EMERGENCY MANAGEMENT ROUNDUP

EXPECT THE UNEXPECTED

Optimizing Meteorological Observation Networks

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EMERGENCY MANAGEMENT ISSUES

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Situation

- DTRA-funded project
- Development of portable weather stations
- **How many sensors do you need?**
- **Where do you place them?**

Methodology Developed

- Comprehensive
  - Based on any observation/modeling system
    - Emergency response consequence assessment
  - Many variables
- General concept
  - Determine objective
  - Characterize observation/modeling system
  - Perform statistical evaluation
    - Use Observation System Simulation Experiment (OSSE) theory
  - Suggest location of additional sensors
    - Targeted observations

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Test of concept

- See if OSSE theory works
  - Local real-time emergency response atmospheric modeling system
- Evaluate model precision
  - With tracer data could evaluate error
- Develop field study at Rocky Flats

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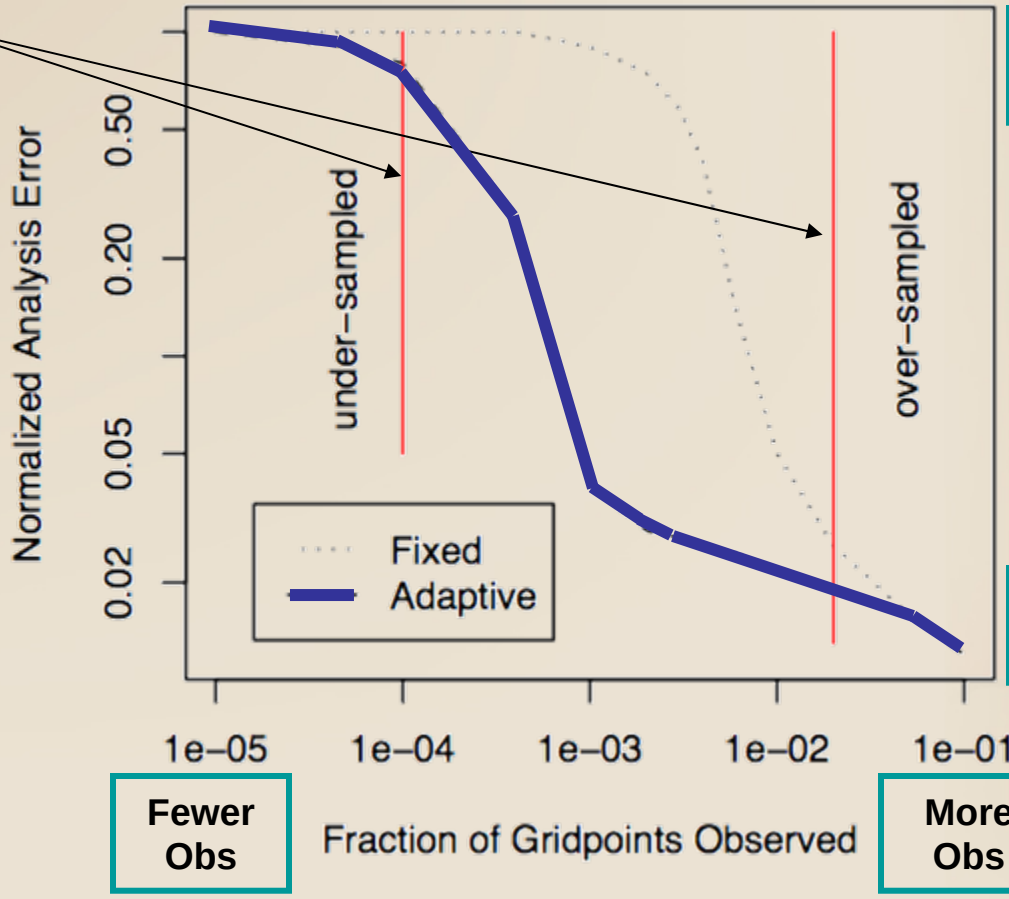
Observation System Simulation Experiment (OSSE) Theory

