

Radar Precipitation Monitoring and Flood Detection

(What was so unusual about 2007?)

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How did 2007 distinguish itself?

- An extreme event is the occurrence of precipitation or runoff that is relatively infrequent.
- Events can be characterized as extreme in terms of amount, intensity, geographic distribution (area), and recurrence.
- Several examples of extreme event characterization will be described for the August 18-19 event that caused flooding in Oklahoma in 2007.

Severe Thunderstorm Event:

August 18, 2007



- SPC MCD 181255
OKZ000-TXZ000-181500-
MESOSCALE DISCUSSION 1790
NWS STORM PREDICTION CENTER NORMAN OK
0755 AM CDT SAT AUG 18 2007
AREAS AFFECTED...NW TX...ERN TX PANHANDLE...WRN OK
CONCERNING...HEAVY RAINFALL

VALID 181255Z - 181500Z

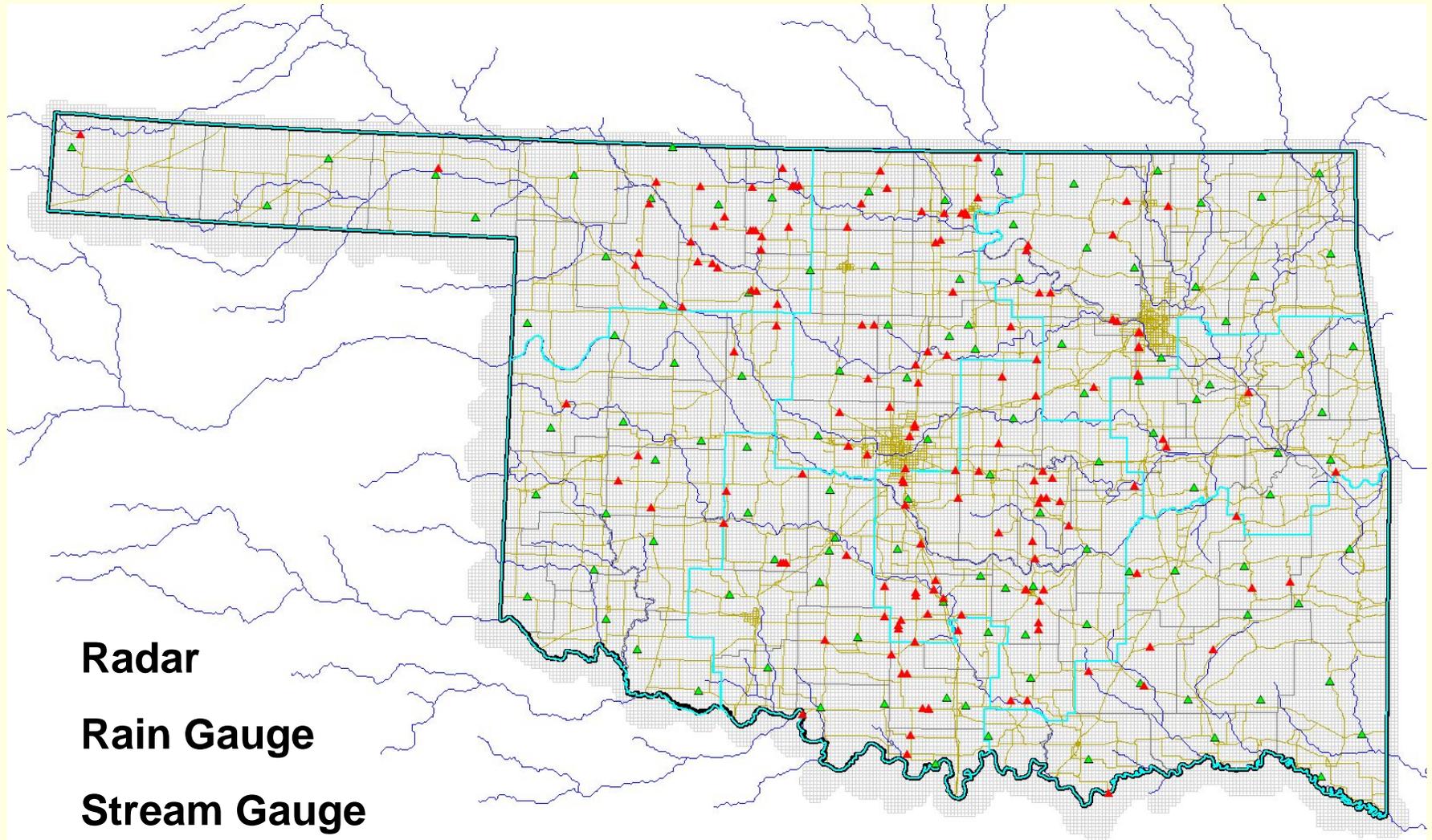
HEAVY RAINFALL ASSOCIATED WITH TROPICAL DEPRESSION ERIN WILL SPREAD
NWD ACROSS NW TX...THE ERN TX PANHANDLE AND WRN OK OVER THE NEXT 2

TO 4 HOURS. RAINFALL RATES UP TO 2 INCHES PER HOUR
WILL BE LIKELY WITHIN THE HEAVIEST RAINBANDS.

THE LATEST SFC ANALYSIS PLACED TROPICAL DEPRESSION ERIN JUST TO THE
SOUTHWEST OF LUBBOCK TX. RAINBANDS NORTHEAST OF THE CENTER ARE
LOCATED ON THE WRN EDGE OF A GRADIENT OF LOW-LEVEL MOISTURE WHERE
SFC DEWPOINTS ARE IN THE LOWER 70S F. LIFT NORTHEAST OF THE CENTER
IS ALSO BEING ENHANCED LIKELY DUE TO WARM ADVECTION ASSOCIATED WITH
A 40 KT LOW-LEVEL JET IN NCNTRL TX. IN ADDITION...OBJECTIVE ANALYSIS
INDICATES THAT PRECIPITABLE WATER VALUES EXCEED 2 INCHES FROM THE
RED RIVER SWD TO NEAR ABILENE TX. THIS AIR WITH HIGH MOISTURE
CONTENT SHOULD SPREAD NWD WITH TIME INTO THE ERN TX PANHANDLE AND
WRN OK. THIS COMBINED WITH SFC HEATING AND LIFT ASSOCIATED WITH THE
LOW-LEVEL JET WILL SUPPORT THE DEVELOPMENT OF NEW THUNDERSTORMS
CAPABLE OF PRODUCING HEAVY RAINFALL THROUGH LATE MORNING.

