

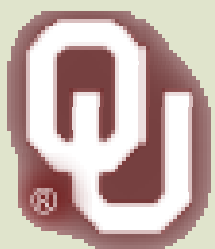
# A Hydrologically Relevant Framework for QPE Evaluation and Probabilistic Flood Prediction

Zac Flamig

JJ Gourley

Yang Hong

Manos Anagnostou



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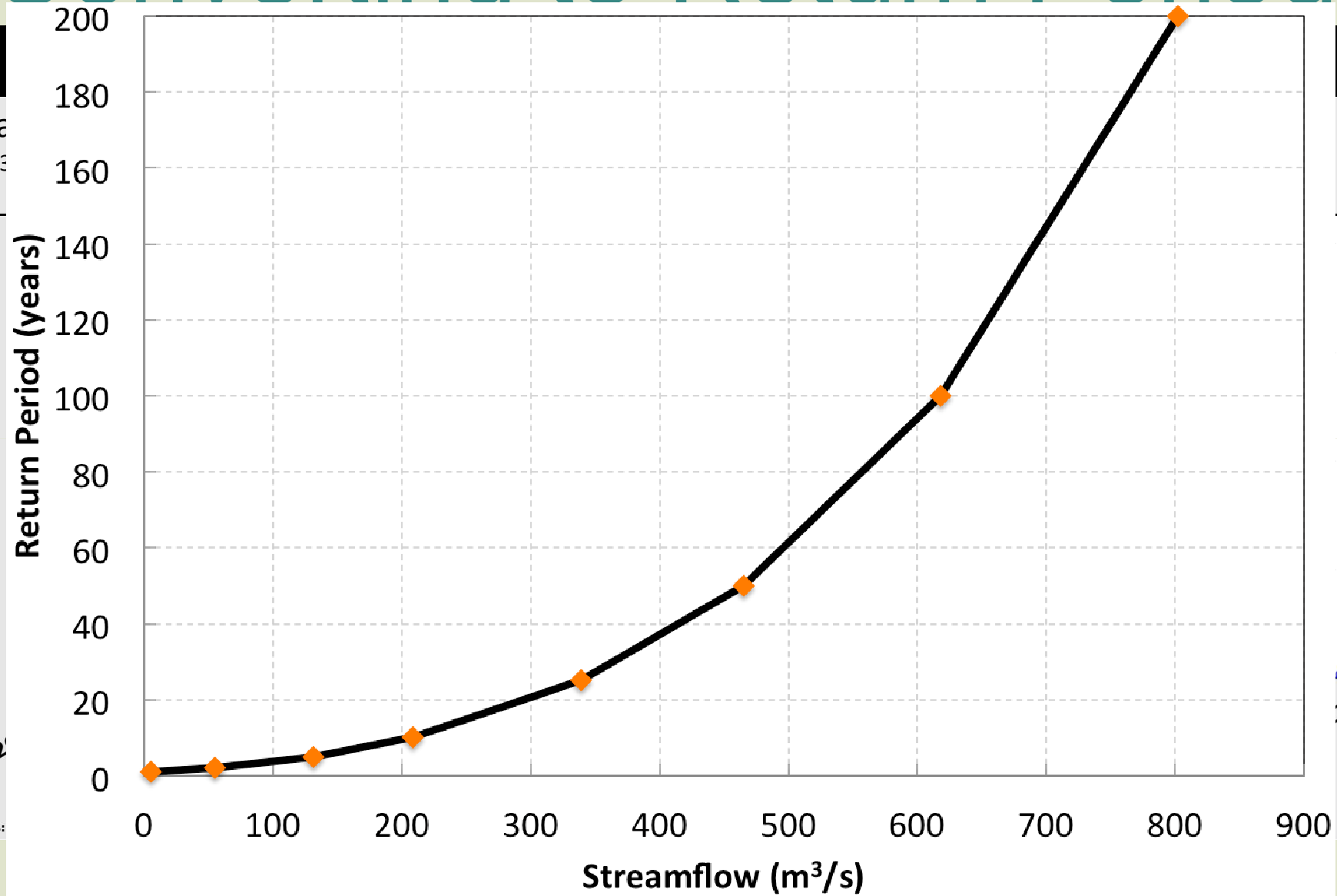


# Probabilistic Flood Framework

- Expand on Threshold Frequency
  - Uses rarity of streamflow to determine severity of potential flooding
  - Probabilistic instead of deterministic
- Use 2-year return period as threshold\*
  - Correlated with bank full conditions
  - Start of nuisance flooding
  - Same method applies to other thresholds (e.g., 50-yr/catastrophic flooding)

\*Carpenter, T. M., Sperflage, J. A., Georgakakos, K. P., Sweeney, T., & Fread, D. L. (1999) National threshold runoff estimation utilizing GIS in support of operational flash flood warning systems. *J. Hydrol.*, **224**, 21-44.