Operational Range



More Error

Less Error

- Adapted from Morss et al. (2001)

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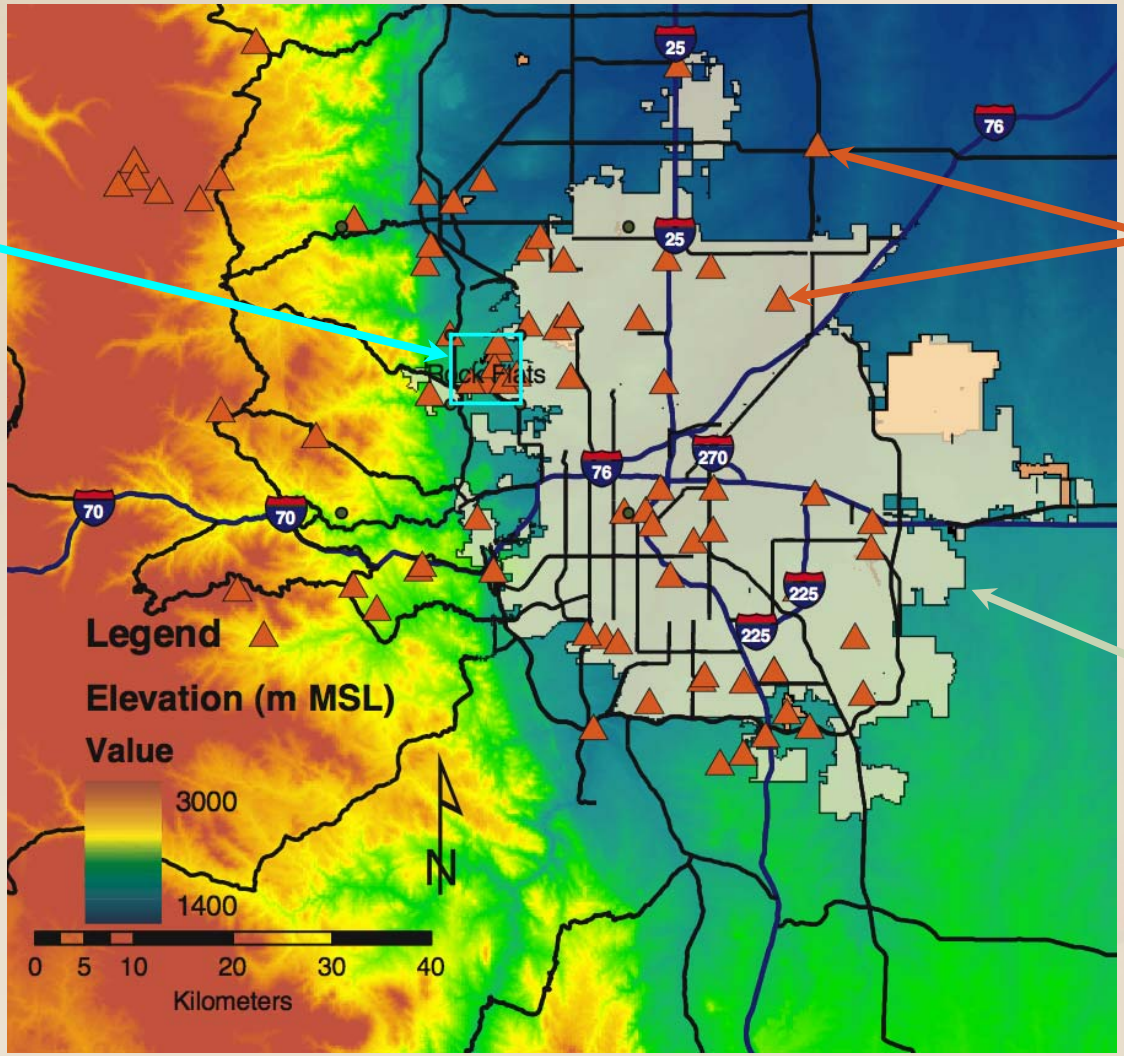
Area of Interest