..BROYLES.. 08/18/2007

Observation Network



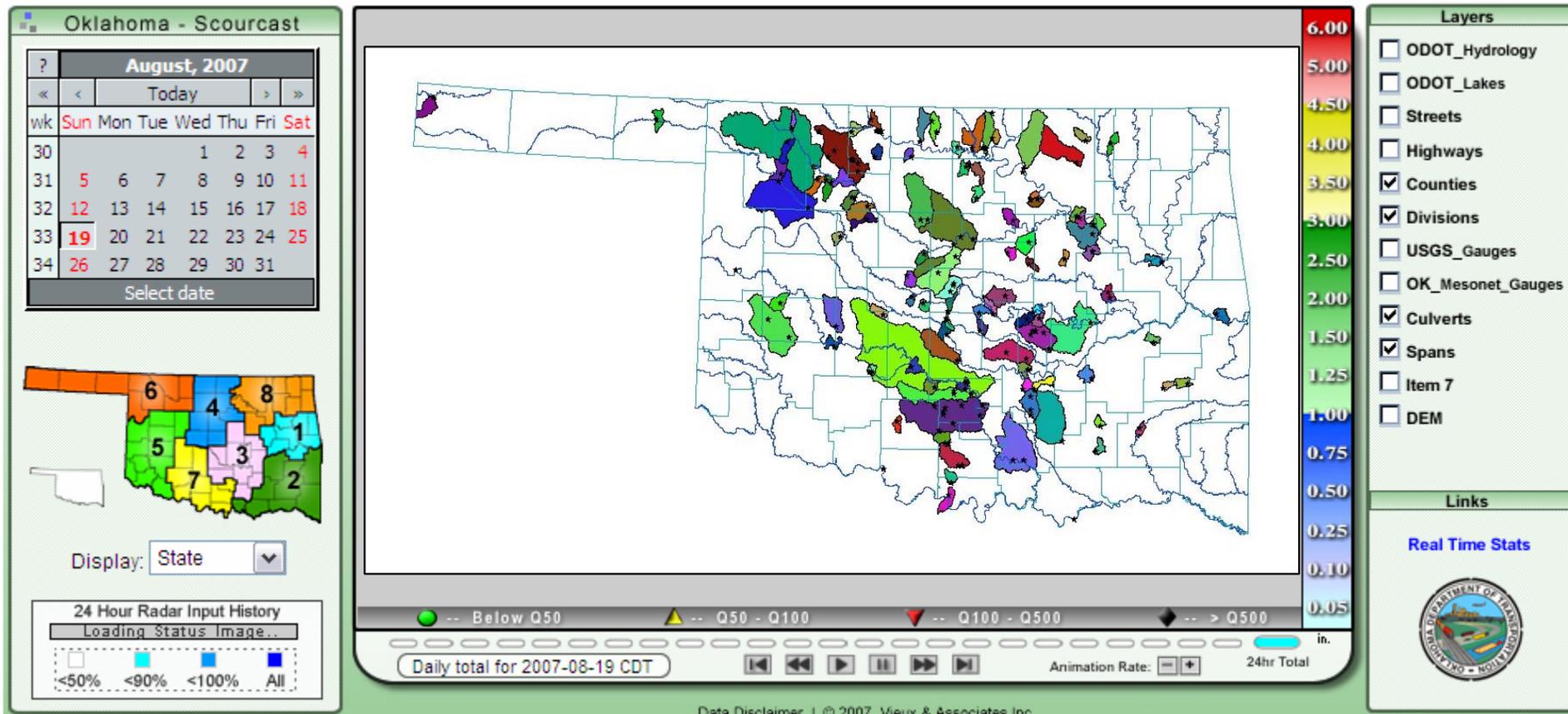
Radar

Rain Gauge

Stream Gauge

Scour Critical Bridges

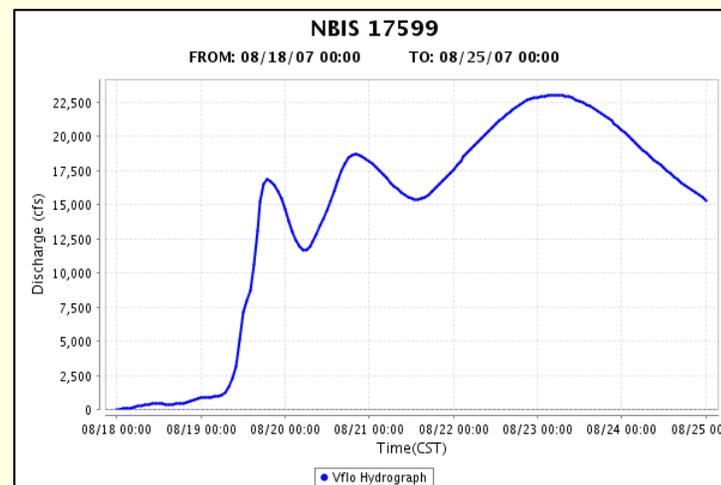
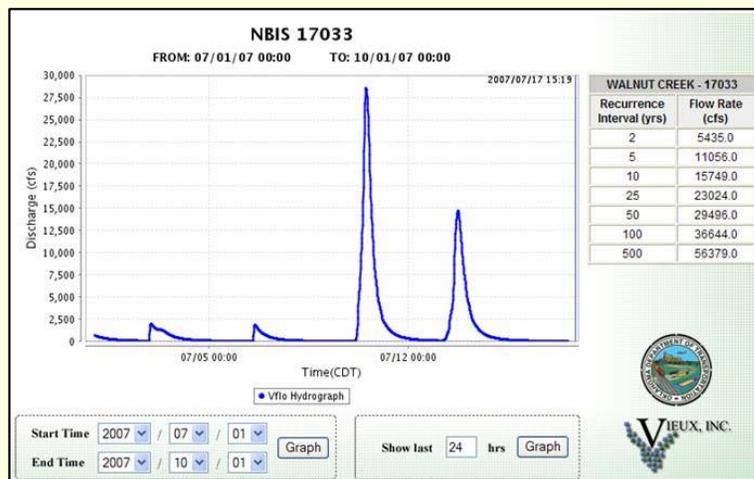
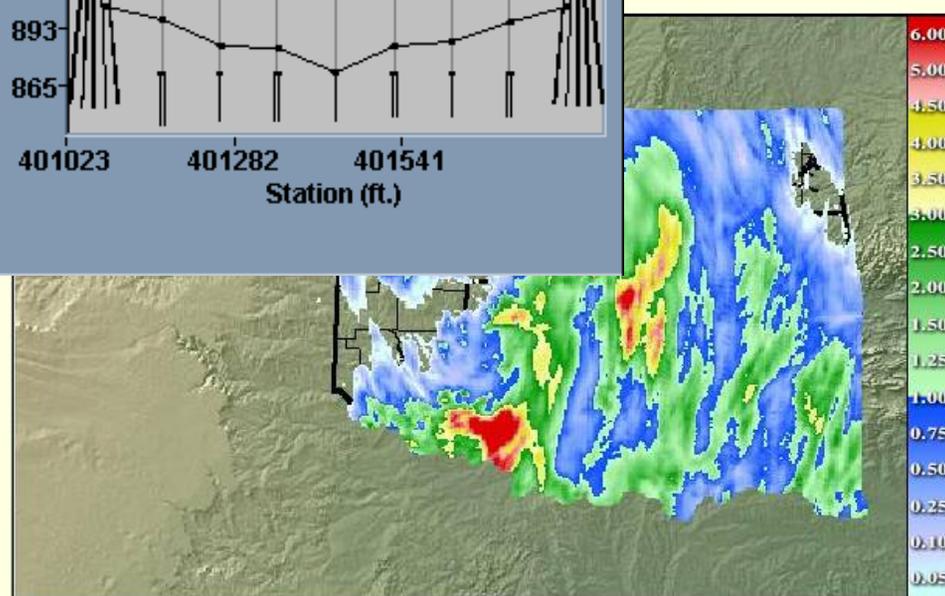
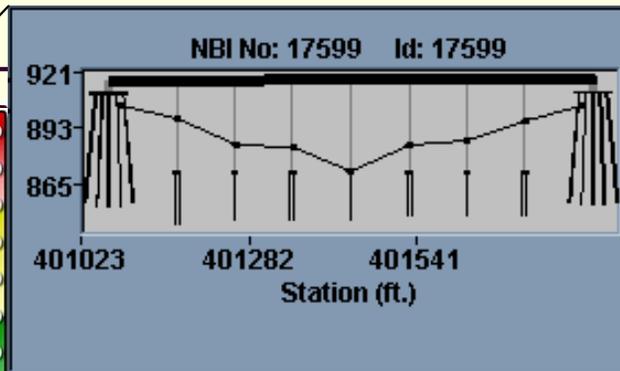
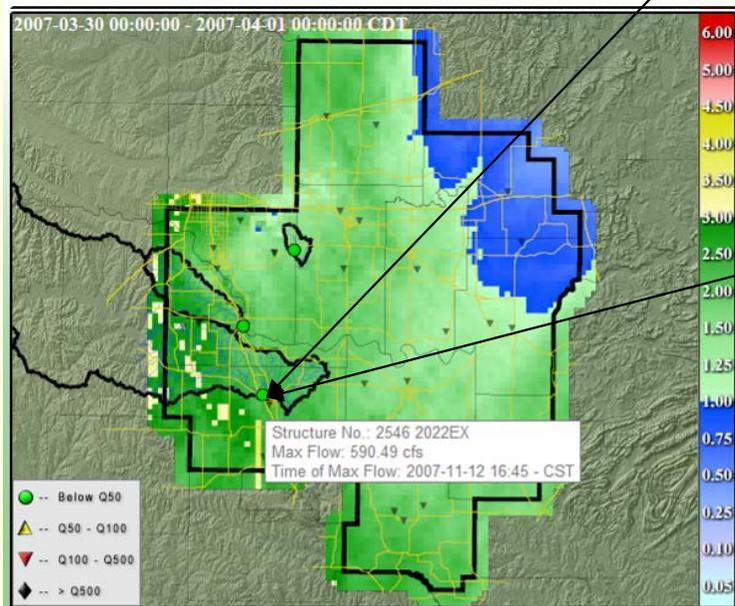
ODOT/FHWA



Which bridge are at risk of scour?

