Regionalization and Streamgage Network Extension

ACWI Ad-hic
Network Review Committee

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Regionalization

- Historically applied to flow statistics (e.g. 100-year Flood Flow, 7Q10, Annual mean, August median, etc.)
- Regression links flows to basin characteristics
- Cross-correlation and auto correlation requires unit software
- Equations are developed for sub-state regions based on hydrology, geology, climate
- “Extends” data through time and space by pooling information from several sites
- Provides estimates at ungaged sites
- Methods for transfer of timeseries under development

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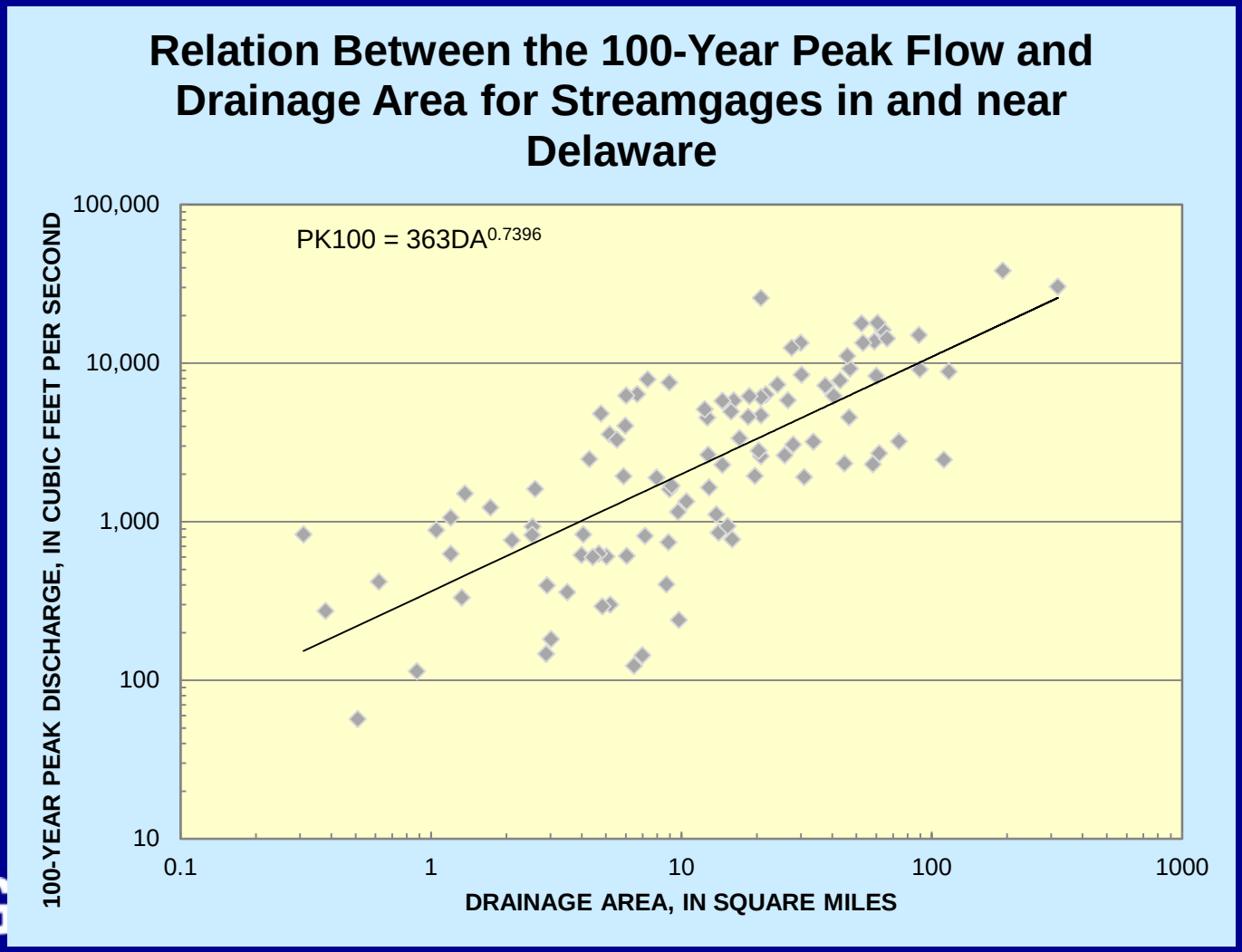
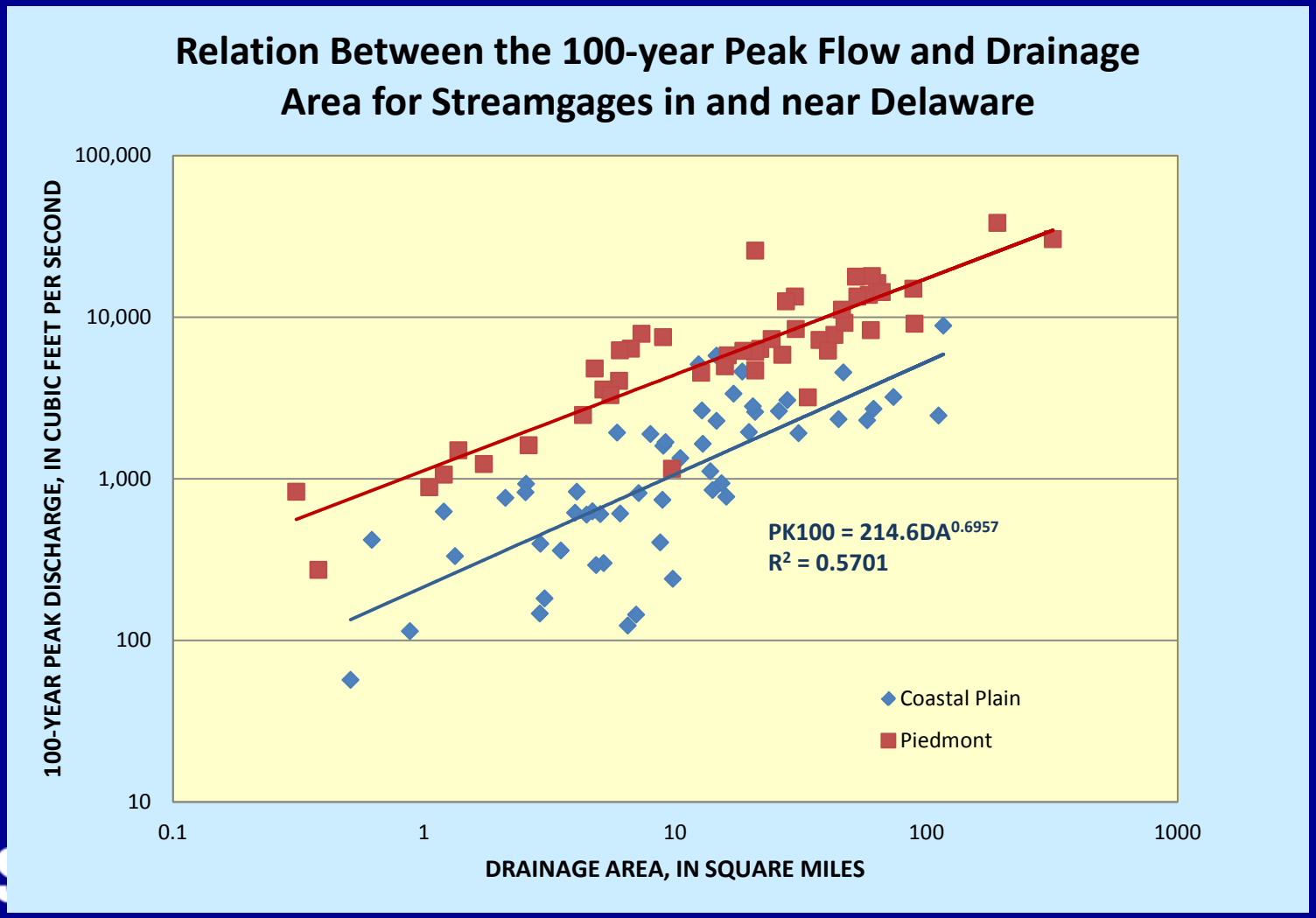
Example Regression Plot