Existing Stations

Denver Metropolitan Area

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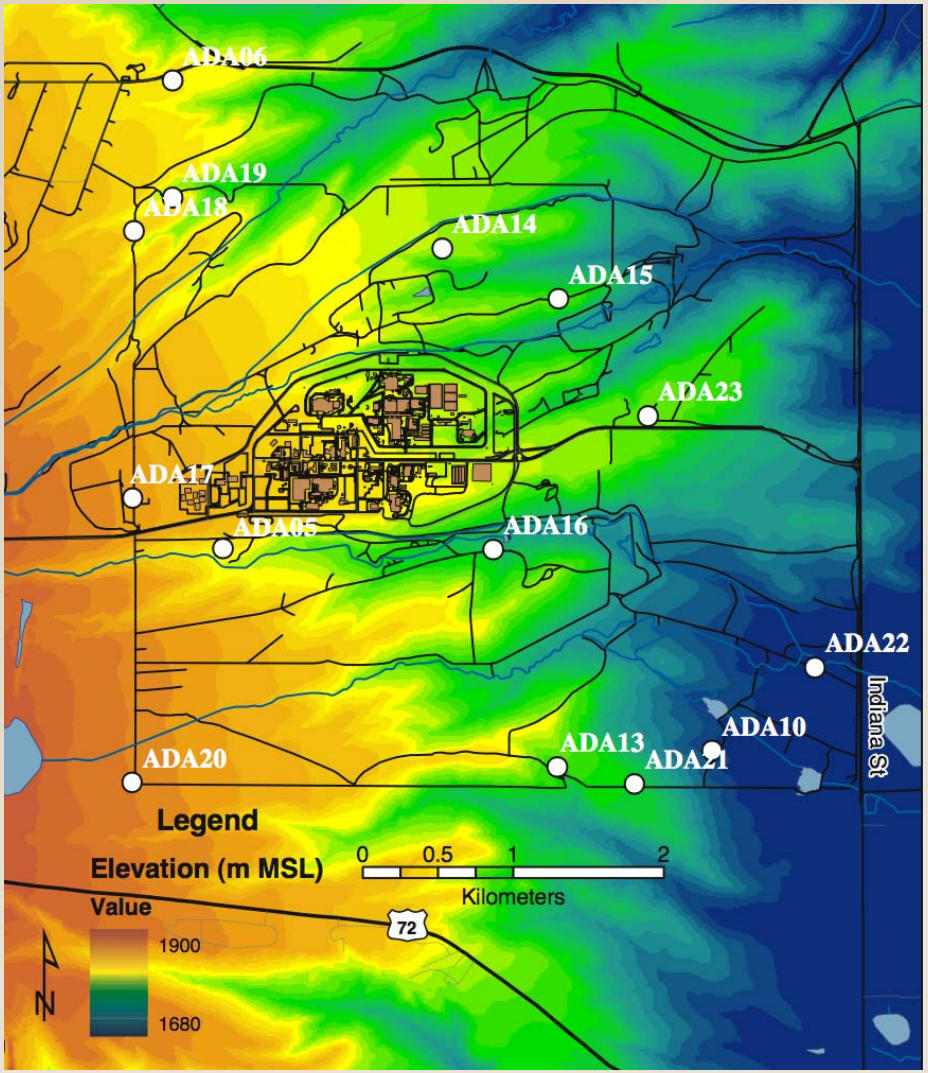
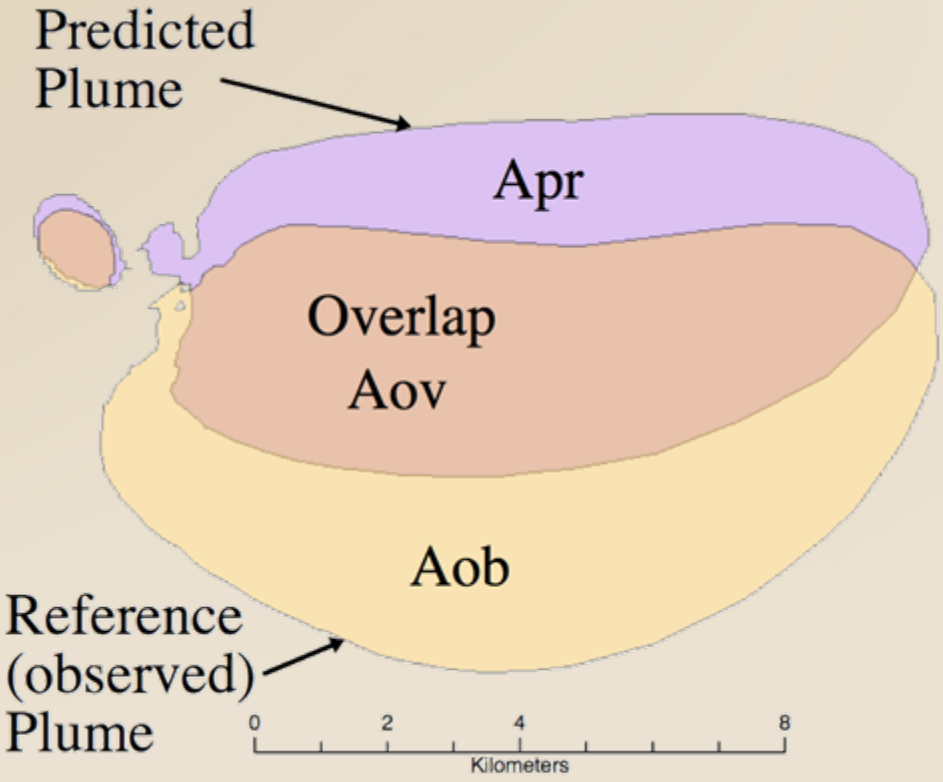


