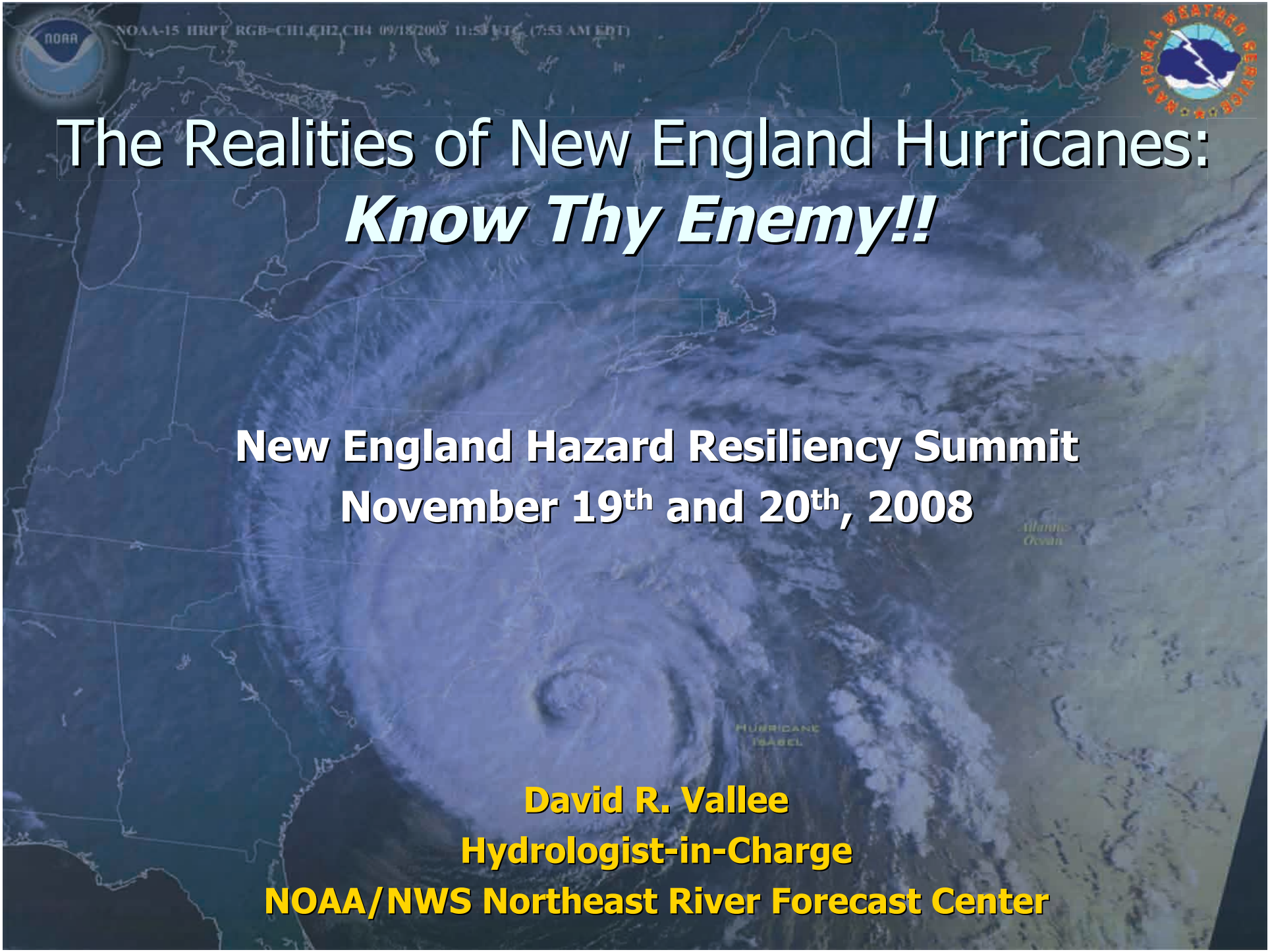


The Realities of New England Hurricanes: *Know Thy Enemy!!*

New England Hazard Resiliency Summit
November 19th and 20th, 2008

David R. Vallee
Hydrologist-in-Charge
NOAA/NWS Northeast River Forecast Center

Objectives

- Understand the behavior of our New England breed of Tropical Cyclone
  - A historical perspective
  - The three primary hazards
  - How can we best prepare ourselves?
    - Short term impacts
    - Long term ramifications
    - Local / Regional thinking

ANYTHING WITH A NAME IN THE BAHAMAS
Everyone in New England needs to pay careful attention!
Florida
CUBA
25N
Hurricane Floyd, September 13, 1999

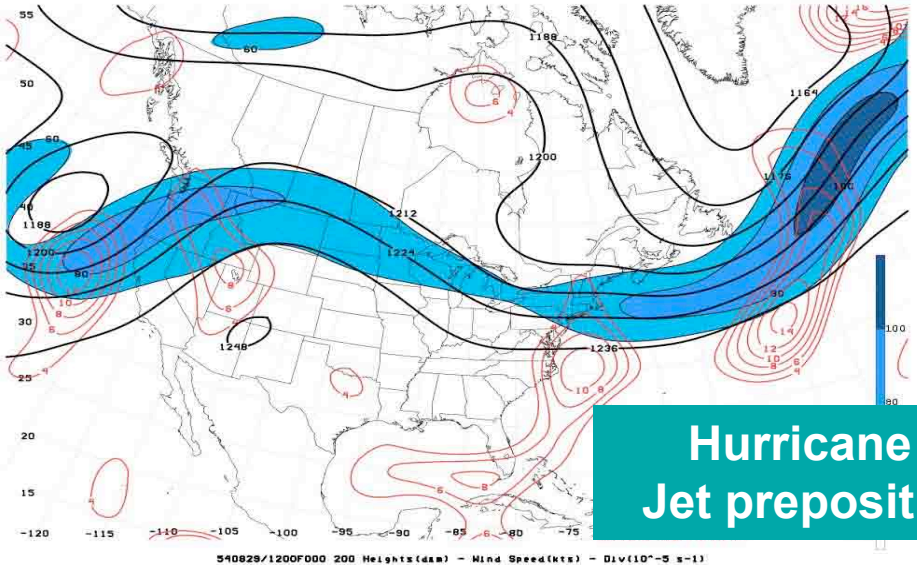
Common Characteristics

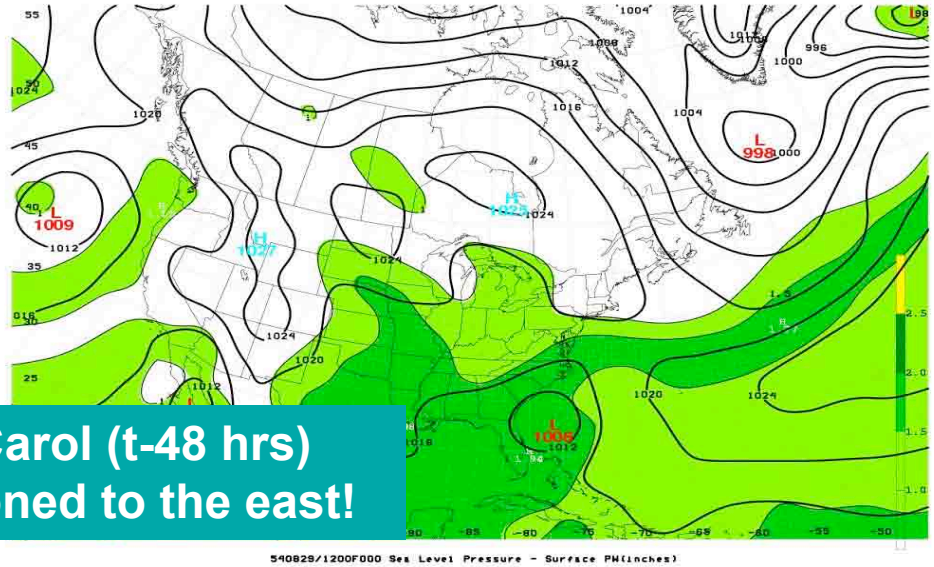
- Rapid acceleration up the coast
- High winds focused east of the track
- Storm surges focused east of the track
- Heavy rainfall usually focused along and west of the storm track

