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

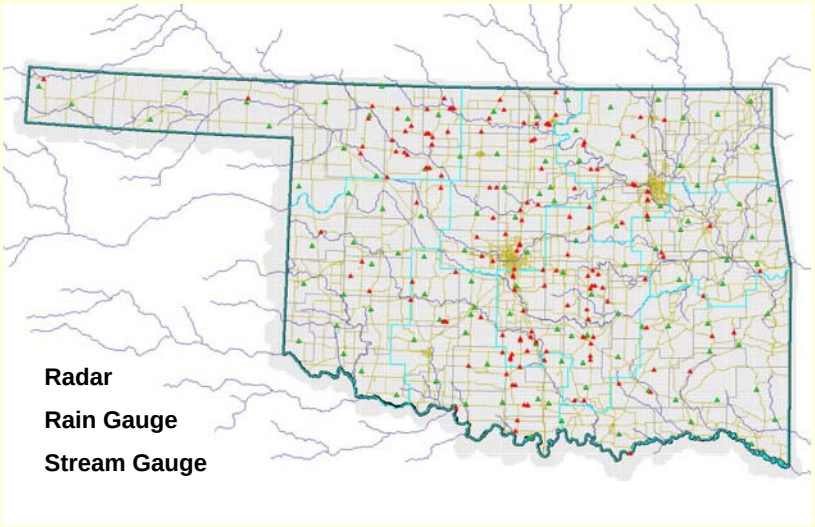
- SPC MCD 181255
  OKZ000-TXZ000-181500-
  MESOSCALE DISCUSSION 1790
  NWS STORM PREDICTION CENTER NORMAN OK
  0755 AM CDT SAT AUG 18 2007
  AREAS AFFECTED...NW TX...ERN TX PANHANDLE...WRN OK
  CONCERNING...HEAVY RAINFALL

  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.

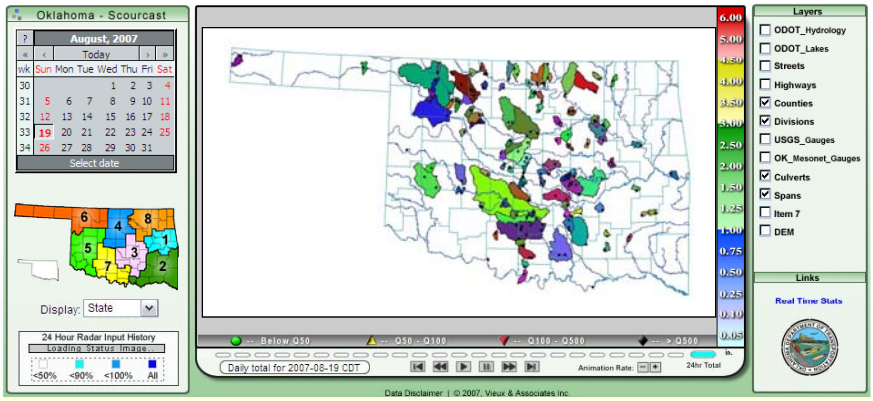
  THE LATEST SFC ANALYSIS PLACED TROPICAL DEPRESSION ERIN JUST TO THE SOUTHWEST OF LUBBOCK TX. RAINBANDS NORTHEAST OF THE CENTER ARE LOCATED ON THE WRN EDGE OF A GRADIENT OF LOW-LEVEL MOISTURE WHERE SFC DEWPOINTS ARE IN THE LOWER 70S F. LIFT NORTHEAST OF THE CENTER IS ALSO BEING ENHANCED LIKELY DUE TO 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 NWWD 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

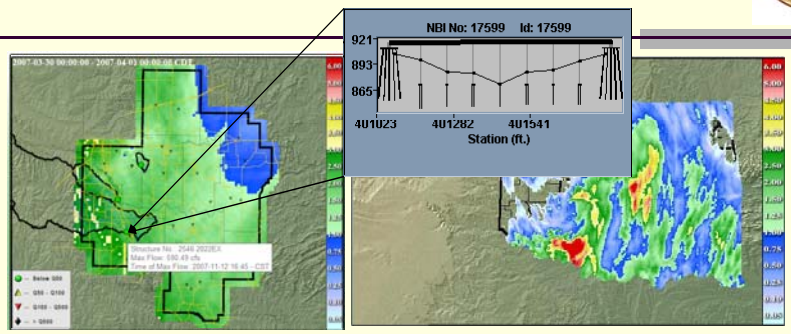


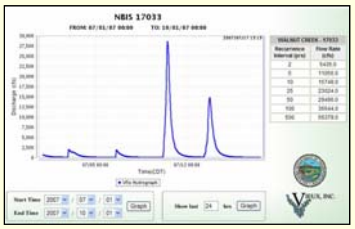
Scour Critical Bridges
ODOT/FHWA

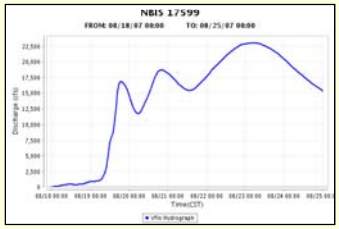


Which bridge are at risk of scour?