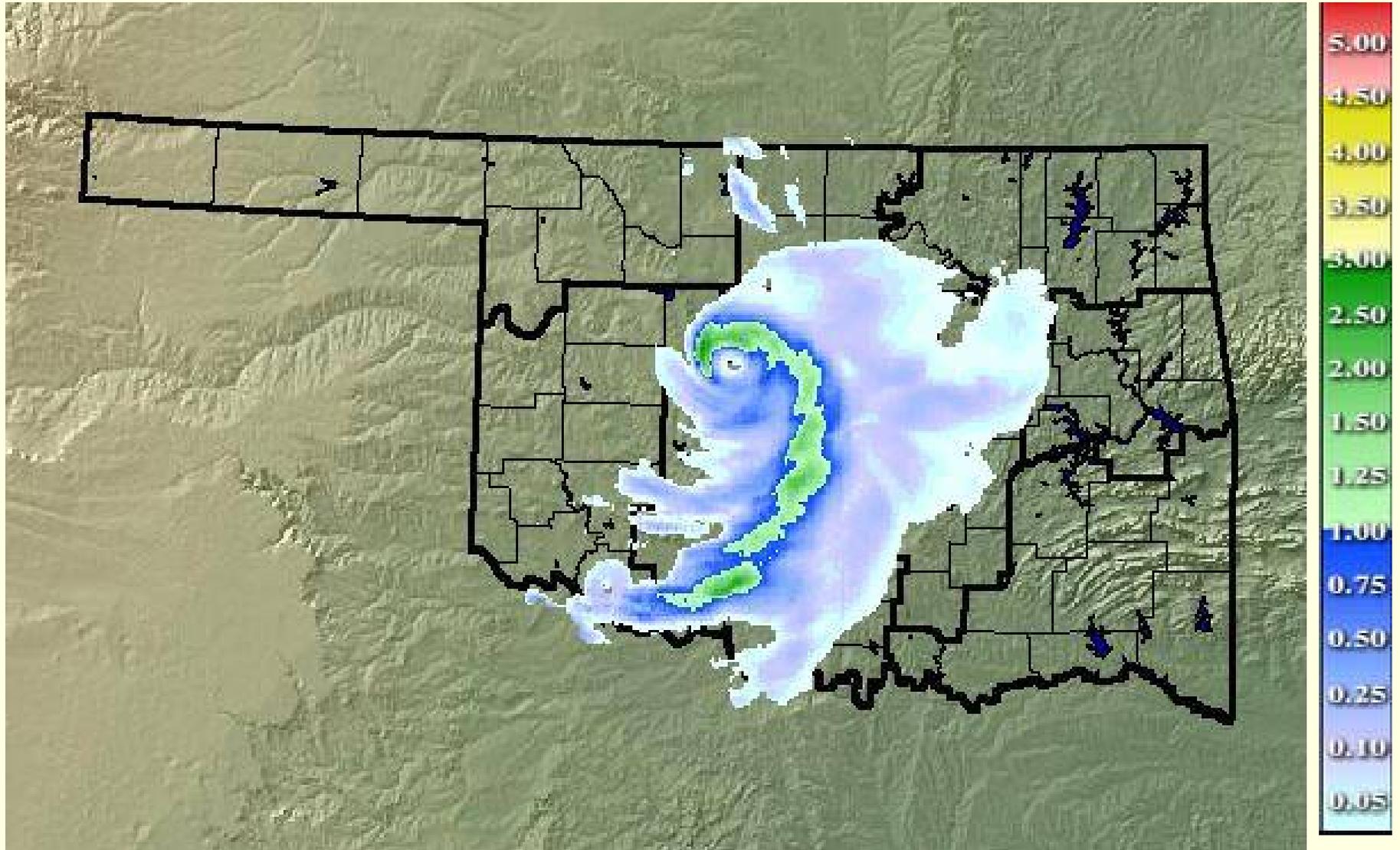


Real-time Monitoring of Scour Risk



Radar Precipitation

Remnants TD Erin - August 18-19, 2007

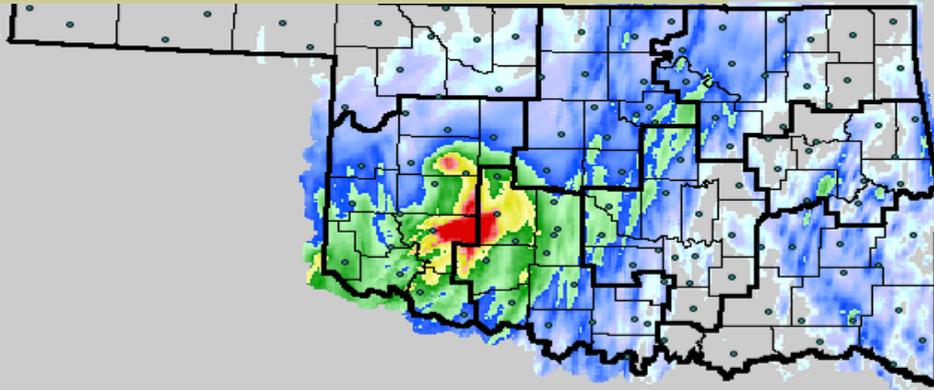


Radar Rainfall Totals

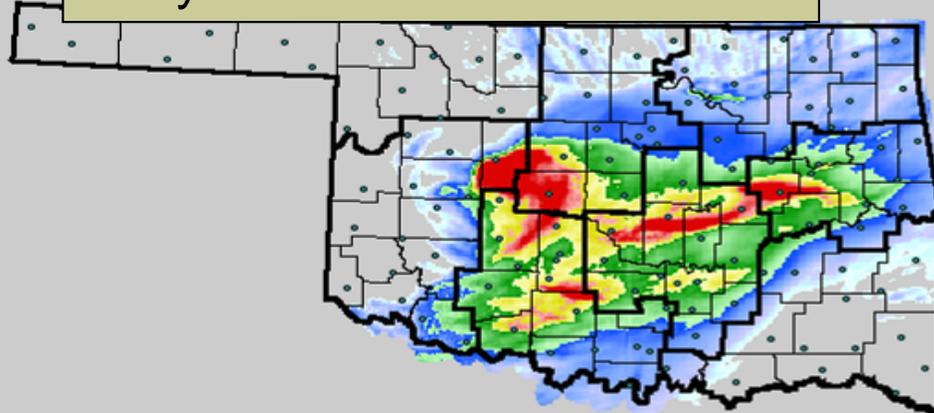
Remnants TD Erin - August 18-19, 2007



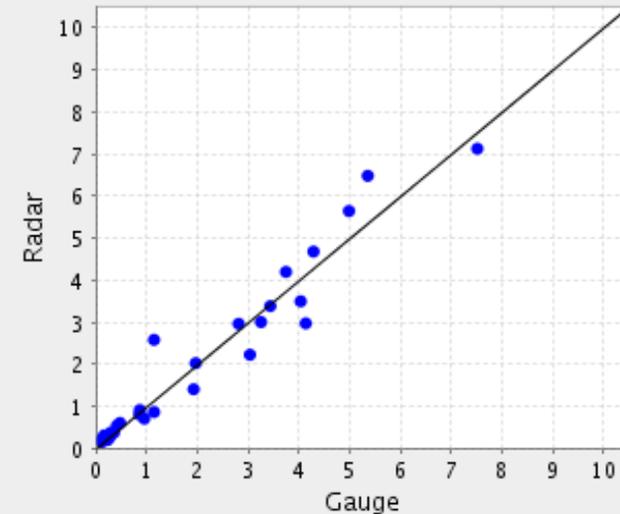
Daily total for 2007-08-18 CDT



Daily total for 2007-08-19 CDT



Calibrated RG Pairs



Mean Bias Correction =
1.748
Average Difference =
 $\pm 11\%$

Without correction: 1 inch
would be 0.56 inches

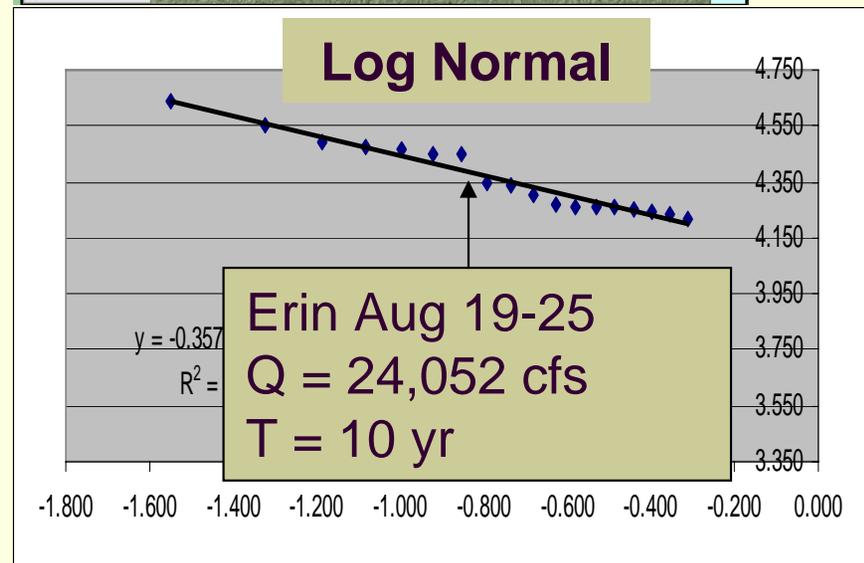
