

MSAT

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Q: Which answer best describes the perfect relationship between verification and modeling? That is, verification is to modeling as:



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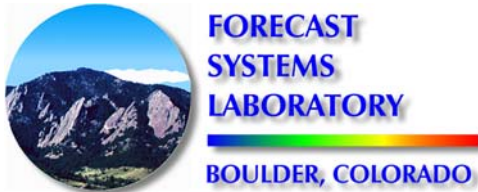


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- C) Darth Vader : ObiWan Kenobi

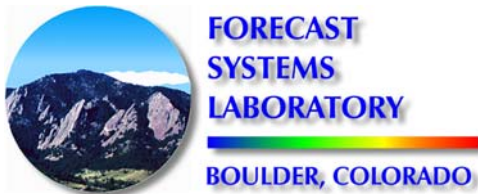


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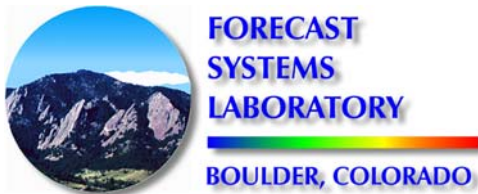


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- D) ObiWan Kenobi : Darth Vader
- E) Gilbert : Sullivan



Uncertainty of Verification Data

Examples from the Real-time US Precipitation Network

Edward Tollerud

(Thanks to Andy Loughe and Bill Moninger,
RTVS and ESDIM)

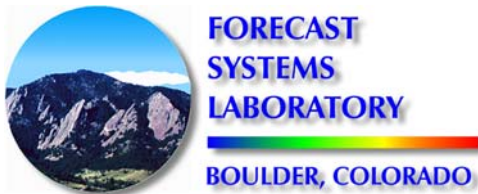


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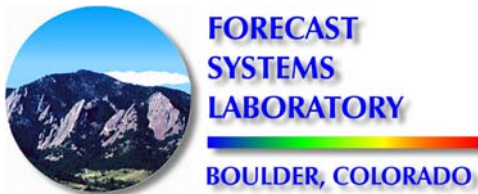
Issues and objectives

- * Desires/Assumptions of “perfect data”
- * Distinguishing Between Kinds of Uncertainty
- * Implications for Use of Verification
- * “Error Bars” for verification numbers
- * Making Verification data more representative



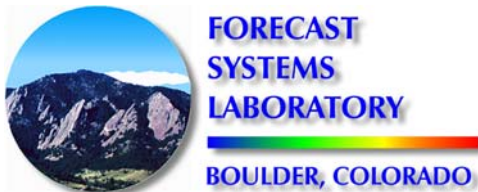
Sources of Uncertainty

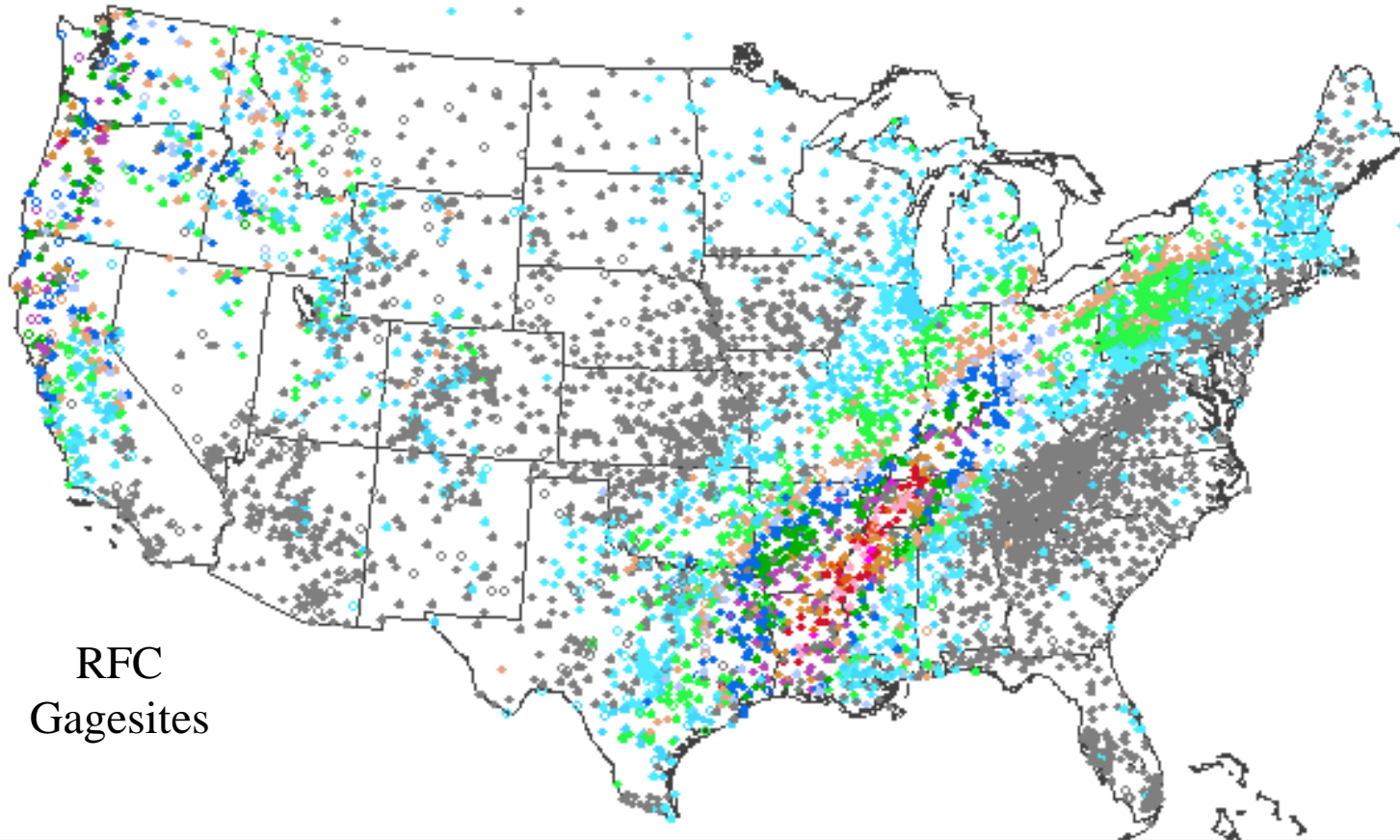
- * Random Observation Problem
- * Systematic Errors from network observing practices
(eg. Gage exposure; observing practices)
- * “Natural” Variability and Representativeness Error
(e.g., point estimates, gridpoint estimates, and areal averages)



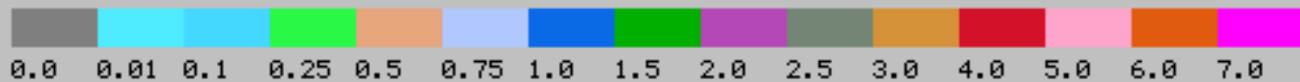
Outline of Presentation

- 1) Describe Data
- 2) Illustrate Systematic Problems
- 3) Describe Quantitative Relationship between Verification and the Quality of Verification Data
- 4) Present an Approach to Isolate Uncertainty Due to Actual Data Errors from “Natural” Variability





