



# The Difficulty of Achieving Good Precipitation Estimates for Use in Real-time Drought Monitoring

**Greg Story**

**Climate Focal Point  
Hydrometeorologist**

**NWS/WGRFC Fort Worth**



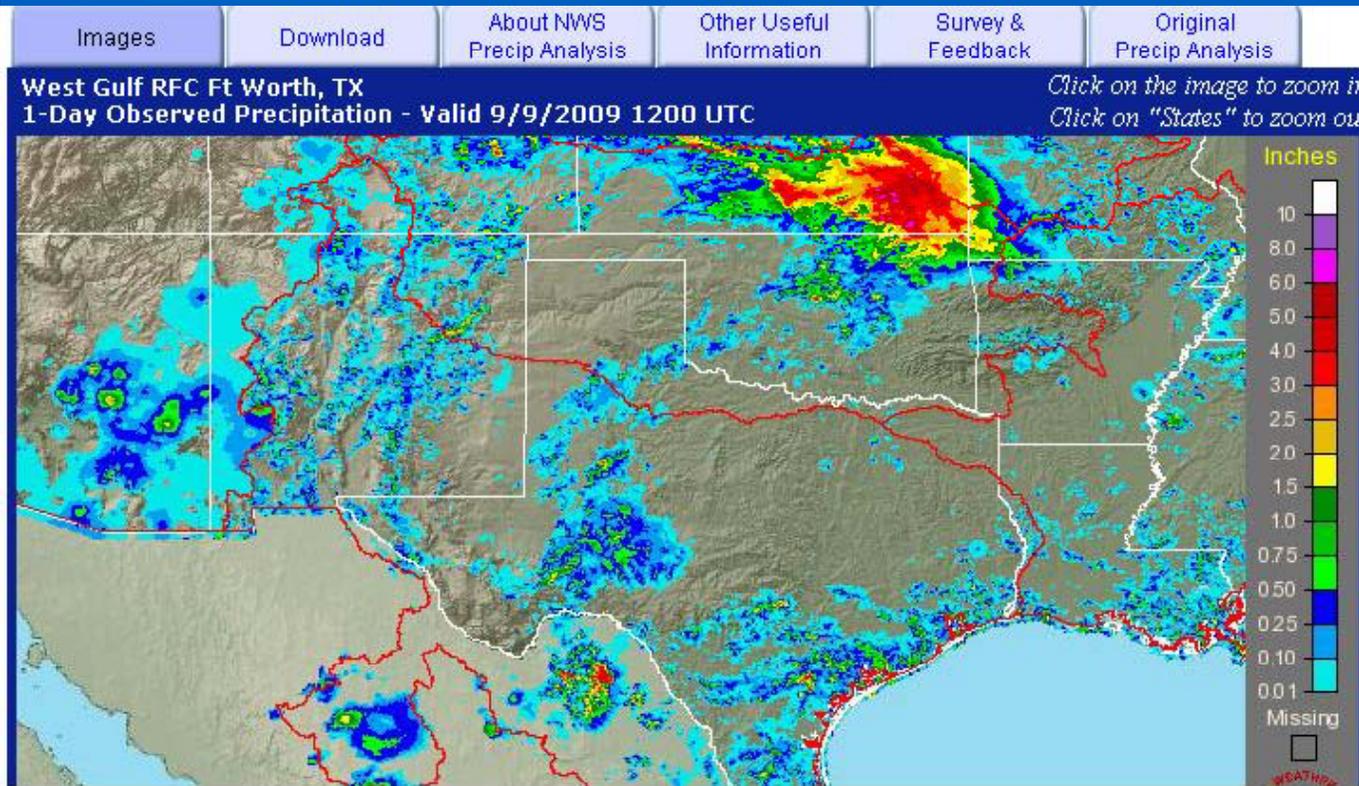
# Goals for this presentation



- To discuss the problems with each type of precipitation data that is used in the climate community.
- To show how the WGRFC compensates for these shortcomings using a program called MPE over our area of responsibility.
- To make you familiar with present capabilities of the MPE program.



