The Role of Climate in Food and Waterborne Diseases: Floods and Droughts

Chip Konrad

Associate Professor
Director of the Southeast Regional Climate Center
Department of Geography
University of North Carolina at Chapel Hill

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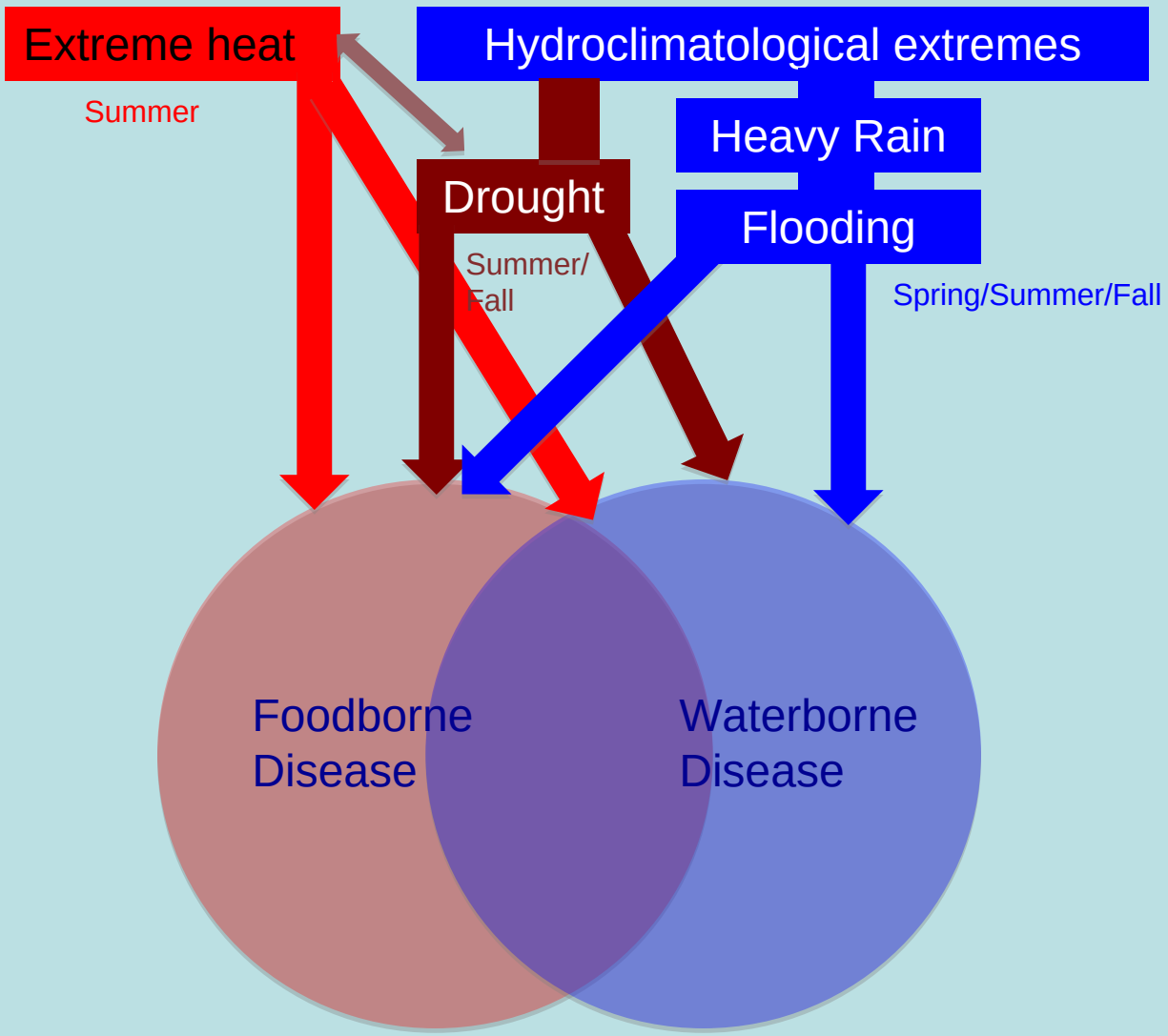
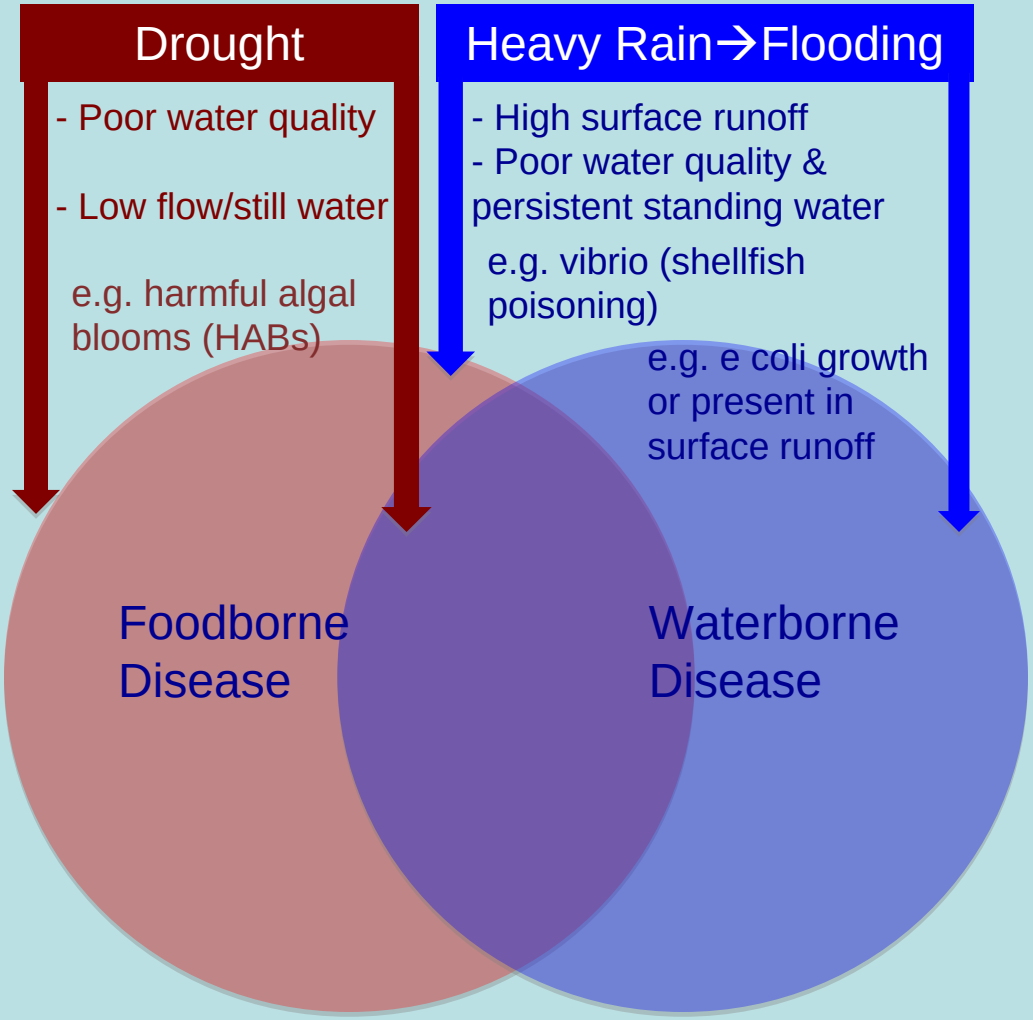
Background


Extreme heat
Summer
Hydroclimatological extremes
Heavy Rain
Drought
Flooding
Summer/
Fall
Spring/Summer/Fall
Foodborne
Disease
Waterborne
Disease

Background


Drought
- Poor water quality
- Low flow/still water
e.g. harmful algal blooms (HABs)
Heavy Rain→Flooding
- High surface runoff
- Poor water quality & persistent standing water
e.g. vibrio (shellfish poisoning)
e.g. e coli growth or present in surface runoff
Foodborne Disease
Waterborne Disease

