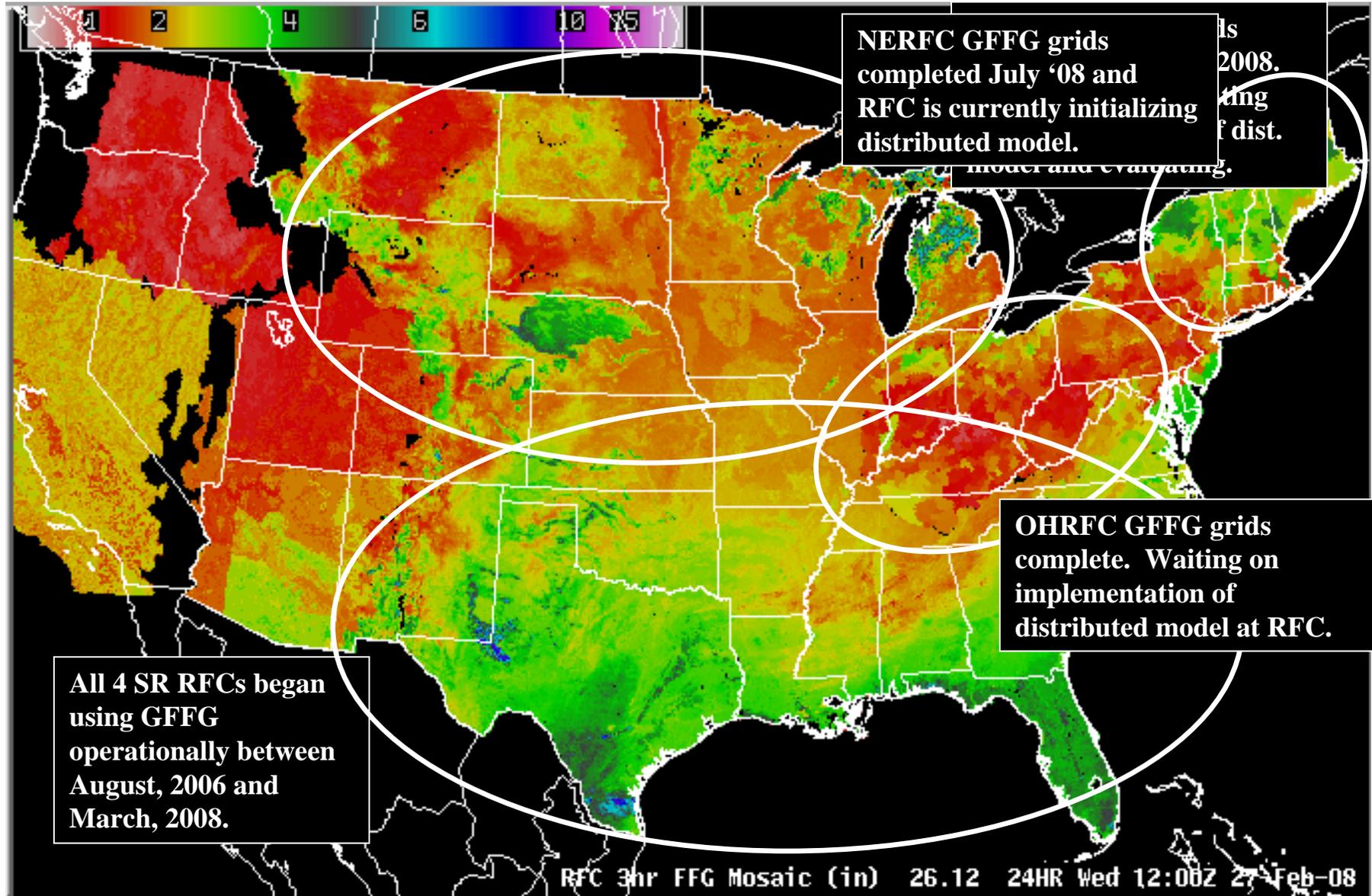# DOH Workshop

ABRFC's GFFG/Distributed Modeling Work

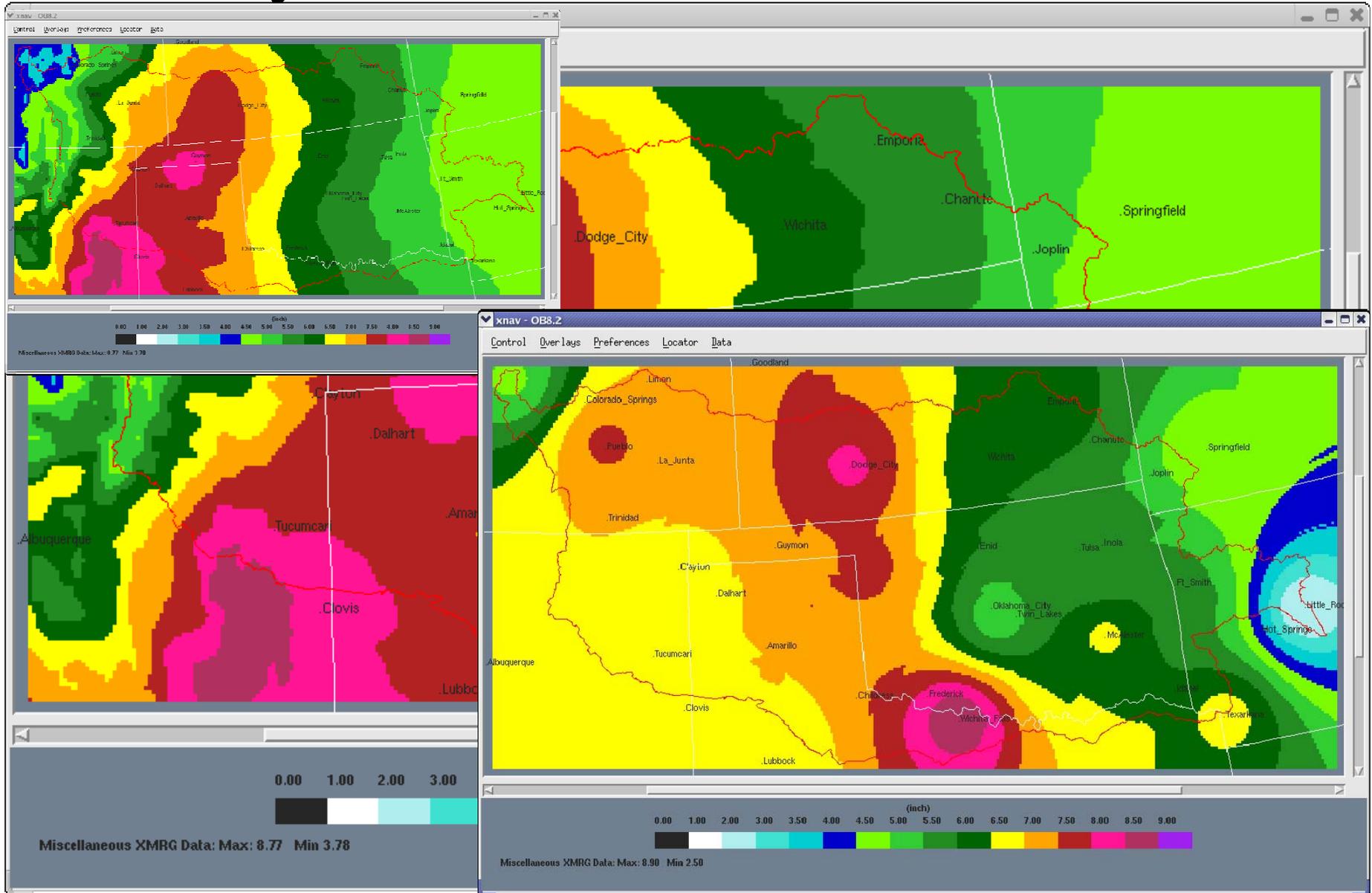William E. Lawrence
7/16/2008

GFFG Using Distributed Model for Soil Moisture Accounting

- Research Distributed Model being used for soil moisture accounting .