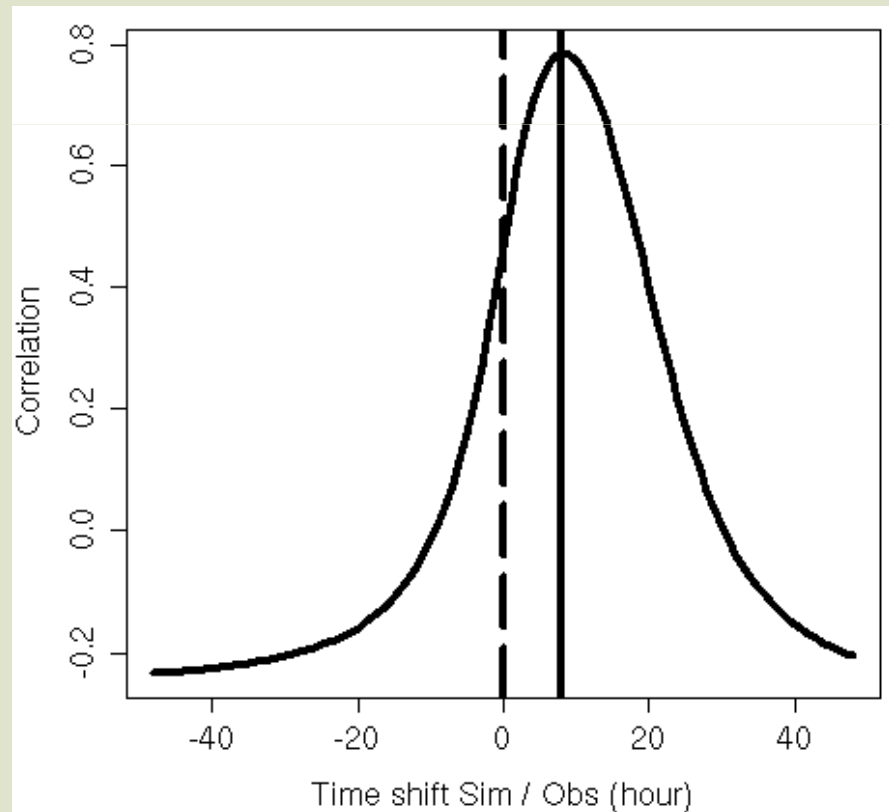
# Converting to Return Period



Water Resources Council, 1976: *Guidelines Determining Flood Flow Frequency*. Bulletin 17, Hydrology Committee, Department of Agriculture, Soil Conservation Service, 24 pp.