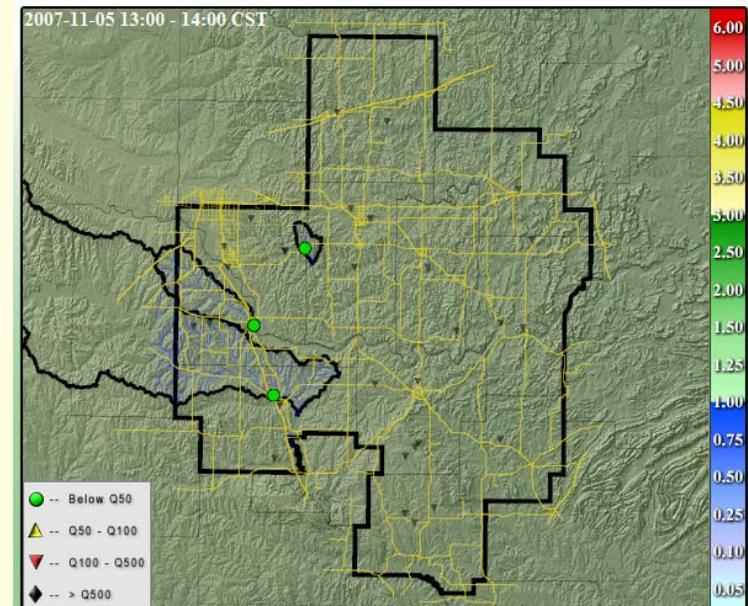
Rainfall Extremes v. Streamflow

Remnants TD Erin - August 18-19, 2007



Washita Annual Series

Year	Q (cfs)	Rank	P	T
5/29/1987	43600	1	0.009025	110.8
5/18/1957	35800	2	0.023466	42.6
5/10/1993	31200	3	0.037906	26.4
5/11/1950	30000	4	0.052347	19.1
6/9/1995	29100	5	0.066787	15.0
10/22/1983	28400	6	0.081227	12.3
5/3/1990	28000	7	0.095668	10.5
6/10/1941	22000	8	0.110108	9.1
5/22/1949	21700	9	0.124549	8.0
5/23/1951	20100	10	0.138989	7.2
10/1/1945	18600	11	0.15343	6.5
...	...	69

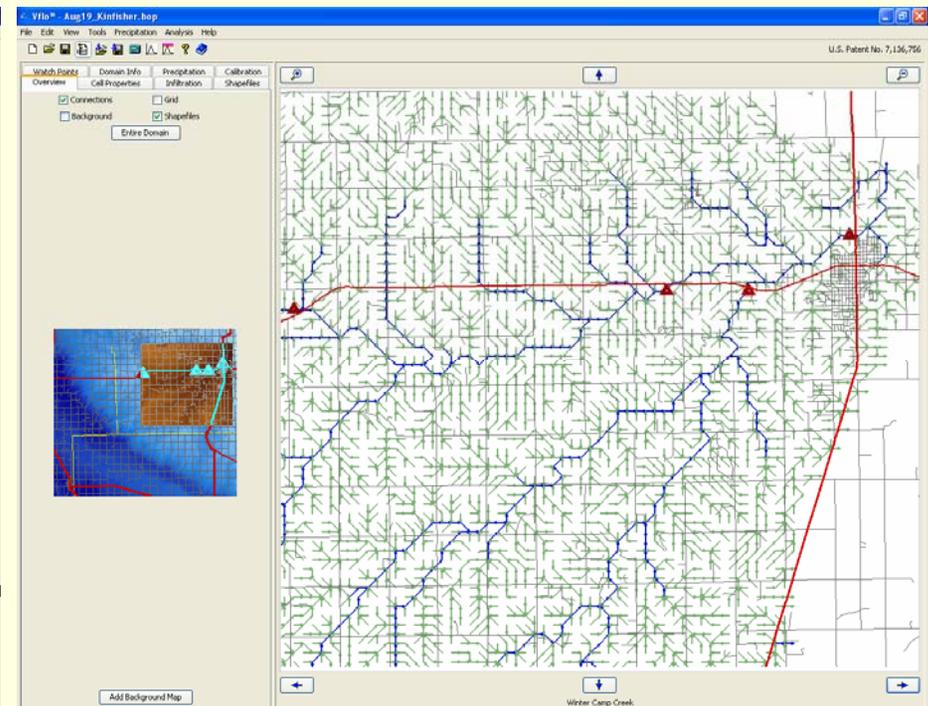
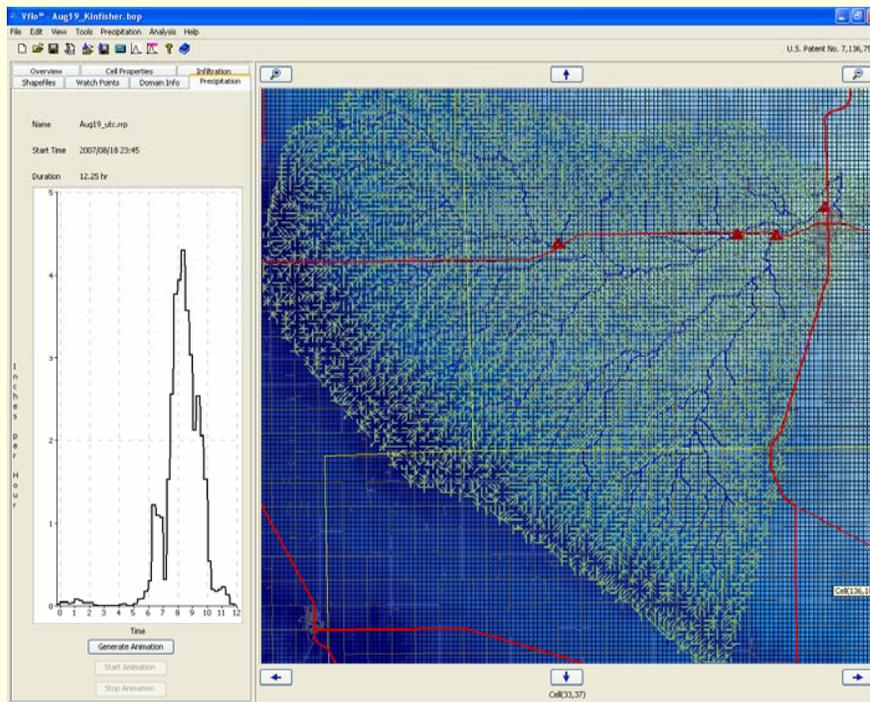