- NCRFC, MBRFC and soon NERFC, studying how the frozen ground and snow models perform in DM so that GFFG will be representative during winter months and DM model states will be accurate after thaw.

- Will need to develop methodology in GFFG to lower values for available water in snowpack.

- As part of FY07 GFFG AHPS project, DM enhanced to ingest daily PE xmrgs and distribute to model time step.
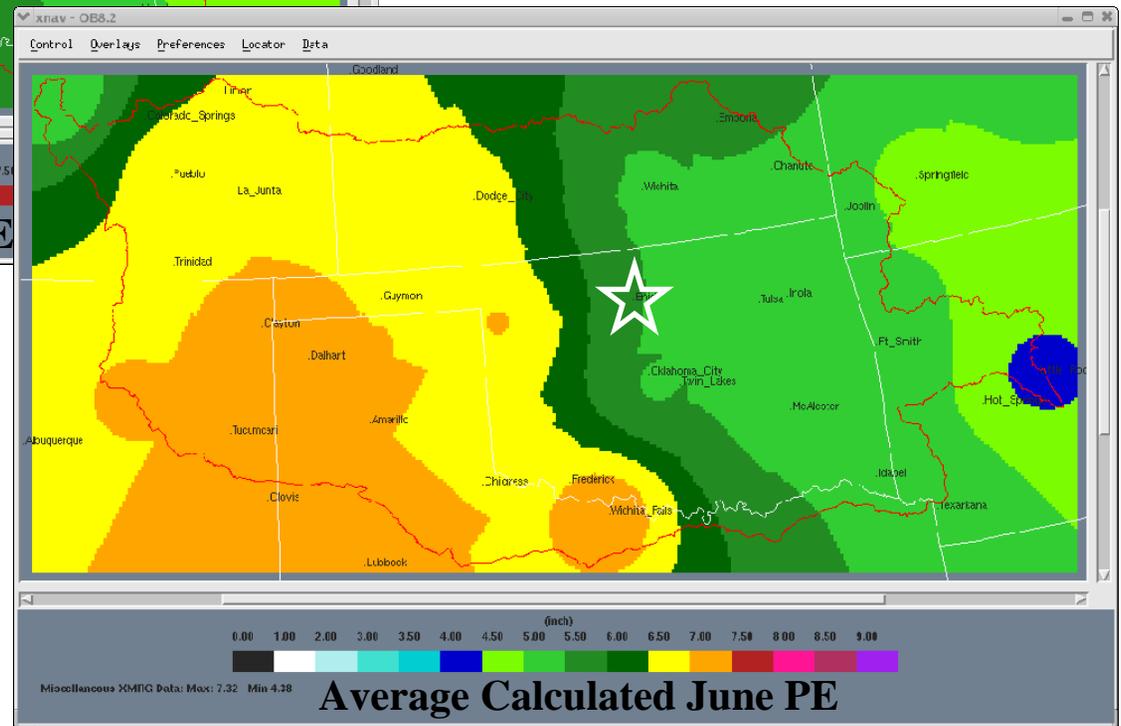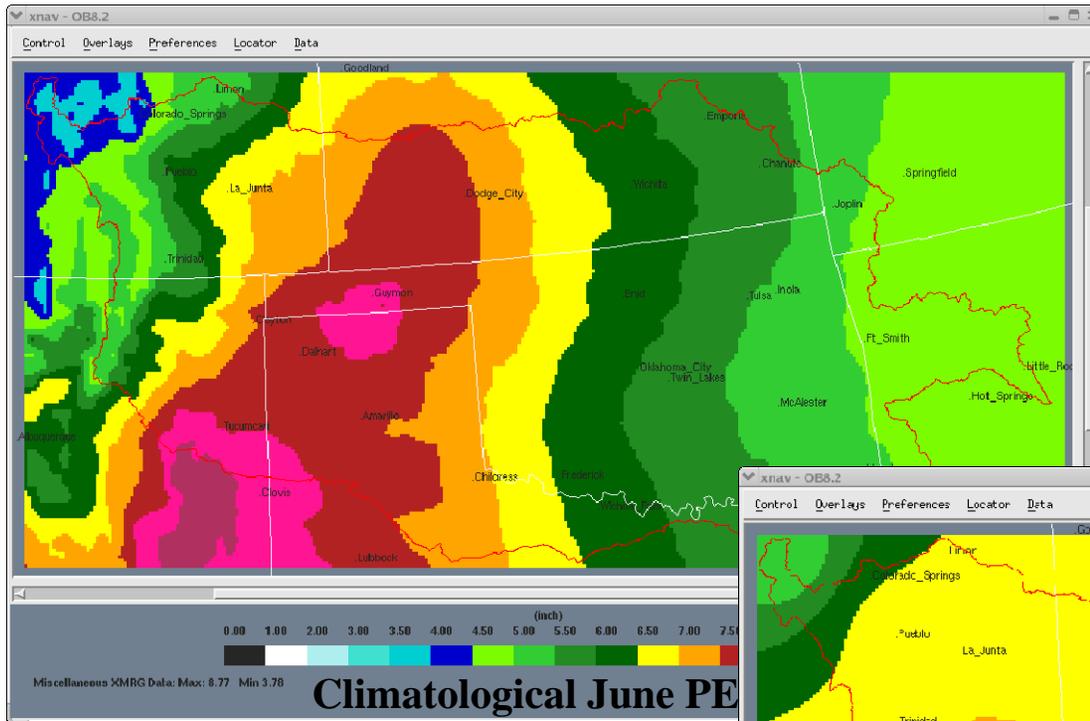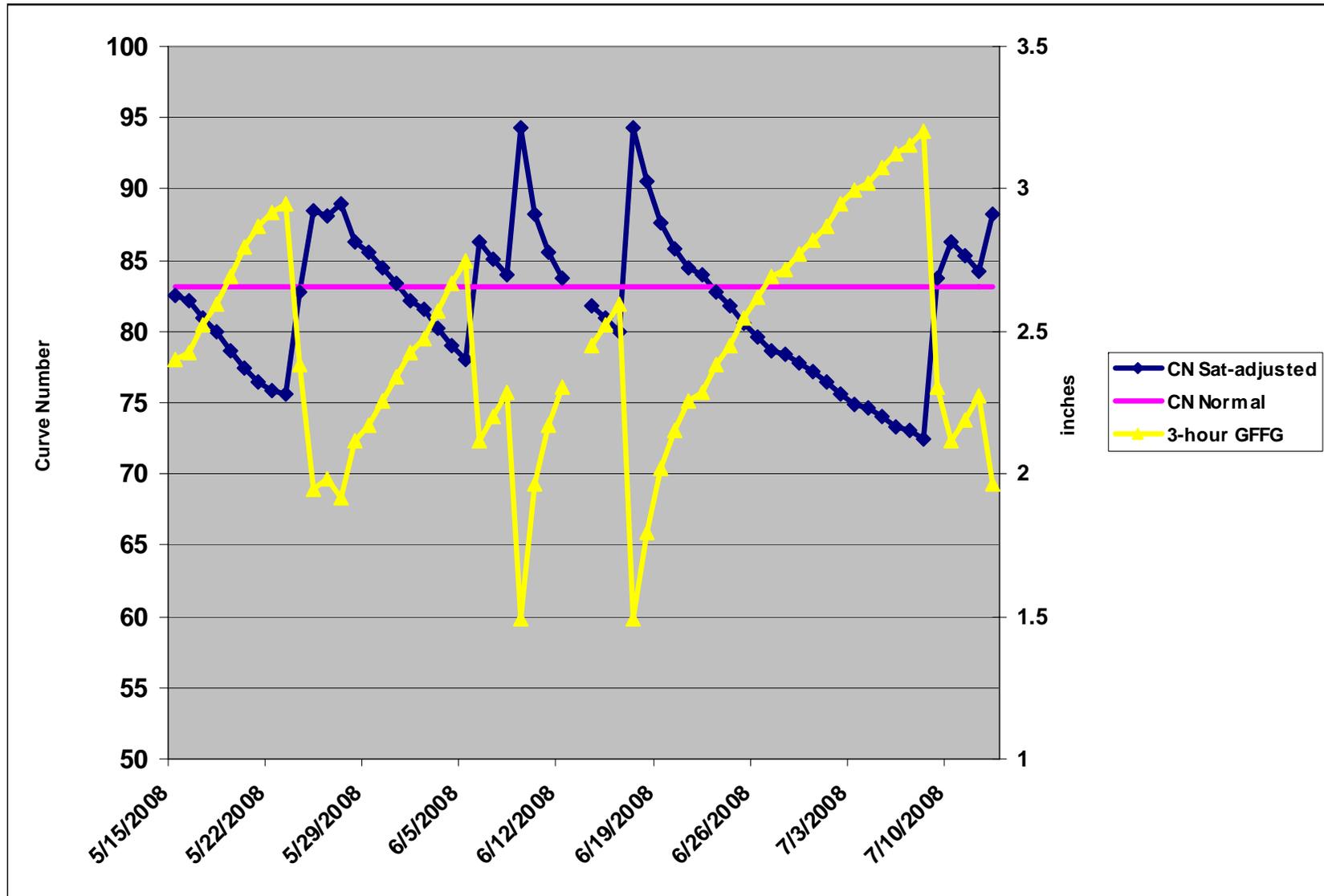
GFFG Implementation