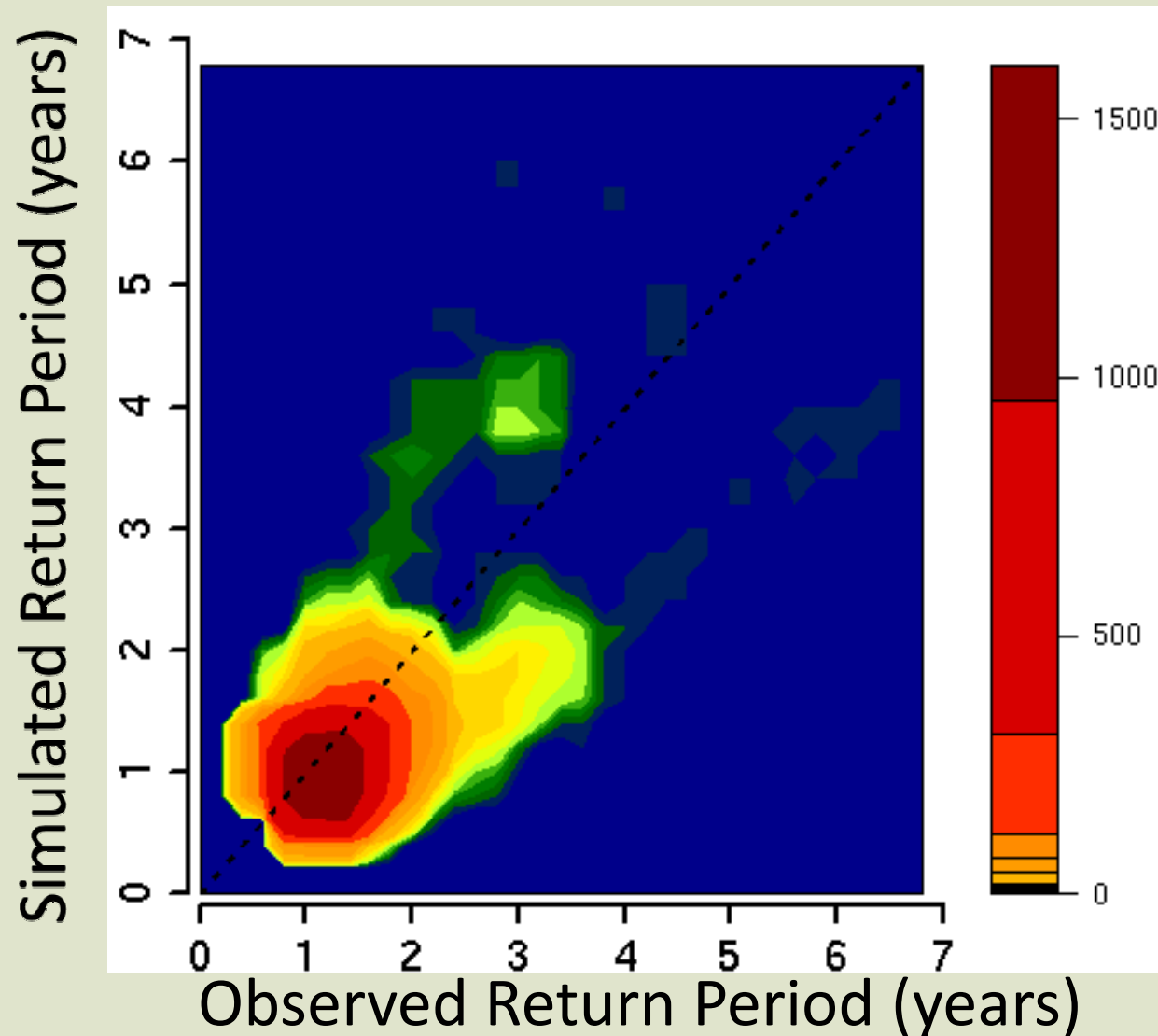
# Time Shift Correction

- Maximize Pearson Linear Correlation Coefficient
  - Between Simulation & Observed Return Period
  - Shift +/- 48 hours
- Related to model
- Routing
- Can calibrate
- Or just shift



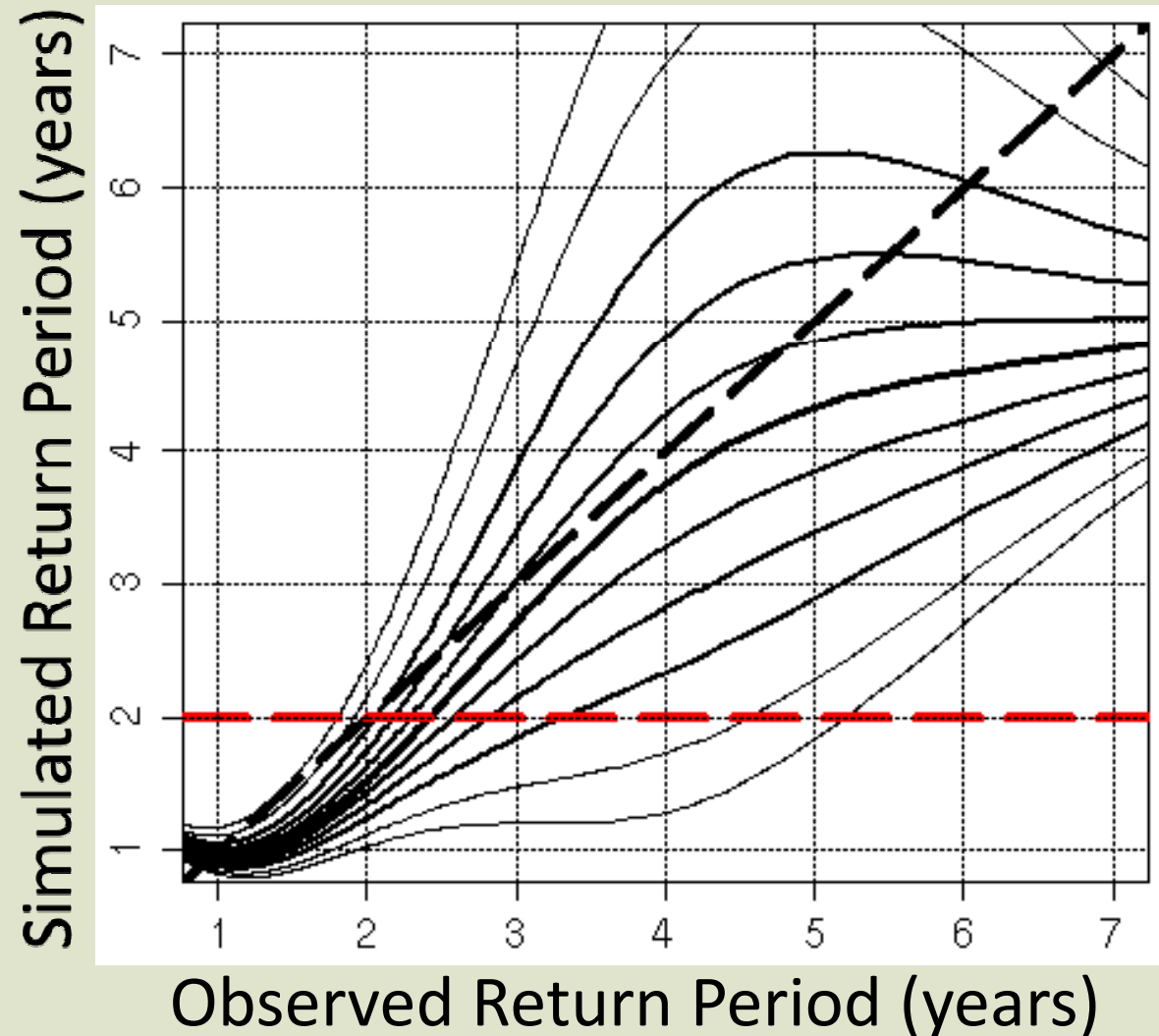
# Compare!