# Precipitation Data Available on-line and can be downloaded

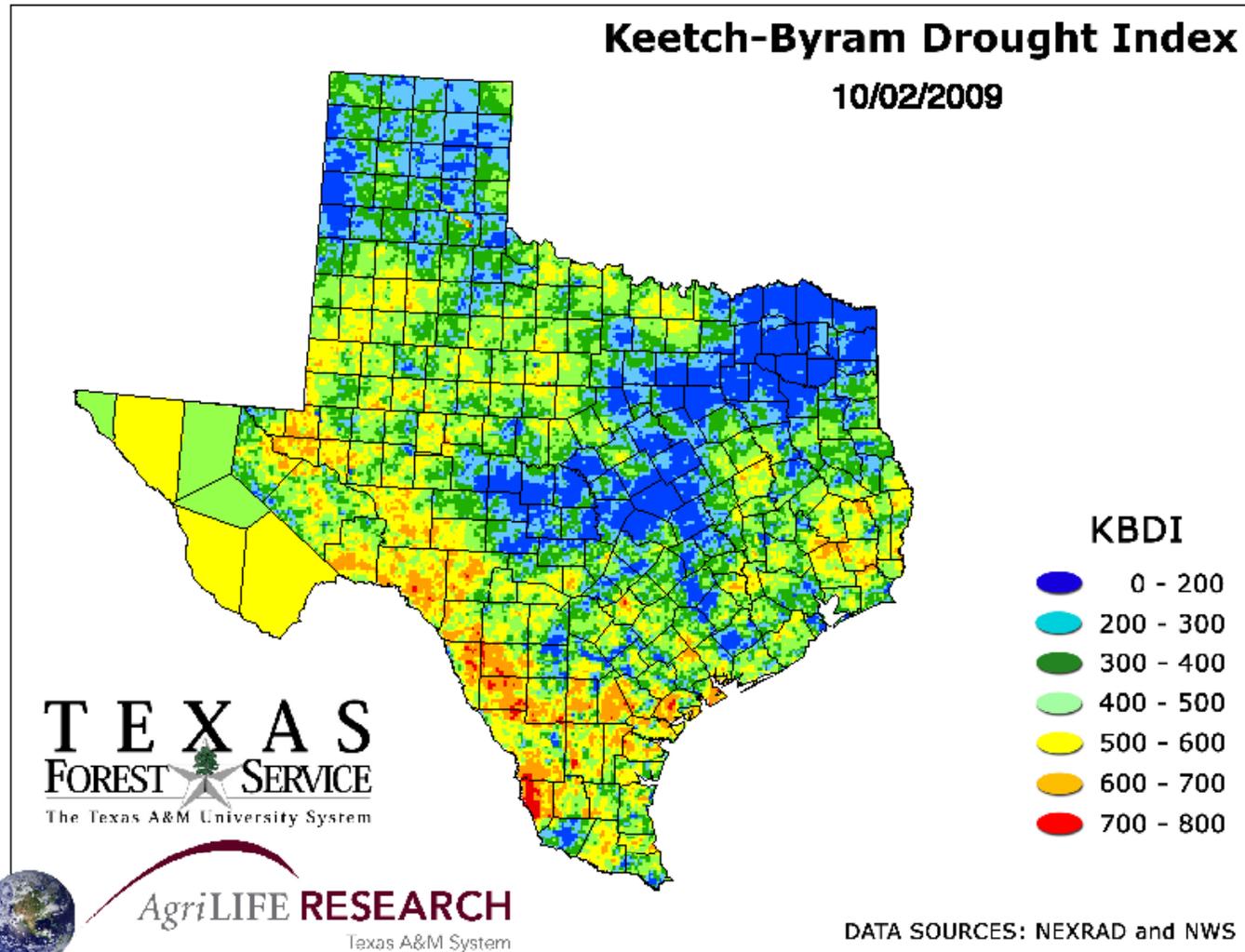


Many groups inside and outside the NWS are interested in good quality precipitation estimates.

<http://water.weather.gov>

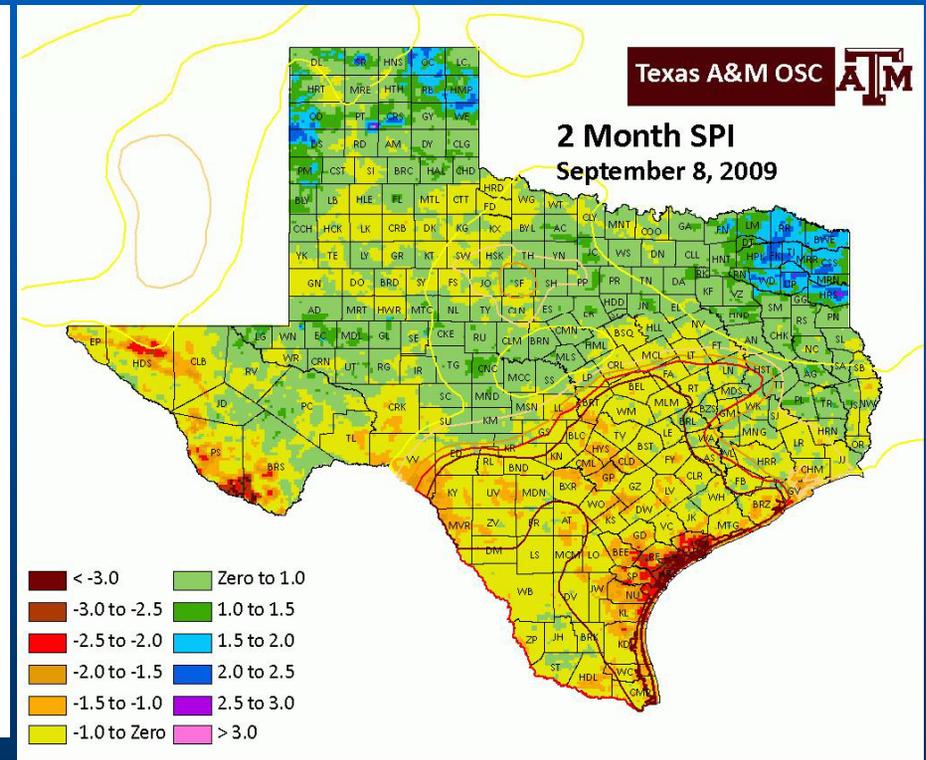
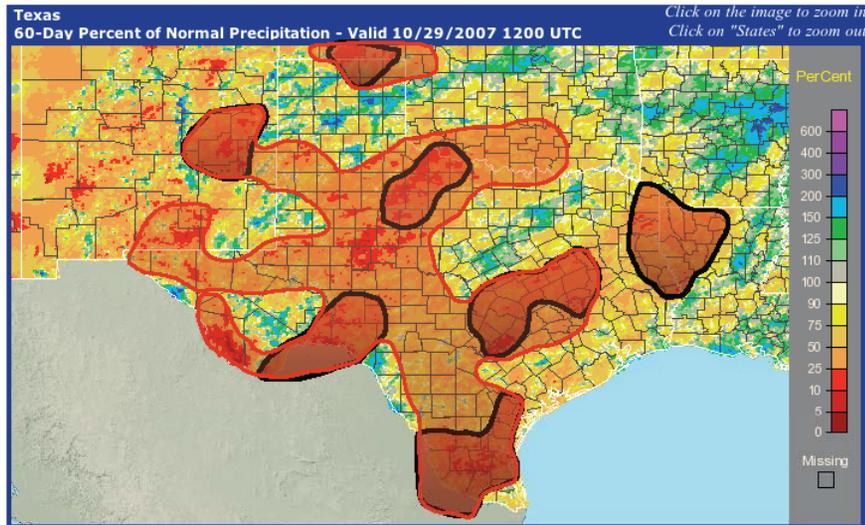