Real-time Monitoring of Scour Risk

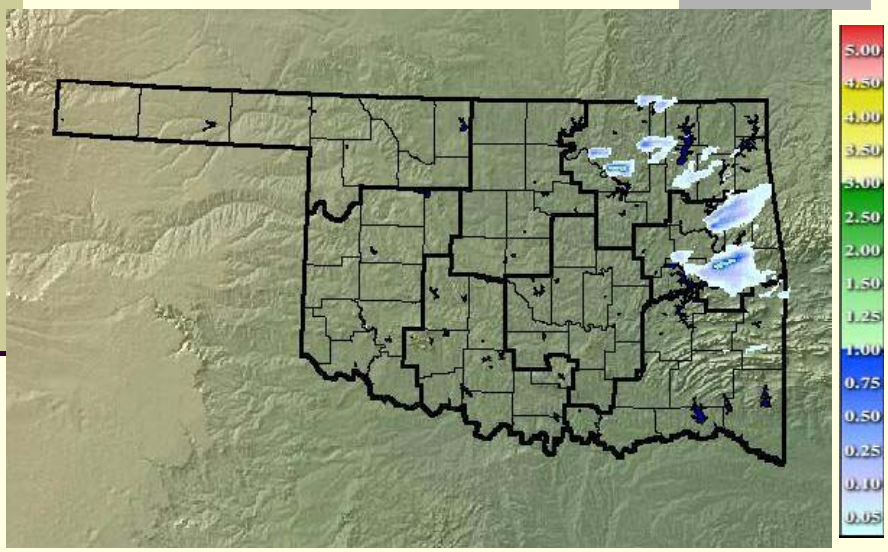






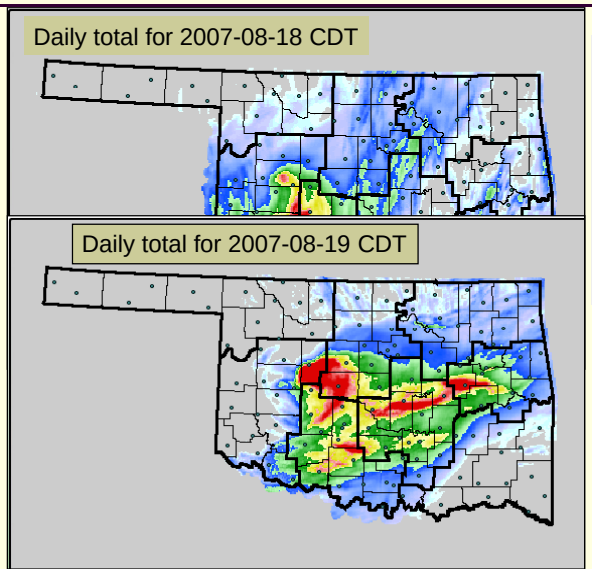
Radar Precipitation

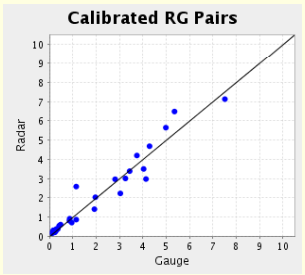
Remnants TD Erin - August18-19, 2007



Radar Rainfall Totals

Remnants TD Erin - August18-19, 2007





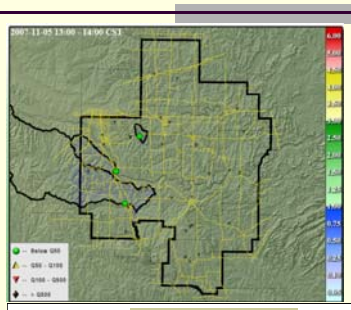
Mean Bias Correction = 1.748
Average Difference = ± 11%

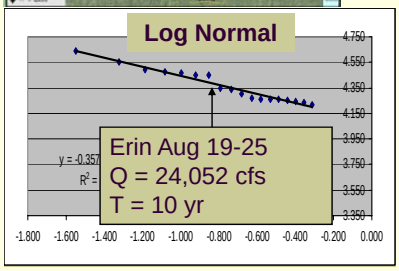
Without correction: 1 inch would be 0.56 inches