- Scatter/Density Plots, Made from Time Series

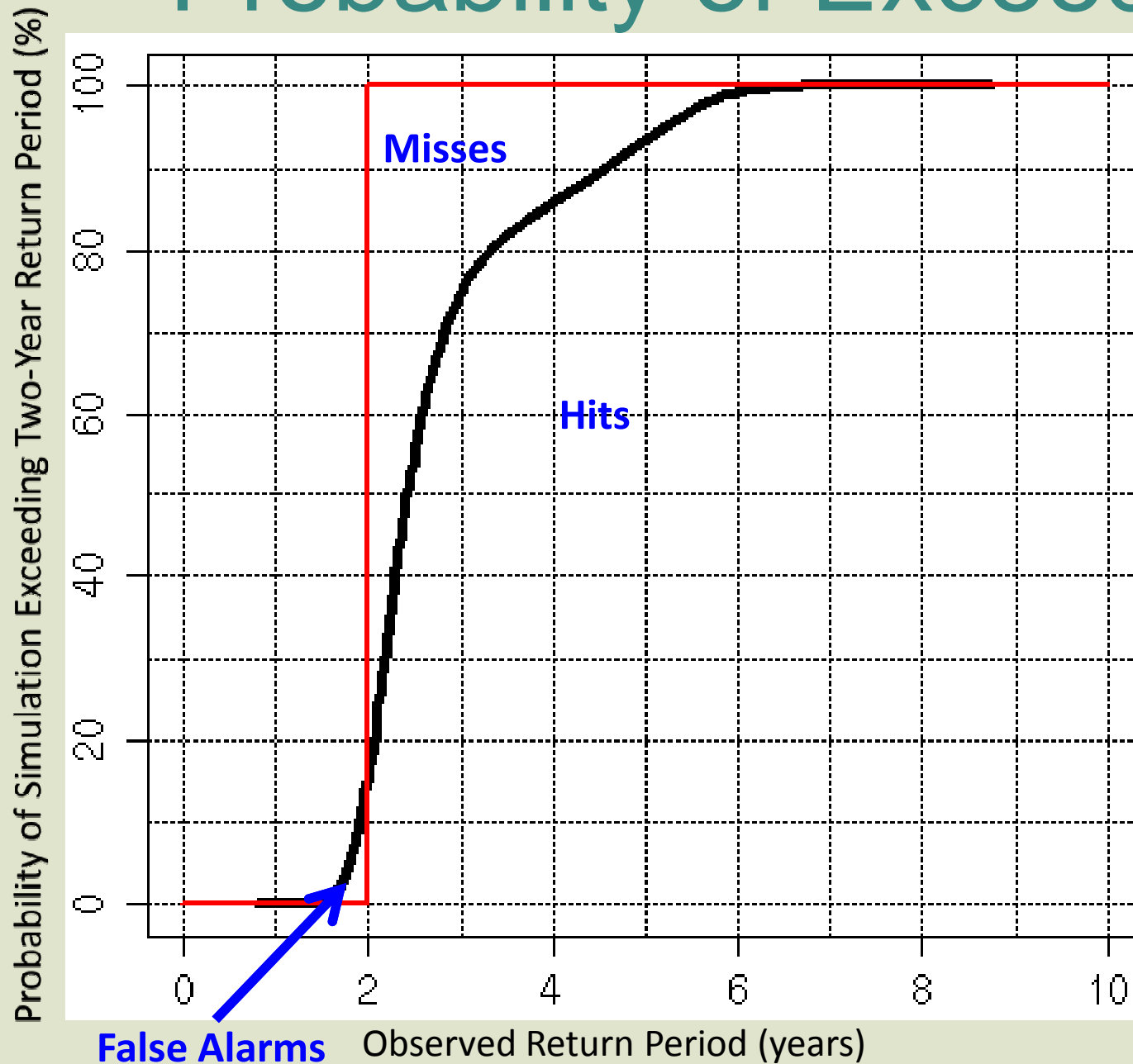


# Error Model

- Generalized Additive Model for Location, Scale and Shape (GAMLSS)