Local scale heavy rain

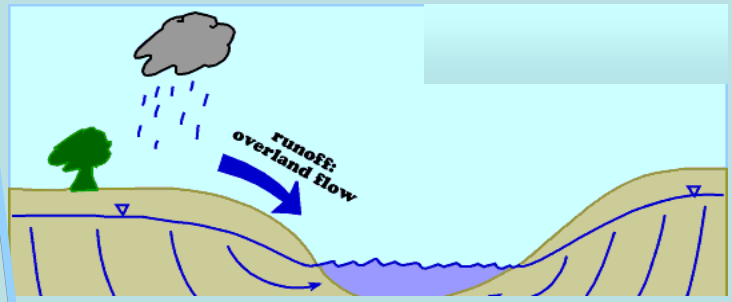
e.g. Thunderstorms

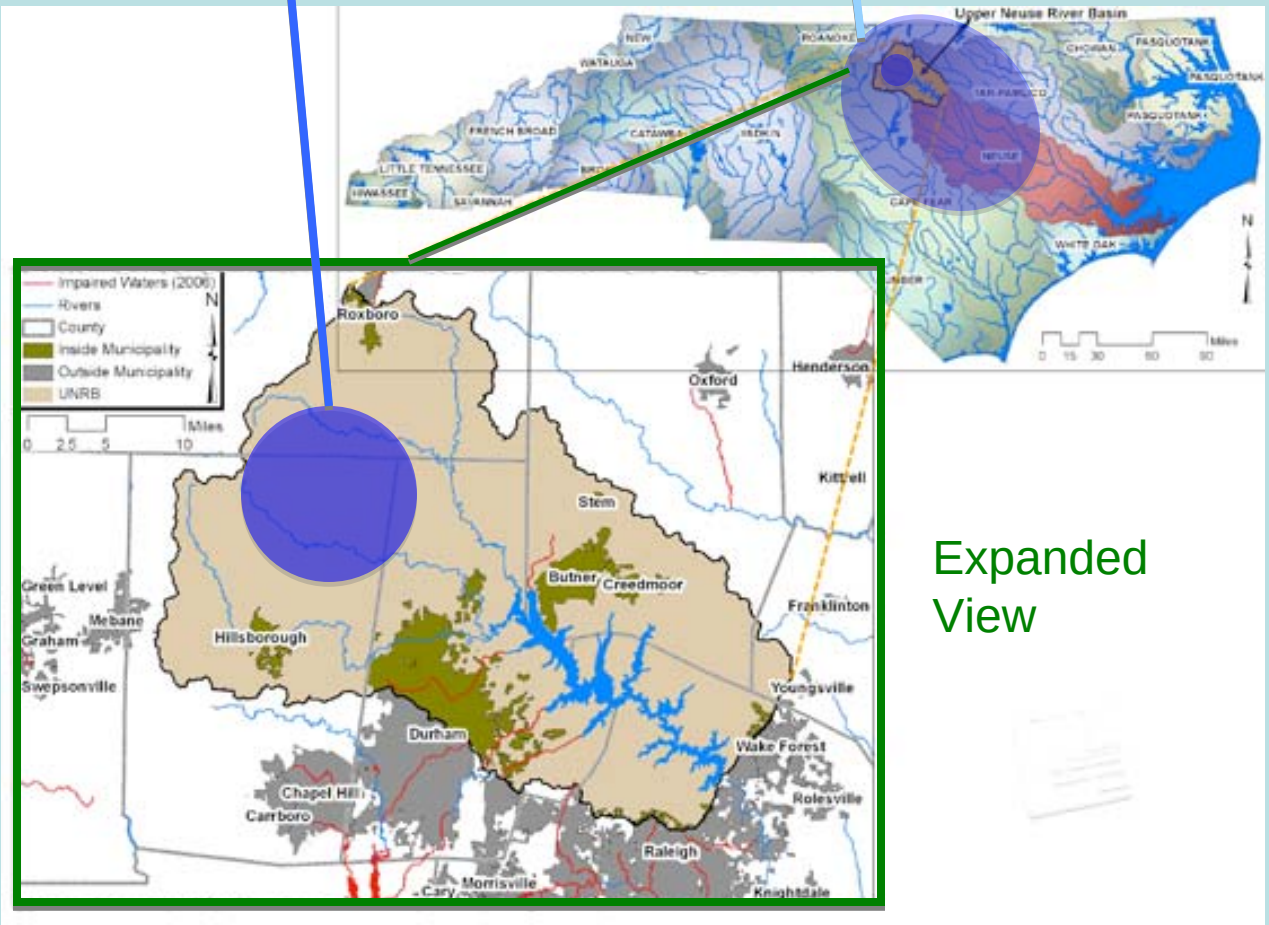
Flash flooding

Regional scale heavy rain

e.g hurricanes

River flooding





Expanded View

The duration of flooding depends on:

1.Size of the heavy rain region

2.Terrain

Coastal Plain: days to weeks

e.g. Hurricane Floyd in eastern NC (1999)

Piedmont/Mountains: Hours to one day

e.g. Hurricanes Frances/Ivan in mountains of NC

Large scale heavy rain and river flooding tied to:

1. Stalled fronts or slow-moving low pressures with overrunning tropical moisture.

2. Hurricanes & Tropical Storms that make landfall along Atlantic or Gulf Coast.

- Responsible for nearly all of the most extreme precipitation events.

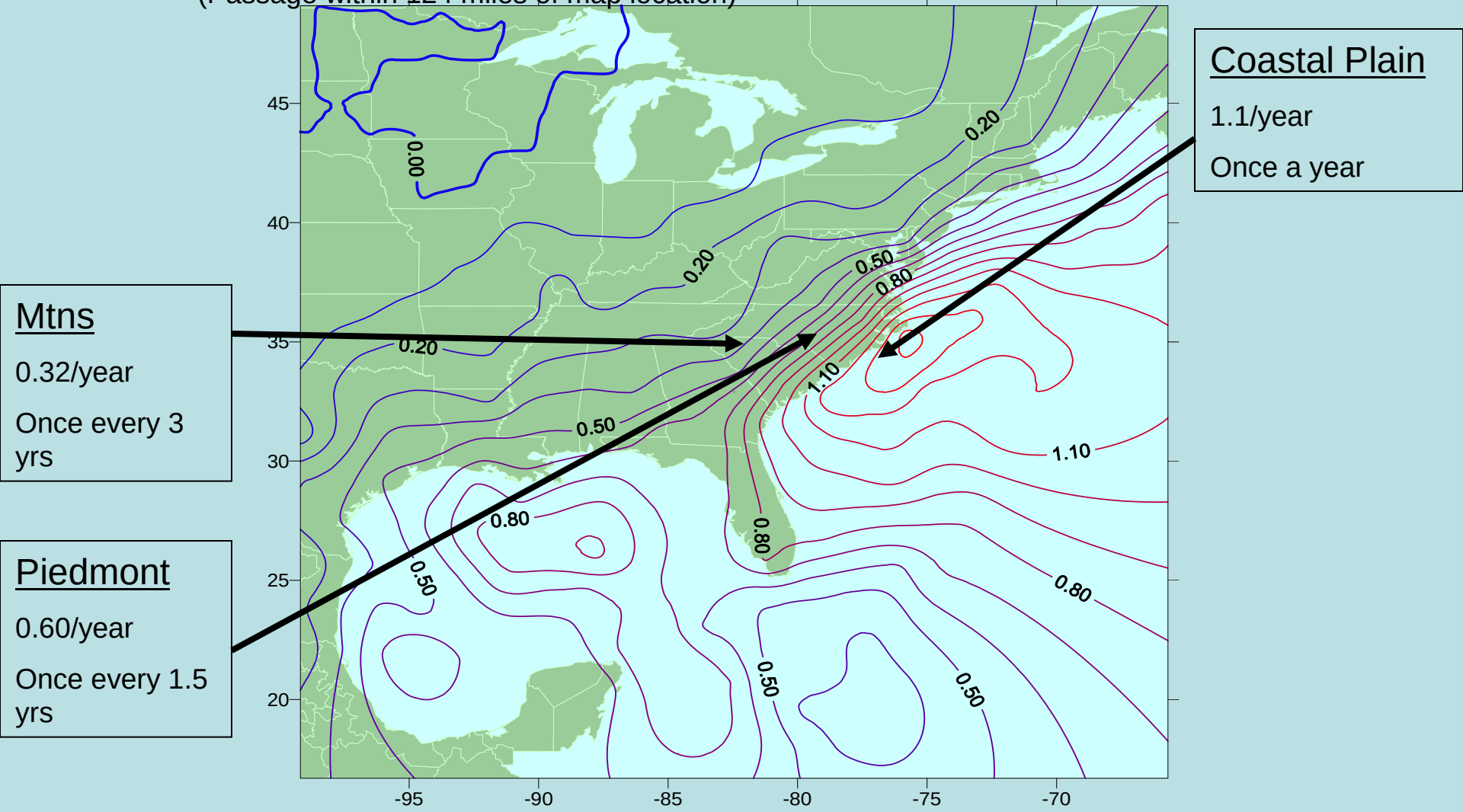
- Cyclone strength only weakly correlated with precipitation amounts.

  Size, speed of movement, frontal interactions are bigger influences.