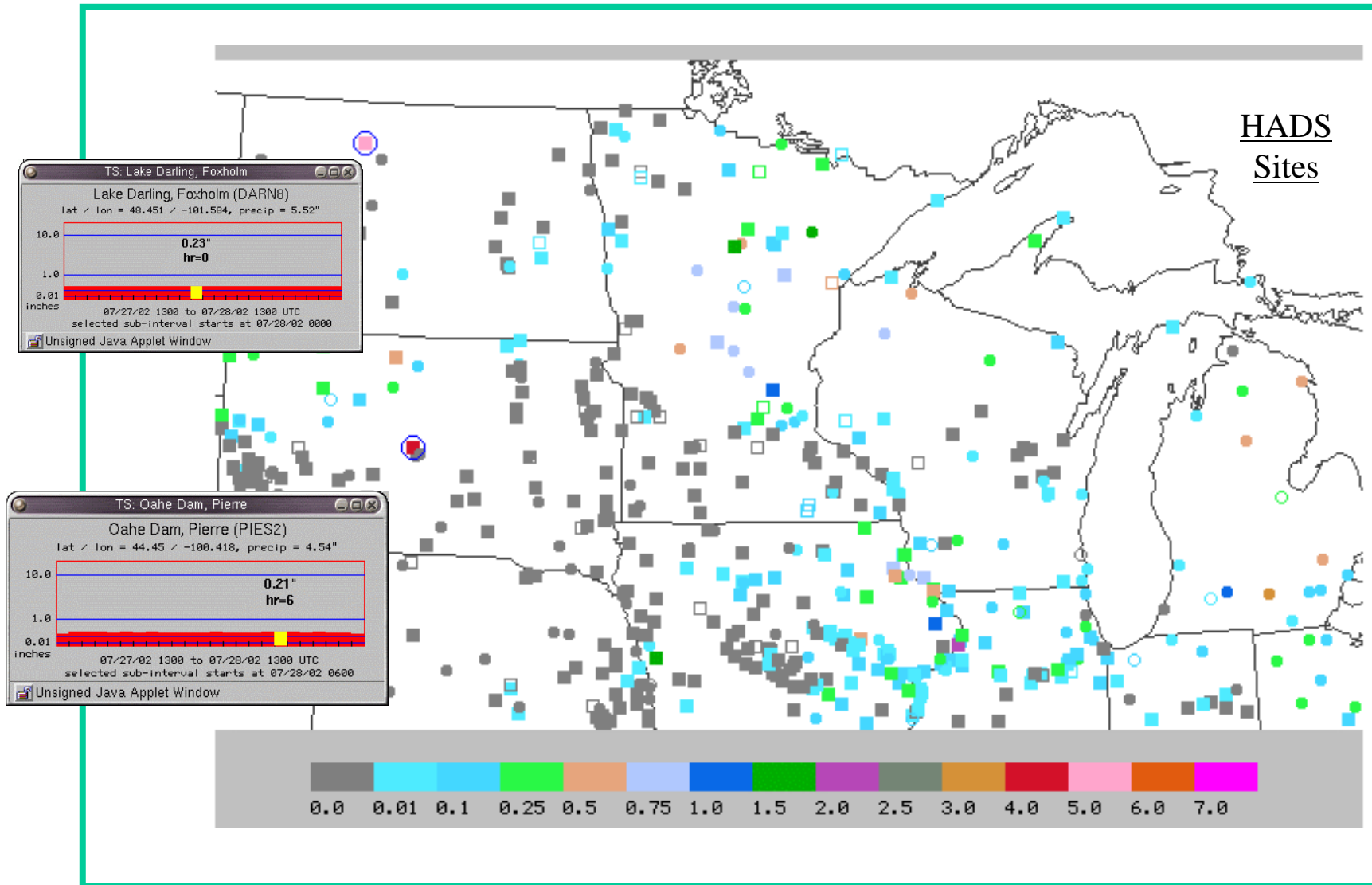
RFC
Gagesites



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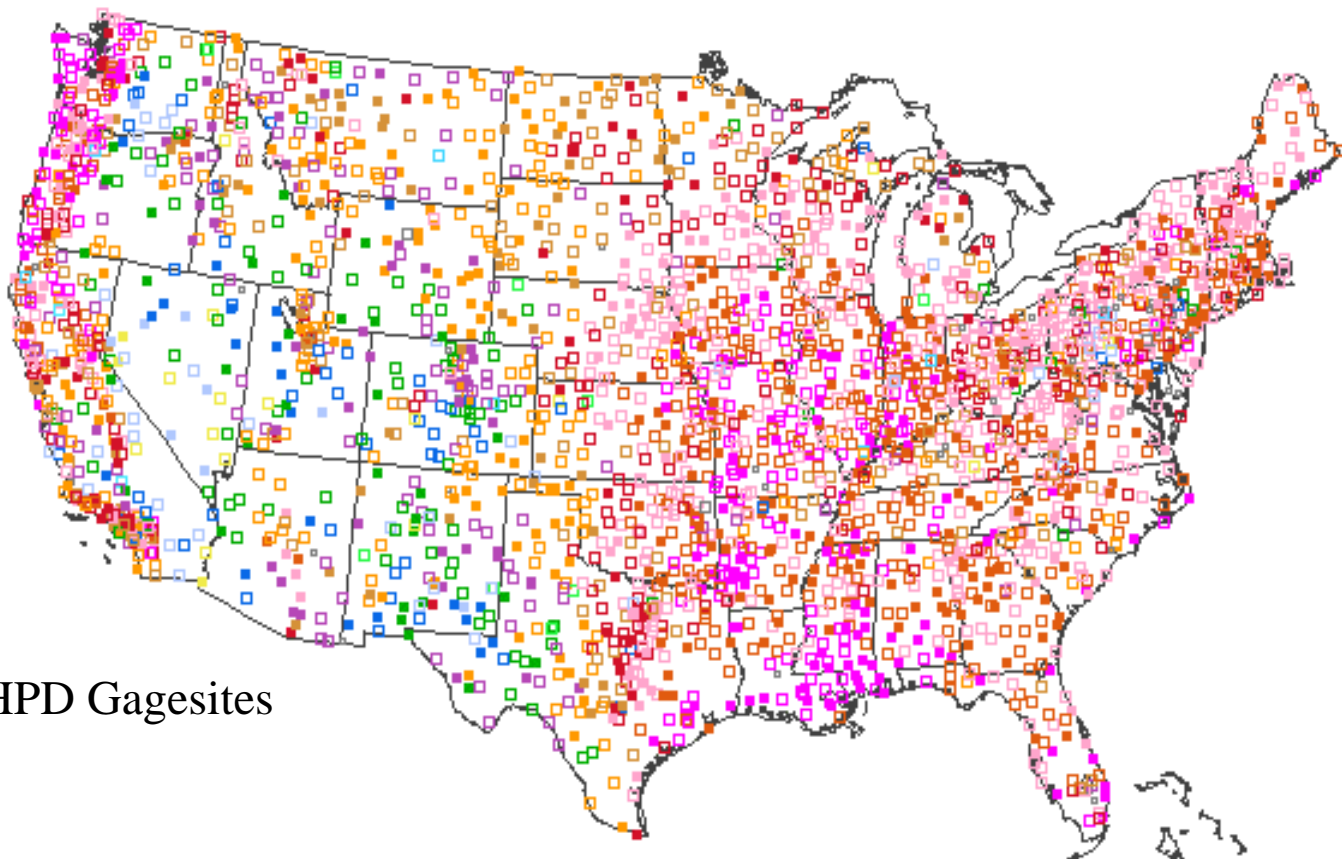