Example Regression Plot with Regions



Example Regression Equation

$PK100 = 1.91DA^{0.980}SL^{0.636}P^{0.536}$

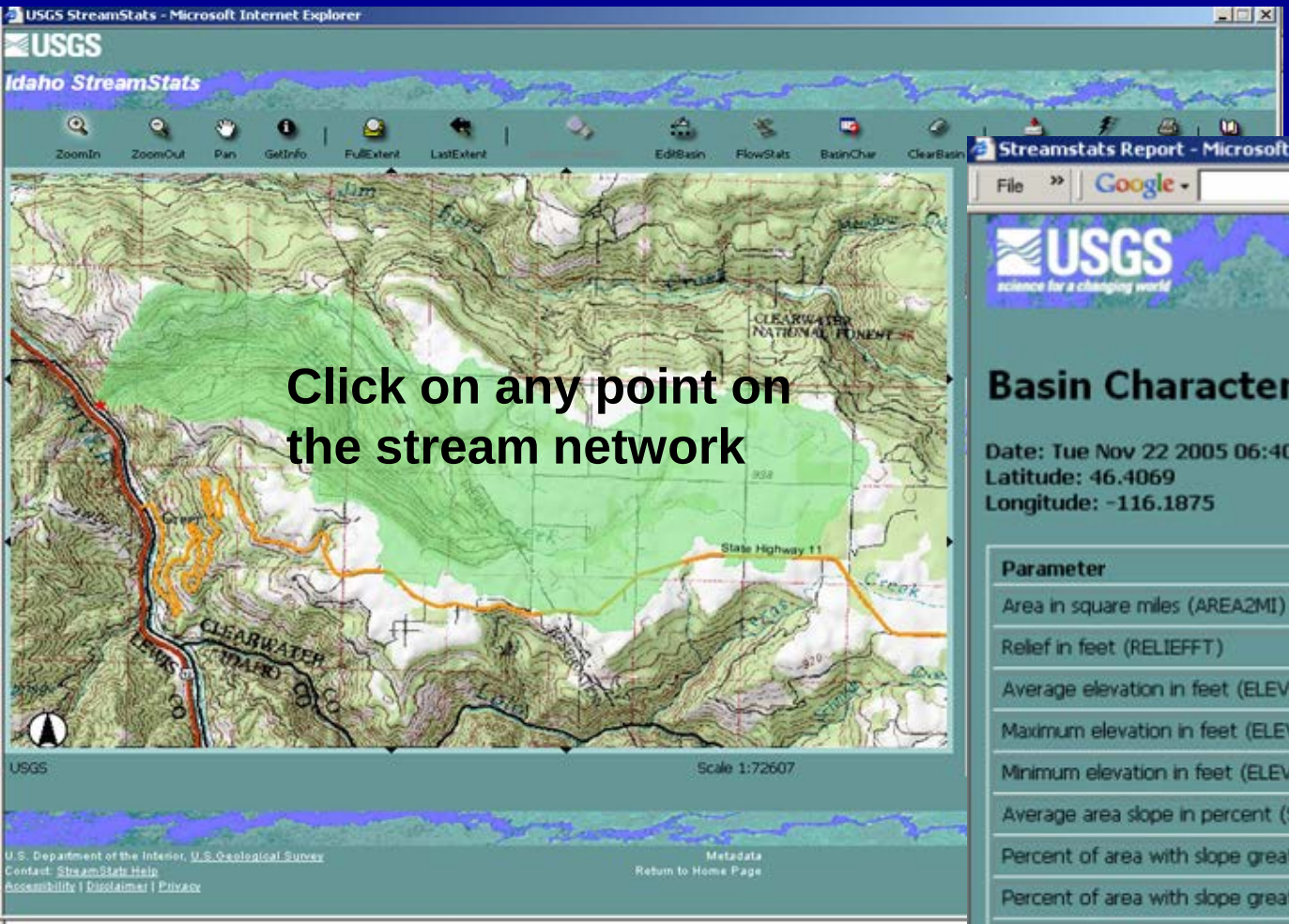
where

- PK100 is the 100-year (1-percent chance) flood, in feet^3/second
- DA is Drainage Area, in square miles
- SL is mean channel slope, in feet/mile
- P is mean annual precipitation, in inches

Citation: Lumia, Richard, Freehafer, D.A., and Smith, M.J., 2006, Magnitude and Frequency of Floods in New York: U.S. Geological Survey Scientific Investigations Report 2006–5112, 152 p.