NERFC GFFG grids completed July '08 and RFC is currently initializing distributed model.

OHRFC GFFG grids complete. Waiting on implementation of distributed model at RFC.

All 4 SR RFCs began using GFFG operationally between August, 2006 and March, 2008.

RFC 3hr FFG Mosaic (in)   26.12   24HR Wed 12:00Z 27 Feb-08

Why Real-Time PE Calculations?

Why Real-Time PE Calculations?

Climatological June PE

Average Calculated June PE

Enid, OK PE and Effect on GFFG

Evolving GFFG Using Customer (WFO) Feedback

• WFOs must be using FFMP to notice a significant difference in their flash flood operations due to GFFG. While county FFG products are issued based on GFFG values they have the same "basin averaging" limitations that the legacy FFG system had.

• Users will notice more variability in GFFG values than in legacy FFG products. When GFFG values are averaged to the basin or county, they generally match up well with the legacy FFG values at that resolution. However, GFFG values in some specific areas will depart dramatically from the legacy values due to the accounting of specific physical parameters.

• As more WFOs receive GFFG and use it via FFMP in their flash flood warning operations, areas of poor performance can be identified and addressed.

• Remember, FFG and GFFG are designed to depict riverine flash flooding of headwater basins, not street flooding, poor drainage, etc.

Evolving GFFG Using Customer (WFO) Feedback

WFO comment 1: GFFG values are not getting low enough when soil moisture conditions are wet and/or immediately following a flash flood event.

GFFG evolution 1: **(a)** Modified "wet" NRCS Curve Number equation by comparing to STATSGO-based saturated hydraulic conductivity values.

(b) Implemented variable ThreshR to estimate the fullness of the channel at any given time using gridded runoff from distributed model and unit hydrograph parameters.

> These two modifications to the original GFFG allows grid cells with excessive rainfall to get **VERY** low (~.08 in/1 hour) as GFFG can estimate that little or no additional runoff is required to produce a flash flood and that the soil has very limited infiltration capacity due to saturated conditions.

(c) Began using daily calculated evapotranspiration (PE) values instead of climatological values.

Evolving GFFG Using Customer (WFO) Feedback

WFO comment 2: GFFG values are not low enough in my specific known flash flood problem areas or *urban areas*.