North Carolina is a magnet for tropical cyclones and hurricanes

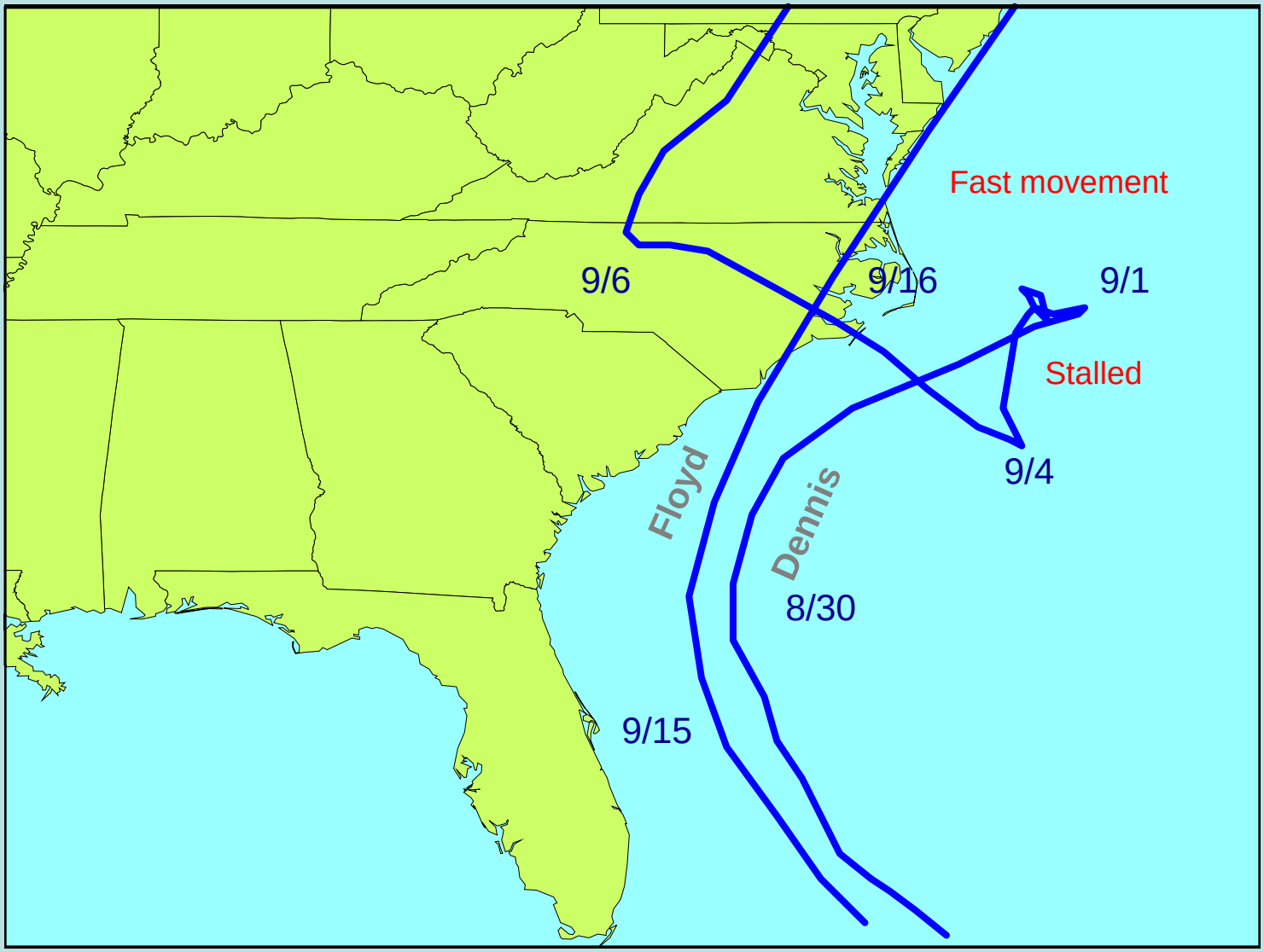
Annual Frequencies of Tropical Cyclones and Their Remnants

(Passage within 124 miles of map location)

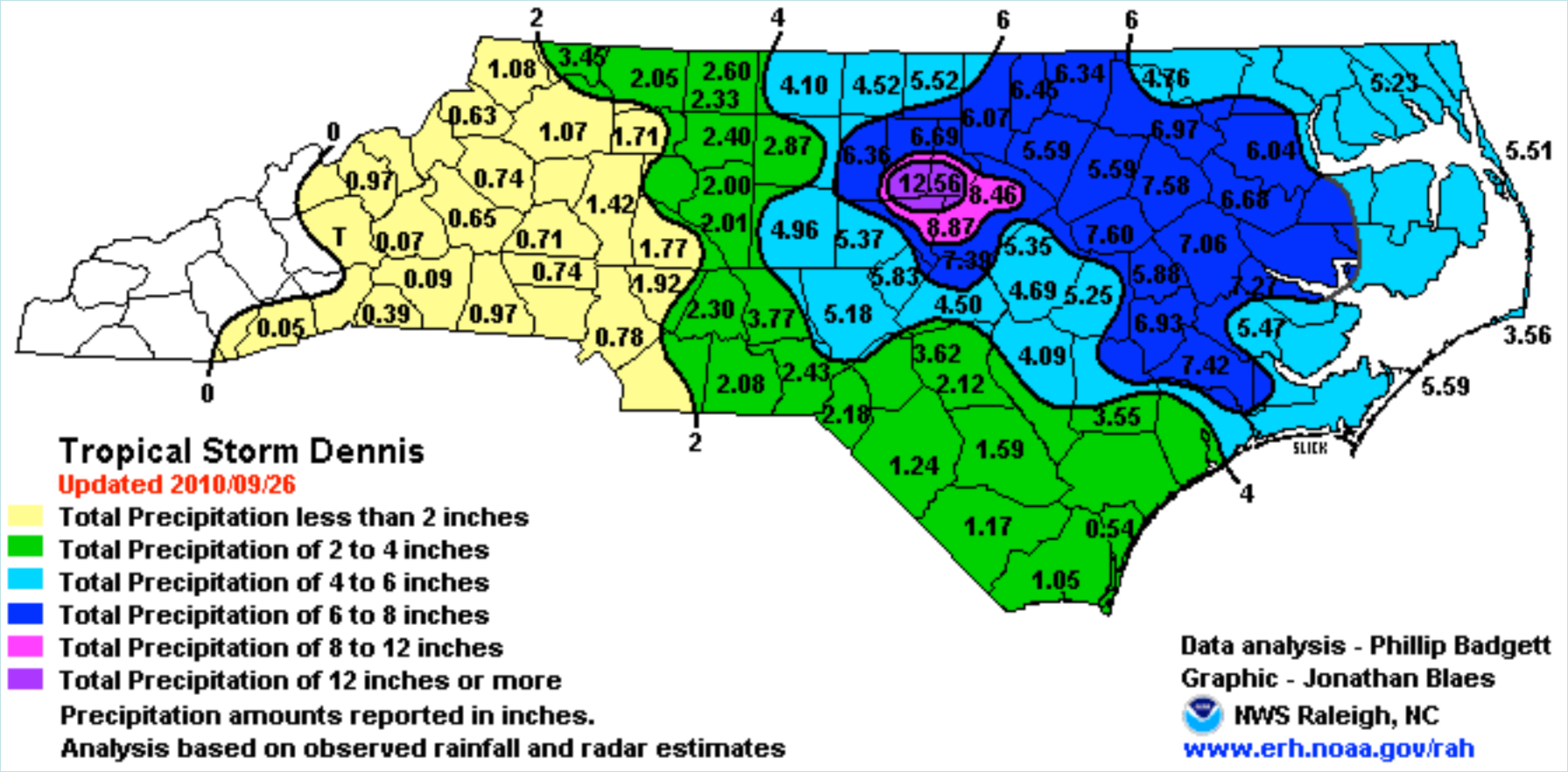


Events often cluster together time.