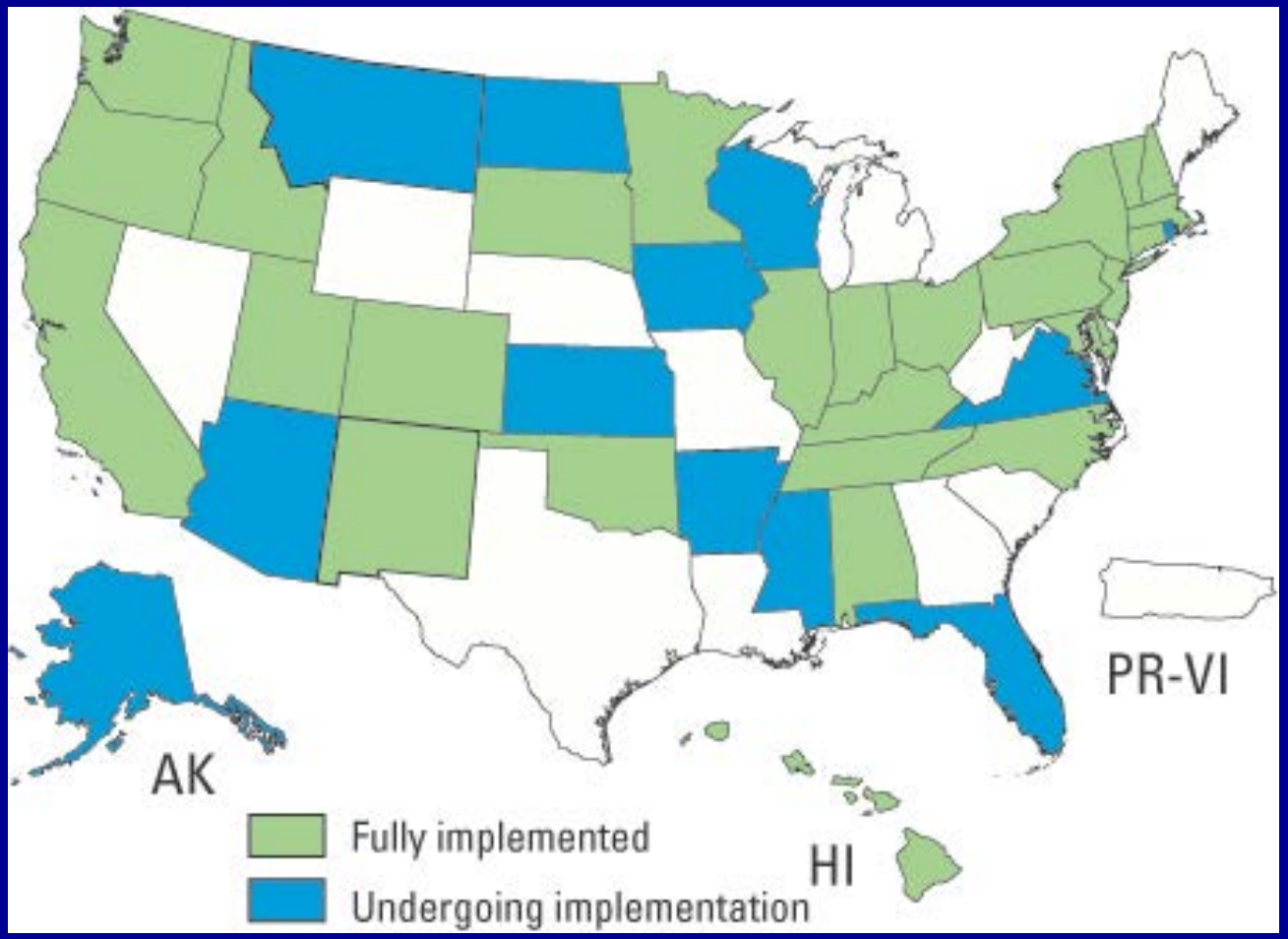
Delivering the Data -StreamStats

- Web-based application
- Provides GIS-piloting to site of interest
- Automatically measures basin and climatic characteristics using GIS
- Provides at-site streamflow statistics for gaged sites
- Solves regional regression equations to estimate statistics for ungaged sites
- GIS DEM and other measurement tools