HADS Sites



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HPD Gagesites



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Systematic Changes in Gage Resolution

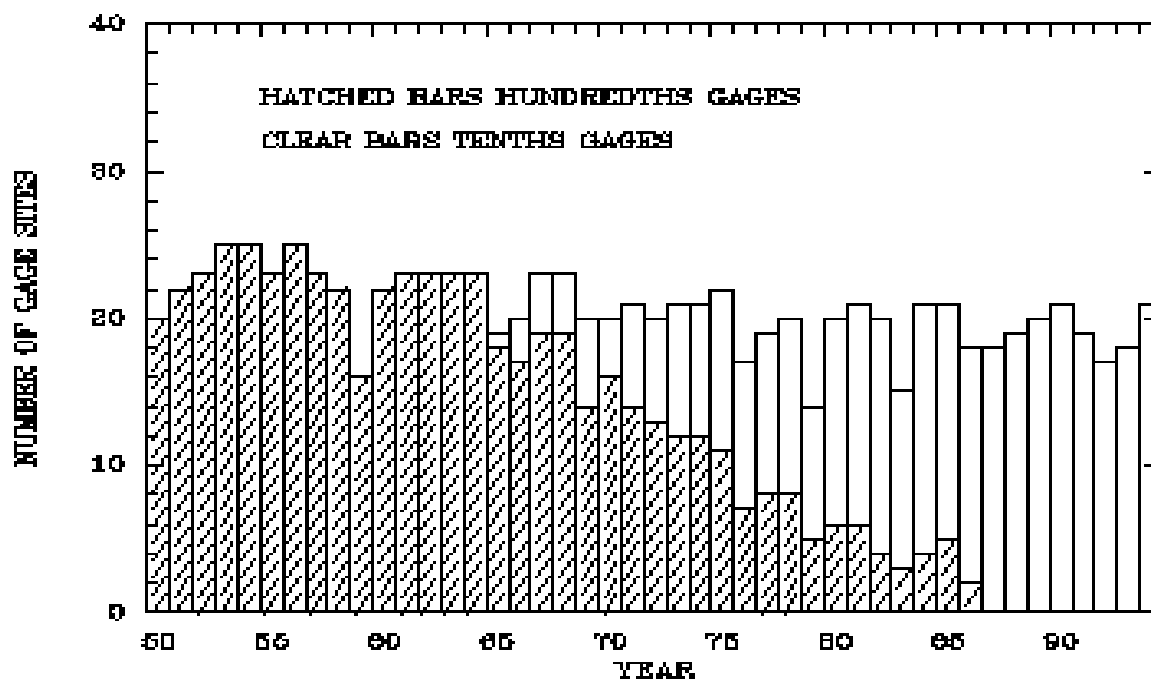


Figure 2. The number of stations with the indicated gage type in Region A on Fig. 1.



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Gage-Related Changes in Precipitation Frequency