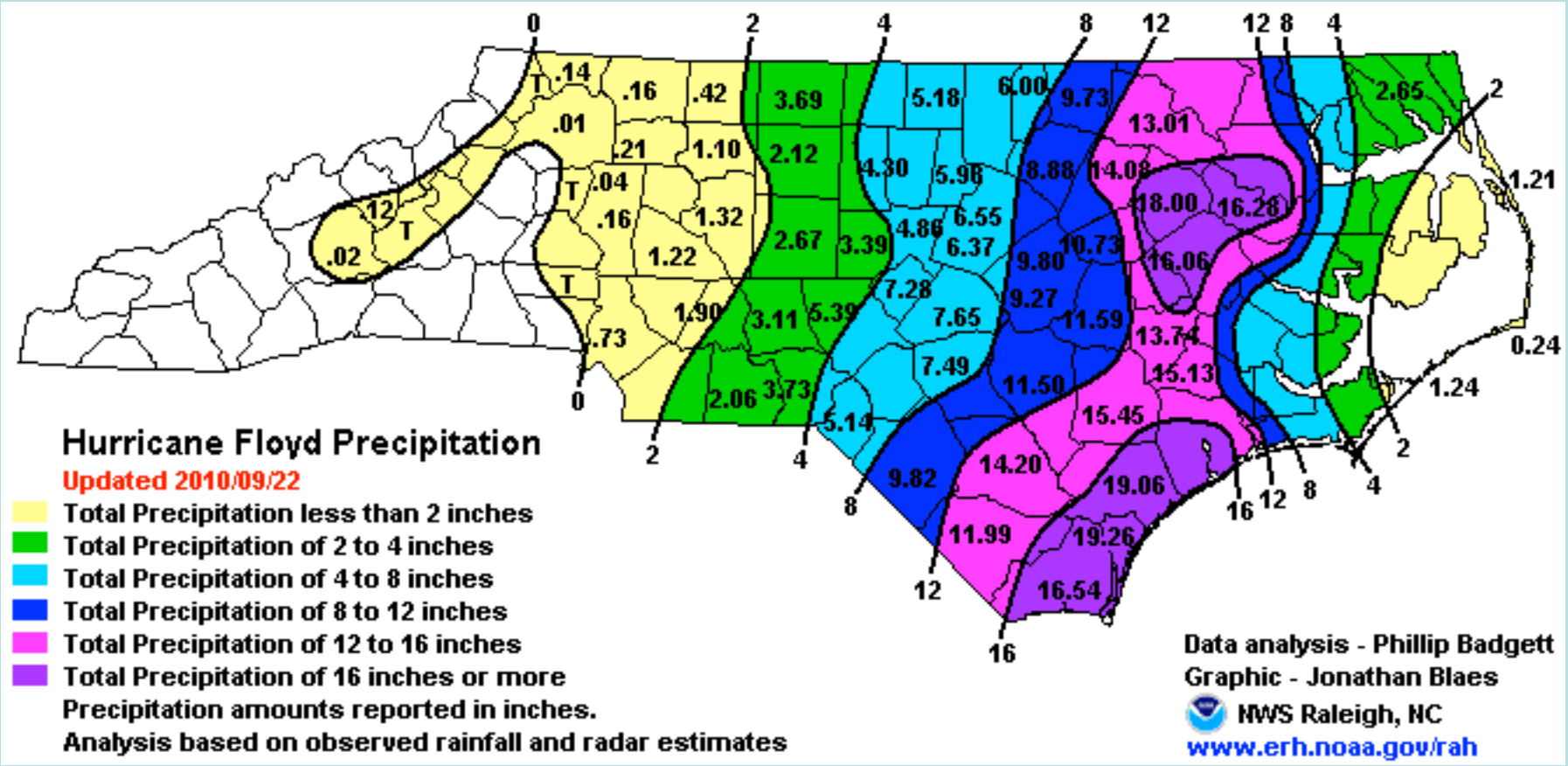
Example: Hurricanes Dennis and Floyd



Hurricane Dennis Precipitation

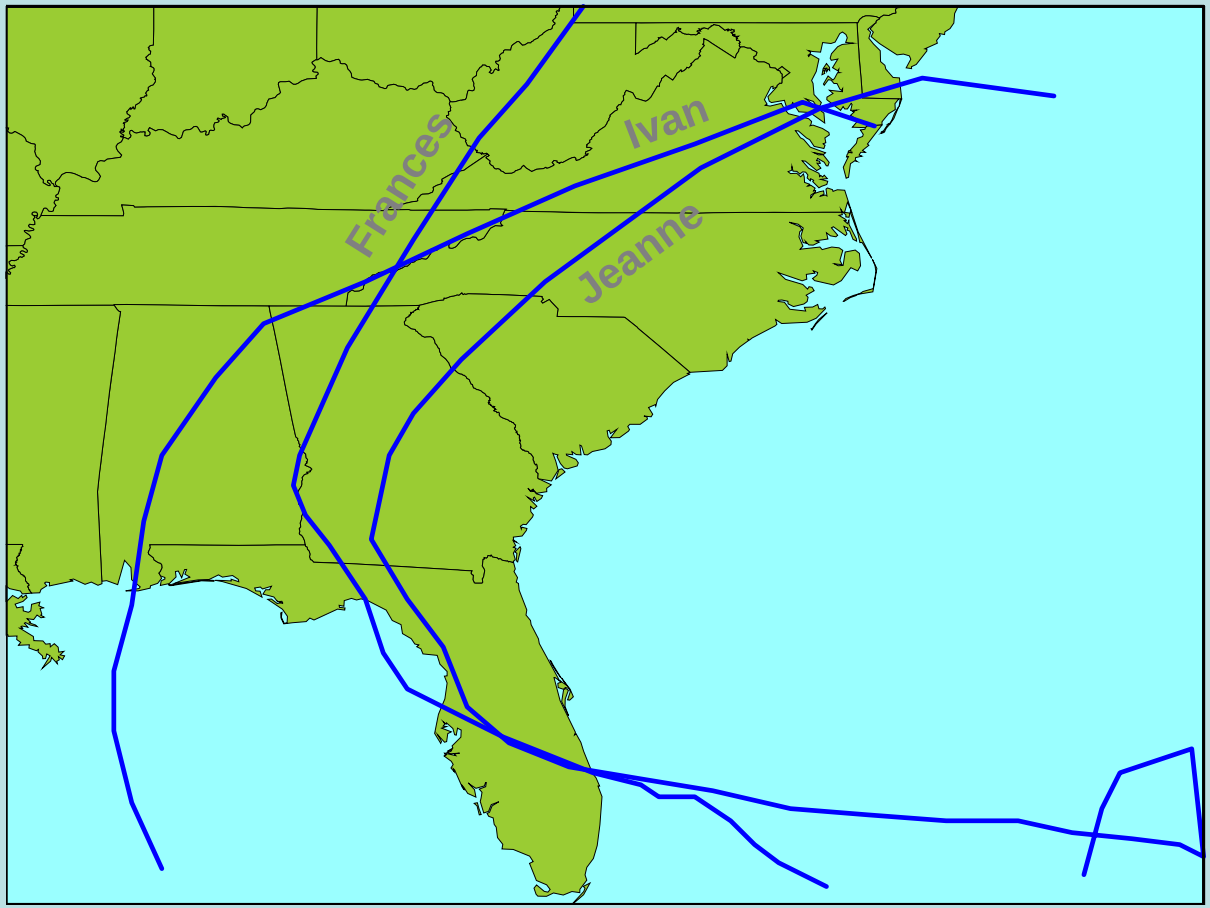


Hurricane Floyd Precipitation

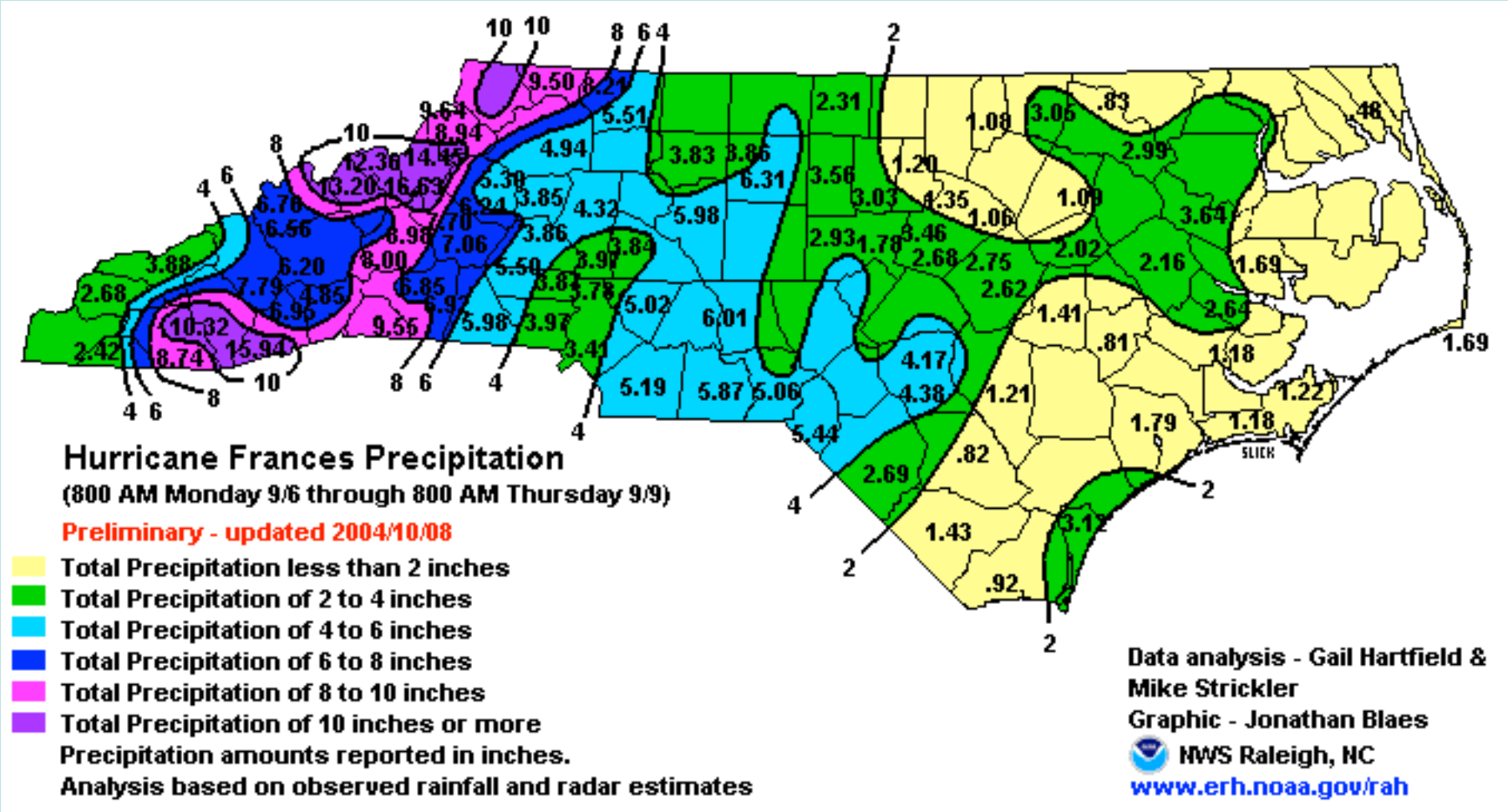