GFFG evolution 2: **(a)** Designed simplified surveying exercise to "measure" the "flash flood/bankfull flow" for a specific location instead of estimating it using GIS datasets for use in the calculation of ThreshR.

(b) Designed technique to allow for forcing of ThreshR values in urban areas where a "forced FFG value" is available from the WFO.

Both of these enhancements allow the WFO to take some level of ownership in the GFFG values they receive from the RFC.

Modifying Threshold Runoff for "Special Cases"

- Threshold Runoff (ThreshR) is the amount of runoff in a specific amount of time to cause streams to exceed bankfull.

- ThreshR is estimated in GFFG by analyzing the slope, land use, soil type and precipitation frequency and magnitude at each HRAP grid cell.

- ThreshR can be modified relatively easily in GFFG using GIS and a simplified field survey of a site that floods *before* bankfull is exceeded.

DEPTH @ BANKFULL

BANKFULL

FLOOD EVIDENCE
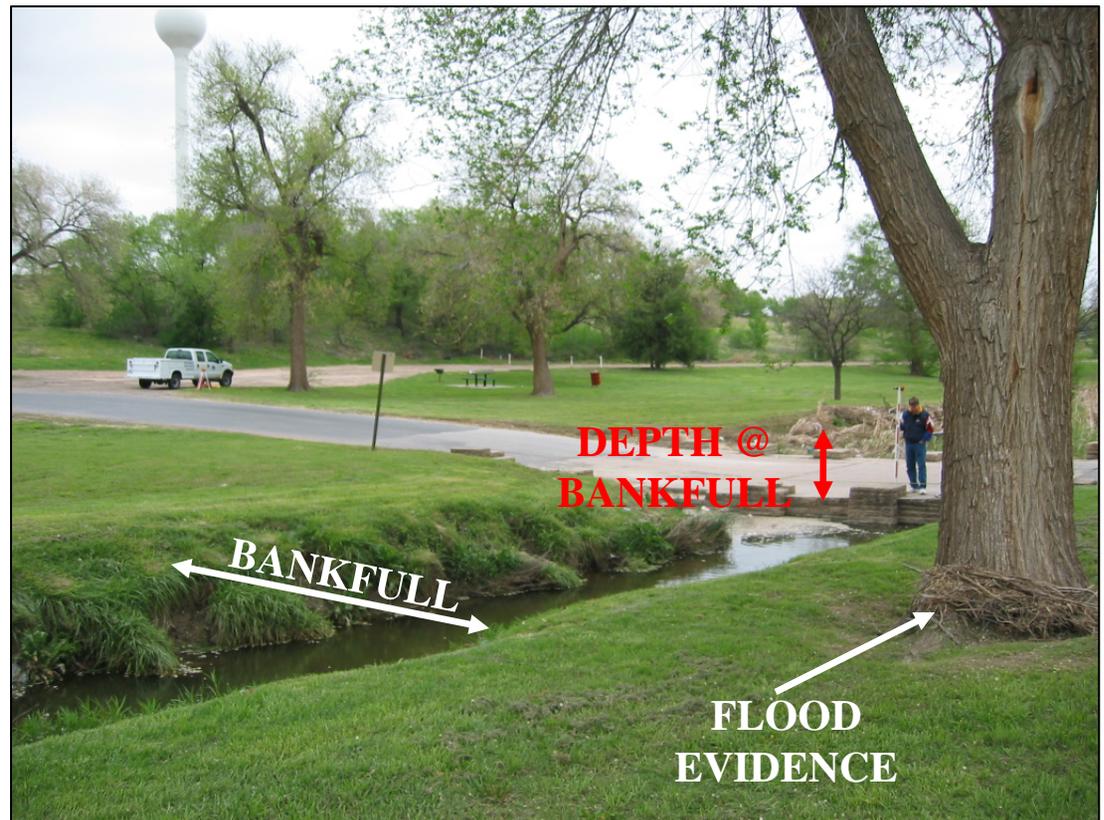
Modifying Threshold Runoff for Urban Areas

- ThreshR is estimated in GFFG by analyzing the slope, land use, soil type and precipitation frequency and magnitude at each HRAP grid cell.