NWS Headwaters Routing

Remnants TD Erin - August 18-19, 2007



- Real-time Vflo (9202 cells @ 300x300 meters)
- Radar precipitation input
- Distributed model with interior watch points
 - Kingfisher @ US 81 (320 sq. mi.)
 - Kingfisher Cr. @ SH 33 (Two Locations)
 - Winter Camp Cr @ SH33

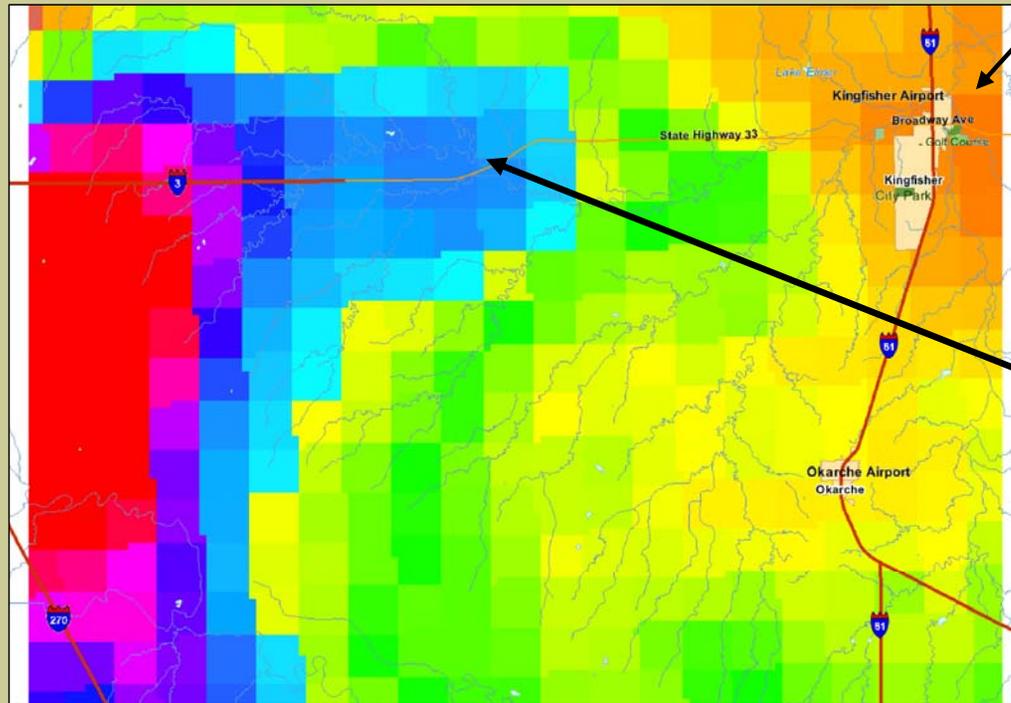


Rainfall Totals

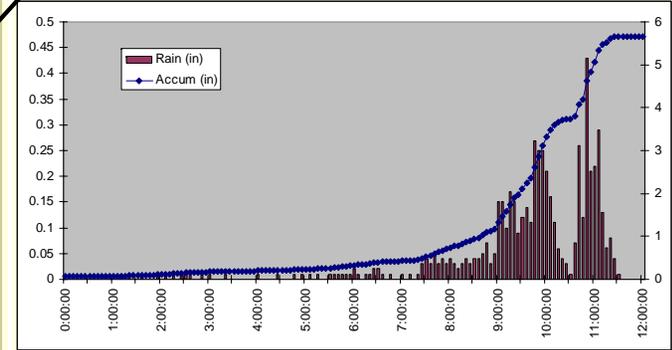
Remnants TD Erin - August 18-19, 2007



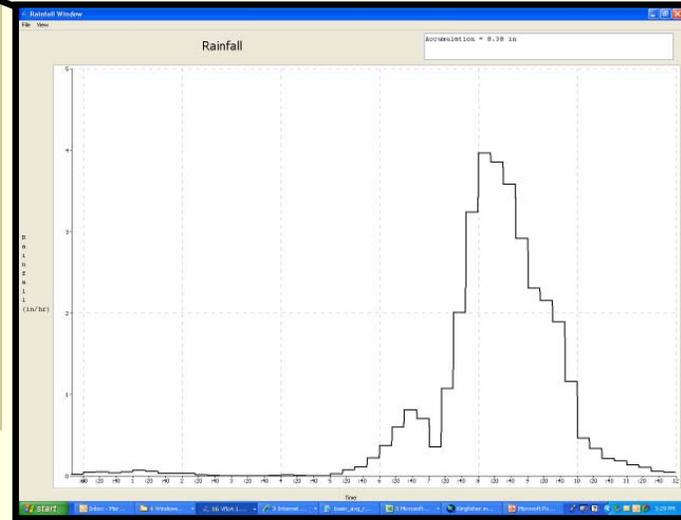
Rainfall Over Kingfisher



Rainfall Depth (in) Value
High : 15
Low : 1
5 Miles



Gage = 5.66 in