Remarkable Acceleration

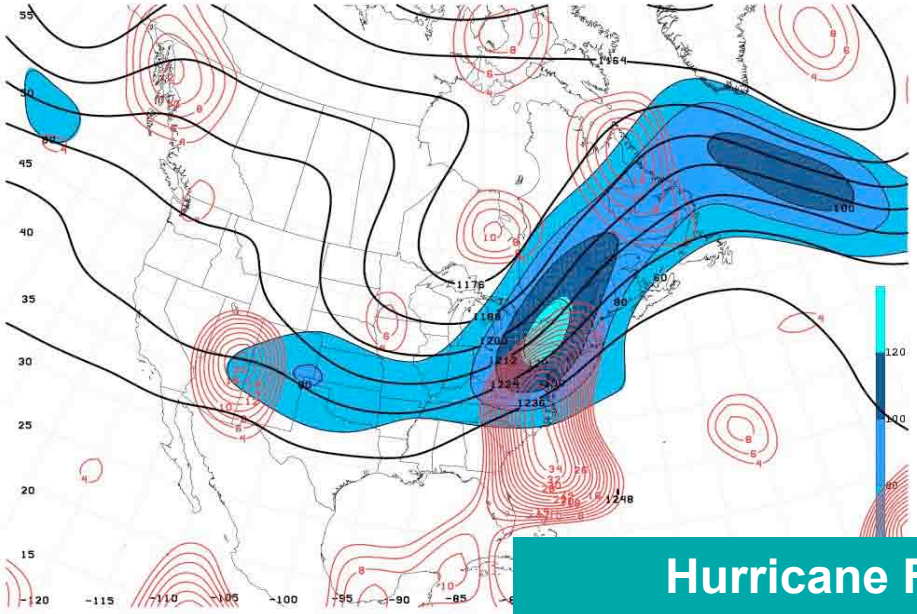
- Rapid Average forward motion at land fall: 33 mph / 51 km/hr.
- The Great New England Hurricane of 1938 made the trip from Cape Hatteras, NC to Providence, RI in 8 hours!
  - Forward speed at landfall was at least 51 mph/82 km-hr and estimated as high as 60 mph/97 km-hr

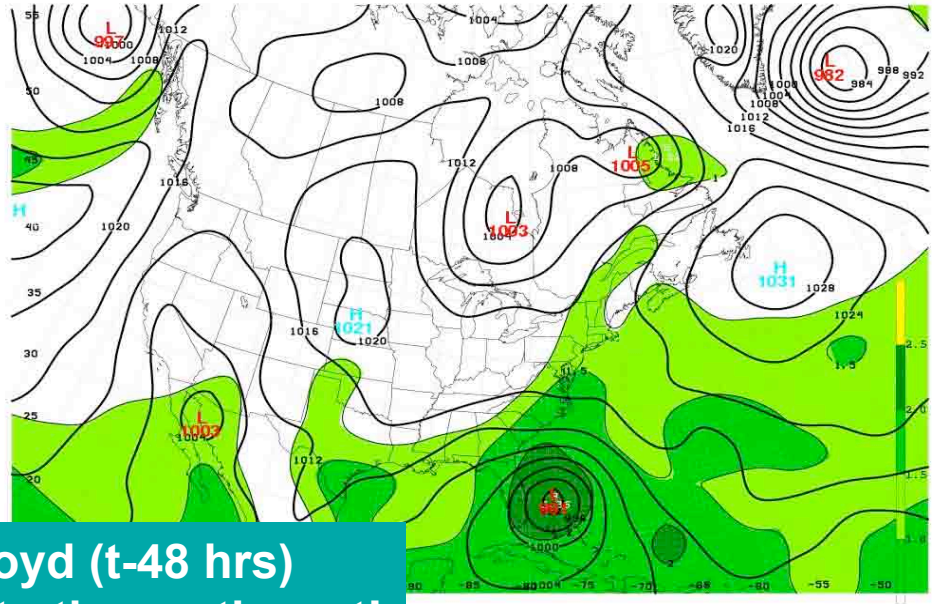
Interaction with the Westerlies





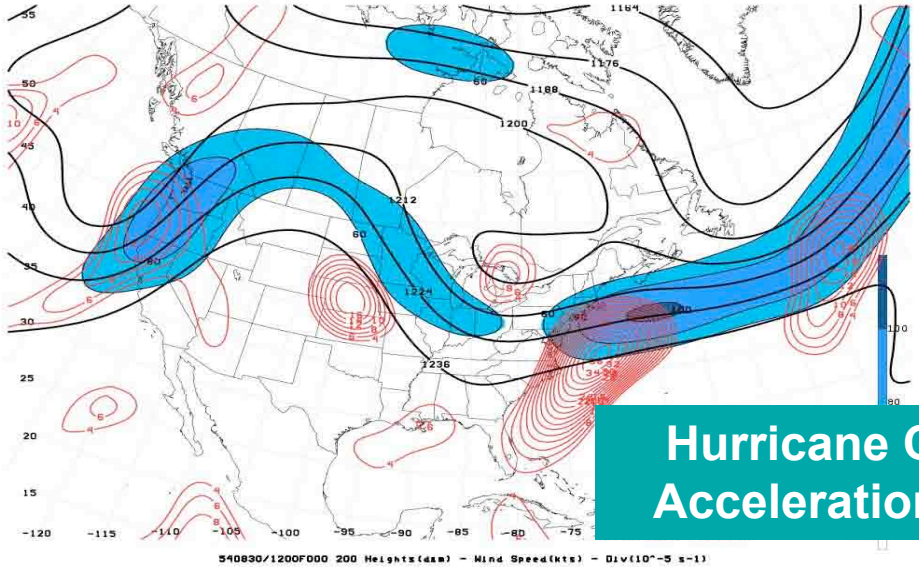
Hurricane Carol (t-48 hrs)
Jet prepositioned to the east!

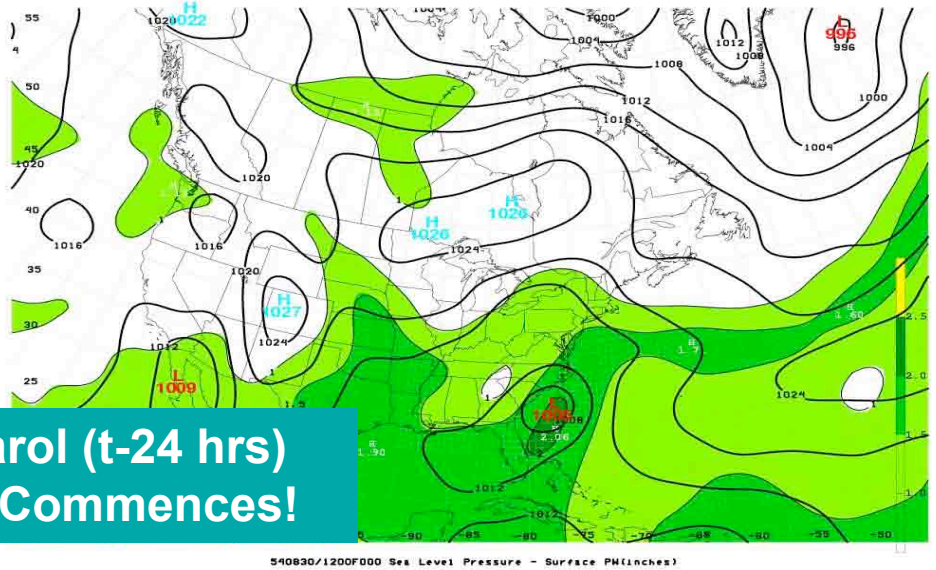




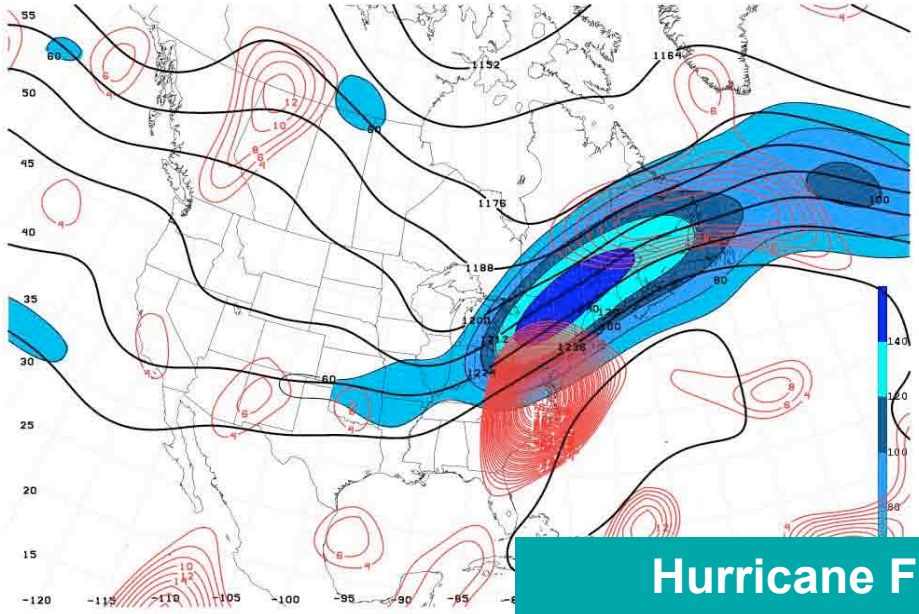
Hurricane Floyd (t-48 hrs)
Jet prepositioned to the northwest!