# Texas Forest Service uses our 4 km data for their KBDI map





# MPE data is used as guidance in making the national drought monitor



Courtesy of Dr. John W. Nielsen-Gammon, Texas State Climatologist



# What is MPE?



- **Multisensor Precipitation Estimator**

- **Inputs**

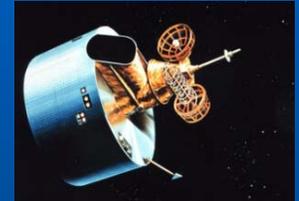
- Radar



- Gauges



- Satellite



- Final multi-sensor precipitation product is ***better than any single sensor.***

- **Goals**

- Reduce spatial inaccuracies and bias errors in rainfall datasets
- Produce a quality precipitation dataset for ingest into National Weather Service (NWS) hydrologic models



# Warning #1

The radar precipitation estimates can be in considerable error.

So why do we use them?

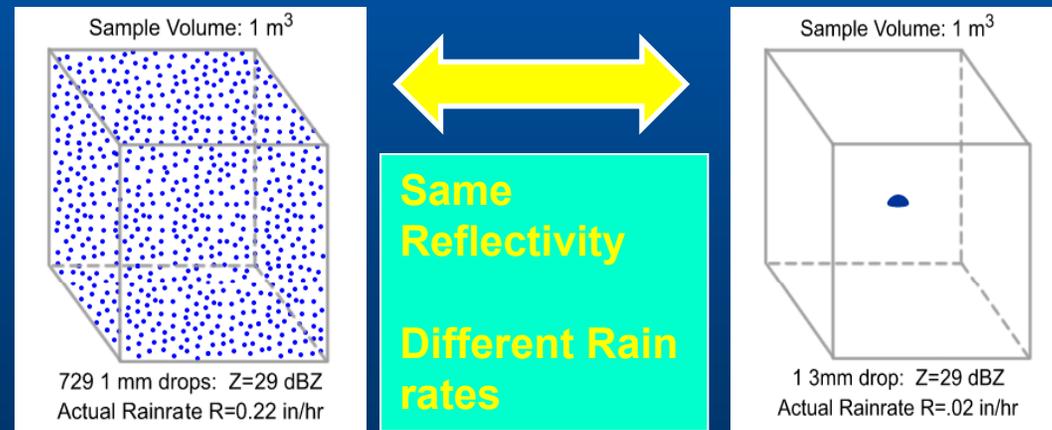




# Need for Radar Estimates



- Radar precipitation estimates are superior in showing the timing and location of rainfall...but
- There are issues with radar
  - Beam blockage and distance (range degradation)
  - Anomalous propagation (AP)
  - Ice processes
    - Hail contamination
    - Sleet and snow (bright banding)
  - Evaporation effects
  - Radar – rainfall (Z/R) relationships and drop size distribution assumptions





# Improving Radar Estimates



- **MPE biases the radar precipitation estimates. The estimates are raised or lowered based on the relationship between the hourly rain gauge value and the radar estimate at the location of the gauge**
- **Two types of radar biases are calculated: field bias (one bias per radar) and local bias (one bias per regional area).**



# Warning #2!

- **Rain gauge data, which is the basis for determining the radar biases, can ALSO be in considerable error.**
- **Manual quality control of the rain gauge data is necessary. Why? Rain gauge data is generally too low in very heavy rain events!**
- **Bad rain gauge data leads to unrepresentative radar biases.**
- **So why do we use gauges?**