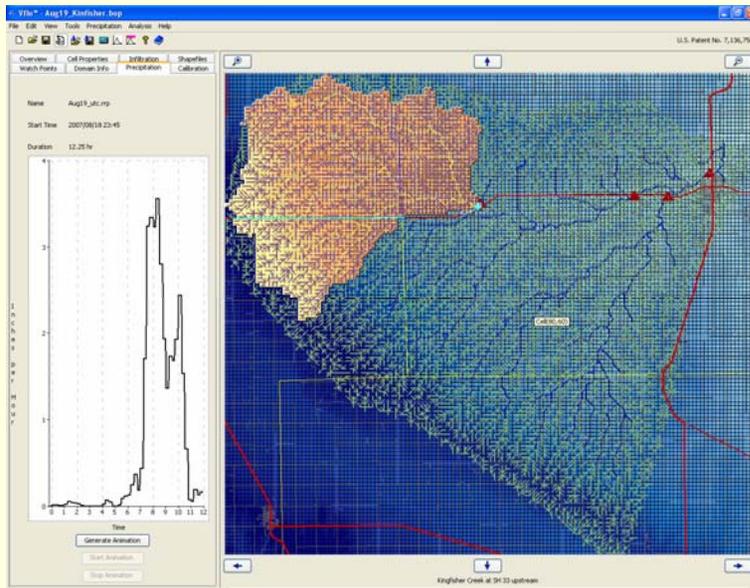


Kingfisher @ SH 33
Radar Average = 8.28 in

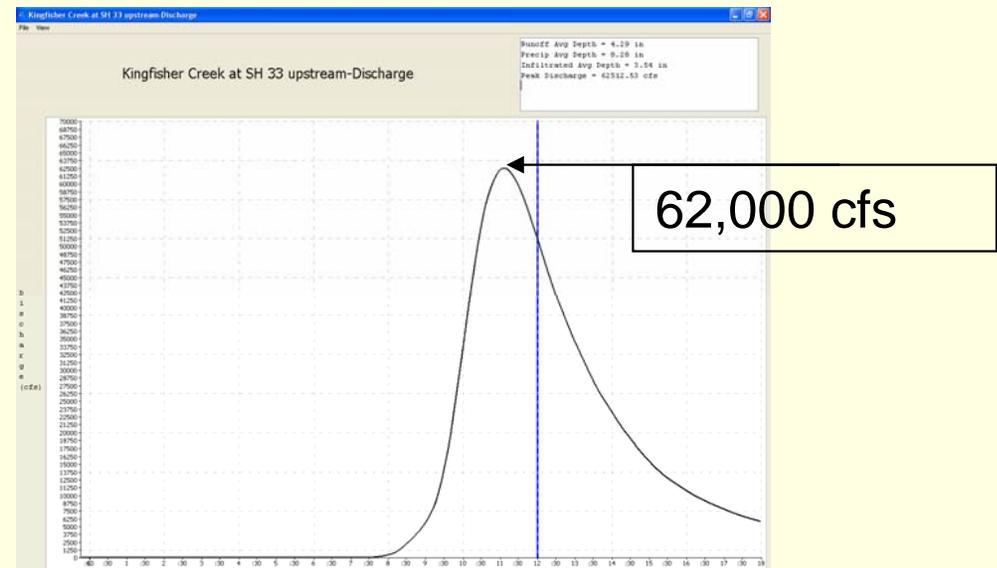
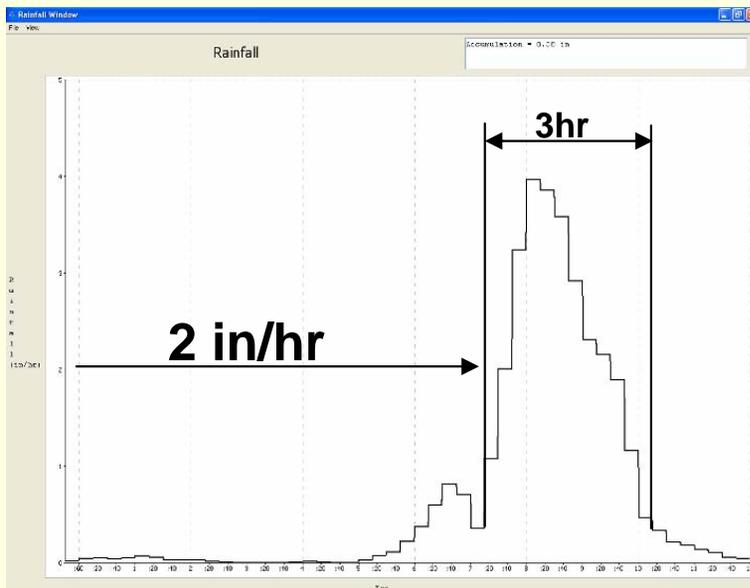
Radar Storm Total Aug 19 00:00-12:00 UTC

Prediction at Interior Locations

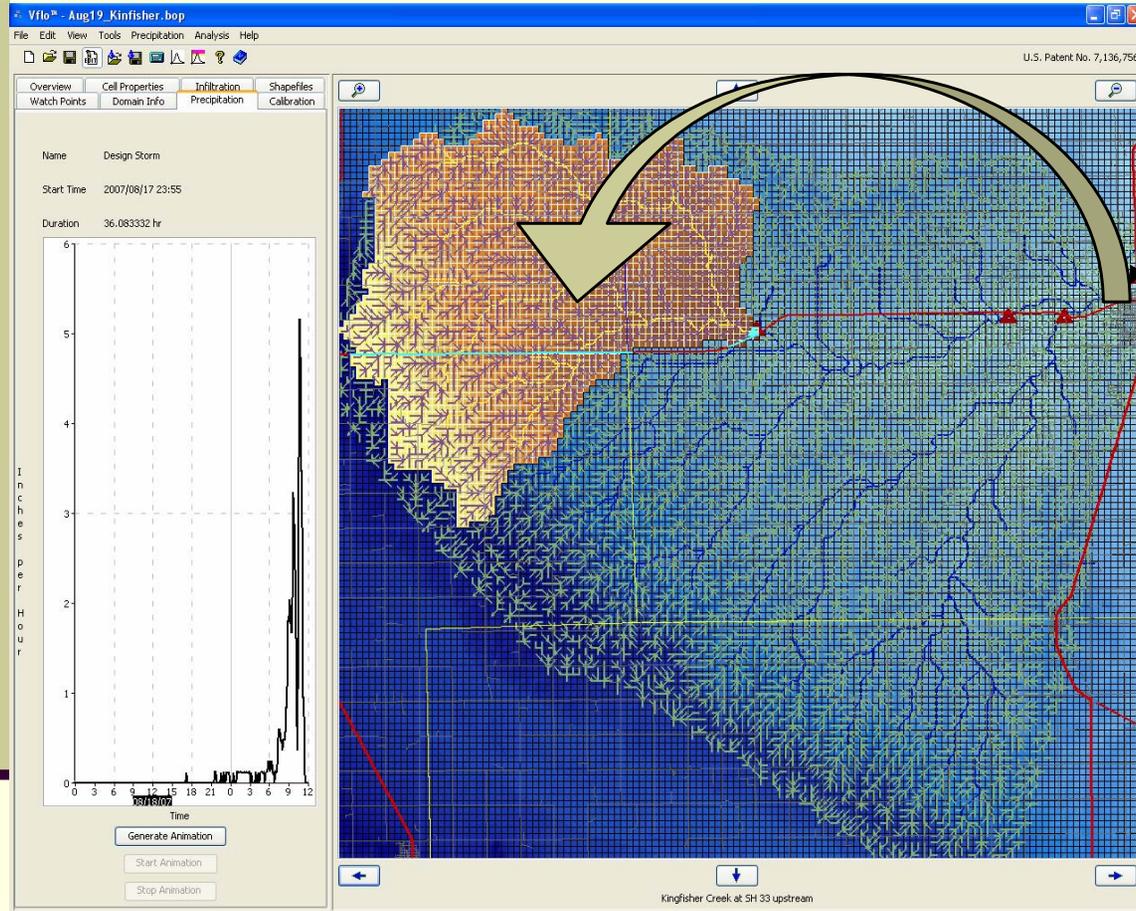
Remnants TD Erin - August 18-19, 2007



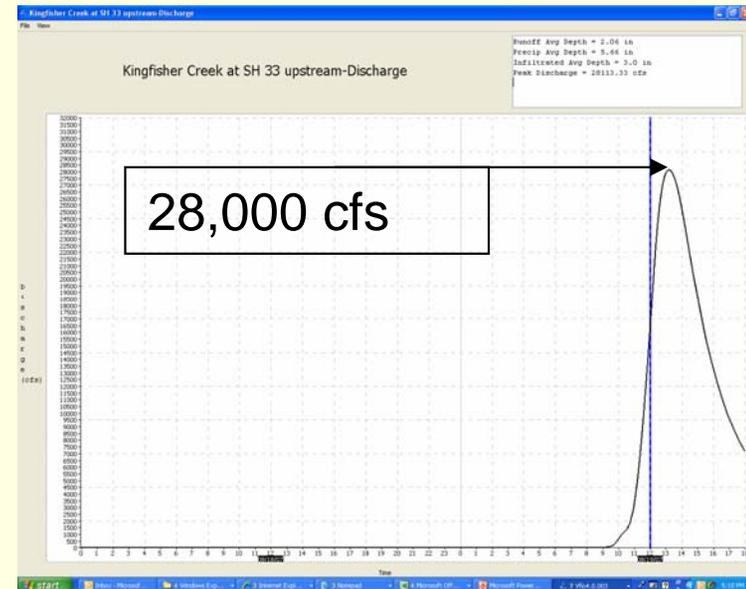
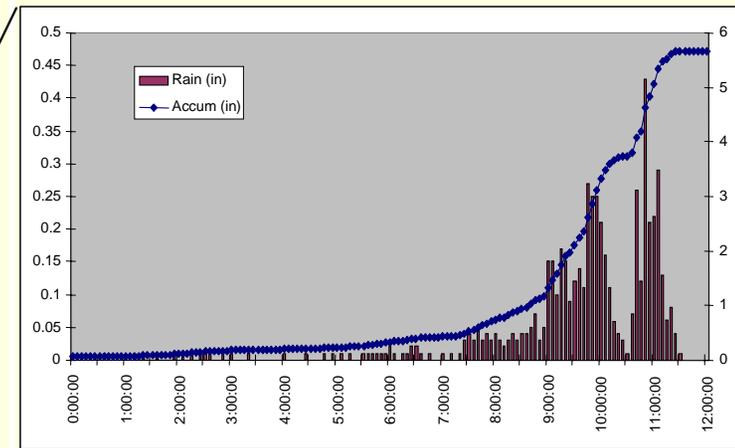
- Kingfisher @ SH 33 (89 sq. mi.)
- Runoff Avg Depth = 4.29 in
 - Radar Precip = 8.28 in
 - Infiltrated Avg Depth = 3.54 in
 - Peak Discharge = 62512 cfs
 - 704 cfs/sq. mi.