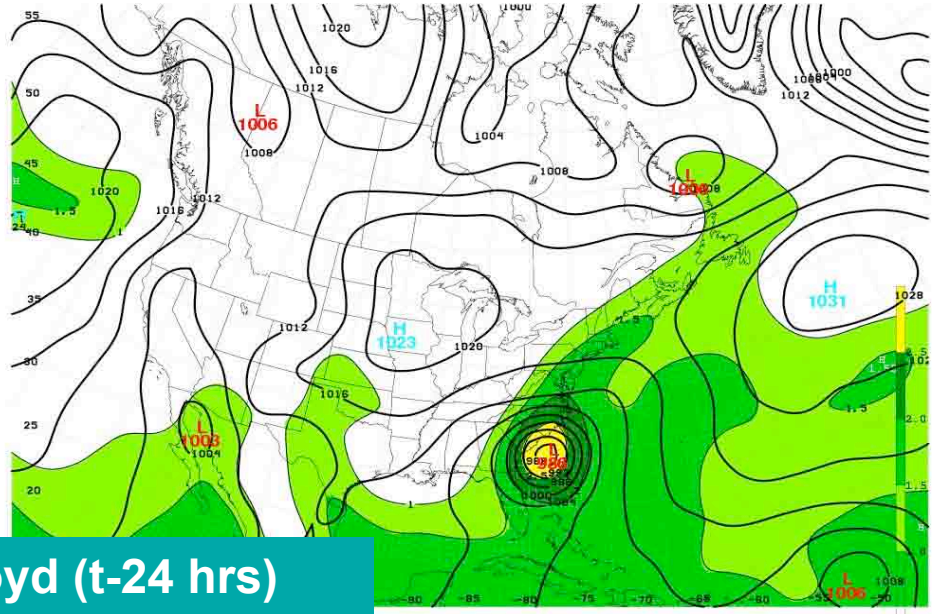
Interaction with the Westerlies





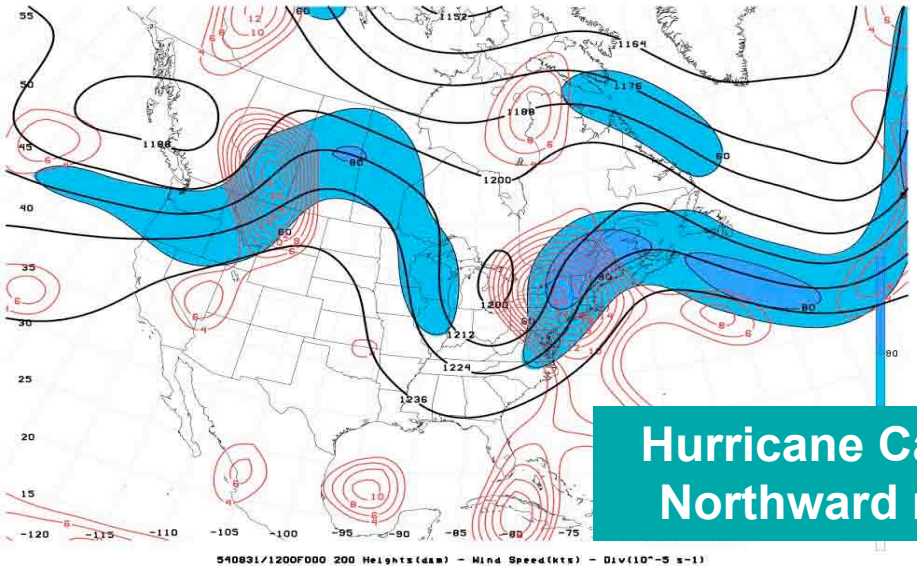
Hurricane Carol (t-24 hrs)
Acceleration Commences!

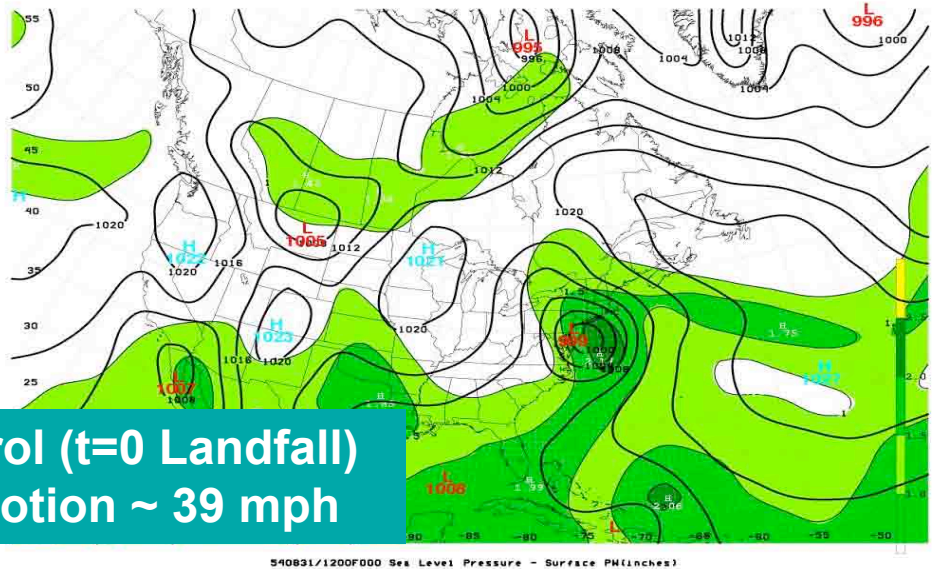




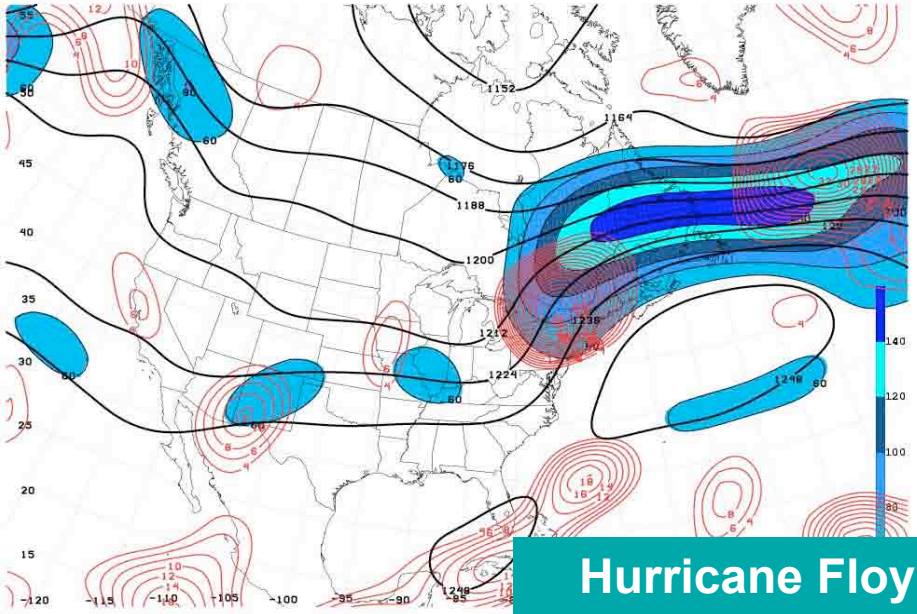
Hurricane Floyd (t-24 hrs)
Acceleration Commences!