Hurricanes Frances, Ivan, and Jeanne in September 2004

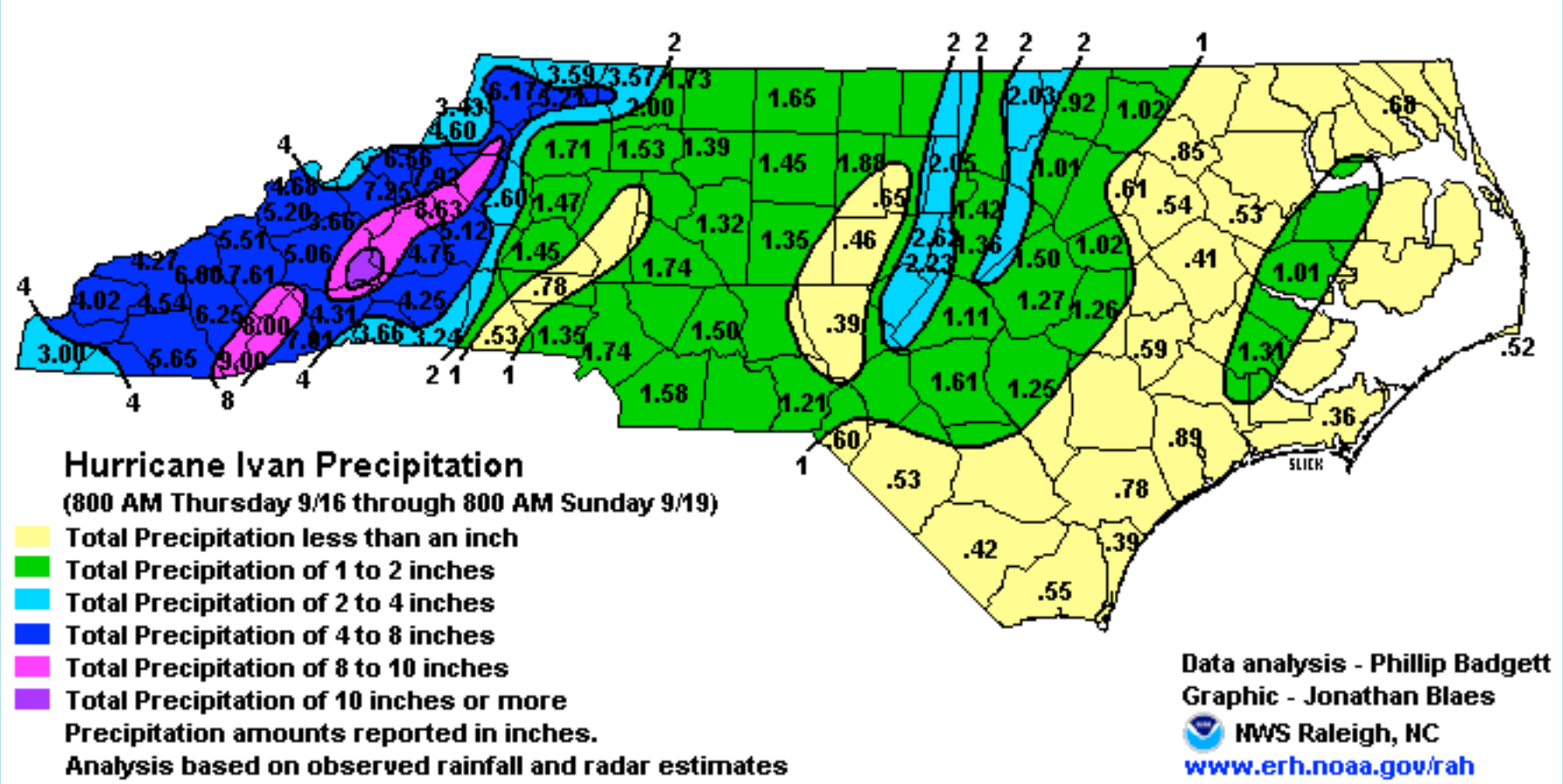
During Sept. 2004 within a period of less than one month, three major tropical cyclones moved across a region that expects one tropical cyclone every three years. Why?