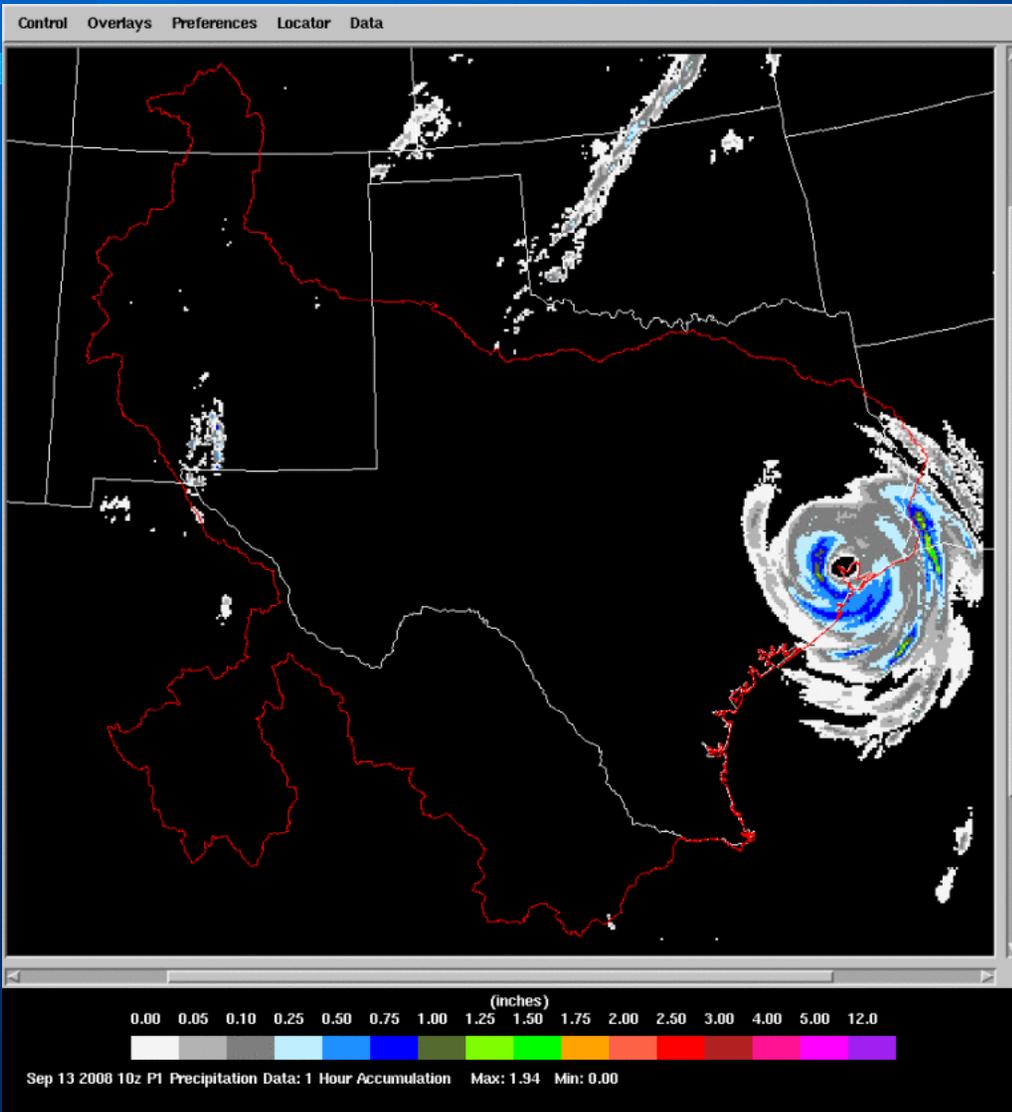
# Need for Gauge Data

- Gauge data provide observed amounts rather than remotely sensed estimates of rainfall
- Issues with gauges
  - Location and maintenance of gauges
  - Loss of “catch” due to high winds ( $\geq 39$  mph,  $\geq 50\%$  loss)
  - Tipping bucket mechanics
    - Calibrated for 0.01” not high rates
    - 6.00” in/hr rate with zero error = more than 0.01” per tip
    - Lose precipitation while bucket tips