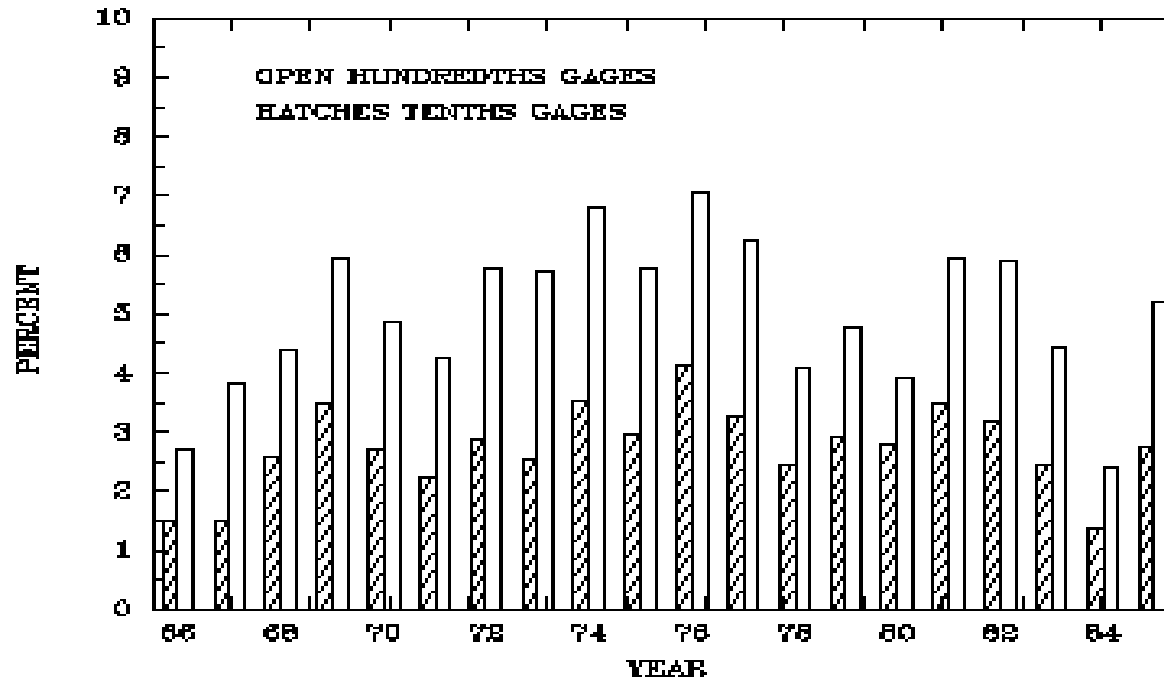


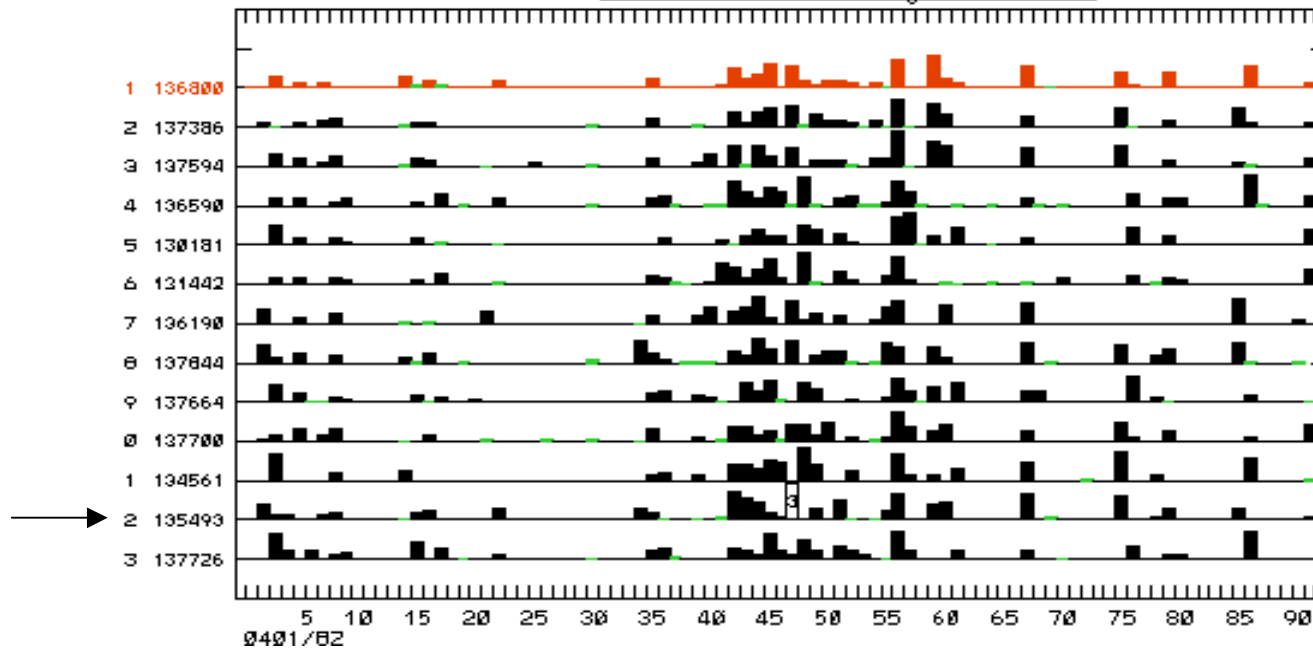
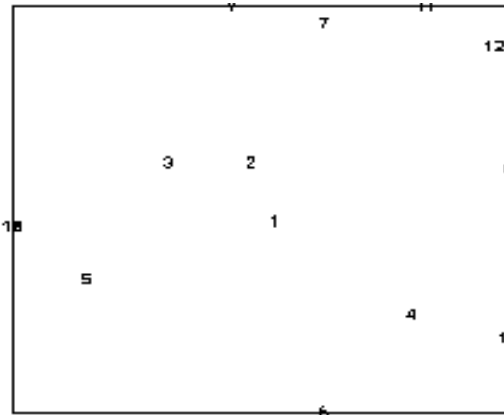
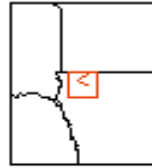
Figure 4. Percent of hours in July with measured precipitation observed by hundredths- and tenths-measuring HPD gages in Region B on Fig. 1.



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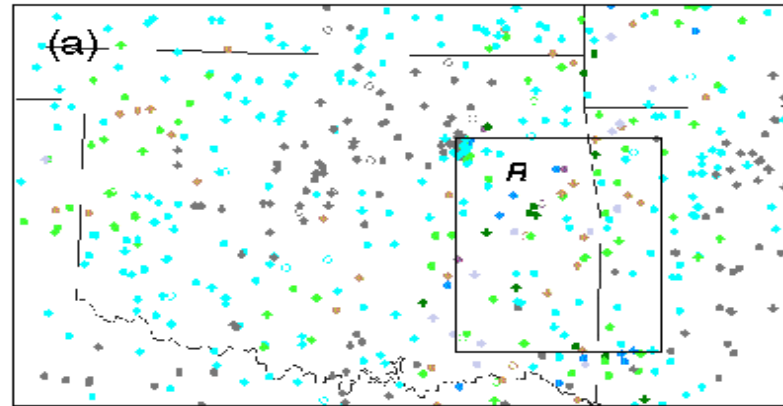
Observation-Time Inconsistency



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RFC observations
on rainy day



RFC observations
on dry day

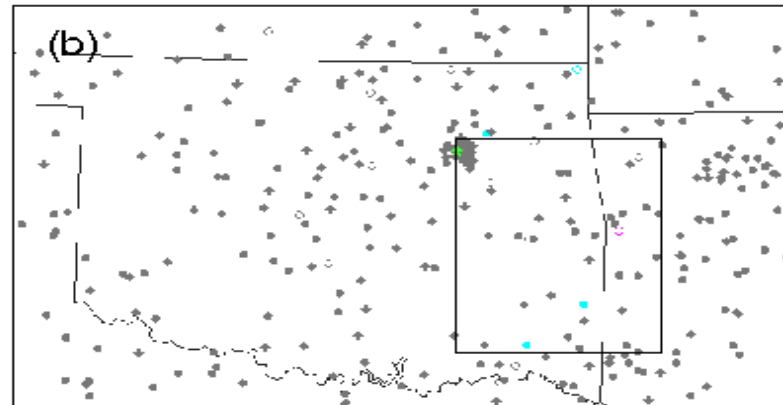


Fig. 2. Gaugesites with precipitation reports (either zero or nonzero) in the RFC-selected datastream on 12 June 2000 (a) and 7 June 2000 (b). Rectangular region "R" indicates sites included in analyses described in Section 3.



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Influence of Non-reported Zero Observations: Average Daily Rainfall over OK Box

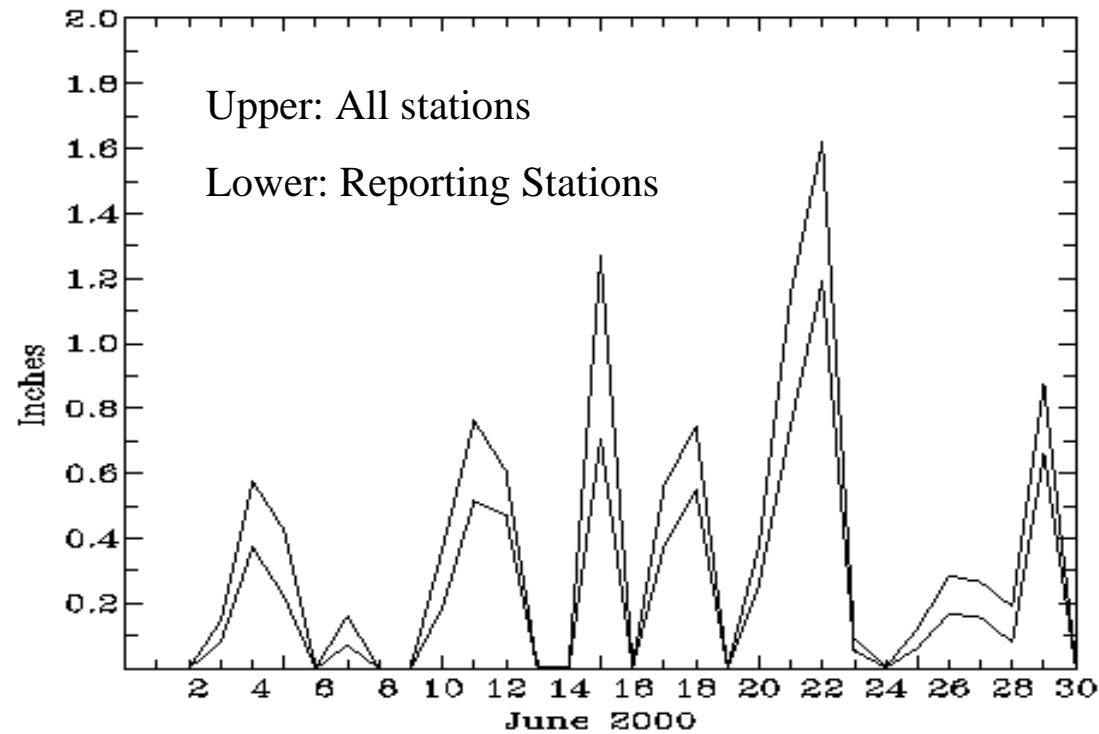


Fig 4. Daily (1200 UTC - 1200 UTC) rainfall averaged over all RFC-selected stations in Region A of Fig. 2. Upper curve shows averages computed excluding apparently missing observations; lower curve indicates comparable averages computed after converting missing observations to zero reports.