Hurricane Frances Precipitation



Hurricane Ivan Precipitation

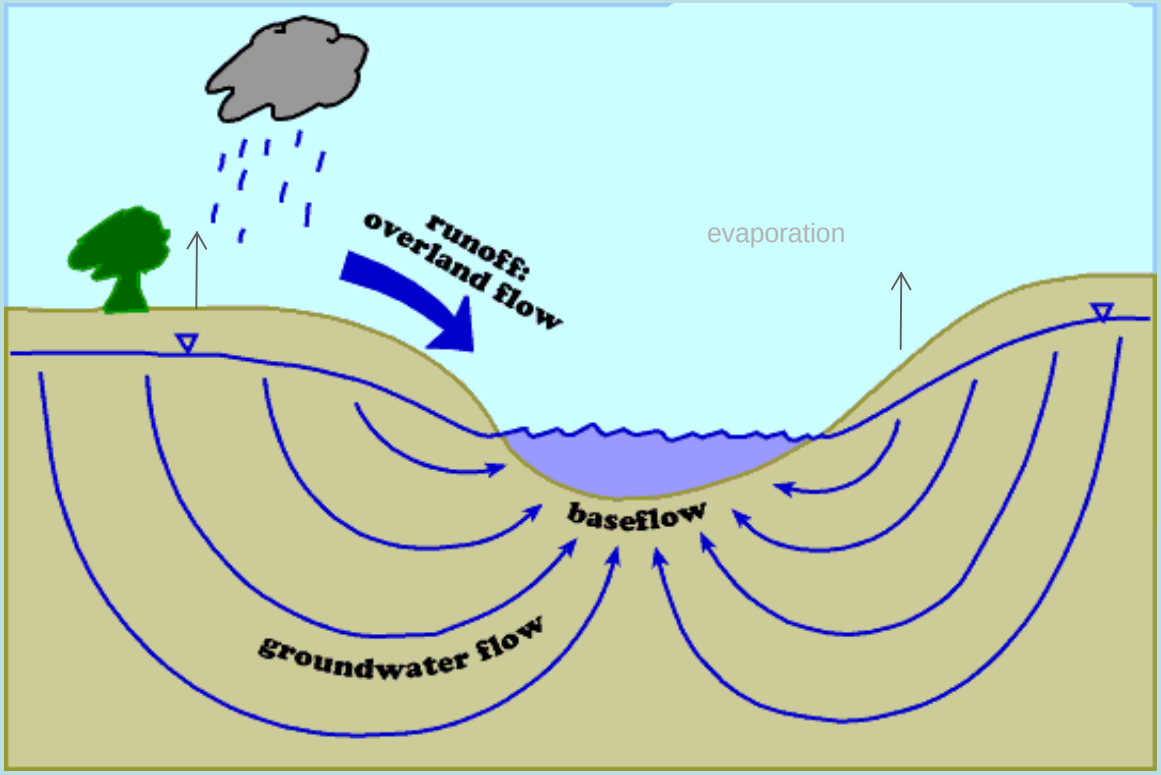


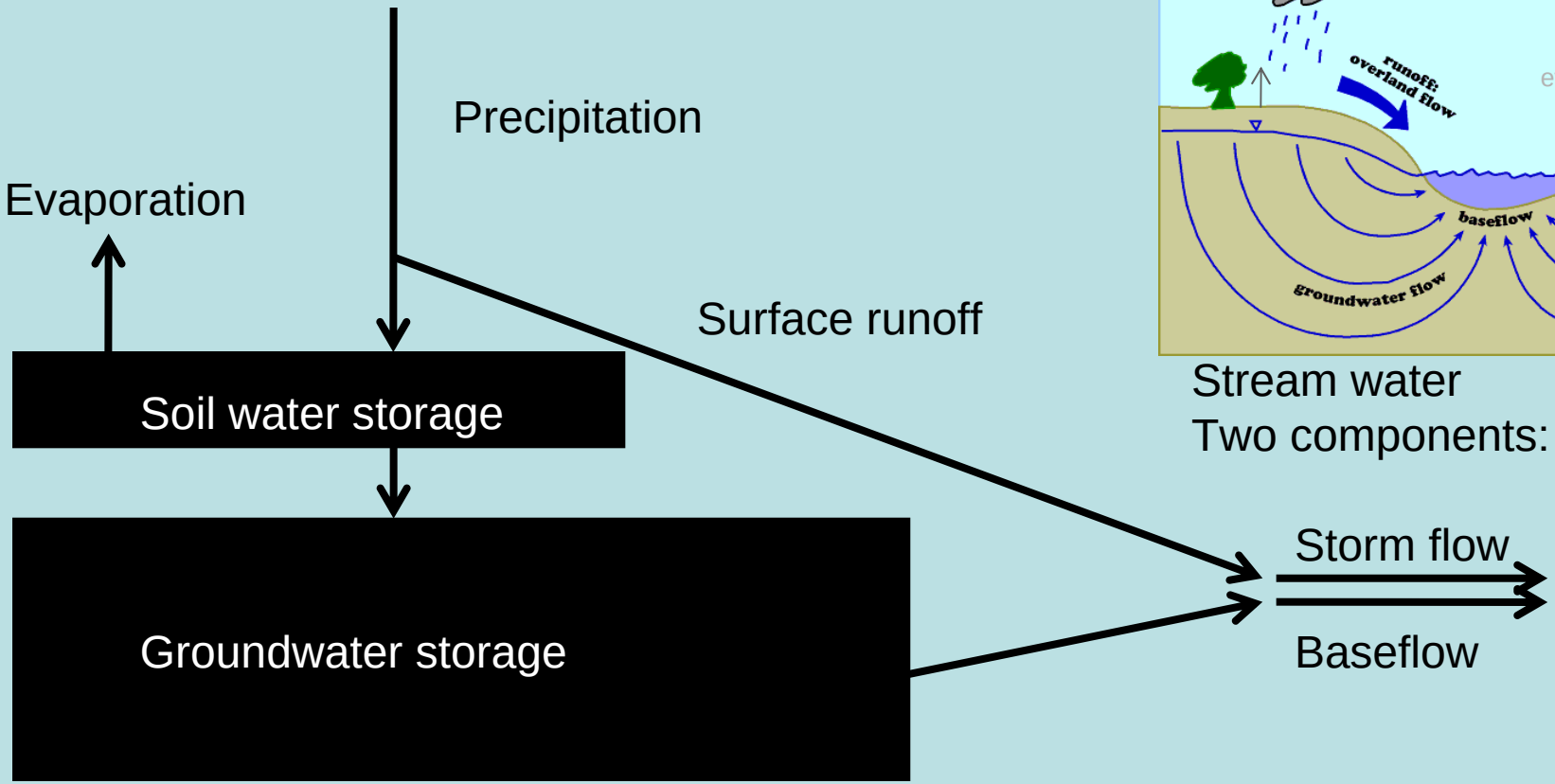
Drought

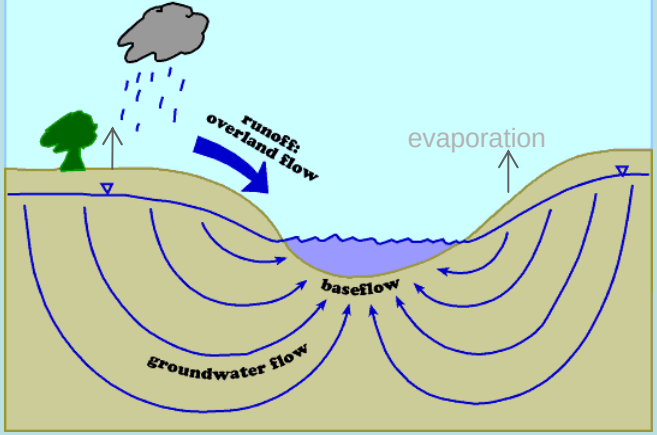
Two basic types according to the duration of the precipitation deficit

•Agricultural – short term (e.g. several weeks) → crop growth

•**Hydrological** – long term (e.g. months to years) → low river flows (e.g. stagnant water) and poor water quality (e.g. pollutants concentrated)







Stream water
Two components:

Controlling factors:

1.Seasonal changes in evaporation and vegetation uptake (evapotranspiration)
Hot conditions can accelerate the progression of drought (e.g. flash drought)

2. Water withdraws (e.g. municipal is very seasonal)

Droughts can be monitored online

http://droughtmonitor.unl.edu/

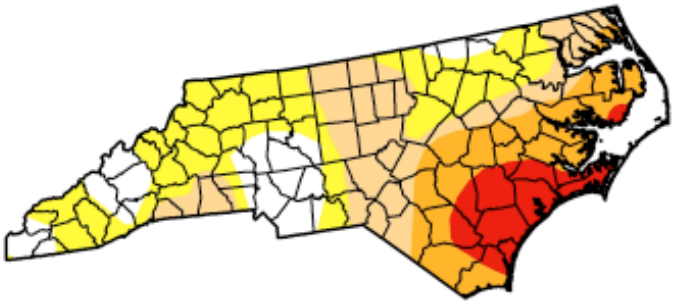
U.S. Drought Monitor

August 9, 2011
Valid 7 a.m. EST

North Carolina

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	14.58	85.42	53.73	29.39	10.56	0.00
Last Week (08/02/2011 map)	30.72	69.28	54.06	29.39	10.56	0.00
3 Months Ago (05/10/2011 map)	31.97	68.03	27.51	0.00	0.00	0.00
Start of Calendar Year (12/28/2010 map)	42.54	57.46	14.89	0.00	0.00	0.00
Start of Water Year (09/28/2010 map)	7.08	92.92	28.93	0.00	0.00	0.00
One Year Ago (08/03/2010 map)	30.57	69.43	28.97	1.91	0.00	0.00



Intensity:

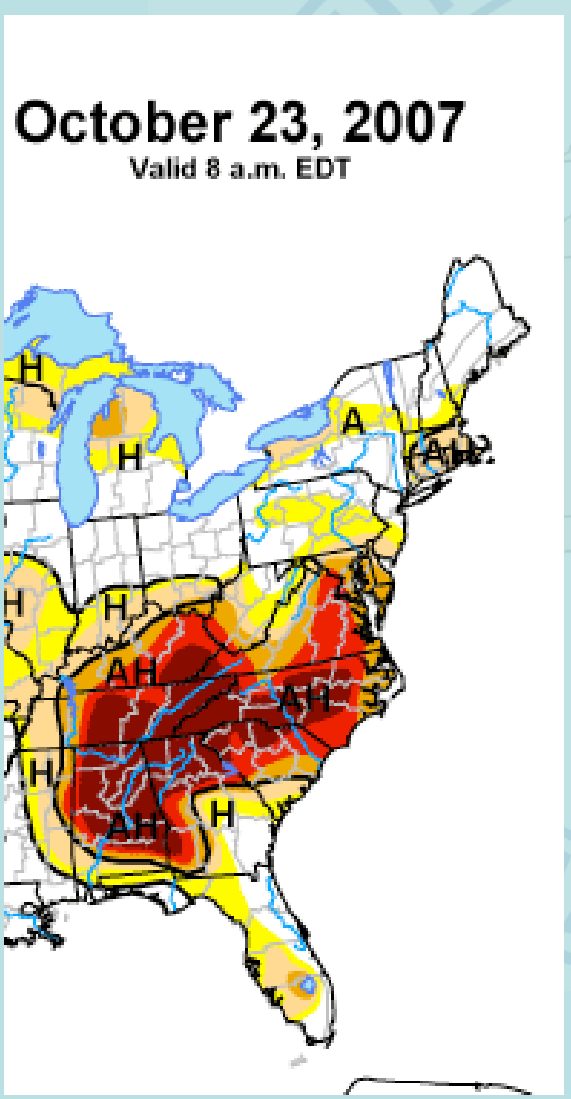
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