# Probability of Exceedance

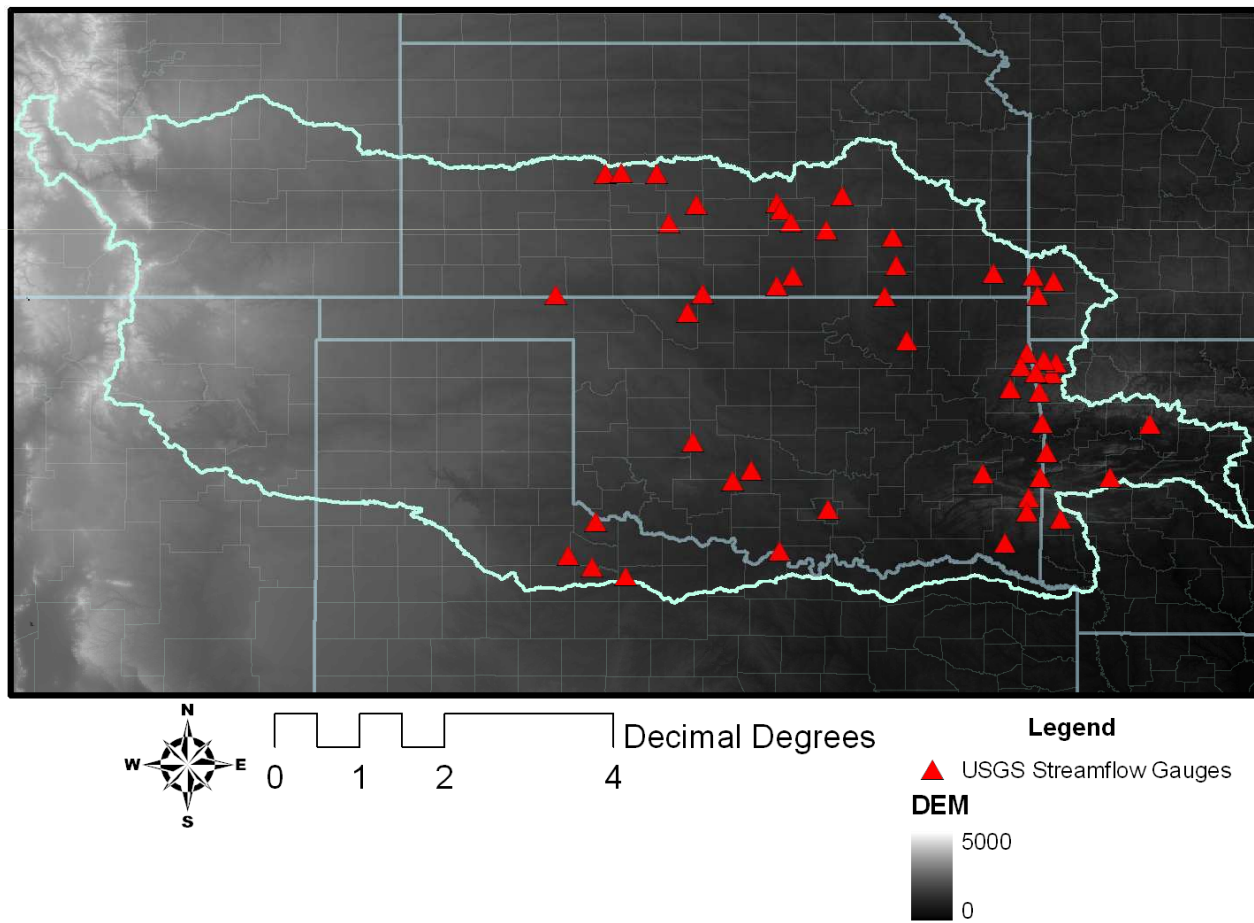


Red Line =  
Perfect

$CSI = \text{Hits} / (\text{Hits} + \text{Misses} + \text{False Alarms})$

# Study Domain & Time Period

- Arkansas & Red River Basins (ABRFC)
- Feb. 2002 to Feb. 2010
  - Overlap of StageIV (native & satellite resolution), 3B42RT & 3B42V6



Gauges must NOT be regulated or snow melt driven, per USGS flagging.