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RFC Gagesites

Rainfall Frequency

HPD Gagesites

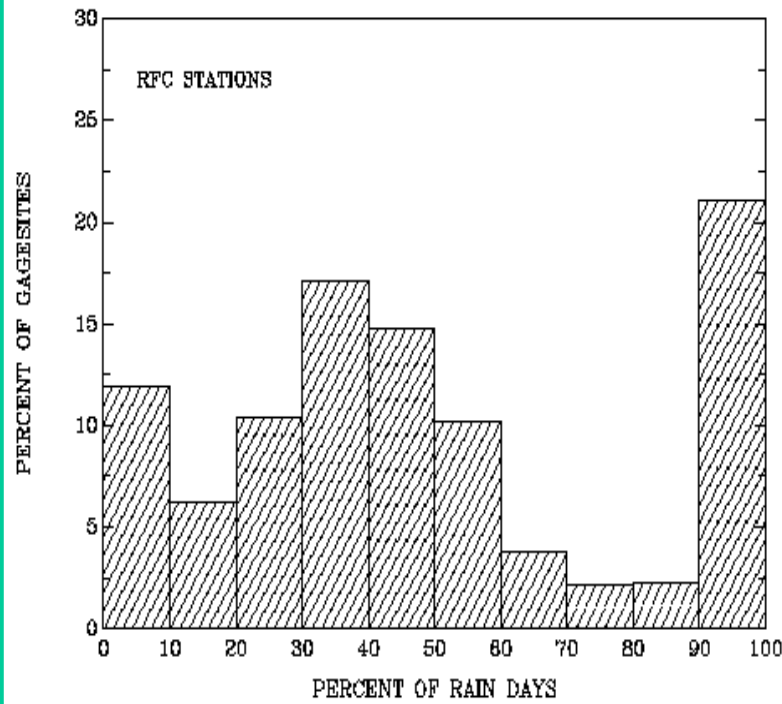


Fig. 6. As in Fig. 5 except for all daily reporting (RFC) stations (~7,500)

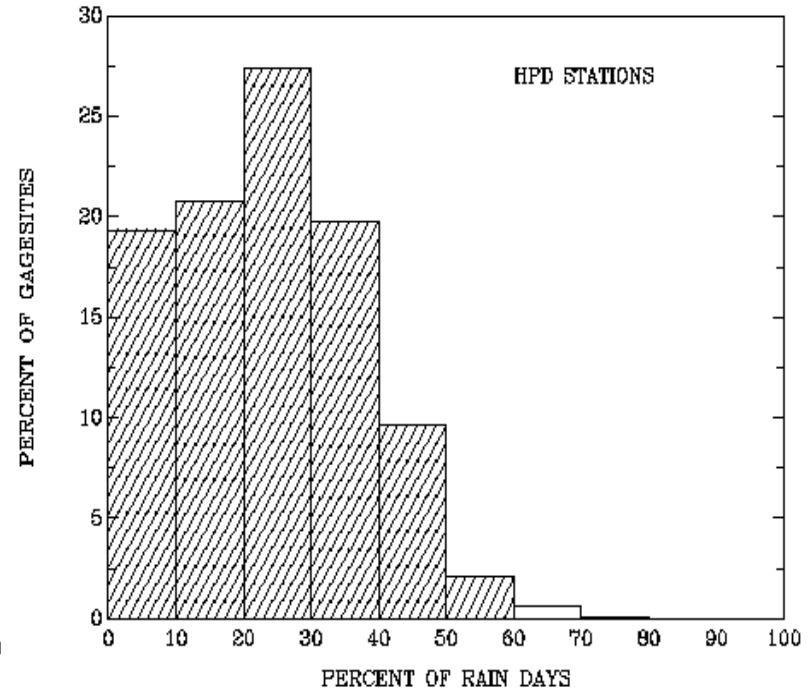


Fig. 7. As in Fig. 5 except for all operating Hourly Precipitation Dataset (HPD) stations (~2,200) during June 1999.