Location of Local Sensors

Maximum Elevation Difference: 170 m

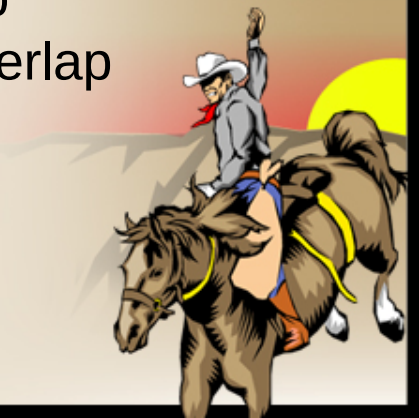
Performance Metric

$$Fractional\ \ Bias\ = \frac{Aov}{0.5\ (Apr\ +\ \ Aob)}$$

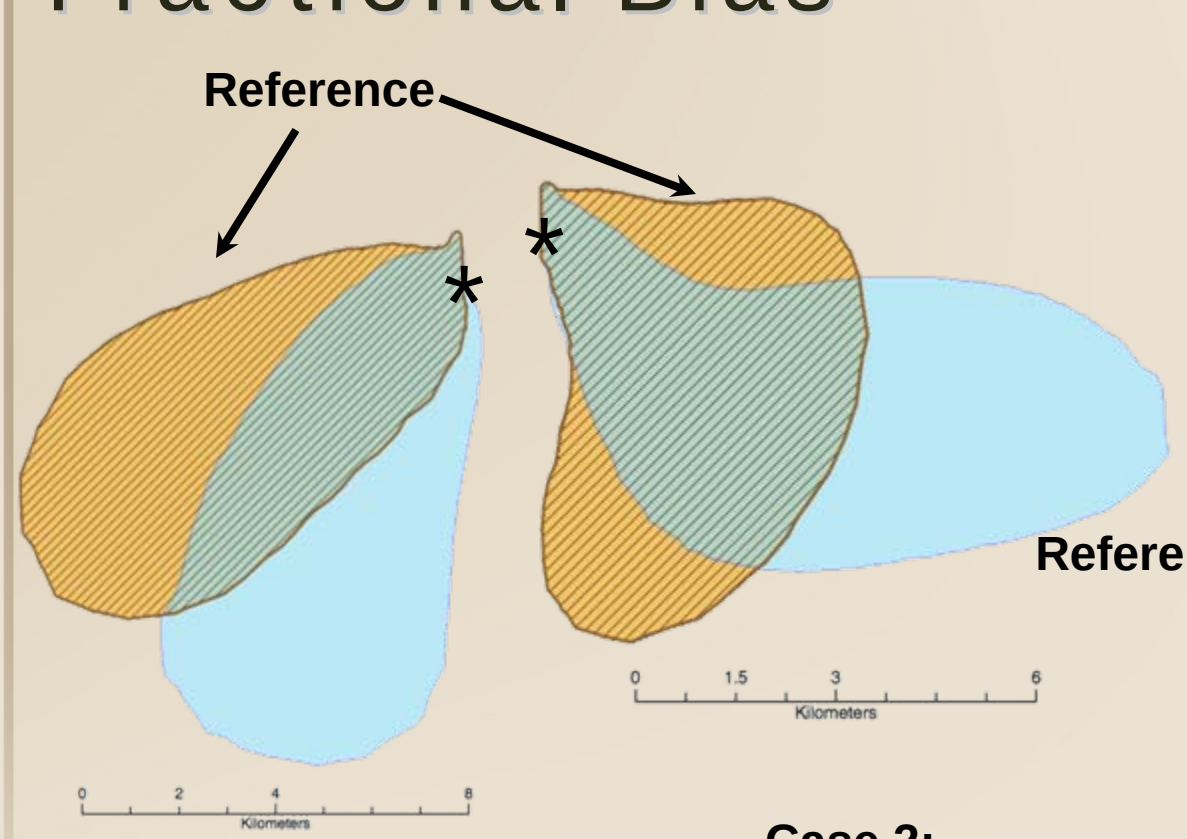


Fractional Bias is a single measure of the overlapping plume area relative to the predicted and reference plumes.