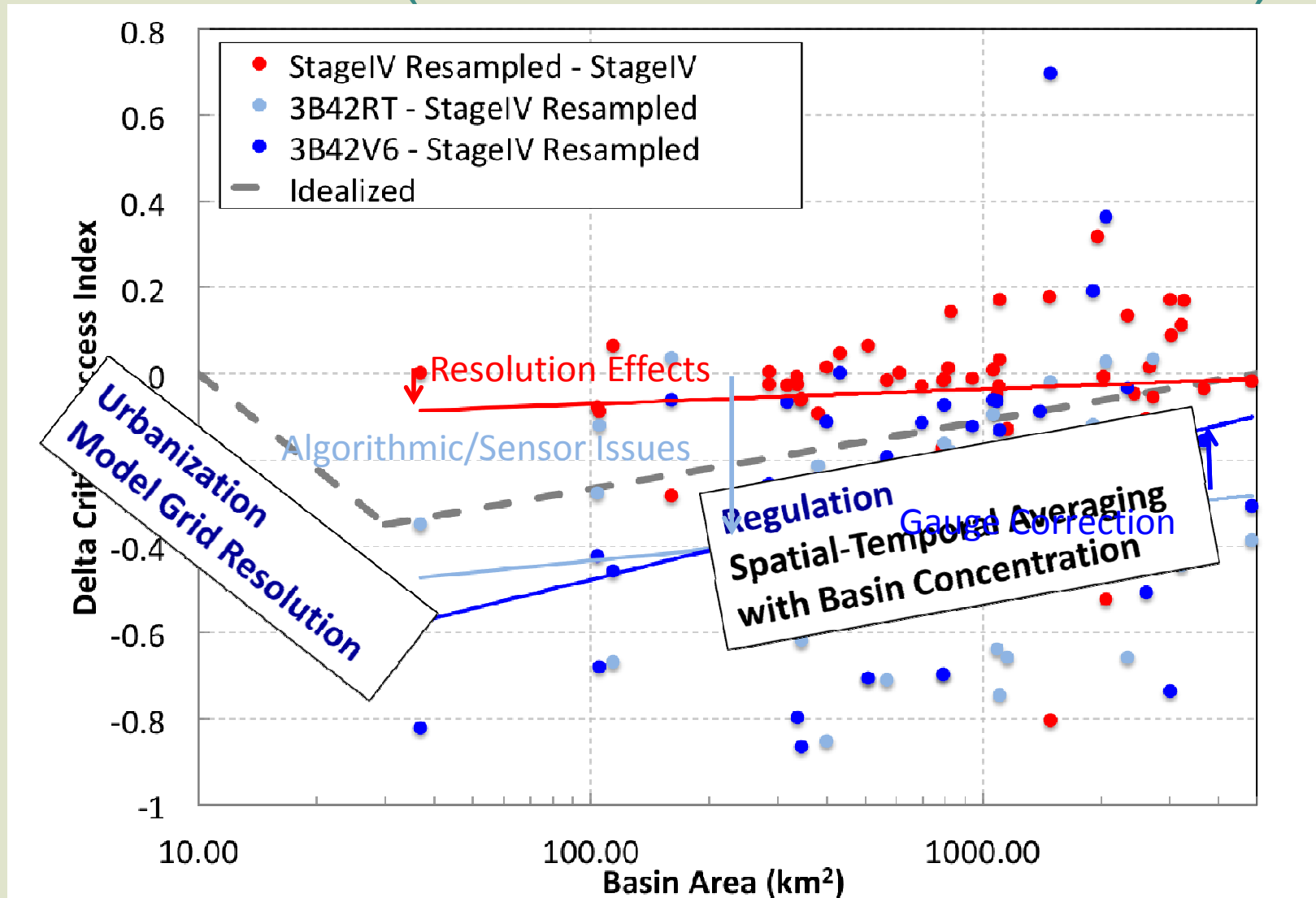
Must have data from 2002-2010

50 Gauges left for evaluation out of 371.



# Results

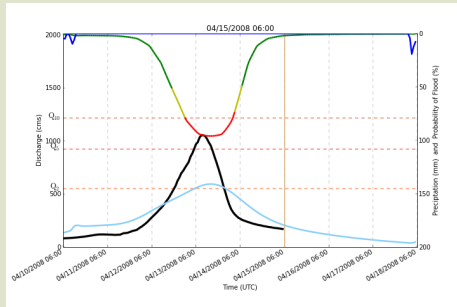
## Delta CSI (Normalized to reference)