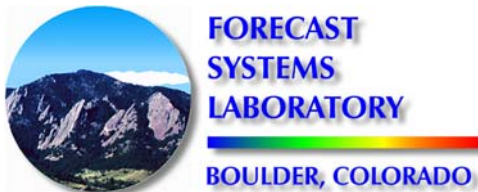


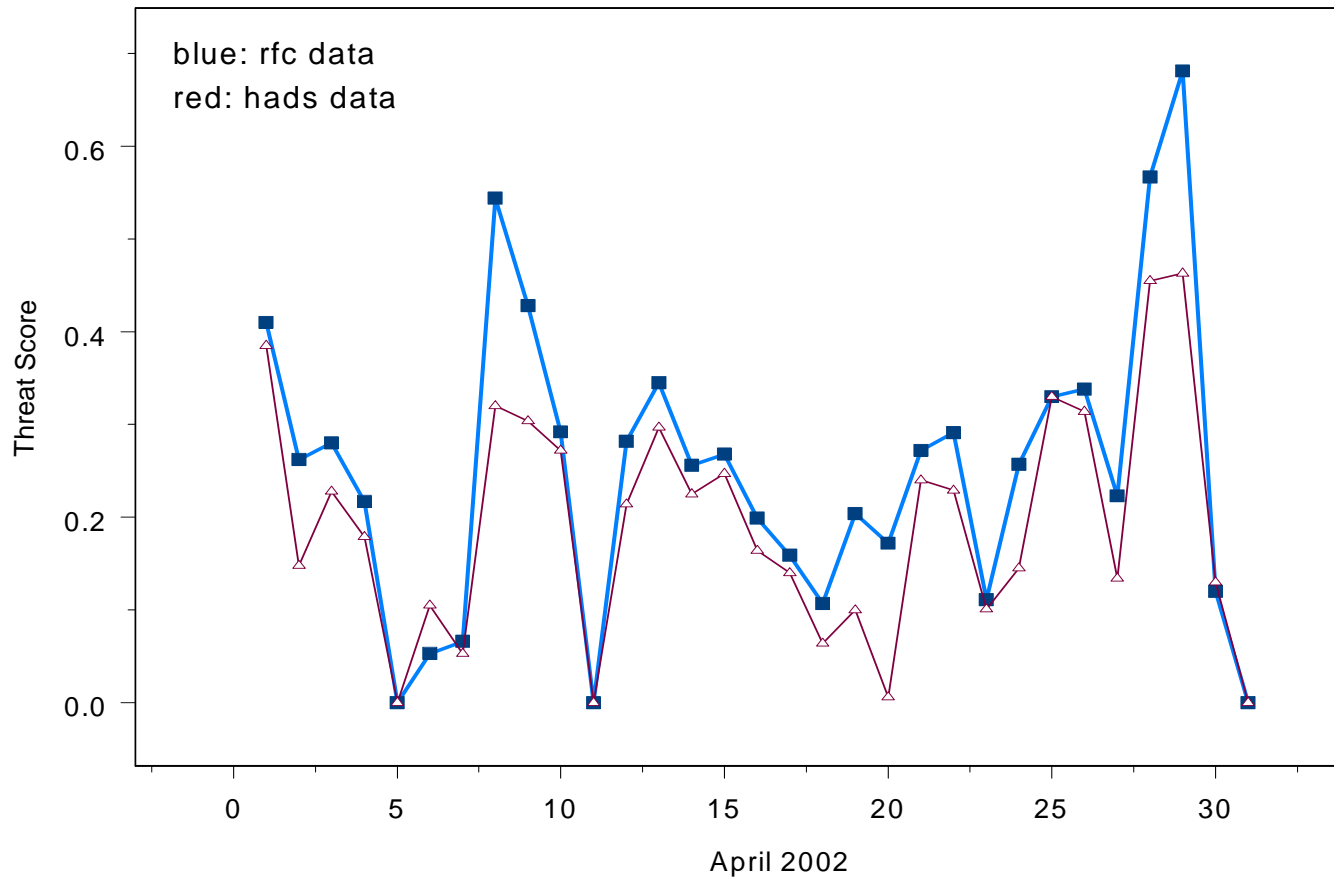
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Quantitative Verification Analysis

- RFC and HADS Observations, CONUS
- All Observations from April 2002
- ETA Model Predictions of Precipitation for first 24 h starting at 1200 UTC
- Compute Bias (Not Shown Here) and Equitable Threat Score
- Compare HADS-only and RFC-only Verification to Directly Assess Impact of Data Quality
- Compute Station-Neighbor Verification as Proxy for “Natural” Variability
- Use Randomization (Bootstrapping) Procedure to Estimate Verification “Error Bars”