Rainfall Extremes v. Streamflow
Remnants TD Erin - August18-19, 2007

Washita Annual Series

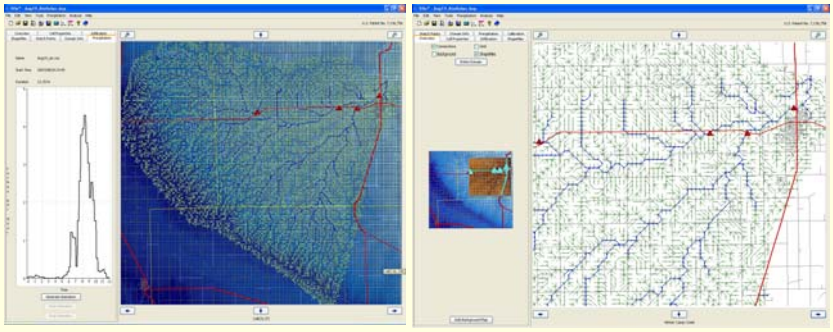
Year	Q (cfs)	Rank	P	T
5/29/1987	43600	1	0.009025	110.8
5/18/1957	35800	2	0.023466	42.6
5/10/1993	31200	3	0.037906	26.4
5/11/1950	30000	4	0.052347	19.1
6/9/1995	29100	5	0.066787	15.0
10/22/1983	28400	6	0.081227	12.3
5/3/1990	28000	7	0.095668	10.5
6/10/1941	22000	8	0.110108	9.1
5/22/1949	21700	9	0.124549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



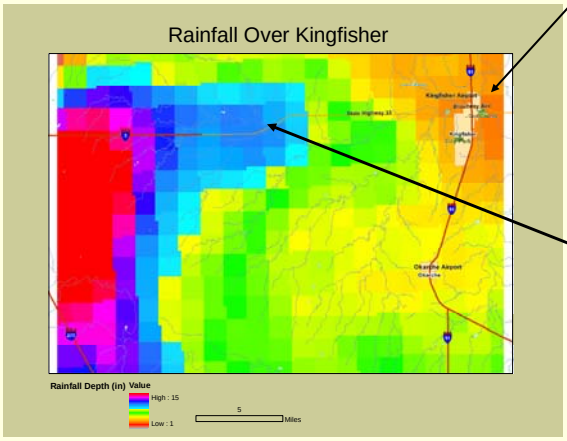


NWS Headwaters Routing
Remnants TD Erin - August18-19, 2007

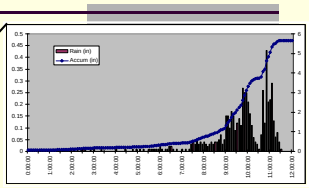
- Real-time Vflo (9202 cells @ 300x300 meters)
- Radar precipitation input
- Distributed model with interior watch points
  - Kingfisher @ US 81 (320 sq. mi.)
  - Kingfisher Cr. @ SH 33 (Two Locations)
  - Winter Camp Cr @ SH33



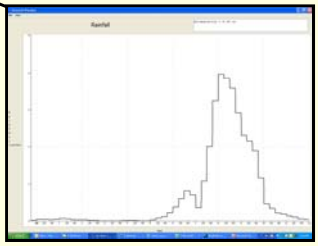
Rainfall Totals
Remnants TD Erin - August18-19, 2007



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

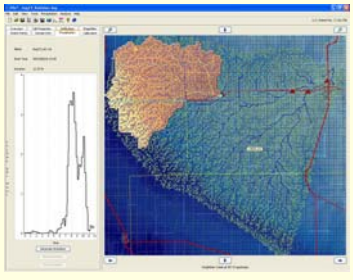


Gage = 5.66 in



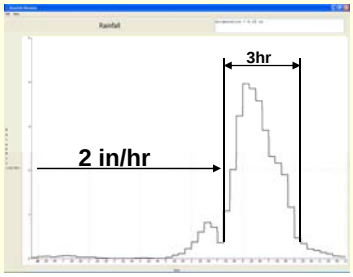
Kingfisher @ SH 33
Radar Average = 8.28 in

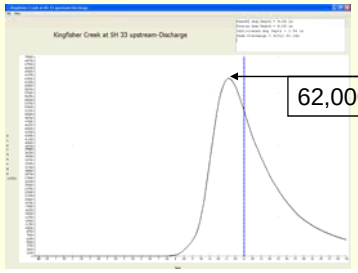
Prediction at Interior Locations
Remnants TD Erin - August18-19, 2007



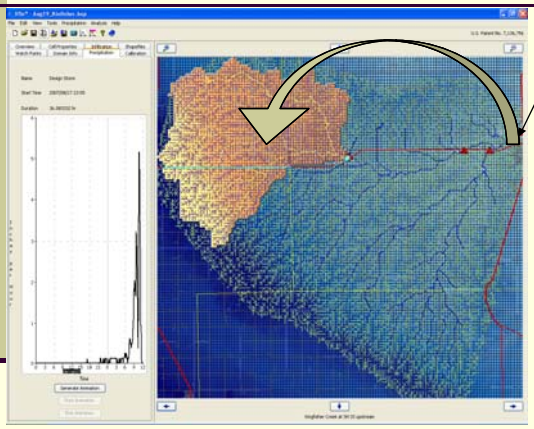
Kingfisher @ SH 33 (89 sq. mi.)

