

# Flooding in Western North Carolina: Some Spatial, Hydrologic, and Seasonal Characteristics

J. Greg Dobson

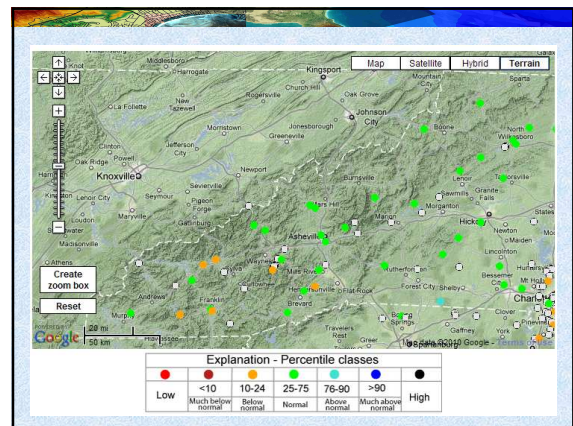
National Environmental Modeling and Analysis Center  
RENCI at UNC-Asheville Engagement Center  
University of North Carolina - Asheville



**CAUTION!!**

## Outline

- Some basic flood and flash flood information
- Spatial and hydrologic aspects of WNC floods
- Seasonal aspects of WNC floods
- Some significant flood events
- Geospatial Visualization tools to address flood issues

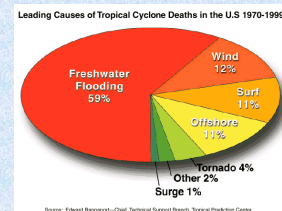


## Basic Flood Facts

- Why talk about floods?
  - Most common, costly, damaging, and deadly of all weather-related phenomenon
  - Over 4 Billion in average annual US losses
  - US averages over 140 annual deaths
  - The problems are getting worse!
    - Increased urbanization
    - Coastal development
- We need a better understanding of floods

## Types of Floods

- Many different types of flood events
  - Coastal and Inland flooding
  - Riverine flooding
  - Urban flooding
  - Flash flooding\*\*



## How Floods are Caused

- Major sources of flooding
  - Heavy or prolonged precipitation
    - Wave Cyclones
    - Isolated Thunderstorms
    - Stratiform Rain
    - Tropical Systems
  - Dam failures
  - Rapid snowmelt
  - Ice jams (and failures)
  - Storm surge

## Flash Floods

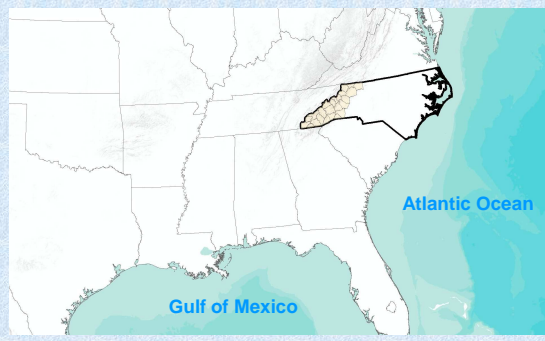
- According to the NWS:
  - *A rapid and extreme flow of high water into a normally dry area, or a rapid rise in a stream or creek above a predetermined flood level, beginning within six hours of the causative event.....*
- Characterized by rapid rise in water, high velocities, and large amounts of debris
- Occur in all 50 states, most common in mountainous areas

## Floods in Western North Carolina

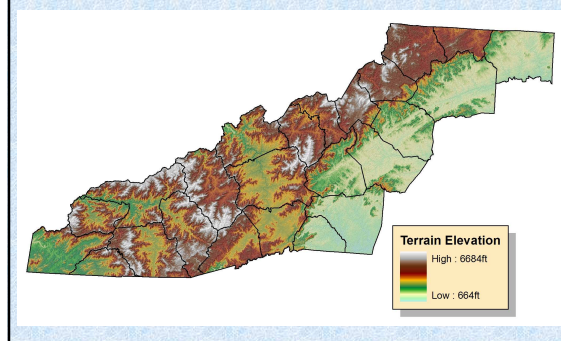
- Most flooding is flash or riverine related
- Can and do occur during any month
- Is a major concern due to terrain and proximity to the Gulf and Atlantic
- Other contributing factors
  - Soil moisture
  - Vegetative cover
  - Amount of impervious surfaces
  - Slope and aspect