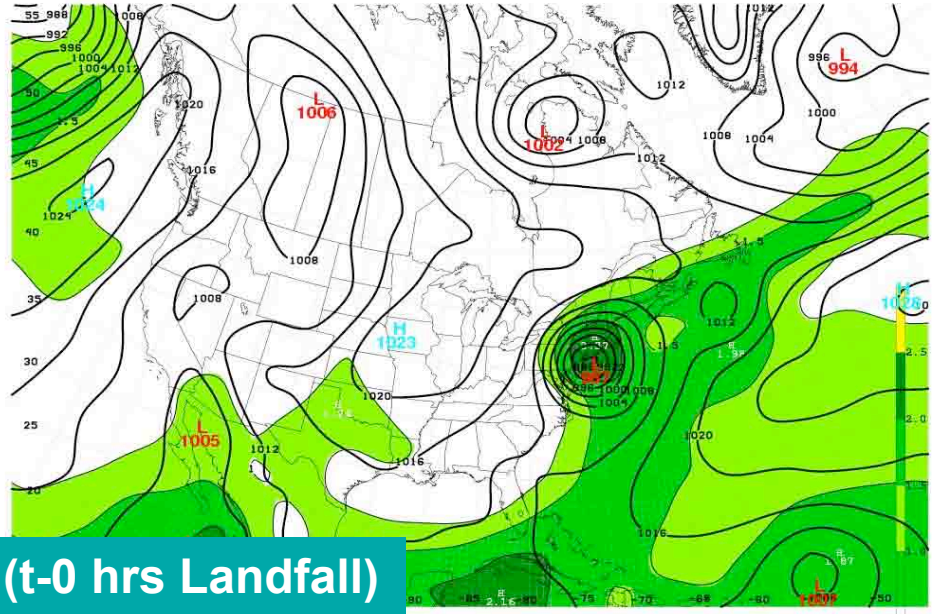
Interaction with the Westerlies





Hurricane Carol (t=0 Landfall)
Northward motion ~ 39 mph



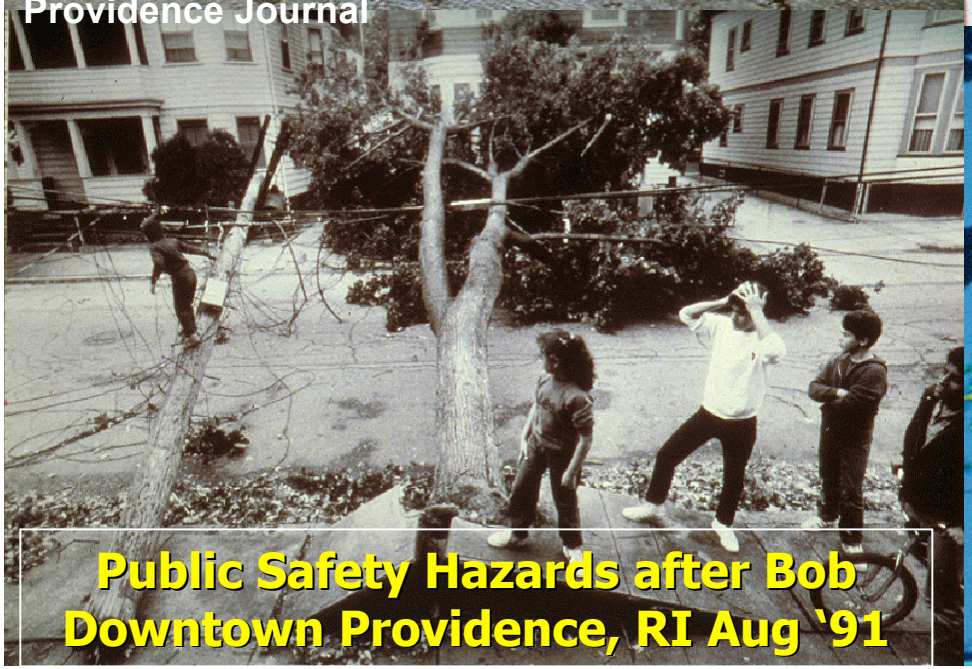


Hurricane Floyd (t-0 hrs Landfall)
North-northeast motion ~ 33 mph

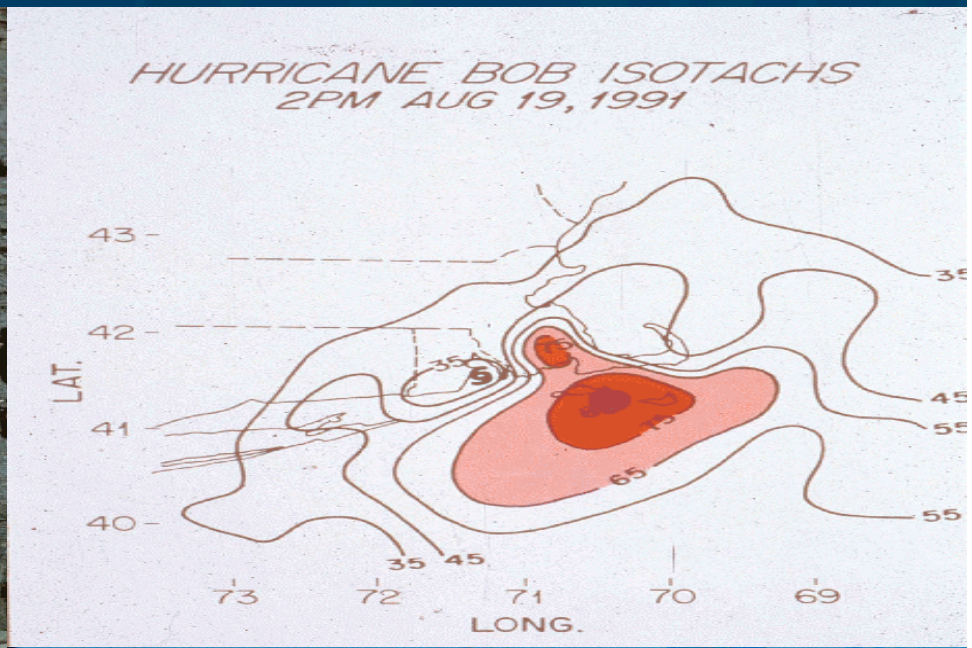
High Winds

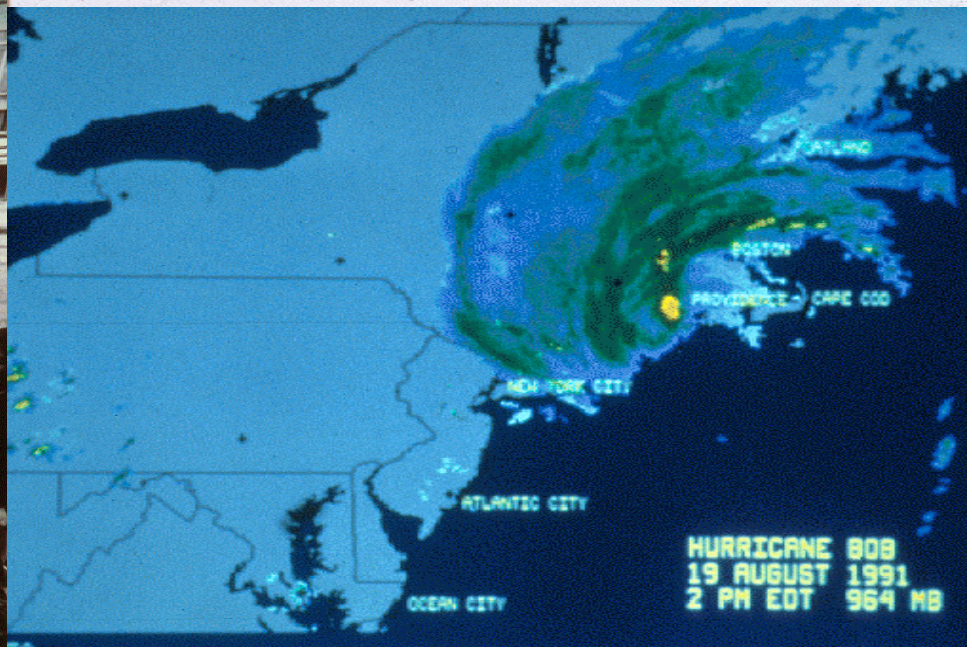
Hurricane Carol Wind Damage, at Bonnet Shores in Narragansett RI.

Providence Journal



Public Safety Hazards after Bob Downtown Providence, RI Aug '91





It’s just a little breeze….

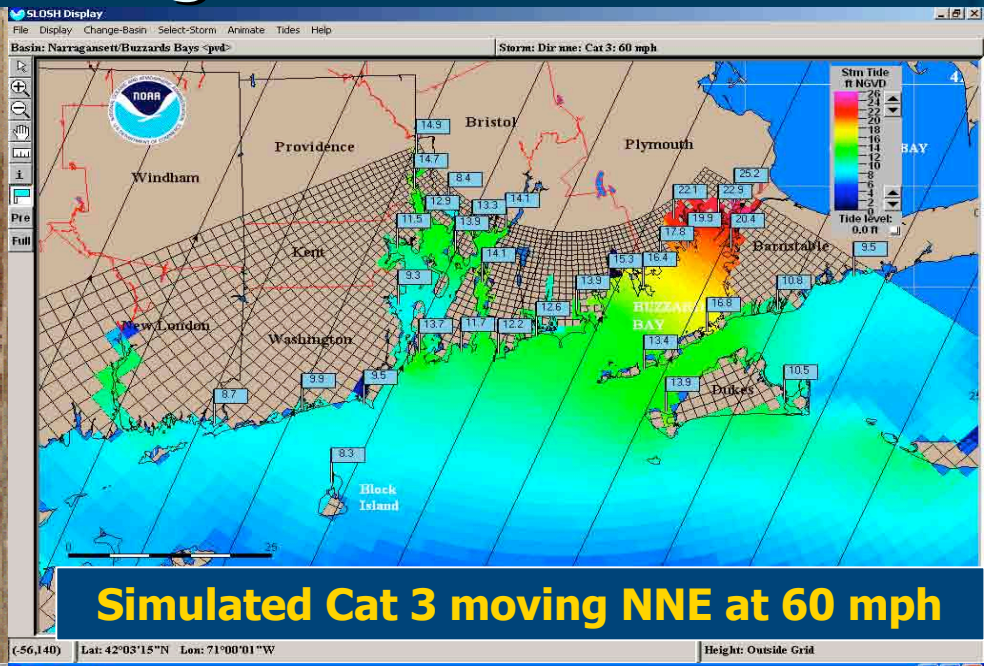
- Trees are weathered for Nor’easters
  - Southerly gales will produce far more wind damage
  - White Pines: Snap – lots of airborne debris
  - Oaks/maples – topple/uproot
  - Power poles – snap at the transformer level
- Structural failures most likely along the immediate coast
  - Are building codes adequate / are they being enforced??
- Power disrupted for days to weeks!
  - Are we prepared to deal with the ramifications of such an impact?
  - Must have a multi-state/regional approach to ensuring communication continues
  - Impacts commerce, transportation, health industry