# Rain Gauge Data are used with caution in high winds



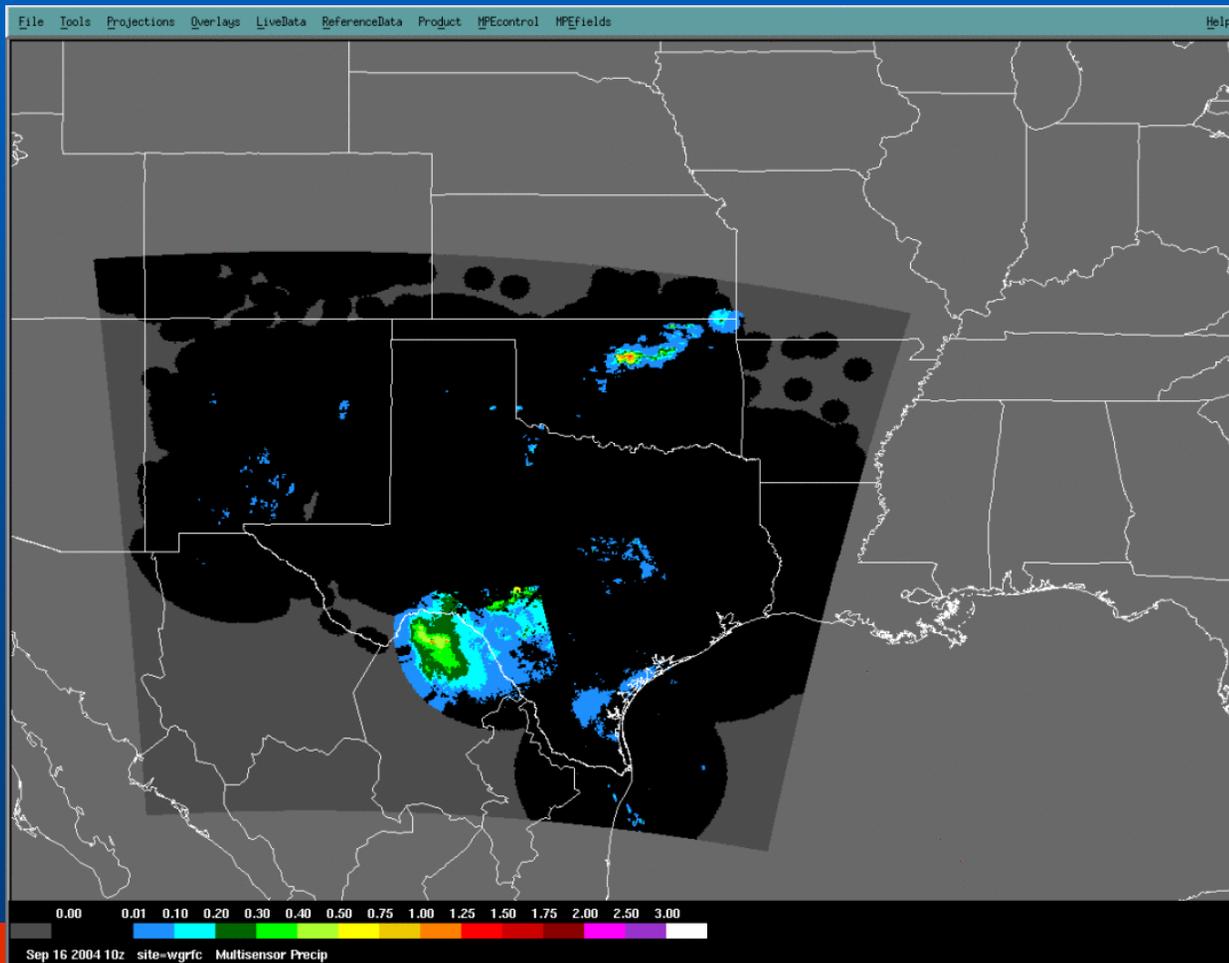
- Extensive rain gauge QC is required in these events. This shows the radar precipitation estimates from hurricane Ike.