0 = no overlap
1 = perfect overlap

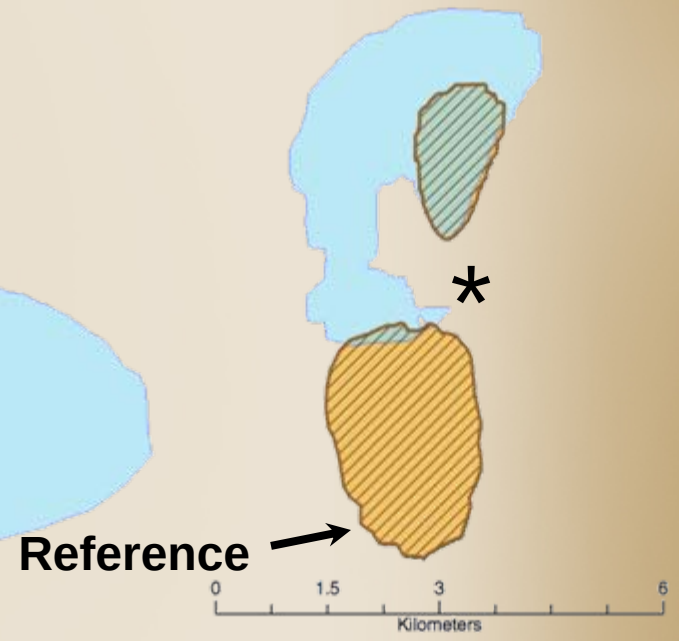


Fractional Bias



Case 1:
FB = 0.419

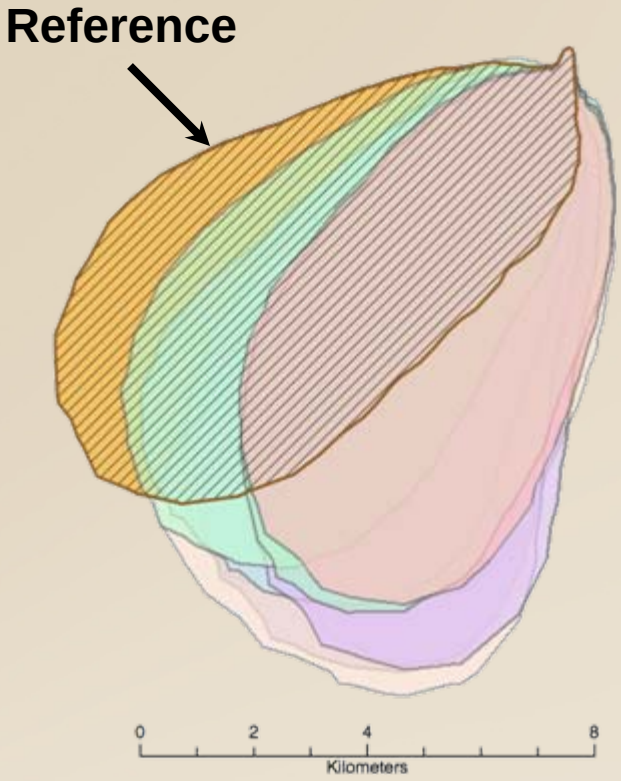
Case 2:
FB = 0.545



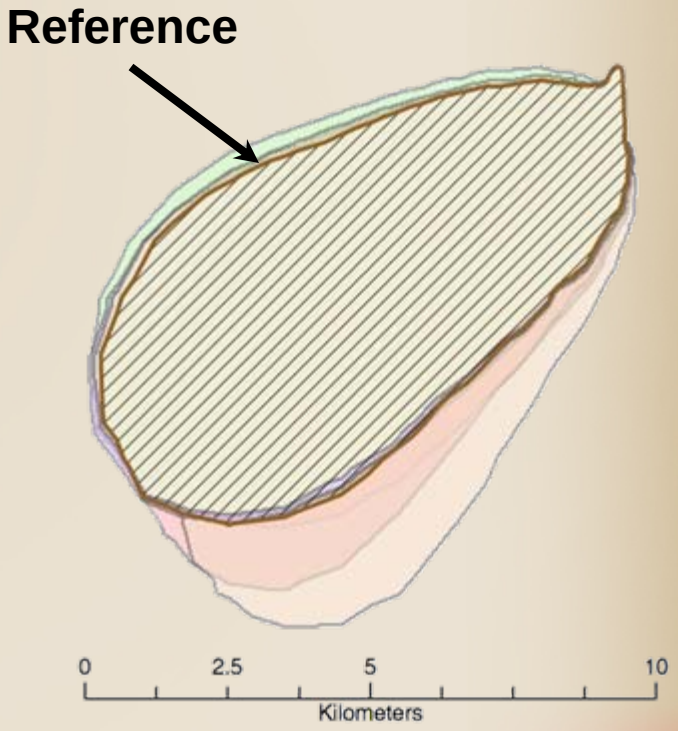
Case 3:
FB = 0.225

*** = release location**

Effect of Adding Observations



1 of 11 Stations used
ave FB = 0.482



10 of 11 Stations used
ave FB = 0.977

