Analysis of National Mosaic and Multi-Sensor Quantitative Precipitation Estimates during warm season rainfall events in Oklahoma

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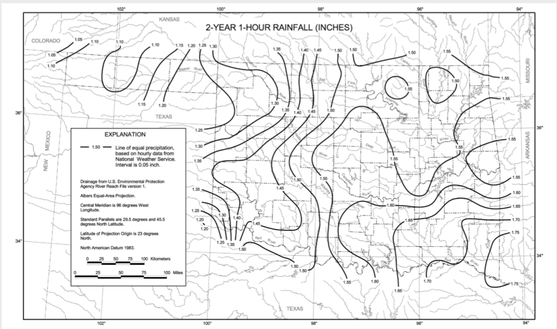
Introduction

Accurate estimates of areal rainfall are critical for water management. Inaccuracies in quantitive precipitation estimates (QPE) can lead to inaccurate stream flow simulations, which provide erroneous information to forecasters responsible for flood and flash flood warning products. The National Mosaic and Multi-sensor QPE (NMQ), developed by the National Severe Storms Laboratory, is a tool used to increase the accuracy of rainfall estimates. The NMQ integrates raw radar, rain gauge, and Rapid Update Cycle (RUC) model data to produce gridded precipitation estimates.

Methodology

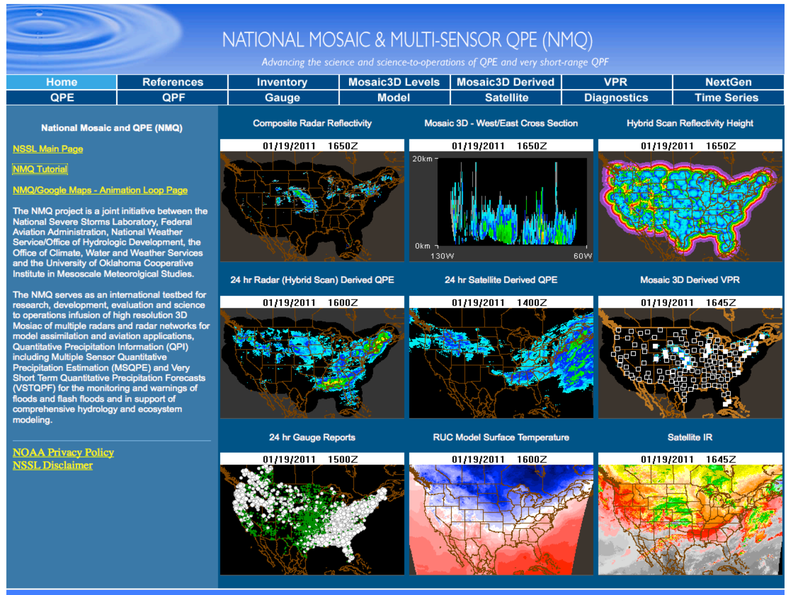
- Examine flood events that meet or exceed 2-yr 1-hour flood criteria in the state of Oklahoma during the month May for years 2004-2010.



- Examine environmental conditions such as CAPE, precipitable water, storm relative helicity, 700 and 850 mb winds.
- Examined antecedent conditions
- Use Vertical Profiles of Reflectivity (VPR) to examine patterns in storm structure and reflectivity during the course of the hour.
- Examined patterns in echo top, reflectivity duration, and maximum reflectivity
- Examined solar and lunar patterns
- Examined La Nina and El Nino patterns
- Examined patterns in timing of events