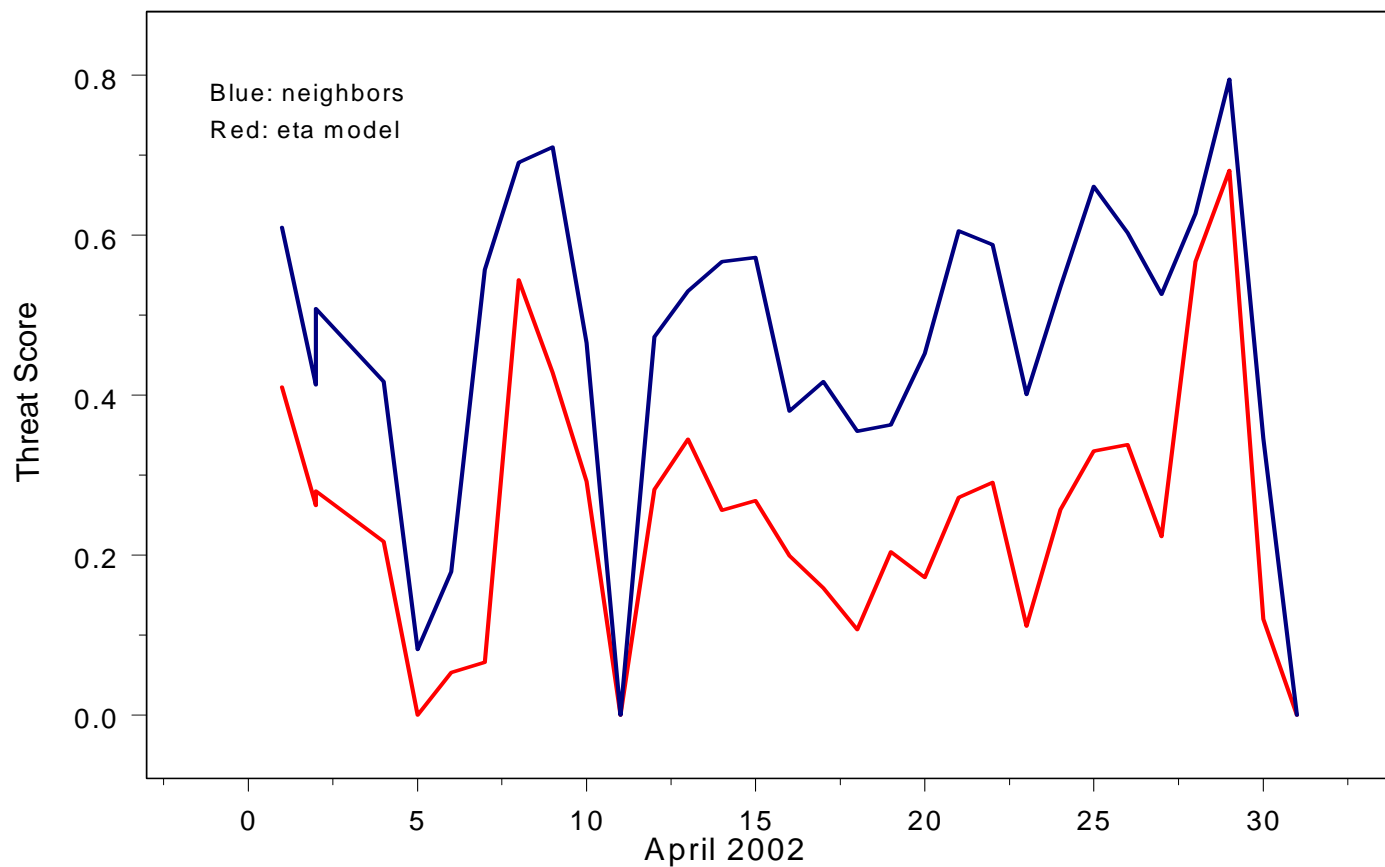




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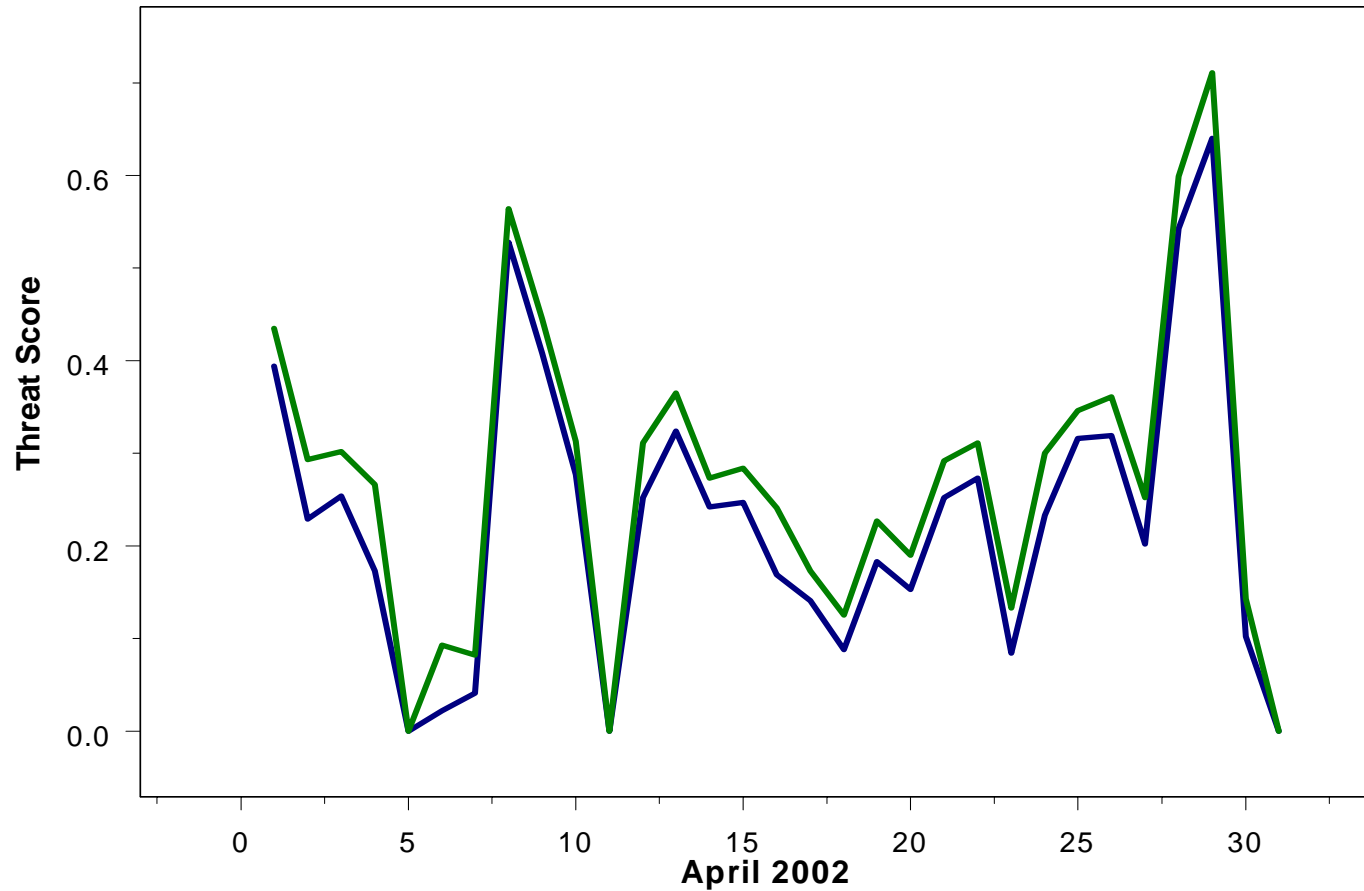
Verification of Daily Rainfall



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10-90% Envelope of Eta Model Precipitation Verification



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Average Percent Differences of Grid-Averages from Random Selection: HADS

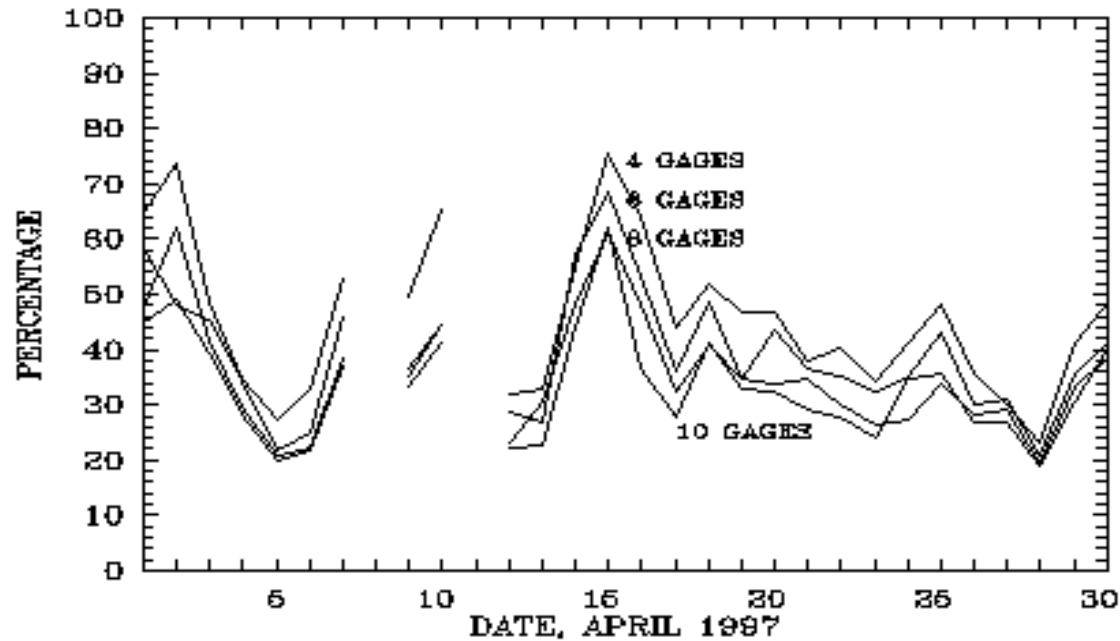
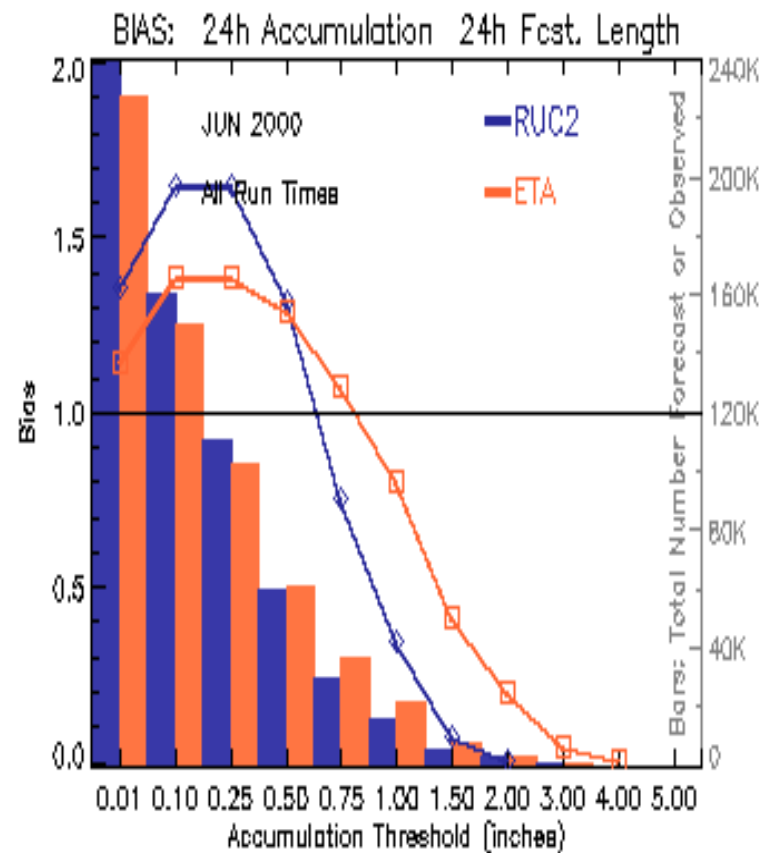
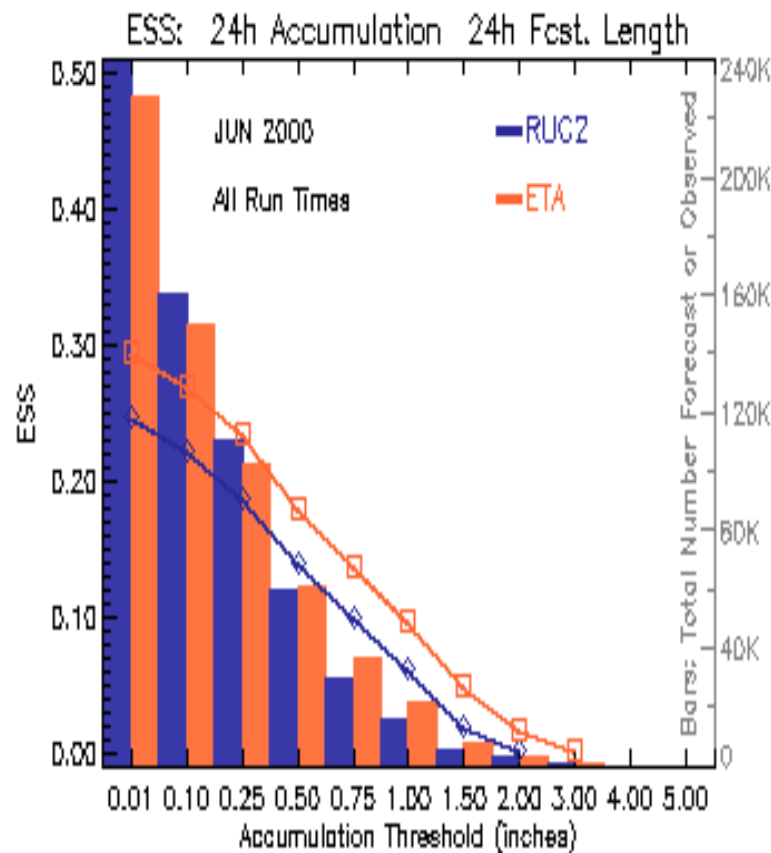