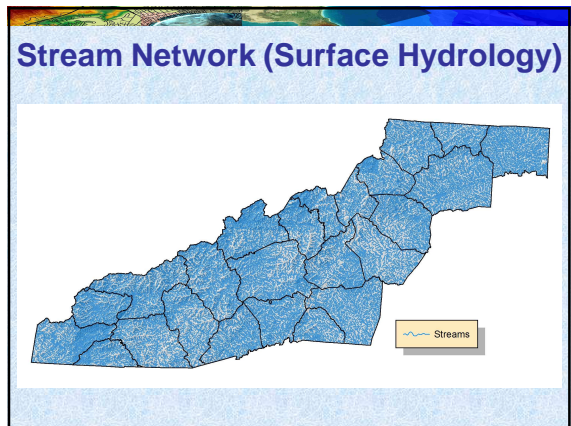
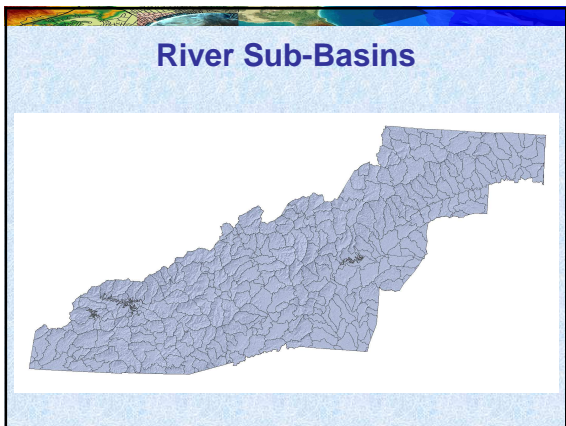
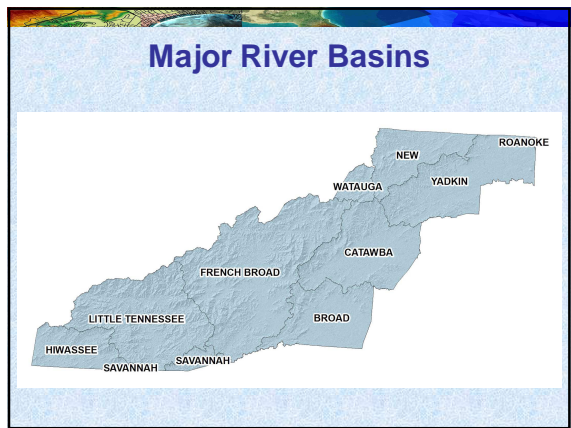
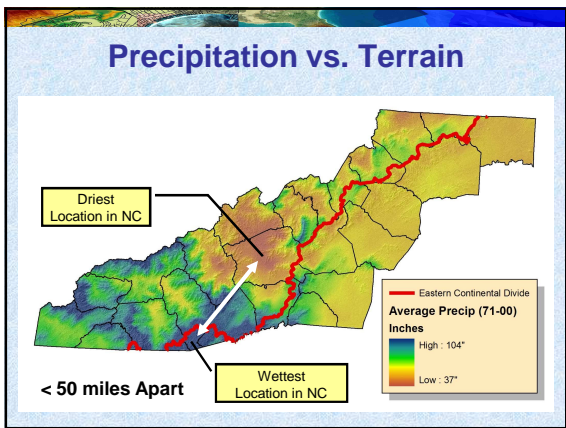
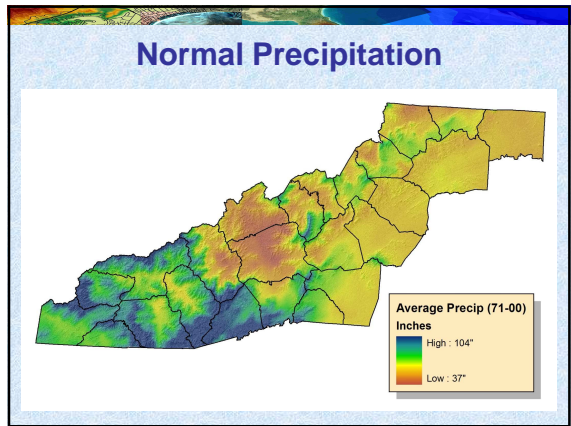
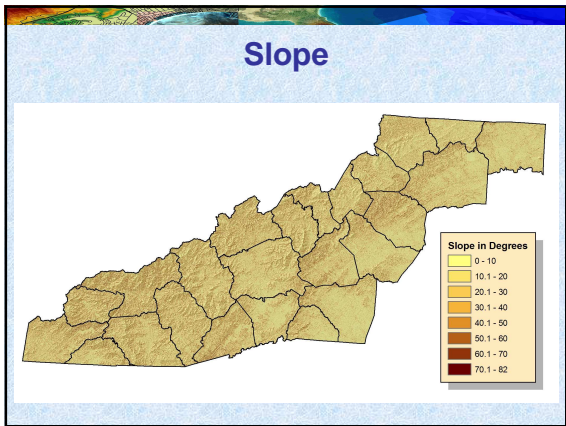
## Spatial and Hydrologic Aspects