Parameter	Value
Area in square miles (AREA2MI)	12.3
Relief in feet (RELIEFFT)	2100
Average elevation in feet (ELEVFT)	2770
Maximum elevation in feet (ELEVMAXFT)	3180
Minimum elevation in feet (ELEVMINFT)	1080
Average area slope in percent (SLPPCT)	19.5
Percent of area with slope greater than 30% (SLPPCT30)	28.2
Percent of area with slope greater than 30% and facing North (SLPPCT30N)	11.7

StreamStats – Implementation Status



- 27 states fully implemented, including network navigation
- 10 states in implementation process
- SC and GA start in fall of 2012

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StreamStats Funding

- Development team primarily funded through NSIP
- Dev. team FY12 budget = $436,500
- WSCs assed for computer infrastructure FY12 total = $166,400 ($5,200/state)Implementation work by WSCs funded through cooperative agreements
  - Total cost since inception (2001) at least $9.3M
  - Cooperator share at least $6.2M

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WaterCensus Daily Flow Estimation Model Comparison

Three Models:

- Drainage Area Ratio
- QPPQ –Flow Duration Curve Transformation
- Precipitation Runoff Modeling System

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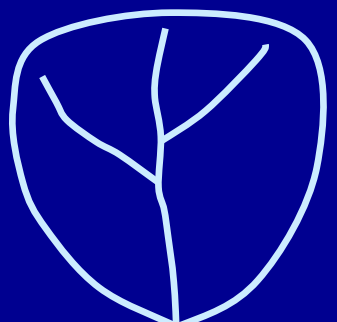
Estimating streamflow at an ungaged site

We propose a two-part method to estimate continuous daily streamflow at ungaged sites:

1. Estimate a flow-duration curve for the ungaged site
2. Transform the estimated flow-duration curve into a time series

QPPQ TRANSFORM REQUIRES BOTH SYNTHETIC AND INDEX GAGE DURATION CURVE

Estimate basin characteristics



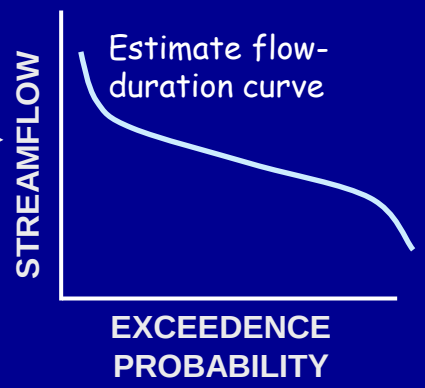
Area = XX.X mi²

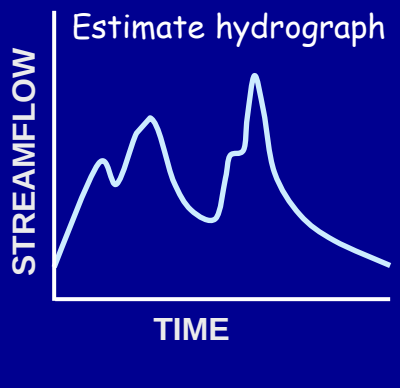
Solve the regression equations

$$\ln(Q50) = a_1 + b_1 * (\ln(Area))$$
$$\ln(Q60) = a_2 + b_2 * (\ln(Area))$$
$$\ln(Q70) = a_3 + b_3 * (\ln(Area))$$

OR

$$\ln(\bar{Q}) = a_3 + b_3 * (\ln(Area))$$
$$\ln(s^2) = a_3 + b_3 * (\ln(Area))$$
$$\ln(m_3) = a_3 + b_3 * (\ln(Area))$$





We will use regression equations that relate measurable basin characteristics to flow-duration-curve statistics

We will then convert the estimated flow-duration curve into a time series of streamflow