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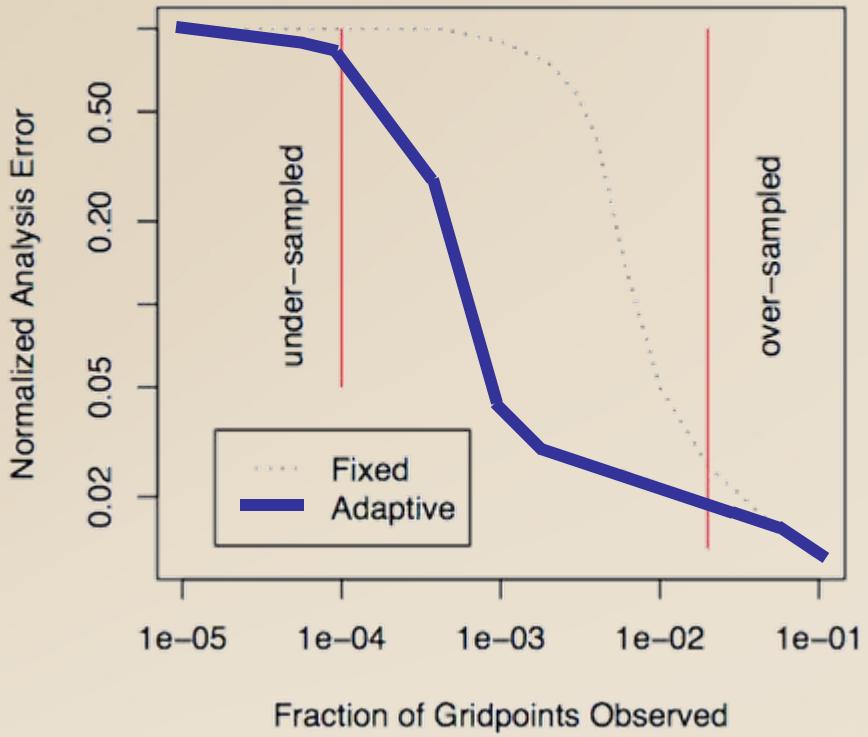
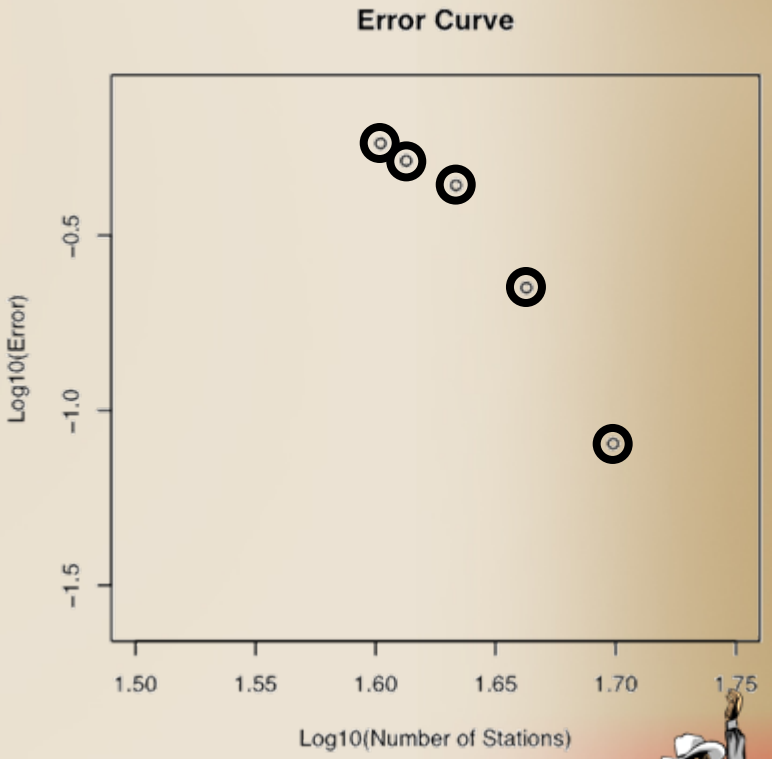
Proof-of-concept



Theory



Experiment

What This Means

- For local modeling/observation systems
  - OSSE error curves appear to apply
  - May be able to use the curves to determine:
    - When you have enough sensors
    - When you need more
    - Which sensors are most important
    - System performance
      - Benchmark
      - Degradation
    - Cost/benefit analyses

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Future Actions

- Automate model/statistical processes
- Field studies
  - Validate use of OSSE error curve theory
  - Wind fields
  - Tracer experiments
- Obtain collaborators
- Develop & incorporate targeted observations
- Develop methodology into package

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