Storm Surge

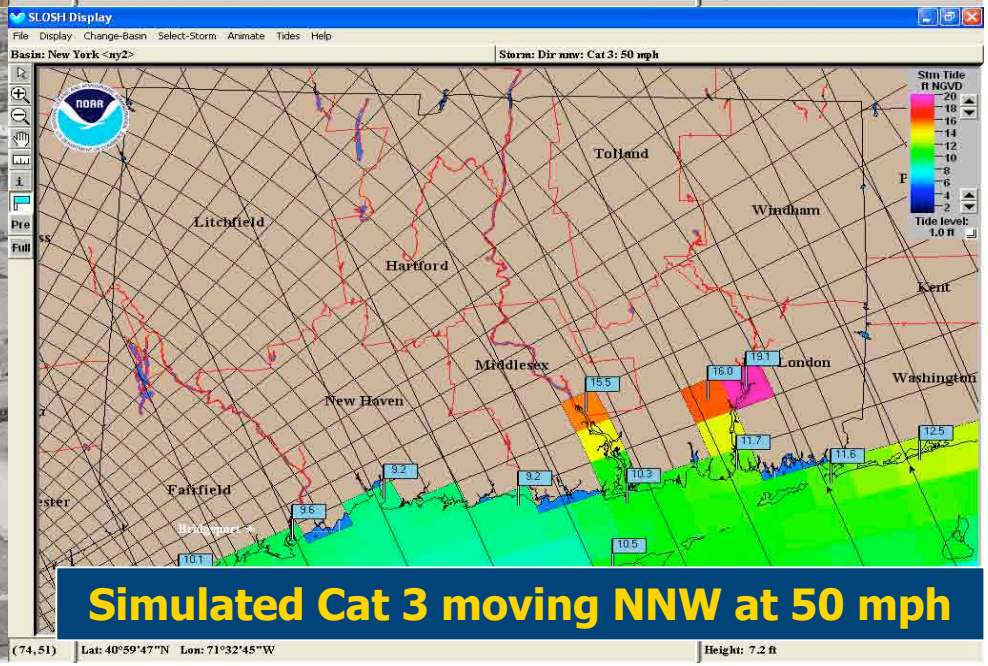
Hurricane of 1938 – Rt. 1A Scenic Narragansett RI.