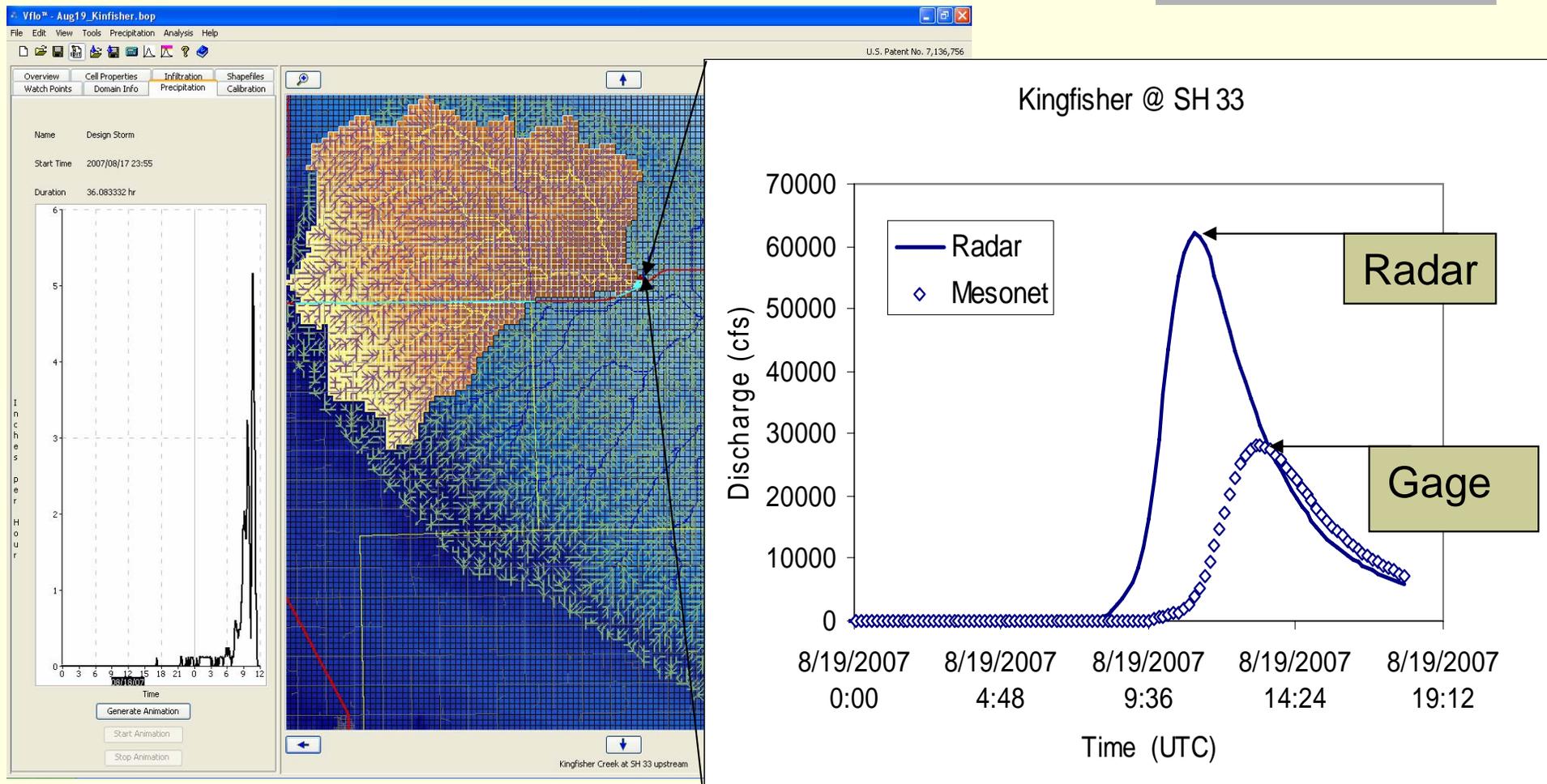
NWS Headwaters Gage Rainfall (KING)