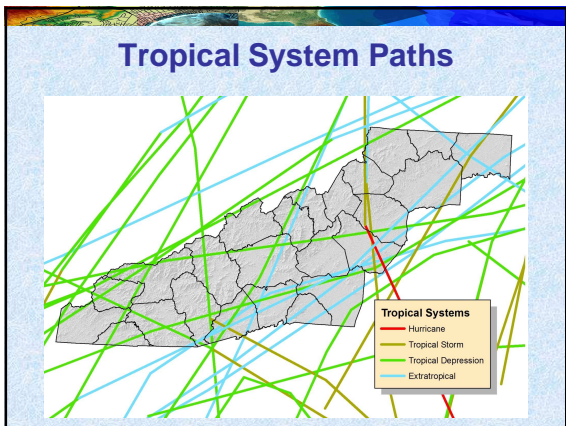
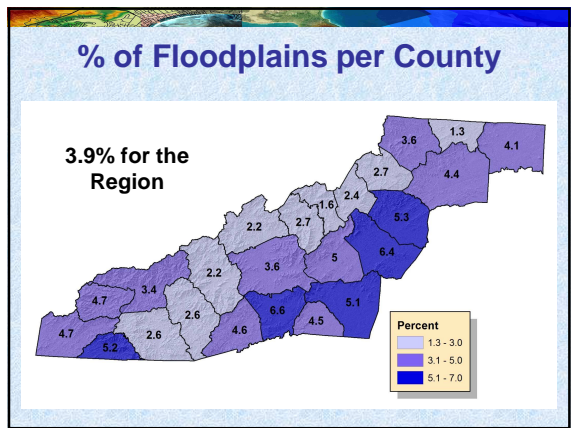
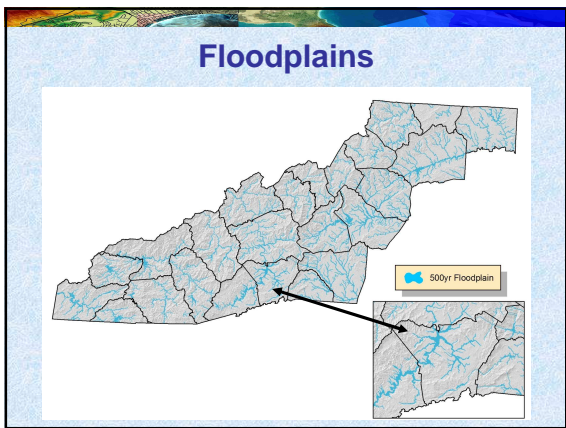
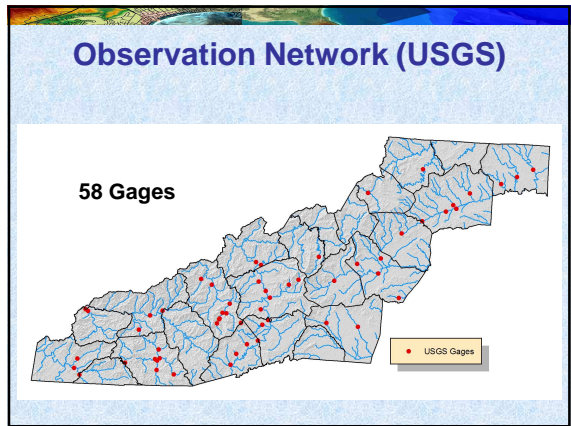
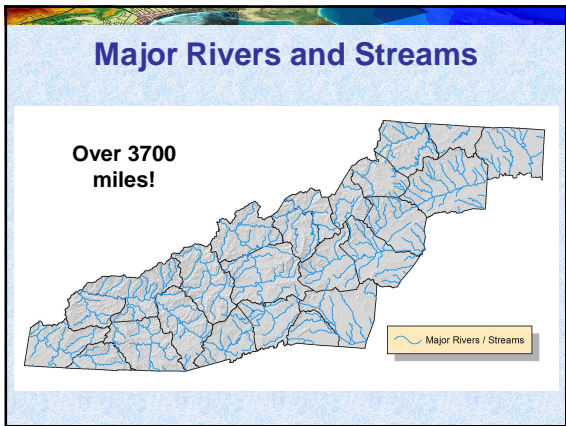
## General Location