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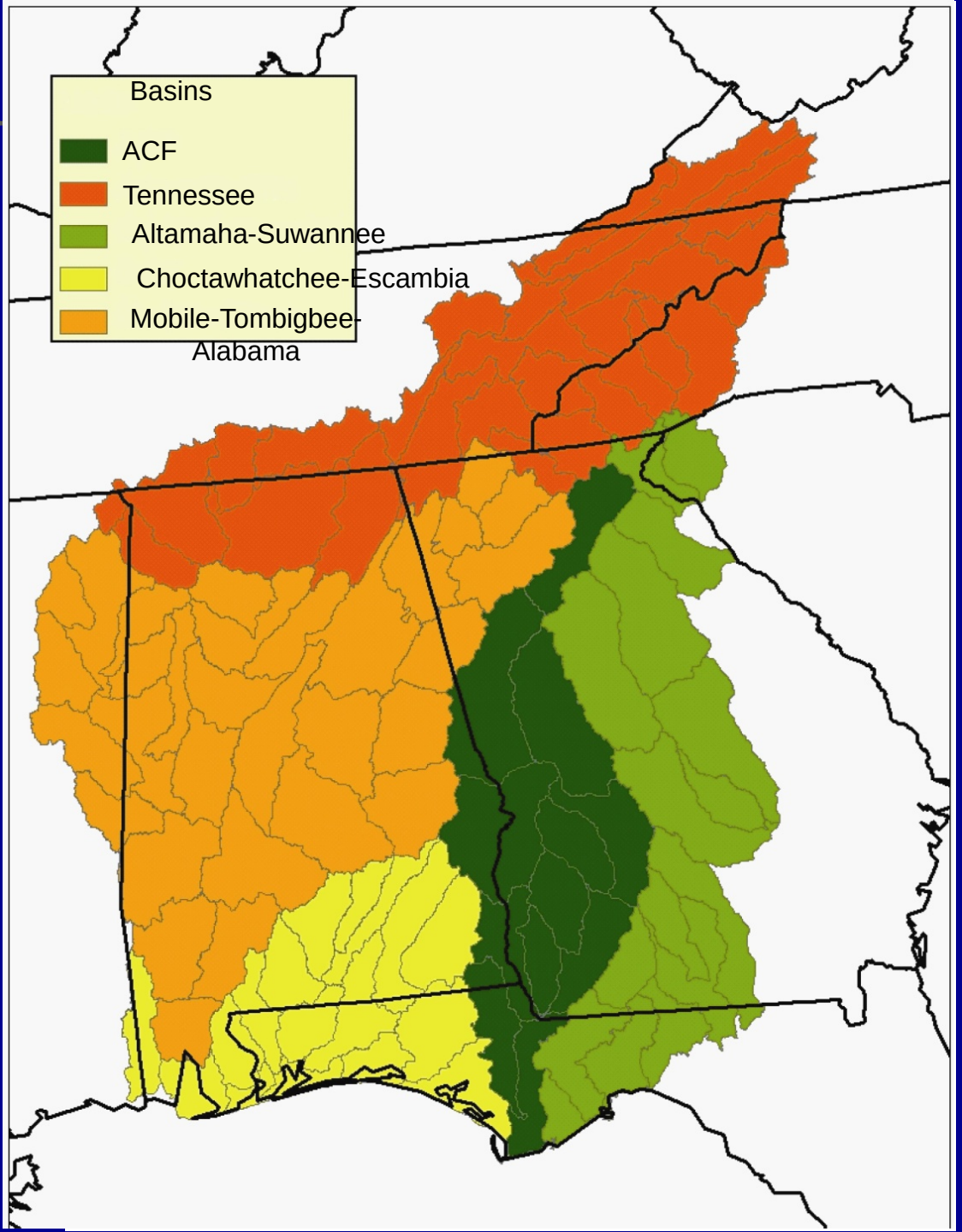
Southeast Model Comparison Study