Providence Journal

Misquamicut Village, Charlestown, RI after Hurricane Carol



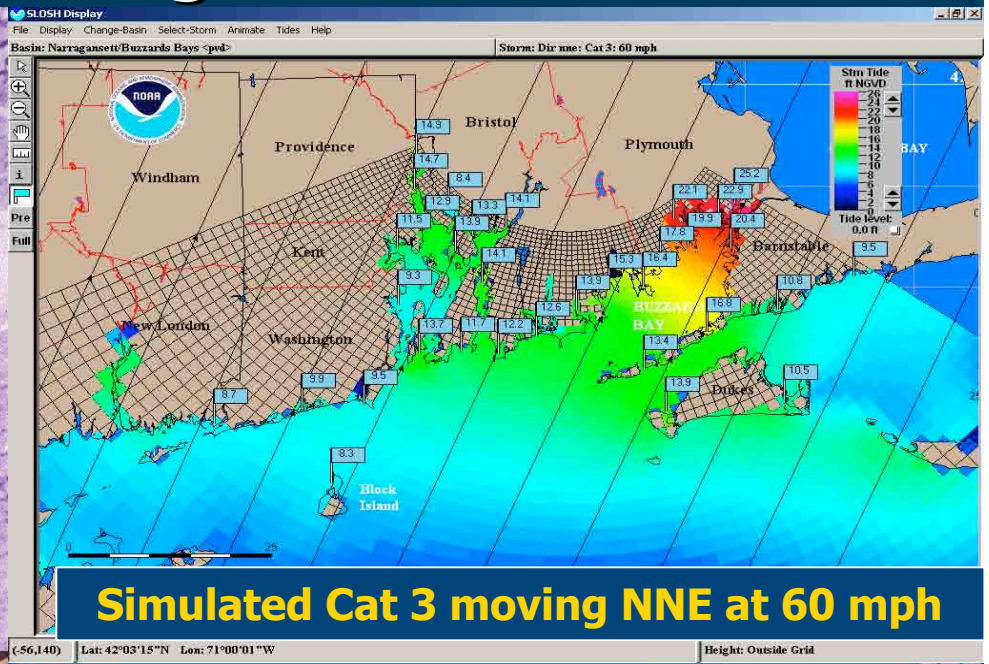
Simulated Cat 3 moving NNE at 60 mph



Simulated Cat 3 moving NNW at 50 mph

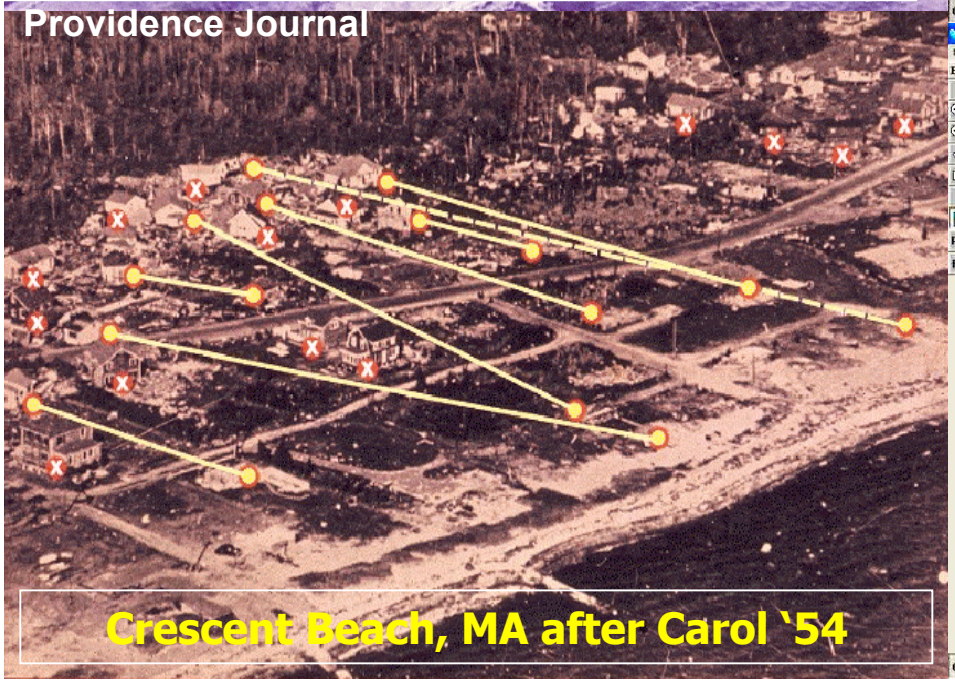
Storm Surge

Crescent Beach, MA before Carol '54

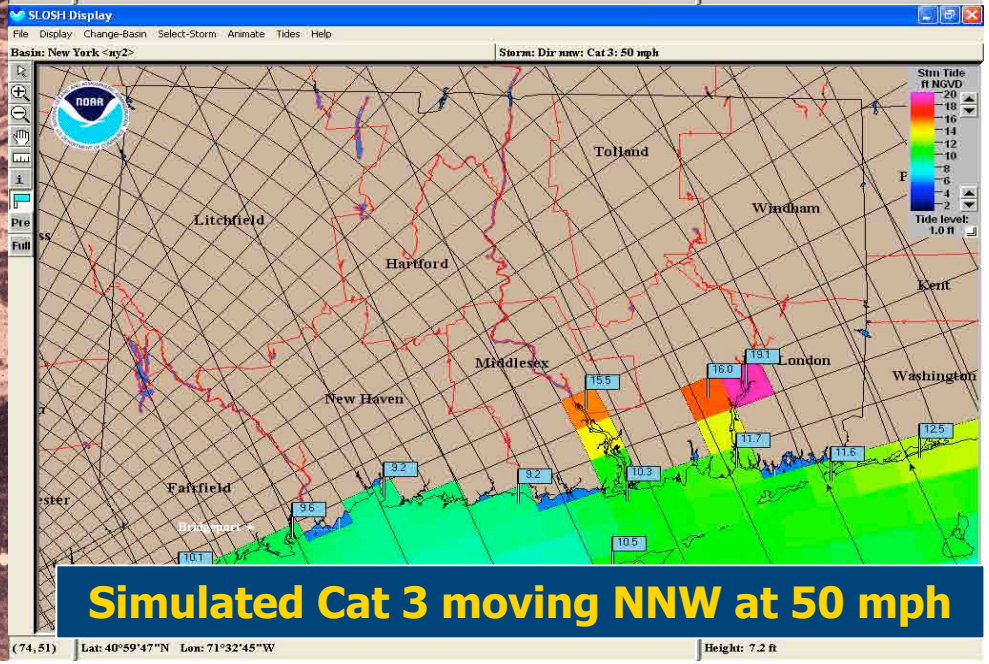


Simulated Cat 3 moving NNE at 60 mph

Providence Journal



Crescent Beach, MA after Carol '54



Simulated Cat 3 moving NNW at 50 mph

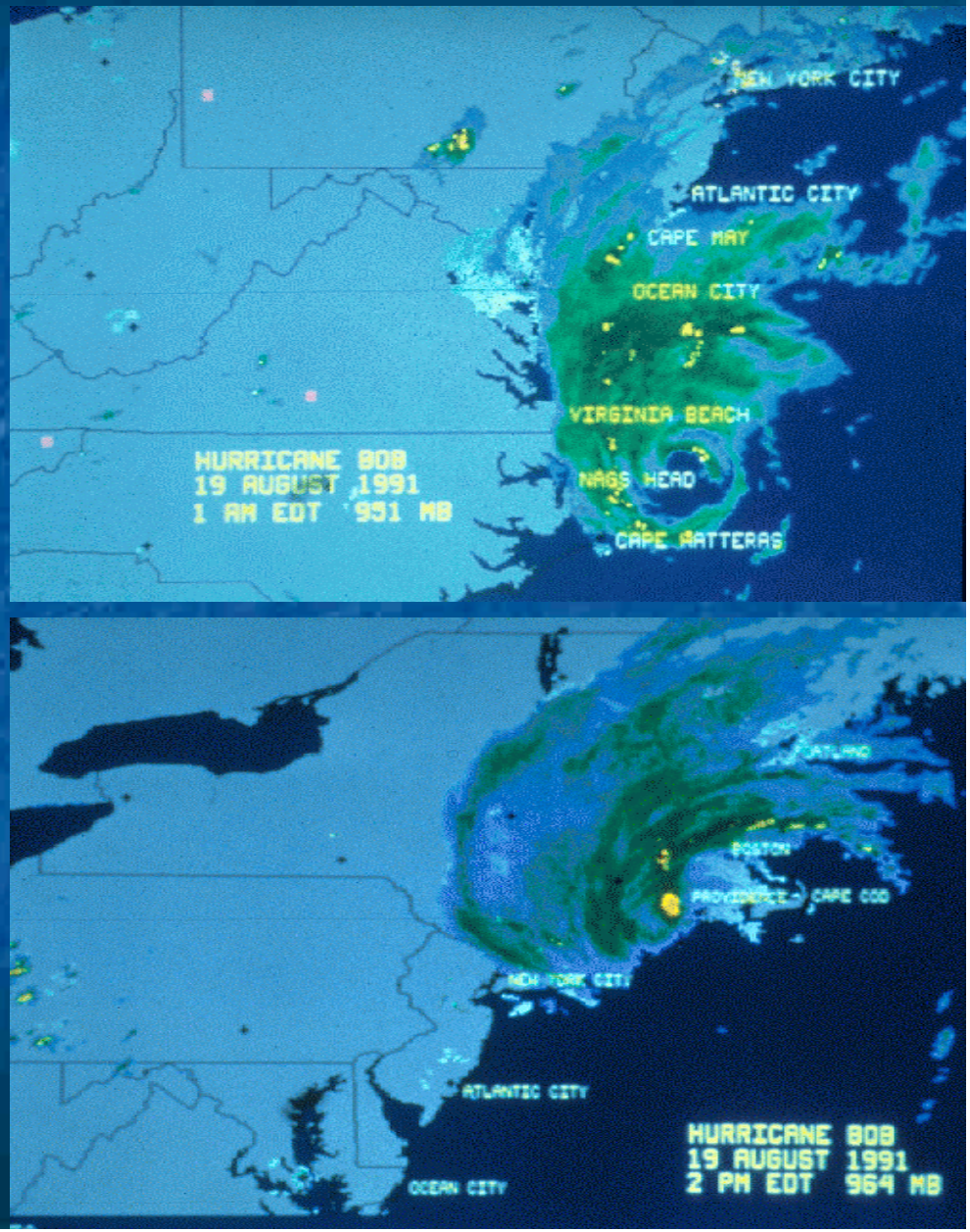
So its just a little ocean wave…

- Portions of neighborhoods – gone
  - Are evacuation plans in place and adequate?
  - Environmental impact of clean up/contamination issues
  - What do you do with the people who's homes have been destroyed?
  - What do you do related to permitting the rebuilding?
    - Hurricane Bob – folks grab hammer/nails and did it as fast as they could – no permits, no enforcement, no inspections!
  - What about infrastructure: The Ports!
    - Loss of commerce, greatly retracted capacity to supply oil, natural gas, etc. (Port of Providence)
  - Are building codes adequate / are they being enforced??

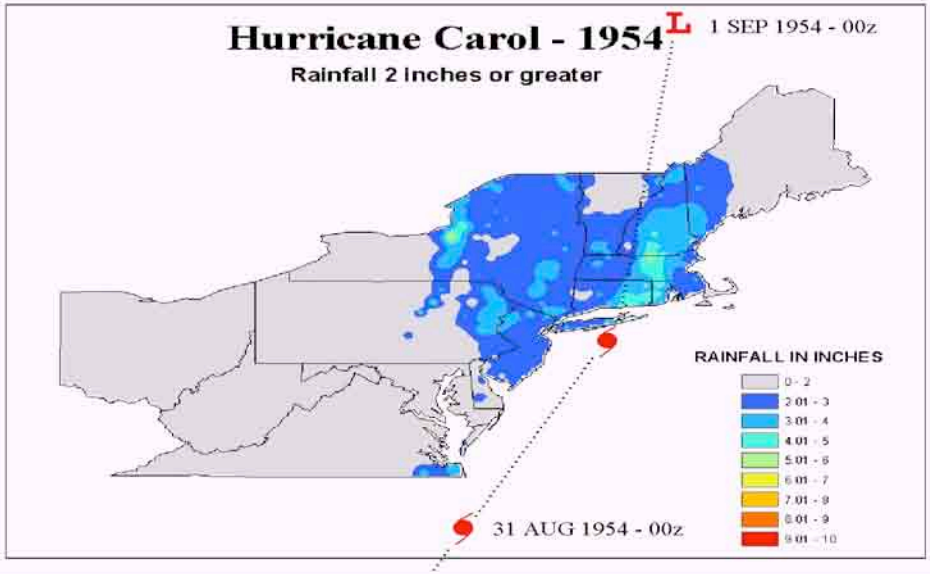
Debris line #2 – Significant debris pushed into properties causing structural damage
Debris line #1 – homes destroyed and dislodged from foundations
And what about all that debris???
Note the inland extent of structural damage!

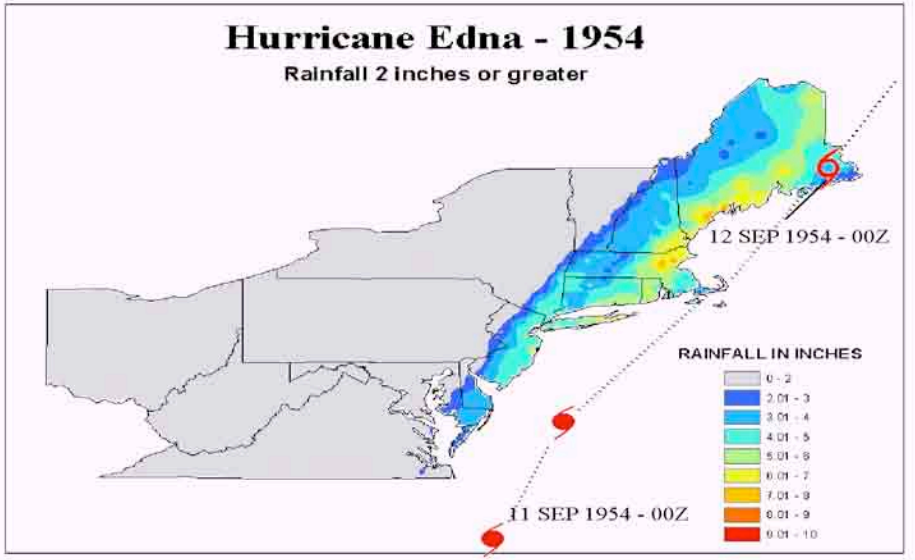
Heavy Rainfall

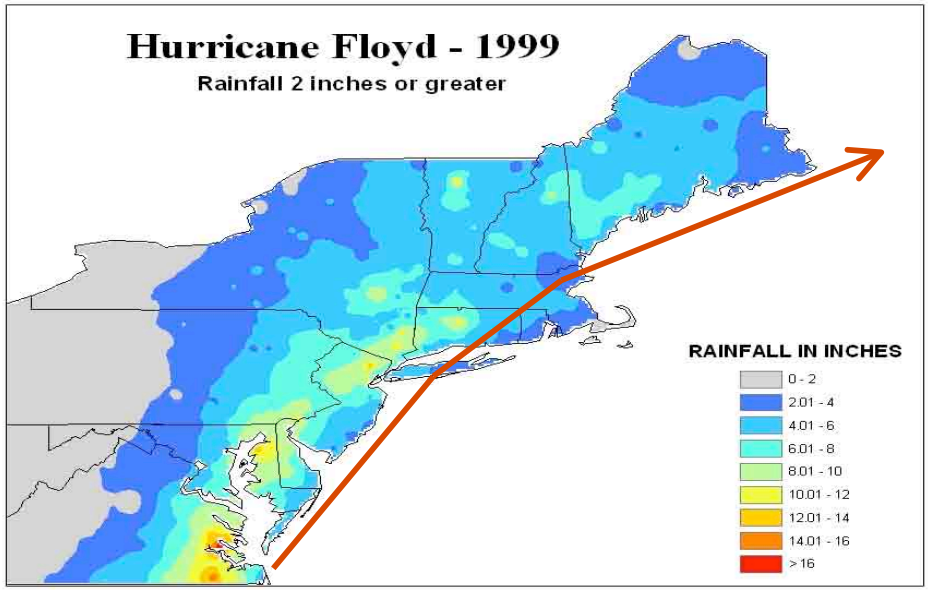
- Two types of distributions
  - Along/Right of Track
  - Left of Track
- Some systems "changed phase" as they turned and accelerated northeastward
- Nearly every tropical cyclone studied was going through some degree of extra-tropical transition
- Nearly ½ of all our storms produced small stream/river flooding in the region!
- Average rainfall 6-8 inches