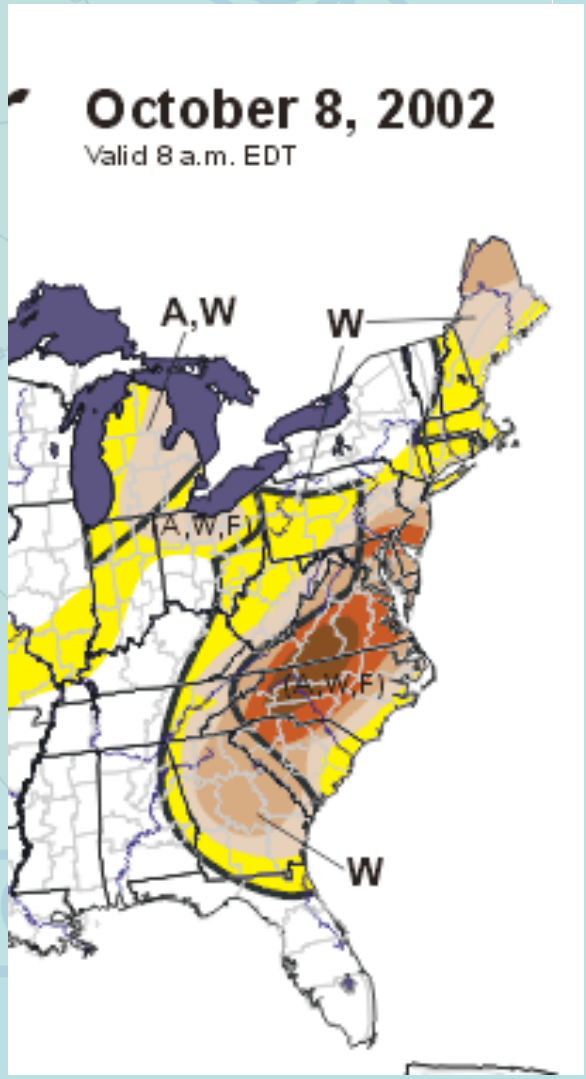
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

Released Thursday, August 11, 2011
Laura Edwards, Western Regional Climate Center

NC has seen two major droughts over the last decade

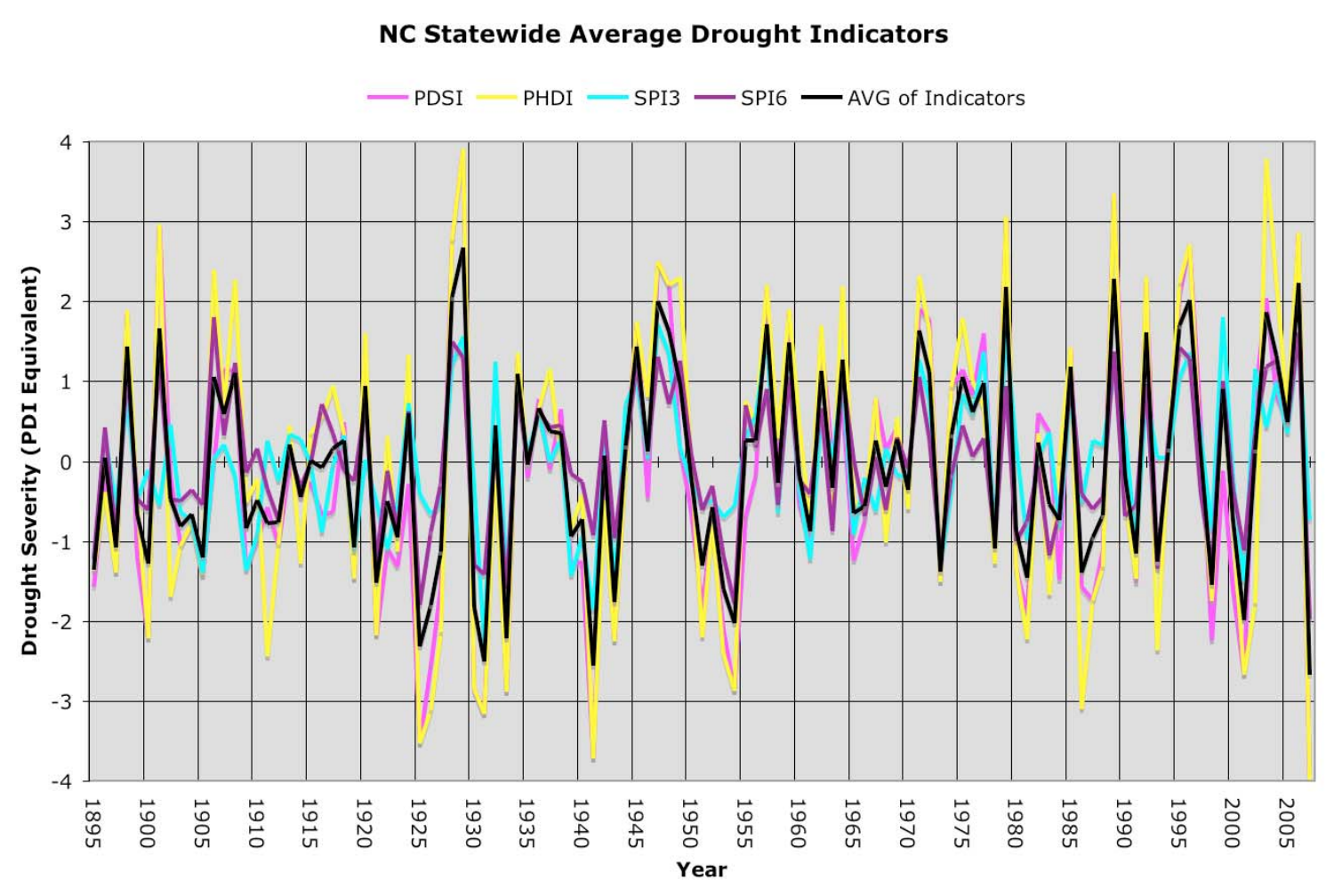




Drought occurrence over the last 110+ years

•Much variability over time – no significant trend

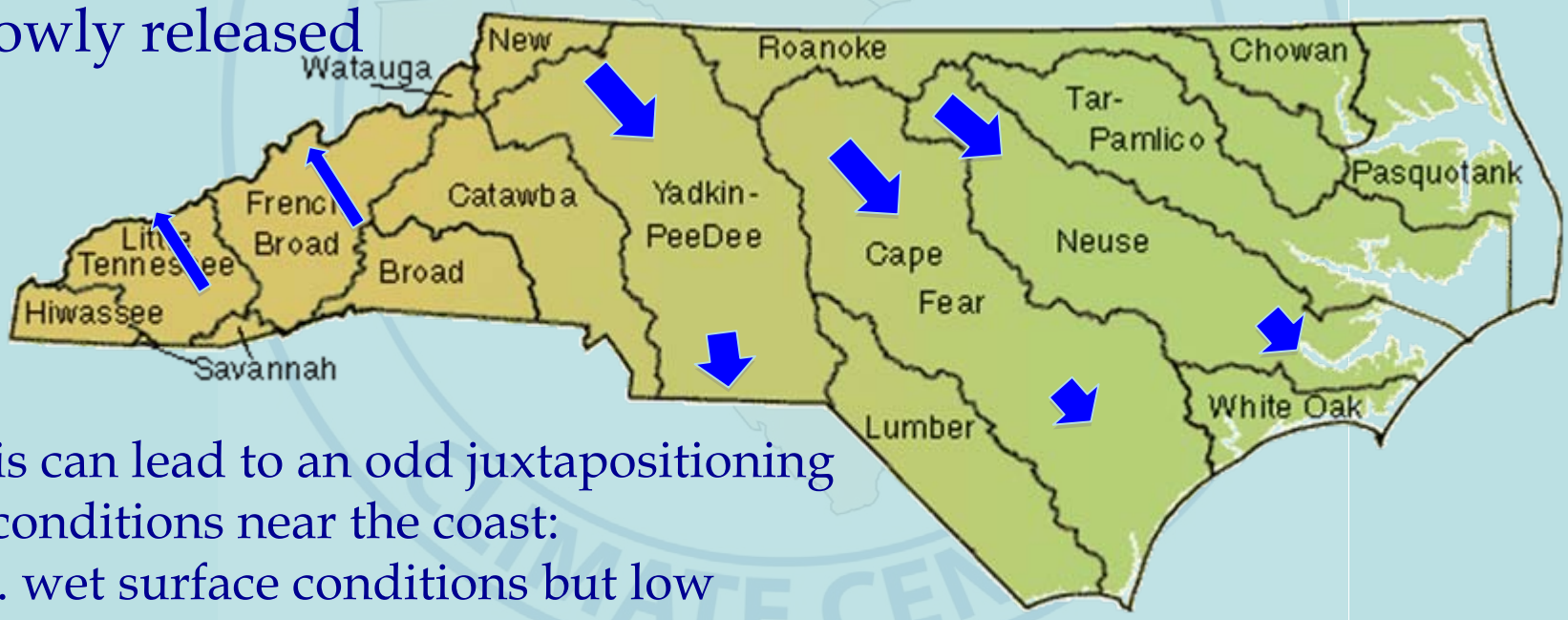
•Droughts in the early 1900's may have been worse (much deforestation in 1800's)