# Radar Data “AP”

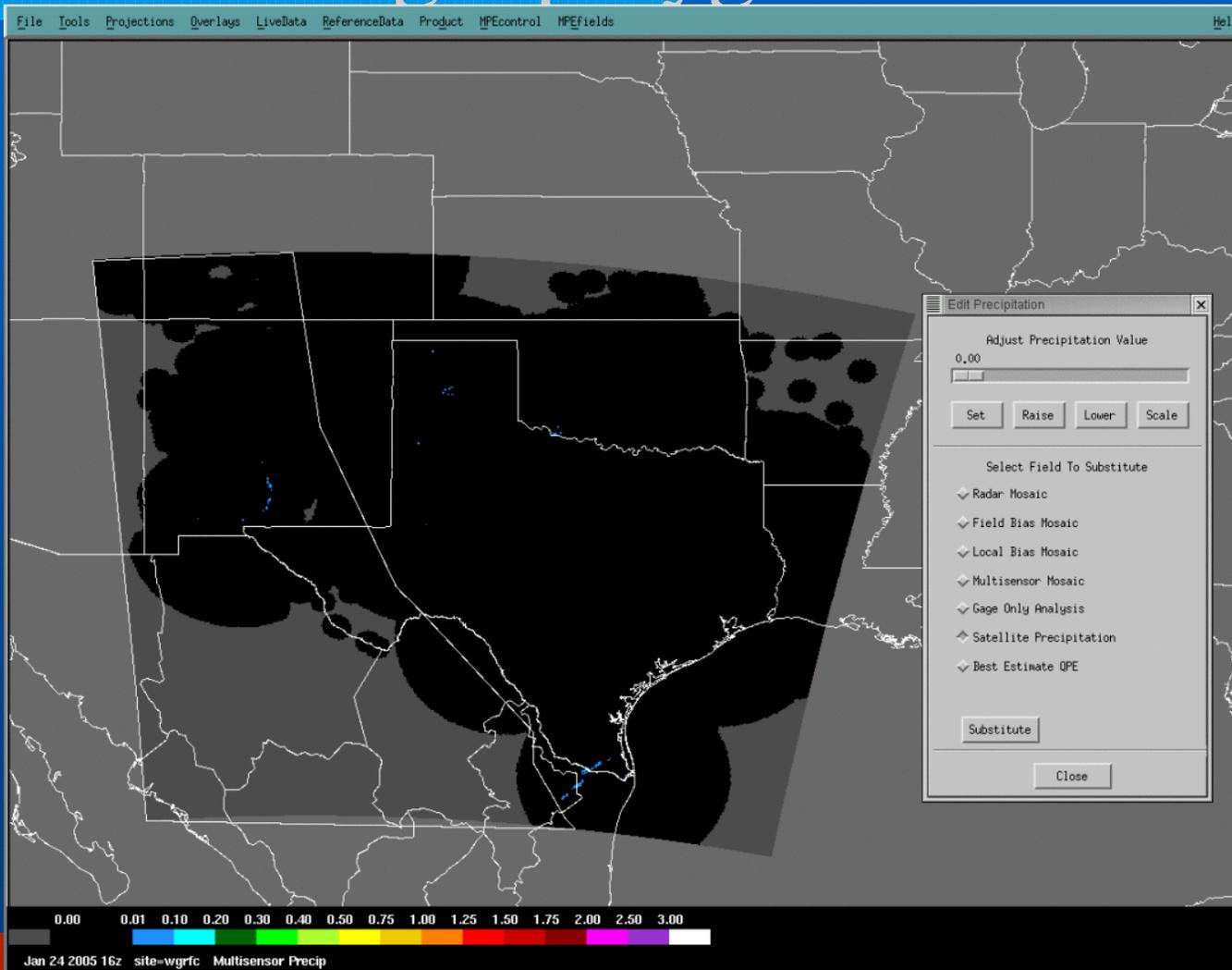


- What is real? Is any of it? We need to eliminate false rain estimates!





# To remove “AP” and/or to insert a better field, we edit it using a polygon edit

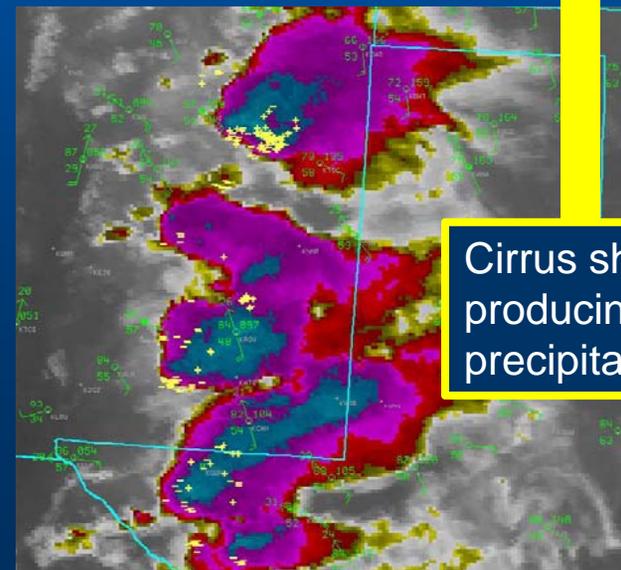
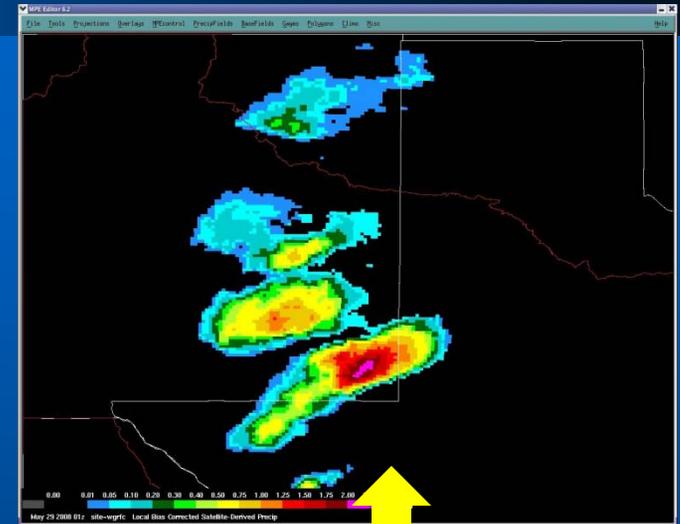