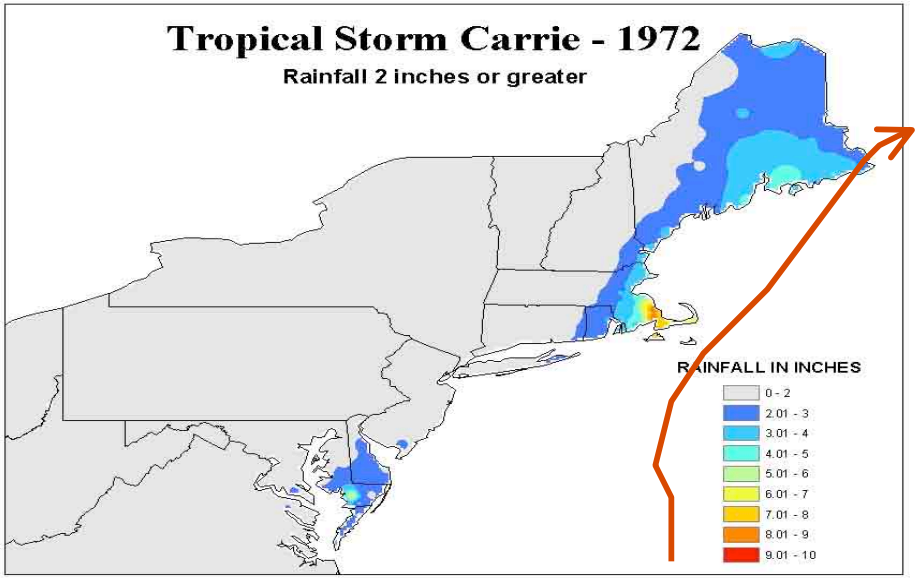


Historical Perspective
Heavy Rainfall Distribution

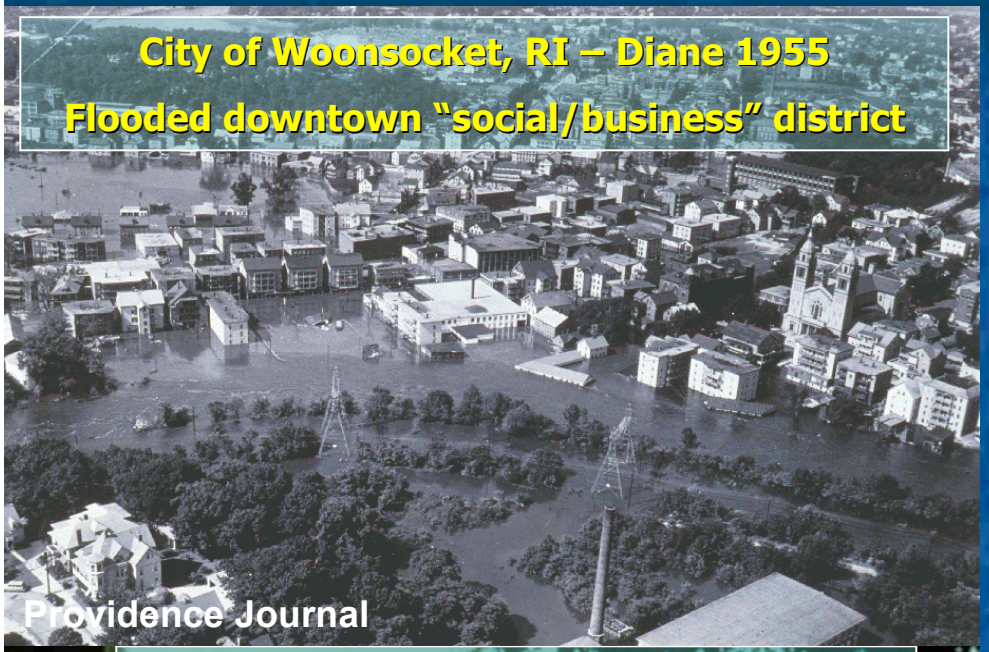


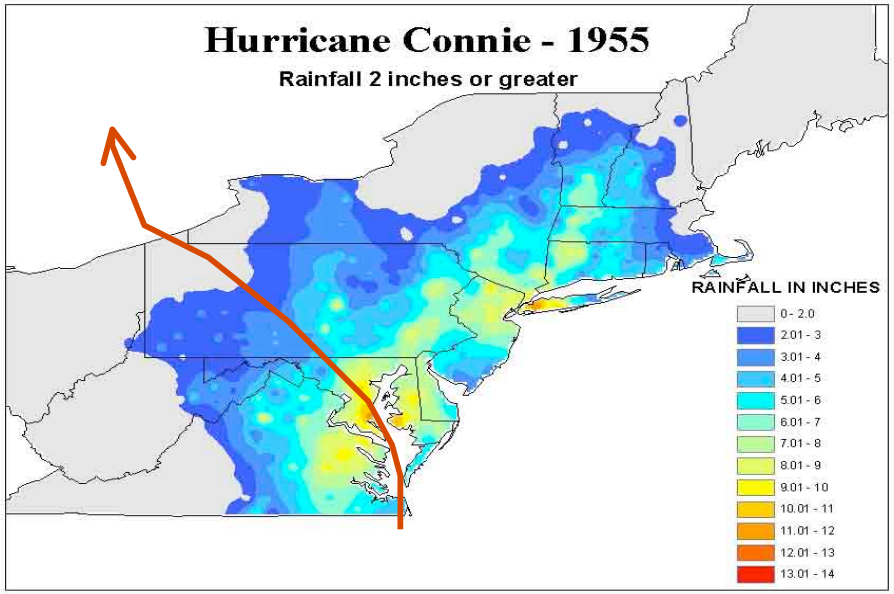


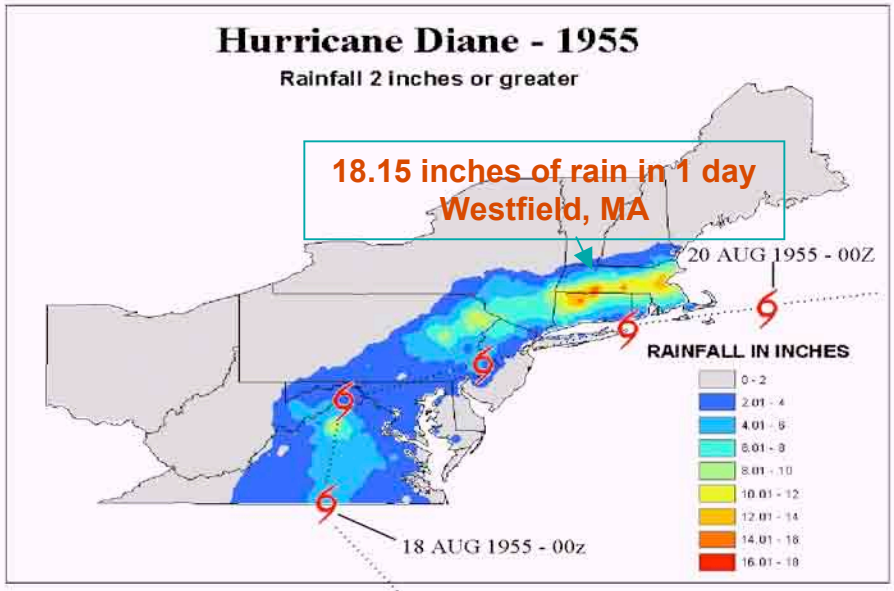




Historical Perspective
Widespread Flooding/Flash Flooding







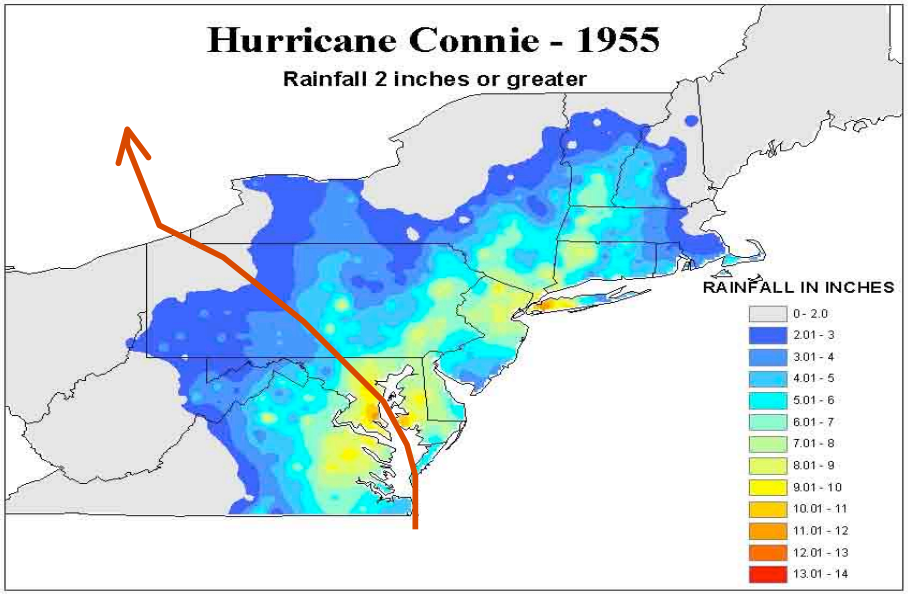
Historical Perspective
Levee Breaches and Dam Failures