Gage Depth = 5.66 in



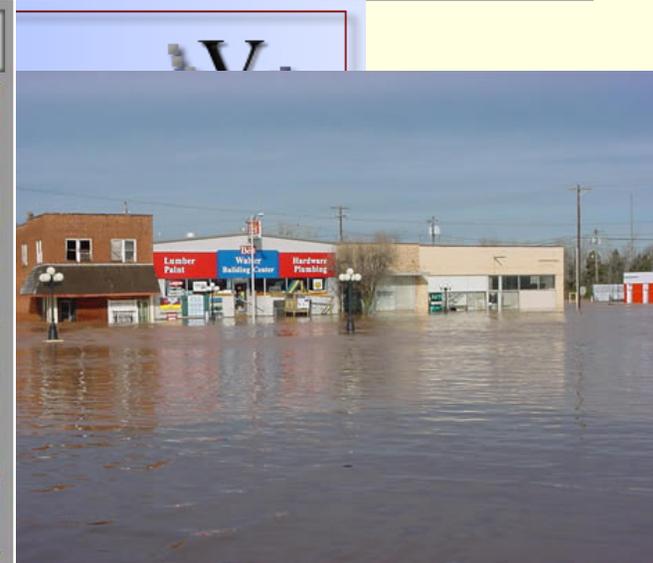
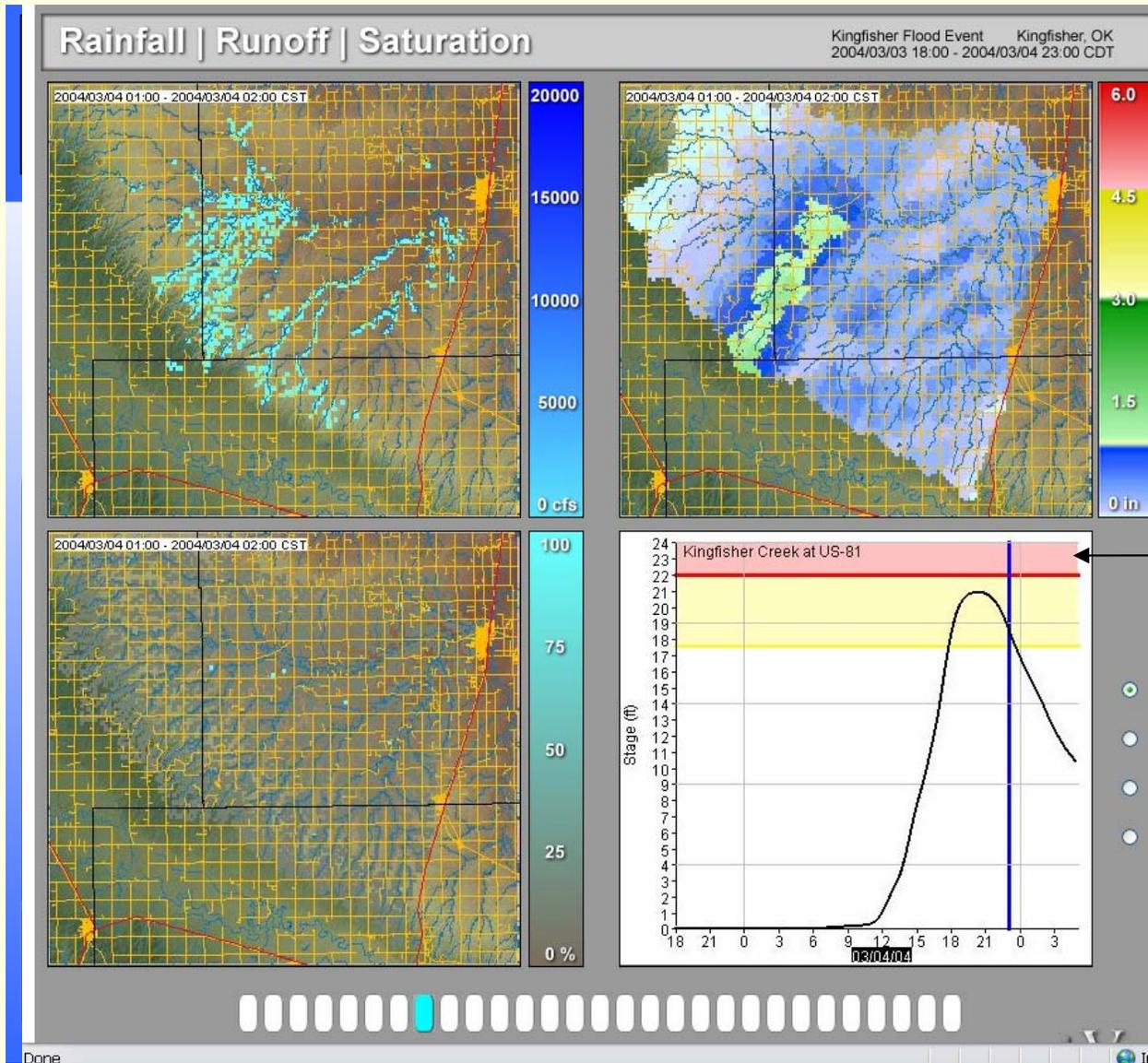
Effect of Spatially Variable Rainfall Kingfisher @ SH 33 (89 sq. mi.)



Gage rainfall input results in flow that is ~ 50% underestimated compared to radar input

NWS Headwaters Forecast

March 4, 2004



Reported Crest: 23.5 feet



NCDC Storm Event

March 4-5 event



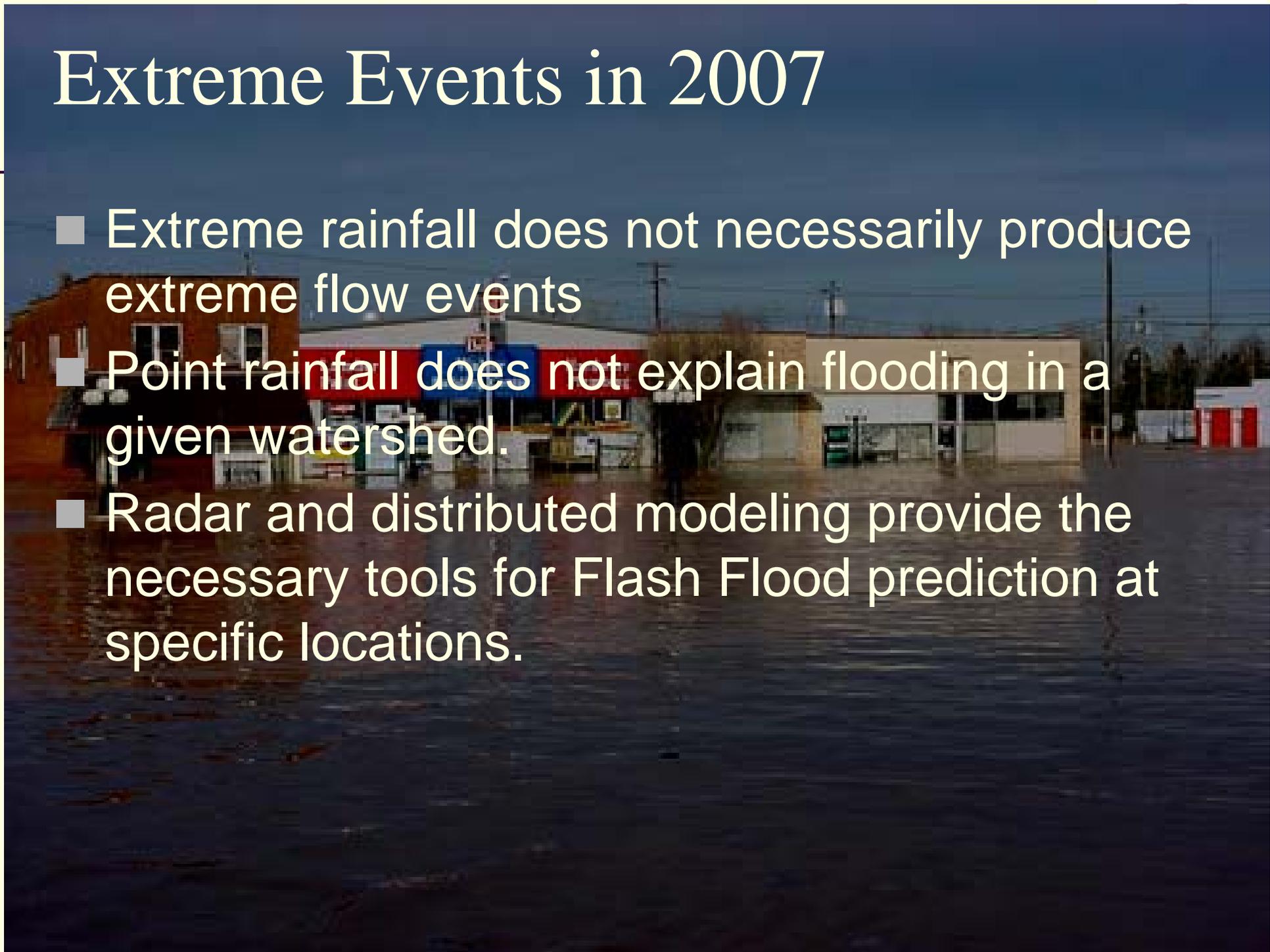
- Storm total precipitation amounts: 3 to 6+ inches over Kingfisher and northern Logan counties with a few totals of 7 to 8 inches reported in southwestern Kingfisher County.
- The heavy runoff along Kingfisher Creek and its tributaries eventually produced flooding in the City of Kingfisher beginning at about 6:00 pm CST on March 4, and eventually blocked U.S. Highway 81 in north Kingfisher by 9 pm CST, and Oklahoma State Highway 33 by 10 pm CST.
- Kingfisher Creek crested at 23.5 feet, 3.5 feet above flood stage, during the early morning hours of March 5.
- This crest was the ninth highest crest of record since the mid 1940s.

NCDC Storm Event Database

Event:	Flash Flood
Begin Date:	04 Mar 2004, 01:30:00 PM CST
Begin Location:	3 Miles West of Kingfisher
End Date:	04 Mar 2004, 06:30:00 PM CST
End Location:	3 Miles West North West of Kingfisher

Extreme Events in 2007

- Extreme rainfall does not necessarily produce extreme flow events
- Point rainfall does not explain flooding in a given watershed.
- Radar and distributed modeling provide the necessary tools for Flash Flood prediction at specific locations.



Questions?



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