- The assumption used is that channel capacity will reach a state of equilibrium based on the above data.

- Urban drainage networks are often not allowed to erode in a natural fashion and therefore the ThreshR values in urban areas can be too high.

- Using WFO-provided Forced FFG values, urban ThreshR values can be reverse calculated to provide GFFG values that closely resemble the Forced FFG values under normal soil moisture conditions.
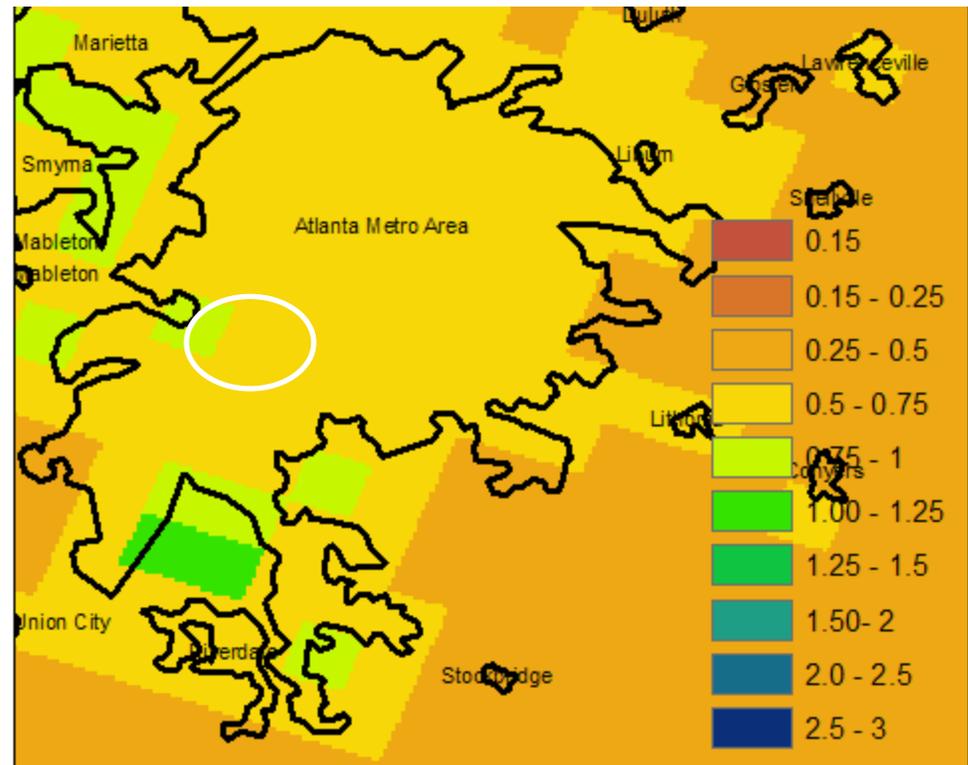
ThreshR value dropped from about 1.35 in/1 hour to about .6 in/1 hour based on a Forced FFG values of 2 in/ 1 hour.

Flash Flood Probability at WFO-Tulsa

CHICLETS
PAGE

Flash Flood Probability at WFO-Tulsa

QPF

GFFG

% Chance Precipitation > GFFG

Probability to Exceed 3hr FFG   THROUGH 07 AM Wednesday

- Uses WFO Tulsa's Probabilistic QPF Methodology (http://www.srh.noaa.gov/tsa/pqpf.htm)

- Assumes exponential distribution of precipitation amounts describes the average precipitation event.

- Assigns probability of exceeding certain precipitation thresholds (0.10, 0.50, 1.0 and 2.0) for a given QPF amount.

- Is applied here by calculating the chance of exceeding a specific GFFG value given a QPF.