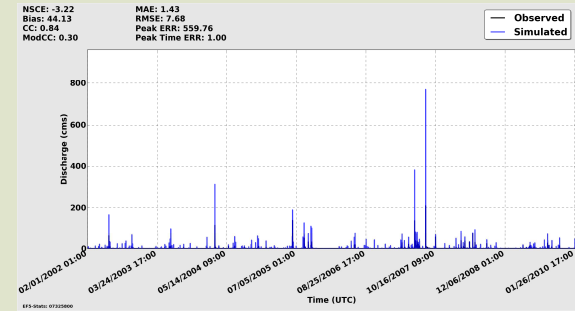
# Probabilistic Flood Predictions

**Time Series**

**Probability**



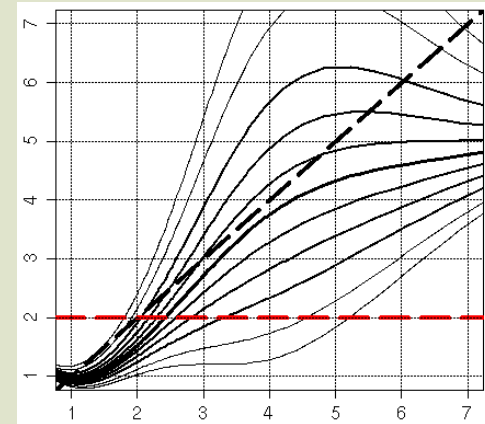
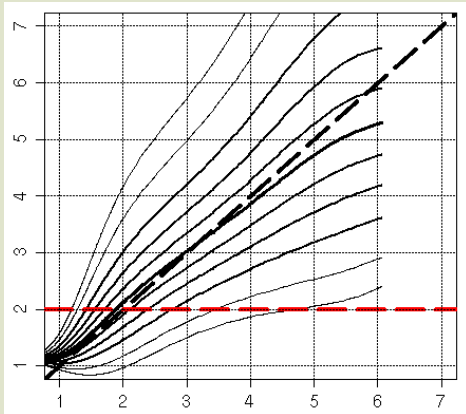
**Streamflow**