- Study Domain
- 182 gages
- “natural” conditions



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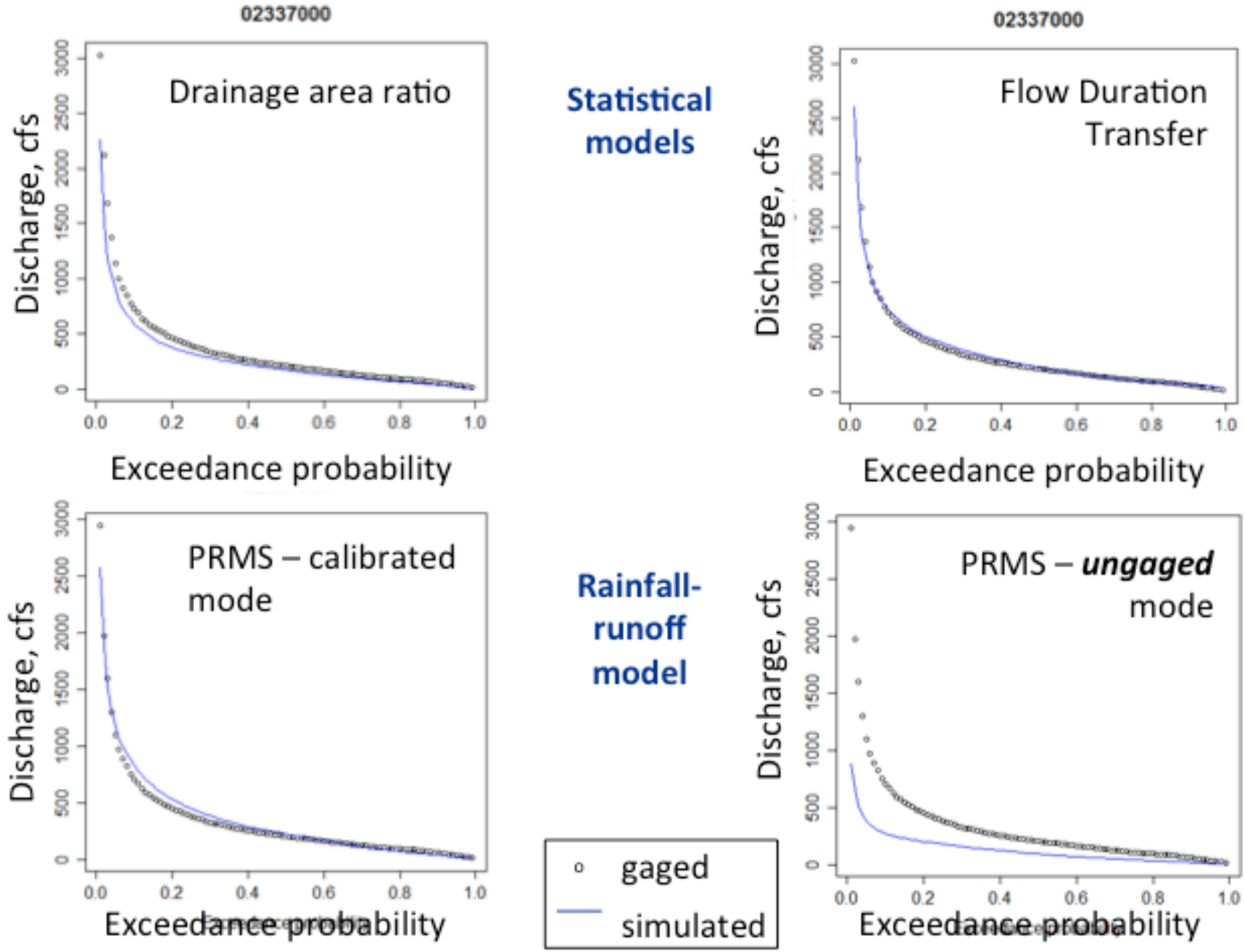
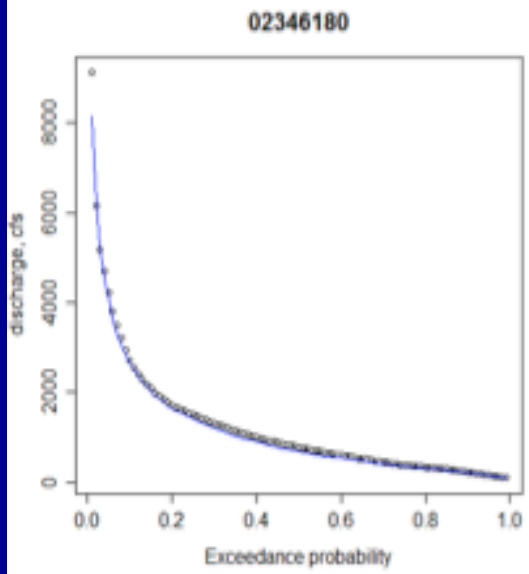
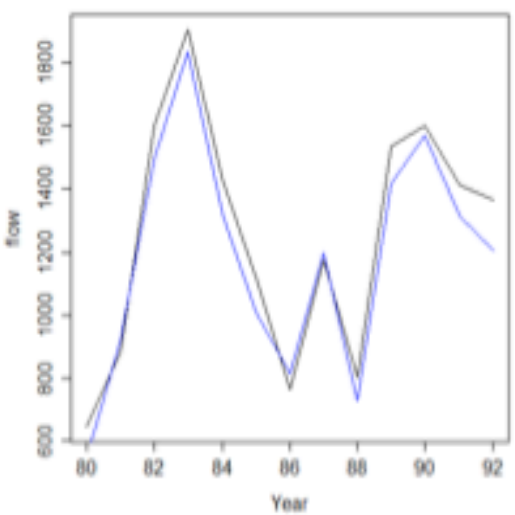
Flow duration curve comparisons: 02337000