Figure 7. Average percentage differences (PDIF; see text) for daily analysis ensembles prepared from HADS observations. Analyses were limited to the indicated average number of rain gage sites per grid area. Analysis region is shown in Fig. 6.




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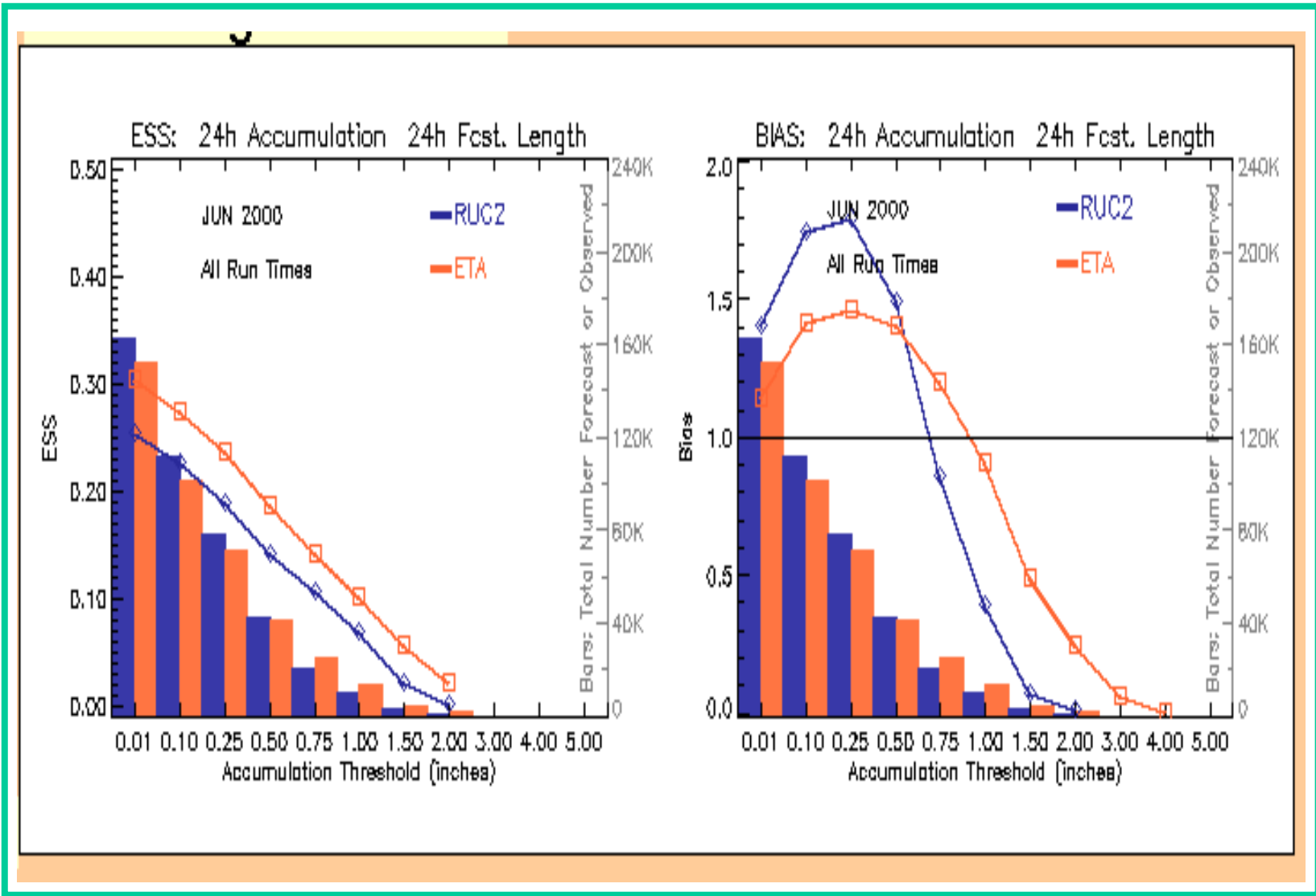


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Conclusions

- 1) Systematic Network Observing Practices Present the Greatest Challenge for Precipitation Verification.
- 2) How do We Deal with Representativeness Errors Caused by High Natural Variability?
- 3) Methods Should be Formulated to Distinguish Natural Variability From Truly Observation-Driven Variability.