## Terrain and Elevation







### Seasonal Aspects

*Cool Season vs. Warm Season*

### Cool Season Flooding

- November – April
- Statistically period of most flooding (76%)
- Mostly the result of Riverine and long duration flooding
  - Cyclones forming in the Gulf (winter maximum) and off Atlantic Coast (March maximum)
- Flash floods can occur during this season, and be associated with large scale events
- Typically affect the entire region

### Warm Season Flooding

- May – October
- Mostly the result of flash flooding, and can be highly isolated
- Peak is reached in summer months (August)
- Wide-spread flash floods can be heavily influenced by tropical systems (late summer and fall) and may occur region wide during such events

### Riverine Flooding in WNC

- Again, responsible for most cool season flood events
- Often result from low intensity, yet long duration precipitation systems
- A secondary peak occurs in late summer / fall due to tropical systems
- Typically are wide-spread events affecting the entire region

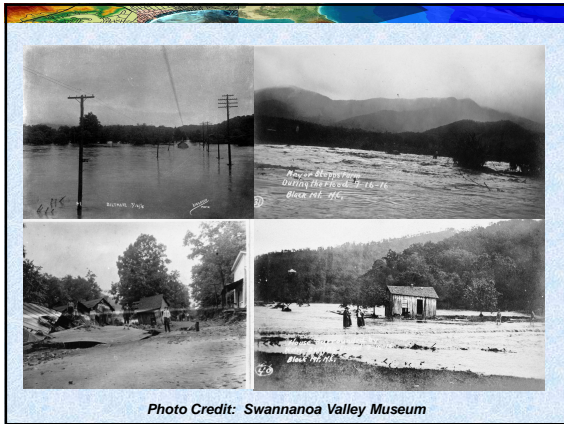
### Flash Flooding in WNC

- While the peak is experienced in summer months, is a threat throughout the year
- In spring and summer, typically occur during late afternoon / evening
  - Convective activity
- In fall and winter, typically occur in early morning hours
  - Large and long-lived systems (tropical systems and wave cyclones)