NSSL SHAVE *(now with flash floods!)*

US flash flood climatologic data is extremely poor
Storm Data not useful for "ground truth" of scientific applications, specifically GFFG:
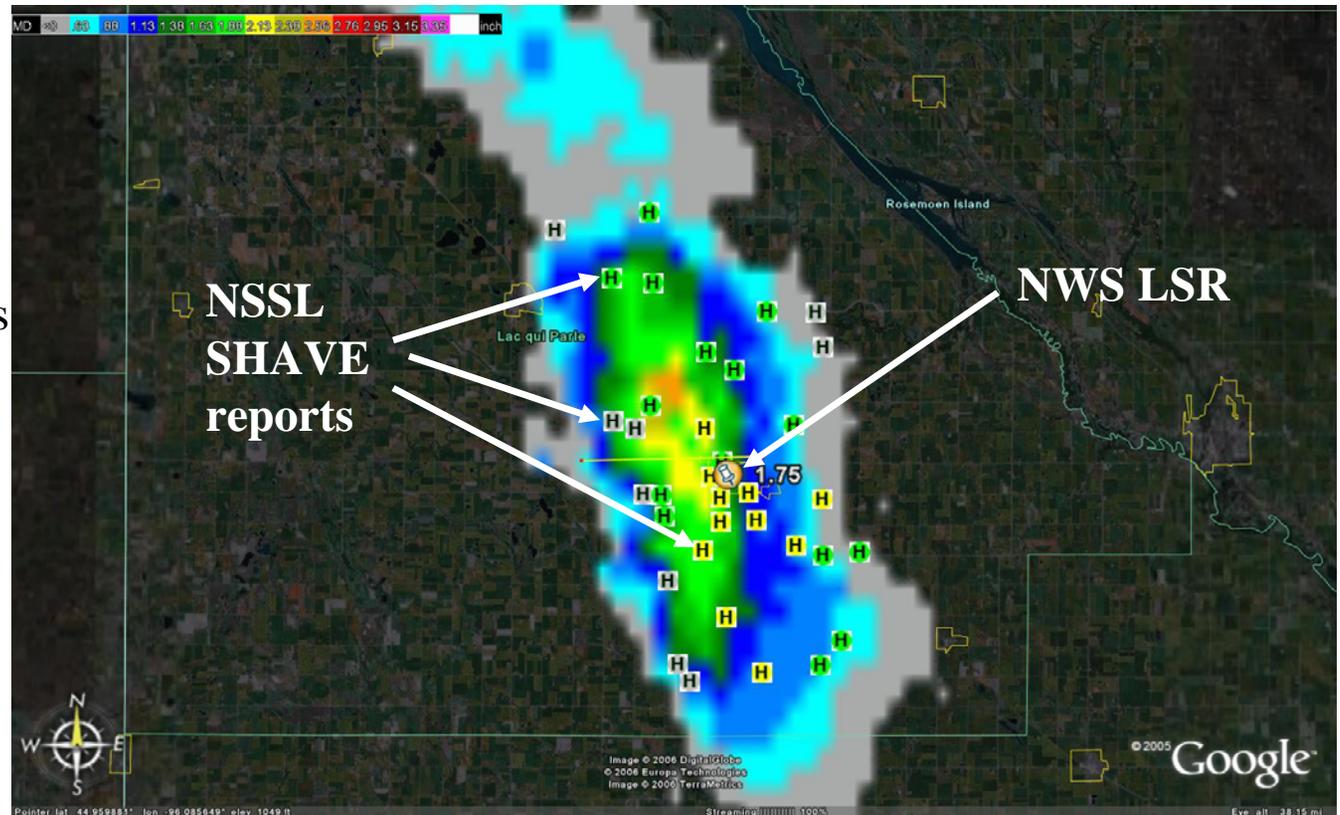Not enough specific information
Not independent of the NWS warning process

HISTORY

2006: collect high temporal and spatial resolution data that describe the distribution of hail sizes in hail swaths produced by thunderstorms

2007: add wind and tornado information

2008: add flash flood component

For more info…http://ewp.nssl.noaa.gov/projects/shave