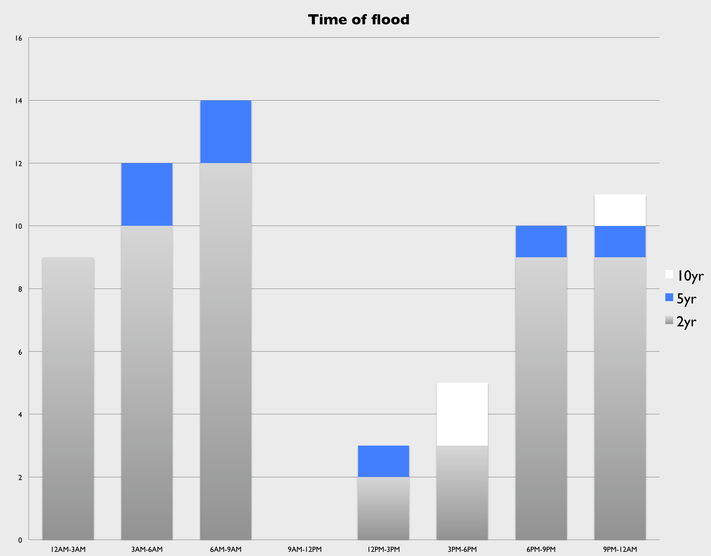
Event Summary

- 54 2-year 1-hour flood events
- 6 5-year 1-hour flood events
- 4 10-year 1-hour flood events
- 2010 had 14 events in 7 days
- 2009 had 10 events in 5 days
- 2008 had 9 events in 4 days
- 2007 had 12 events in 5 days
- 2006 had 7 events in 3 days
- 2005 had 8 events in 4 days
- 2004 had 4 events in 2 days



Timing

Timing of flood events correlate strongly to average sunrise and sunset. Peak number of 1-hour flood events occurred between 6 am and 9 am with a secondary peak between 9 pm and 12 am. The average sunrise for Oklahoma is around 6:30 am and, the average sunset is around 8:30 pm CDT. No correlation was found between flood events and lunar phase.



Results

Environmental Conditions

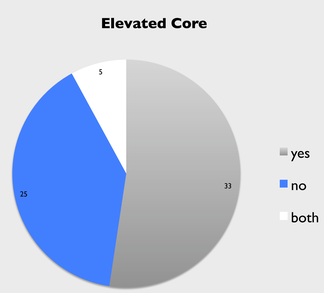
- **Precipitable Water**
  - Max 50.35 mm
  - Min 22.94 mm
  - Average 34.06 mm
  - Standard Deviation 5.63 mm
    - 10 year events: 35.00 mm
    - 5 year events: 36.77 mm
    - 2 year events: 33.79 mm
- **CAPE**
  - Highly variant with a range from 0 J/kg to almost 3000 J/kg
- **Upper Level winds**
  - 850 mb winds averaged around 20 knots with 700 mb winds higher
- **Freezing Level**
  - Remained between 3.5 km and 5 km MSL

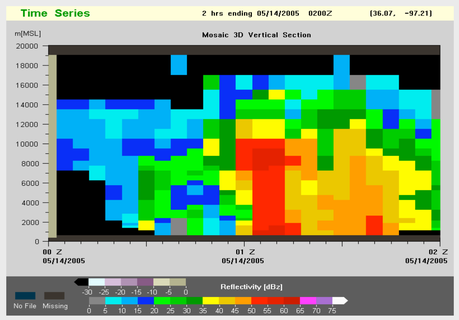
Antecedent Conditions

- **ENSO**
  - All years neutral during May except 2008, which was in a La Nina Phase
  - The winter ENSO phase was neutral for all but 2010, 2008, and 2005. 2010 and 2005 were El Nino winters and, 2008 was a La Nina winter.
- **Drought indicies**
  - No Drought Conditions reported around storm location except in 2006

VPR

- Average duration of reflectivity over 40 dbZ was 39.3 minutes with a standard deviation of 12.5 minutes
- Average echo top was 16 km with a standard deviation of 2 km
- 33 events had an elevated core. 25 events did not have an elevated core and 5 events had both an elevated core and a core at the lowest volume scan.





Conclusion

Flood events occurred in environments of high precipitable water and during the overnight hours. Knowing this favorable timing of flood events can help forecasters in their monitoring of thunderstorms.