**Prognostic Model**

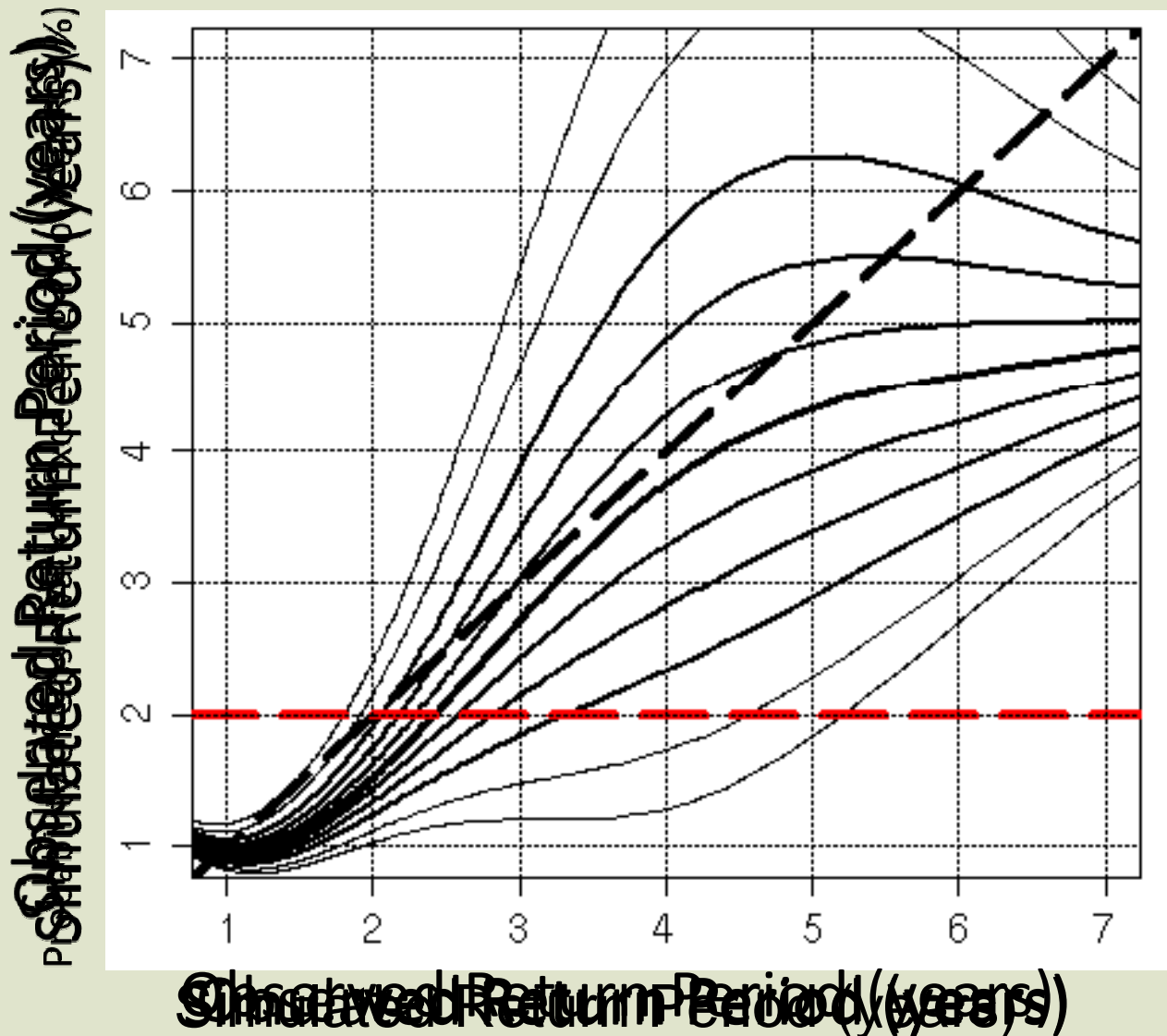
**Diagnostic Model**

**Bayes' Theorem**

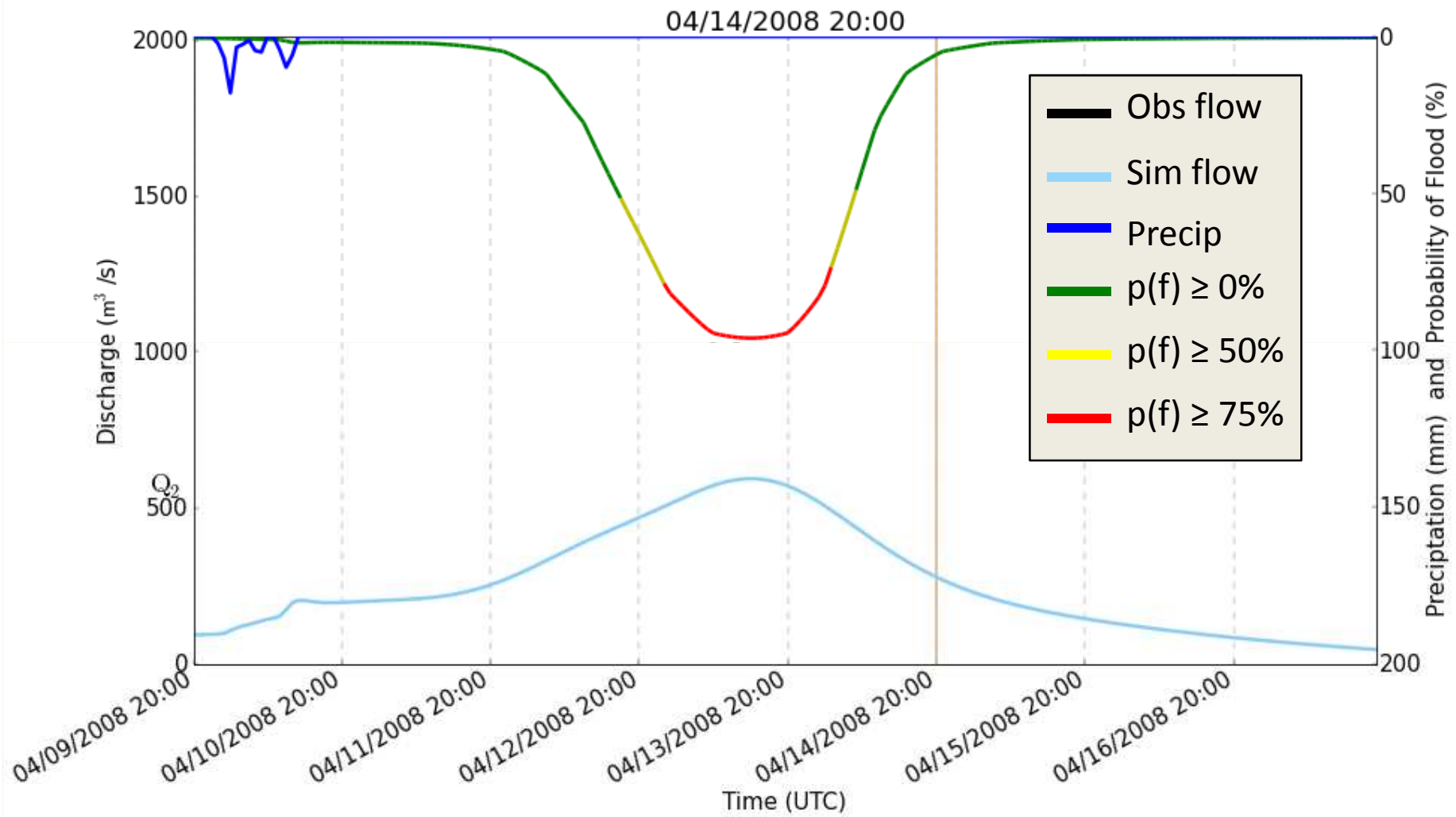


# Prognostic Capability

- “Invert” axes via Bayes’ theorem



# Example of Probabilistic Forecast from Deterministic Simulation



# Conclusions

- Probabilistic Flood Framework useful for evaluating skill of hydrologic model + precipitation estimates
- Probabilistic Flood Framework shows signs of usefulness for generating probabilistic predictions
- 3B42V6 better than 3B42RT for flood monitoring
- Satellite based products skill depends on basin area
- TMPA products have significant performance decrease vs. ground radar based products

## Probabilistic Flood Framework