### Historical and Significant Events

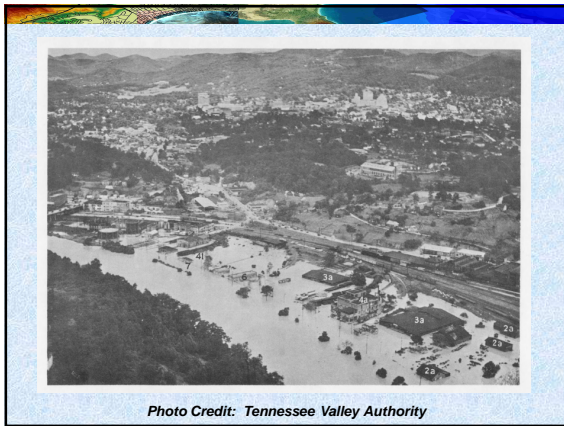
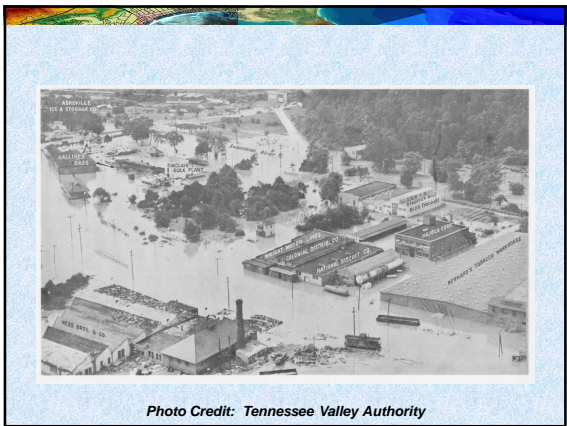
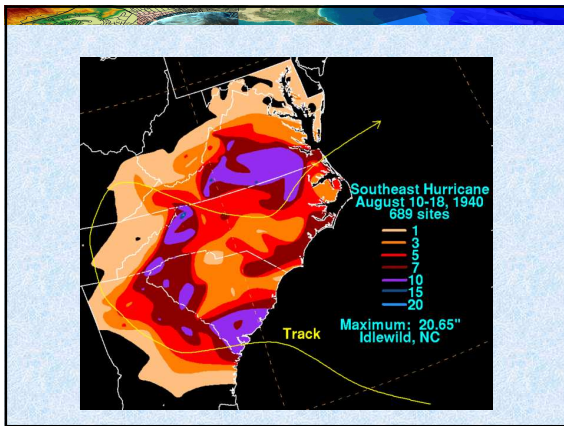
### The Great Flood of 1916

- July 15-16, 1916
- Resulted from hurricane which made landfall at Charleston
- Antecedent conditions prime due to flooding just a few days prior
- Major damage in Asheville area
- As much as 22" of rain east and north of Asheville
- Still the highest flood of record for the French Broad River at Asheville (23.1ft)



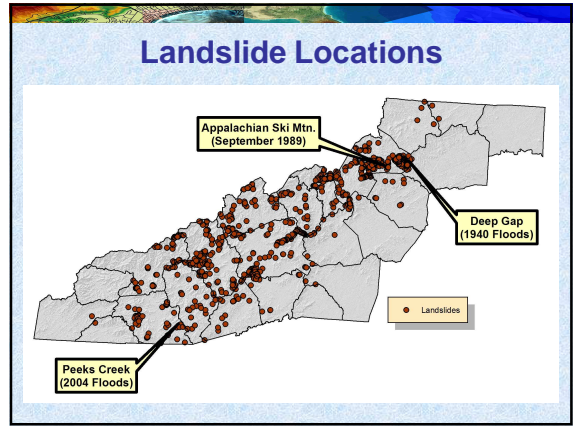
### The 1940 Floods

- Two major floods back to back
- August 13-14, 1940
  - Result of a tropical system
  - >15" of rain area wide; did affect most of WNC
  - Very major damage in the Boone area
- August 30, 1940
  - Resulted from local scale event
  - 6" – 8" in Asheville area
  - Flooding just as bad due to antecedent conditions



### The 2004 Floods

- Three major floods back to back
- Sept. 6-8, Hurricane Frances
  - Major flooding region wide, but variable
  - 4" – 17" of rain
  - Biltmore Village severely impacted
- Sept. 16-17, Hurricane Ivan
  - Area wide, even more variable
  - Peaks Creek landslide
- Sept. 26-28, Hurricane Jeanne



- ### Other Notable Flood Events
- Nov. 5-6, 1977
    - Area wide flooding (non-tropical)
  - Sept. 10, 1992
    - Wall of water through Cherokee Reservation
  - Sept. 4, 1996
    - Extremely isolated event in Hickory Nut Gorge
  - May 5, 2003
    - Area wide flooding due to convective activity

### Geospatial Visualization for Analyzing / Communicating Floods