- 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.

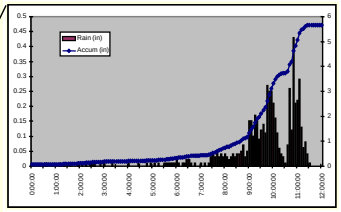


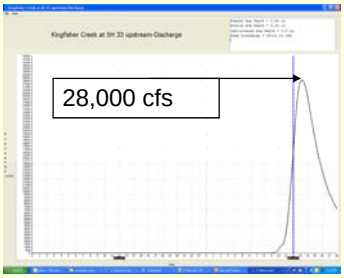


NWS Headwaters
Gage Rainfall (KING)

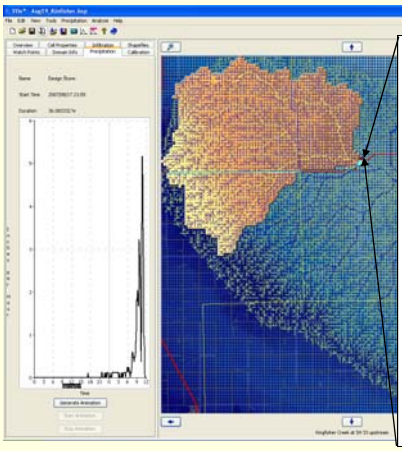


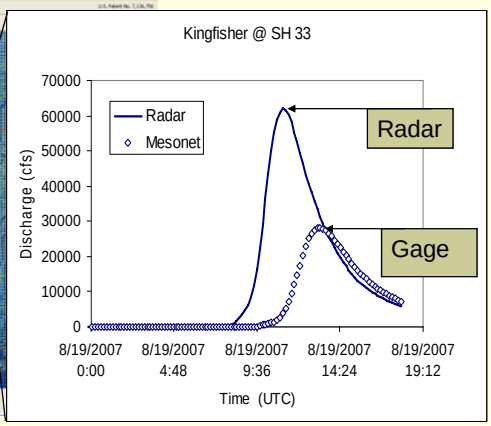
Gage Depth = 5.66 in





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

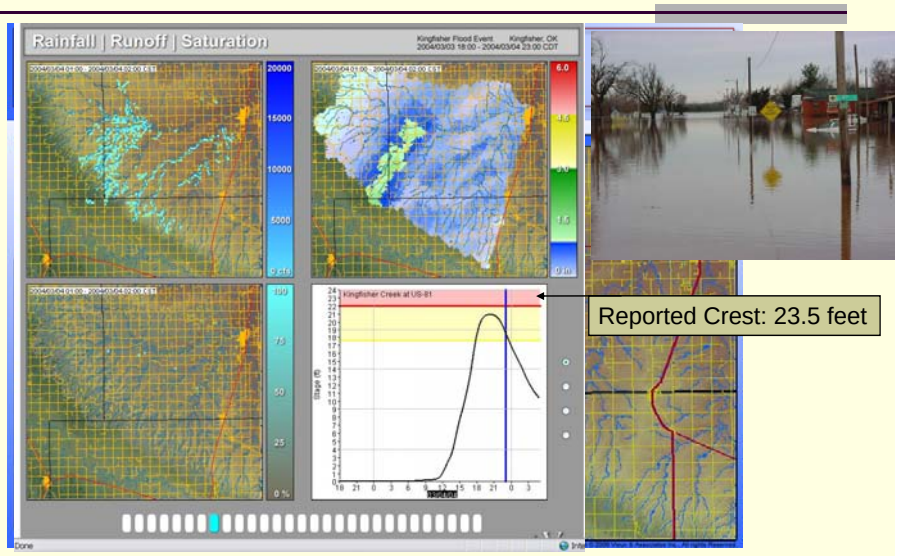




Gage rainfall input results in flow that is ~ 50% underestimated compared to radar input

NWS Headwaters Forecast

March 4, 2004



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.
- Extreme precipitation does not always produce extreme floods.
- Radar and distributed modeling provide the necessary tools for Flash Flood prediction at specific locations.

Questions?

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