From NC State Climate Office

Droughts in the Piedmont can have a impact downstream in coastal plain and estuaries.

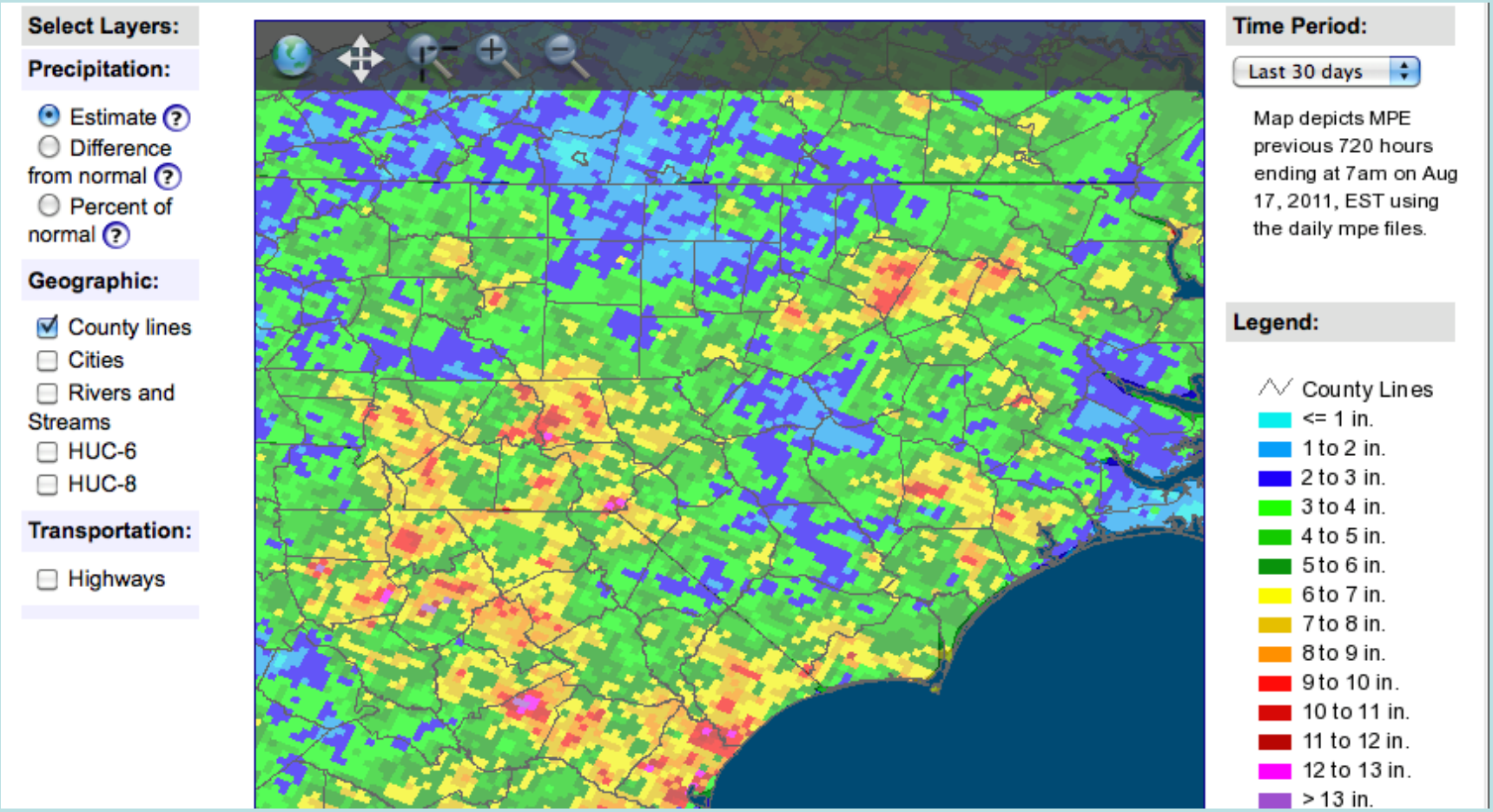
There is often a substantial time lag for the effects to spread downstream
-Slow flows on lower reaches
-Influence of reservoirs – water impounded for months and slowly released



This can lead to an odd juxtapositioning of conditions near the coast:
e.g. wet surface conditions but low flows/water levels (associated with upstream drought).

Two cool tools for monitoring climate extremes at SERCC

1. Detailed Precipitation estimates: http://www.sercc.com/mpe



Developed and maintained by NC State Climate Office

Two cool tools for monitoring climate extremes at SERCC

2. Climate perspectives: http://www.sercc.com/perspectives

Period Thresholds | **Streak Thresholds**

Daily Maximum Temperature Total Period Thresholds
For RDUthr (Raleigh Area) in Raleigh, NC ending Aug 16th, 2011 11:59PM EDT
Rankings based on the 125 year history of this station.
This data was pregenerated on Wednesday, August 17th, 2011 at 7:57 AM EDT

	Month to Date 8/1/11 to 8/16/11	Past Month 7/17/11 to 8/16/11	Season to Date 6/1/11 to 8/16/11	Past Three Months 5/17/11 to 8/16/11	Past Six Months 2/17/11 to 8/16/11	Year to Date 1/1/11 to 8/16/11	Past Year 8/17/10 to 8/16/11
≥ 20F					181 (-0.2) T-31st	228 (+0.1) T-1st	365 (-0.1) T-28th
≥ 30F					181 (-0.1) T-28th	228 (+1.2) T-1st	365 (+1.4) T-9th
≥ 32F					181 (±0) T-26th	228 (+2.0) T-1st	365 (+2.4) T-5th
≥ 40F					181 (+1.7) T-10th	222 (+4.0) T-24th	349 (-2.2) T-81st
≥ 50F					177 (+5.0) T-10th	199 (+1.4) T-47th	309 (-9.1) T-95th
≥ 60F			77 (±0) T-1st	92 (+0.1) T-1st	163 (+7.3) T-12th	171 (+3.2) T-41st	271 (+3.7) T-48th
≥ 70F	16 (+0.1) T-1st	31 (+0.1) T-1st	77 (+0.7) T-1st	92 (+1.9) T-1st	144 (+13.8) 4th	145 (+12.0) T-7th	222 (+17.7) T-12th
≥ 80F	16 (+1.3) T-1st	31 (+2.2) T-1st	77 (+8.2) T-1st	89 (+11.1) T-1st	109 (+15.1) T-3rd	109 (+15.1) T-3rd	159 (+26.3) 3rd
≥ 90F	8 (+1.4) T-41st	21 (+7.2) T-14th	56 (+25.7) T-1st	62 (+30.1) 1st	62 (+28.5) 2nd	62 (+28.5) 2nd	89 (+46.7) 1st
≥ 100F	0 (-0.1) T-7th	8 (+7.5) T-1st	9 (+8.2) 2nd	9 (+8.2) 2nd	9 (+8.2) 2nd	9 (+8.2) 2nd	9 (+8.0) 2nd

Thank-you!

Web: http://www.sercc.com