueblo, CO

Flow Data Set: Arkansas River-Pueblo-FLOW

DSS File Name: C:\Users\IQORMCDAM\Documents\SSP\_Example\_Data\Bulletin\_17C\_Examples\Bulletin\_17C\_Examples.dss

Report File: C:\Users\IQORMCDAM\Documents\SSP\_Example\_Data\Bulletin\_17C\_Examples\Bulletin17Results\B17C\_Example\_4\B17C\_Example\_4.rpt

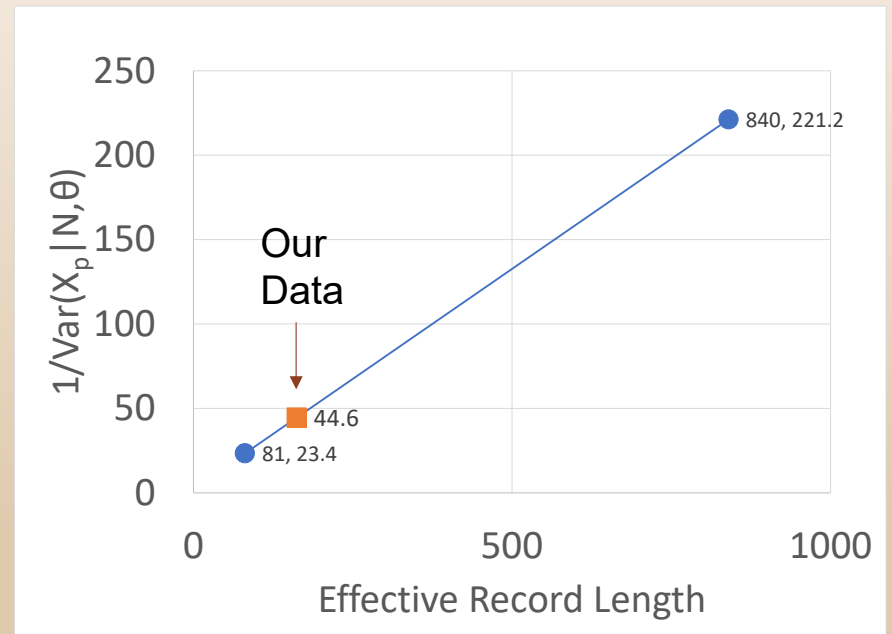
General Options EMA Data Tabular Results

Frequency Curve for: Arkansas River-Pueblo-FLOW

Percent Chance Exceedance	Computed Curve Flow in cfs	Variance Log (EMA)	Confidence Limits Flow in cfs	
			0.05	0.95
0.01	177271.2	0.04959	545179.5	88761.7
0.1	86273.8	0.02243	174363.0	52960.3
0.2	68831.1	0.01666	124061.0	44818.2
0.5	50915.4	0.01061	79376.2	35554.0
1.0	39789.3	0.00717	56639.4	29535.1
2.0	30975.5	0.00463	40893.6	24254.3
5.0	21824.1	0.00249	26670.9	18195.2
10.0	16389.0	0.00165	19298.0	14102.3
20.0	11942.6	0.00128	13706.9	10360.2
50.0	7122.1	0.00096	7985.9	6295.6
80.0	4735.0	0.00057	5211.7	4314.1
90.0	3980.1	0.00071	4375.0	3559.1
95.0	3514.4	0.00127	4036.4	3066.4
99.0	2903.2	0.00394	3794.4	2329.3

Distribution Parameters		Events	
Parameter	Value	Event	Number
Mean	3.886	Historic Events	4
Standard Dev	0.246	High Outliers	0
Station Skew	0.818	Low Outliers and Zero Flows	0
Regional Skew		Missing Flows	755
Weighted Skew		Systematic Events	81
Adopted Skew	0.818	Historic Period	840
EMA Estimate of MSE (G at-site)	0.117	Equivalent Record Length (years)	85 000
Grubbs-Beck Critical Value	0.000		

Buttons: Compute, Plot Curve, View Report, Print, OK, Cancel, Apply





## STAY TUNED

- Most current software does not calculate and report the effective record length for censored data
- Unofficial spreadsheet tools are available
  - Use with caution