# Need for Satellite Estimates



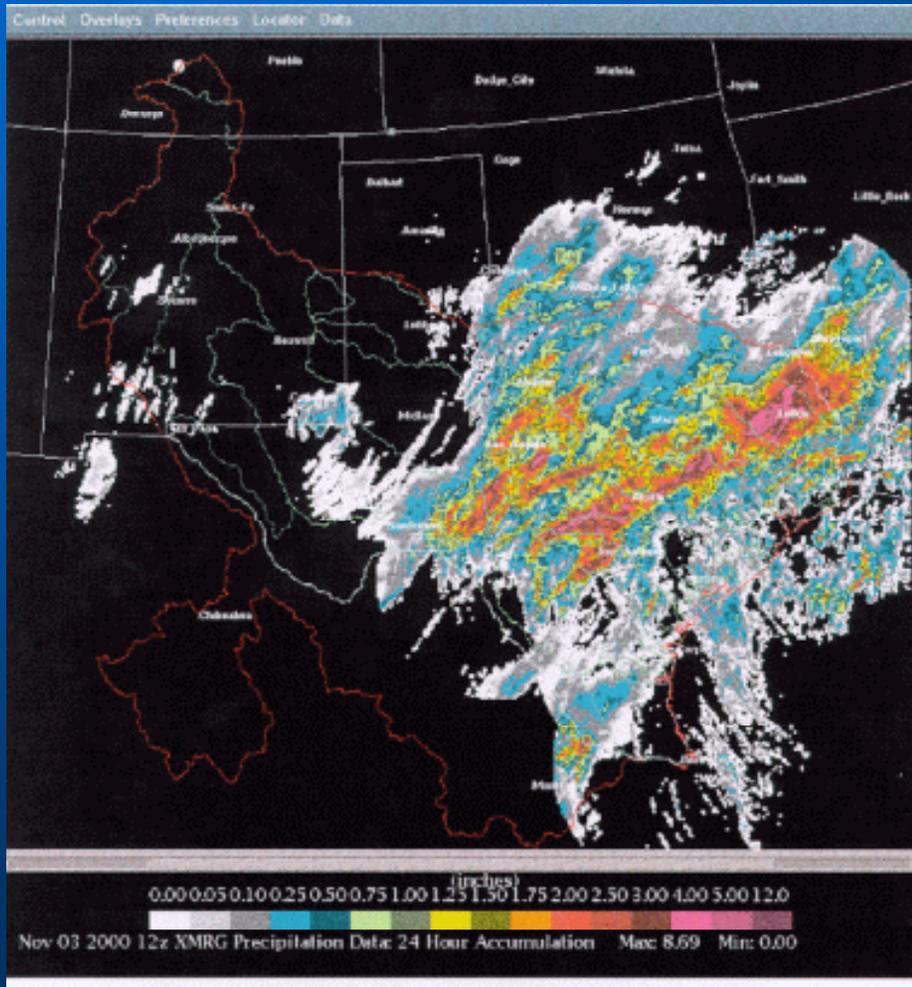
- **Satellite estimates are most useful where radar/rain gauge data don't exist**
- **Issues with Satellite**
  - **Assumes colder temperatures = more intense rainfall**
    - Overestimates from cirrus shields
    - Underestimates from shallow (warm) cloud systems
  - **Parallax Error**
    - Two mile error in low-shear environment
    - Tens of miles in high-shear
    - Progressively worse at higher latitudes



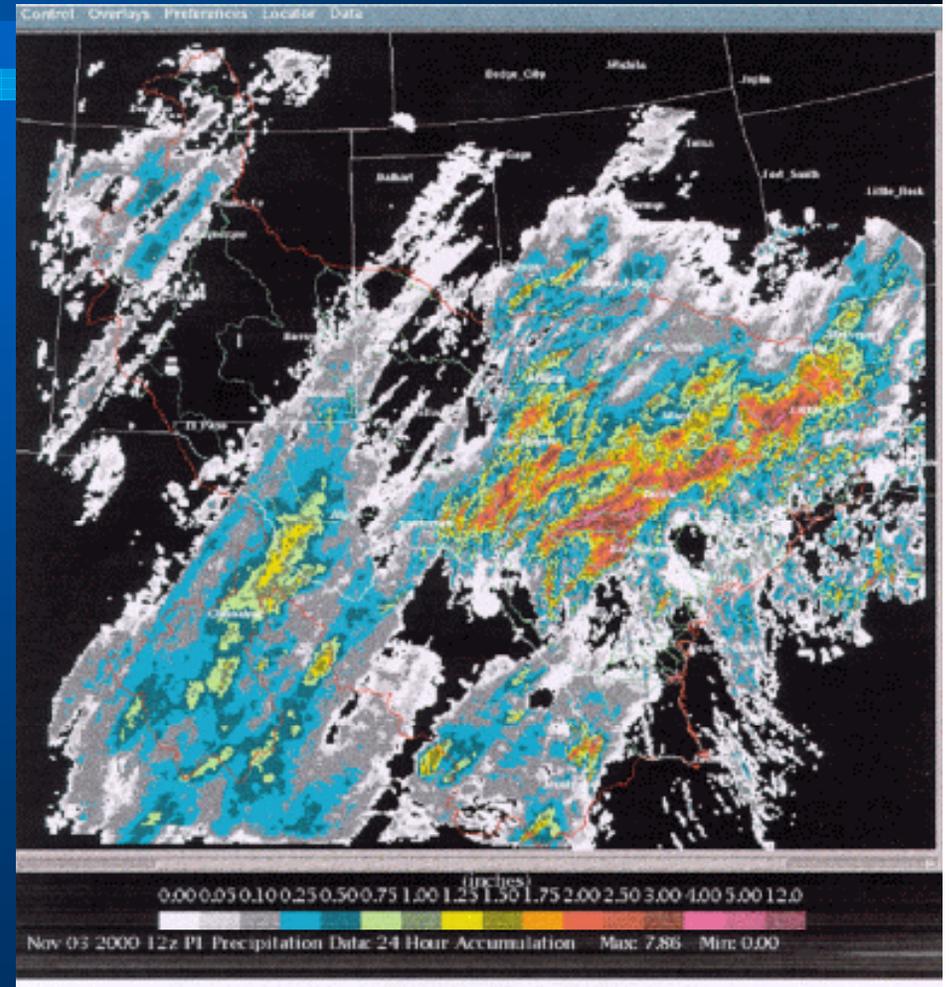
Cirrus shields producing erroneous precipitation estimates