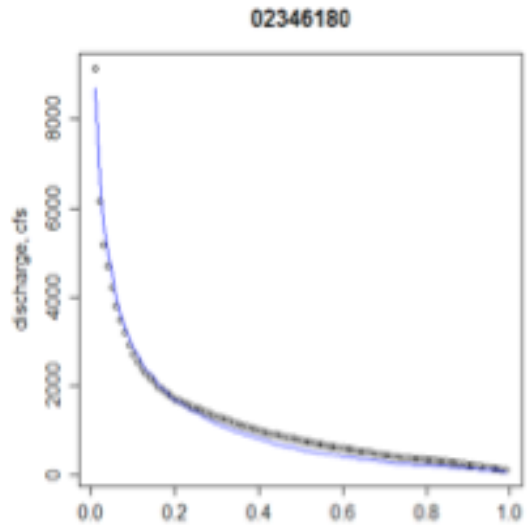
Flow duration curve comparisons: 02346180

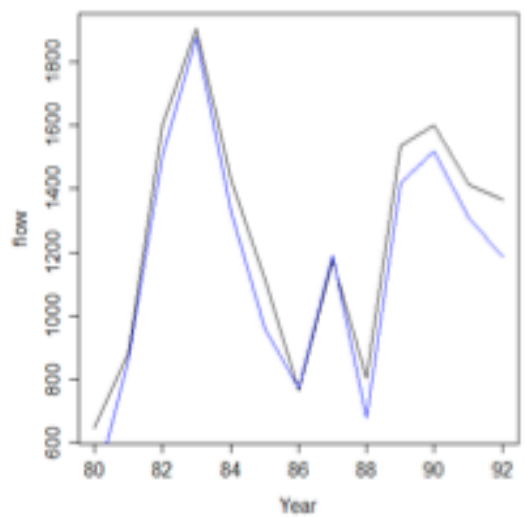
Drainage area ratio





Flow Duration Transfer





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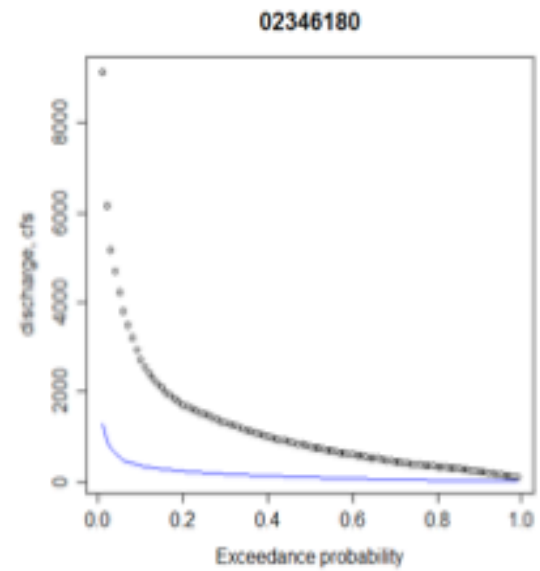

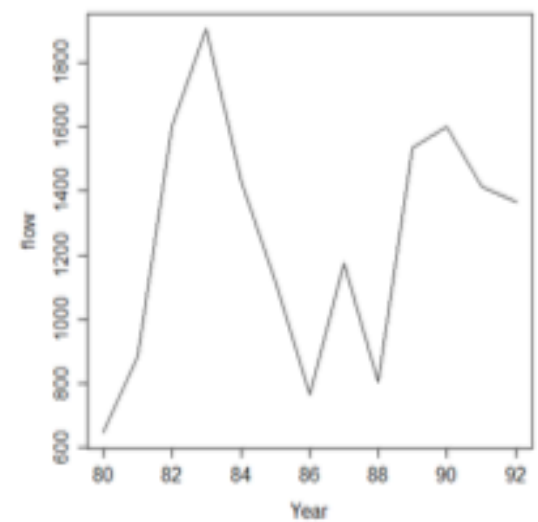

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