# MPE Before and After Satellite Estimates are added



Multi-sensor Mosaic

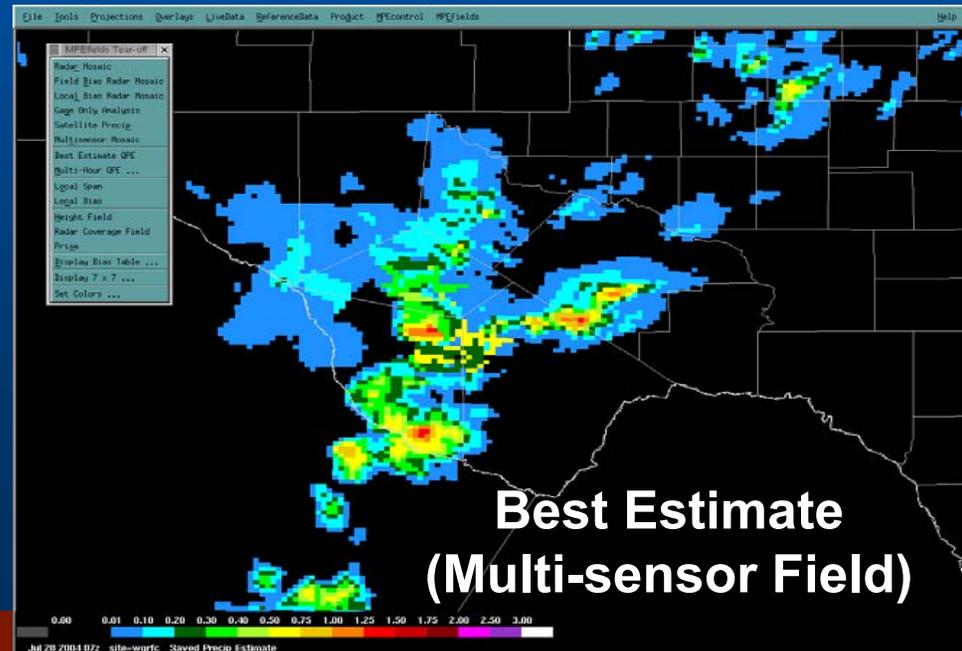
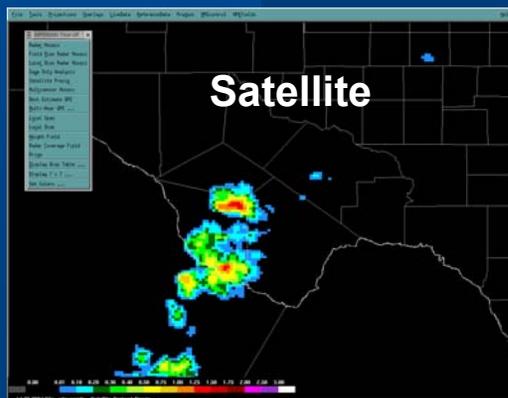
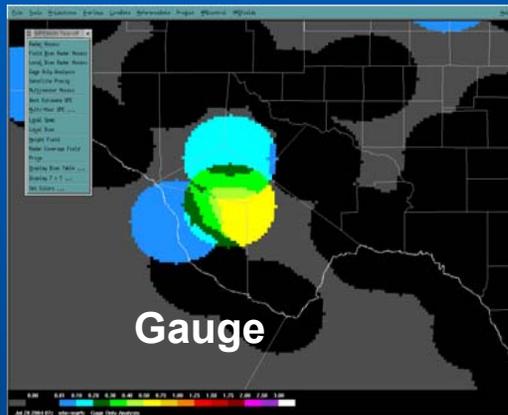
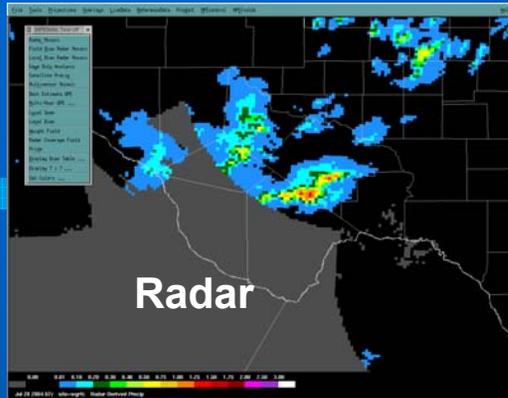


Multi-sensor Mosaic and Satellite  
Estimates

# Precipitation Best Estimate



- 4km x 4km spatial resolution
- 1 hour temporal resolution
- Human quality control of data inputs





# Questions or Comments?

Precipitation products are available through  
our web site:

<http://www.srh.noaa.gov/wgrfc/>

<http://water.weather.gov>

**West Gulf RFC – HAS Team**

**(817) 831-3289 x 4**

**Greg Story                    x 204**

**E-Mail: [Greg.Story@noaa.gov](mailto:Greg.Story@noaa.gov)**



# AHPS Precipitation



West Gulf RFC Ft Worth, TX  
7-Day Observed Precipitation - Valid 9/15/2009 1200 UTC

*Click on the image to zoom in*  
*Click on "States" to zoom out*