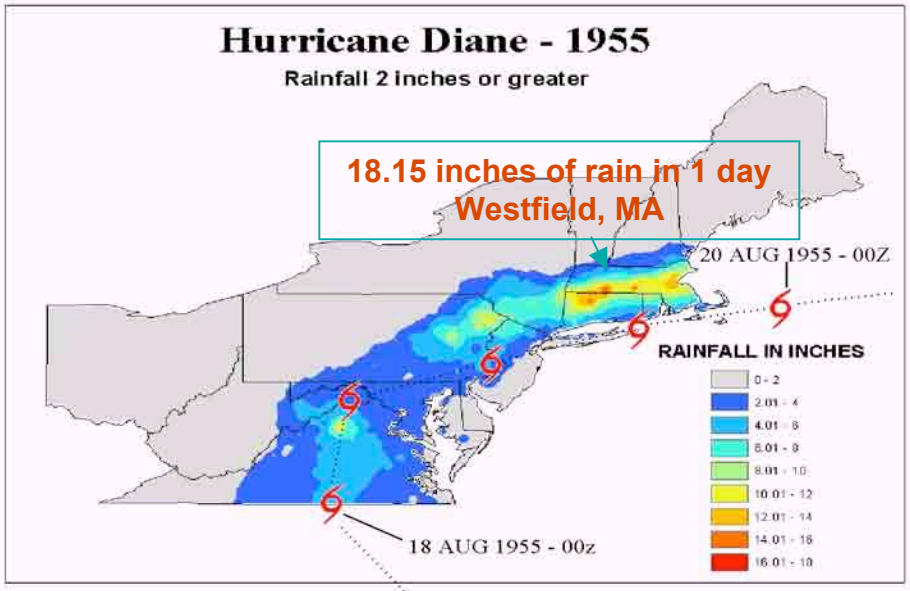
Destroyed Shopping District – Diane 1955
Winsted, CT

FIGURE 3.—Main shopping street of Winsted, Conn., after flood had subsided. Photograph by Hank Murphy, Hartford Times.

Dozens of Dam Failures – Diane 1955
Echo Glen, Charlton, MA

PLATE 6A.—Charlton, Mass. Scene showing dam failure at Glen Echo.

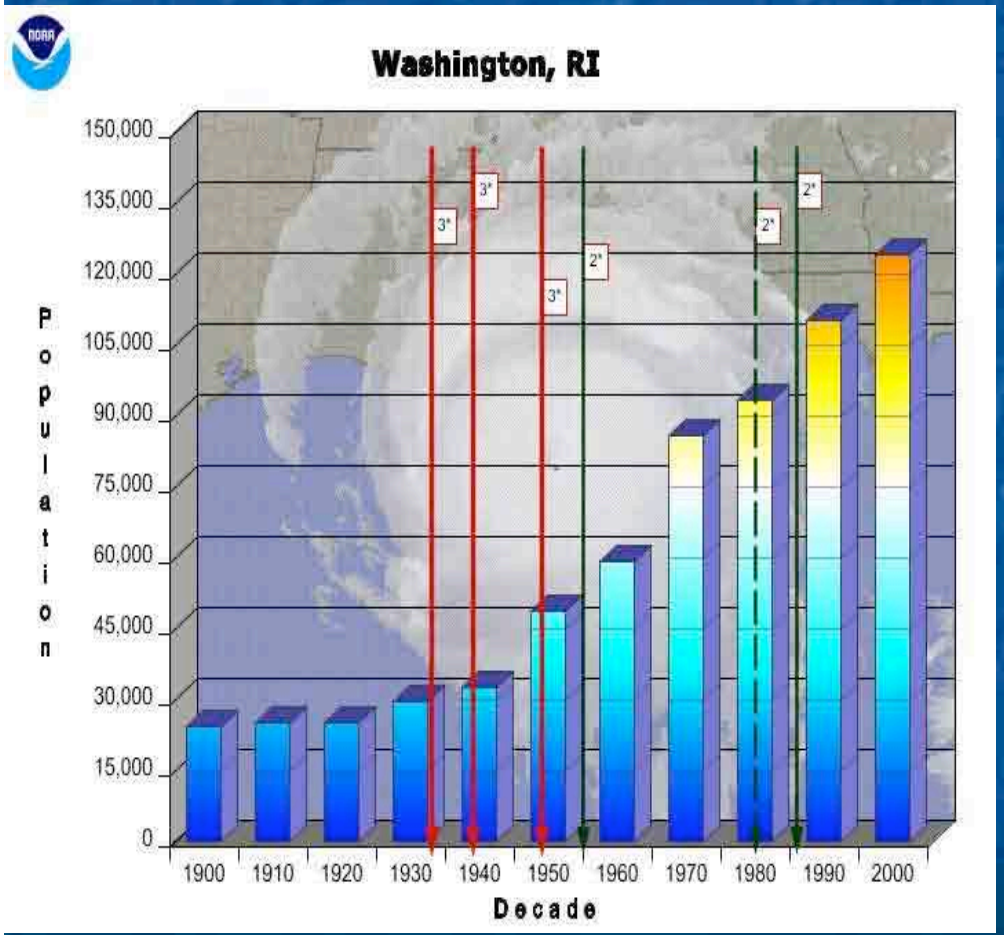


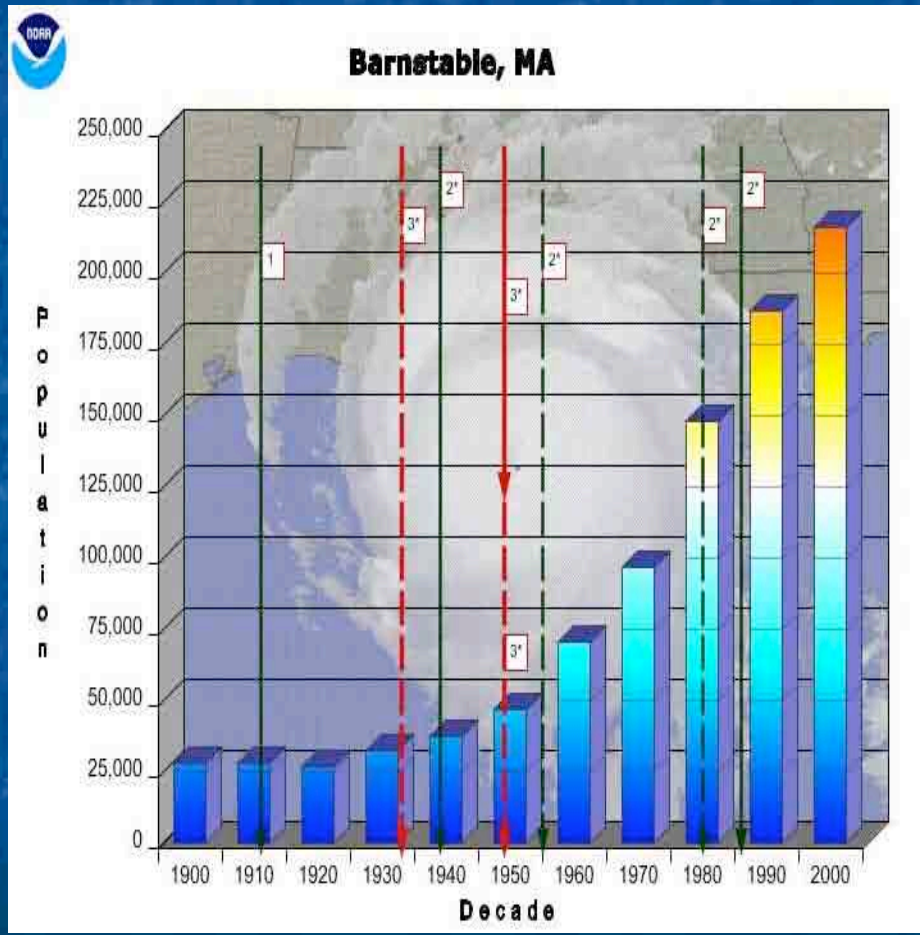


So its just a little water…

- Potential is high for levee breaches and dam failures
- Major flooding of river valleys large and small
  - Are evacuation plans in place and adequate?
  - Environmental impact of clean up/contamination issues
  - What do you do with the debris?
  - What do you do with the people who's homes have been flooded?
  - What do you do related to permitting the rebuilding?
  - Very small percent of folks are in NFIP
  - What about infrastructure:
    - Transportation – road washouts, bridge closures
    - Nursing homes, schools, businesses in the floodplain

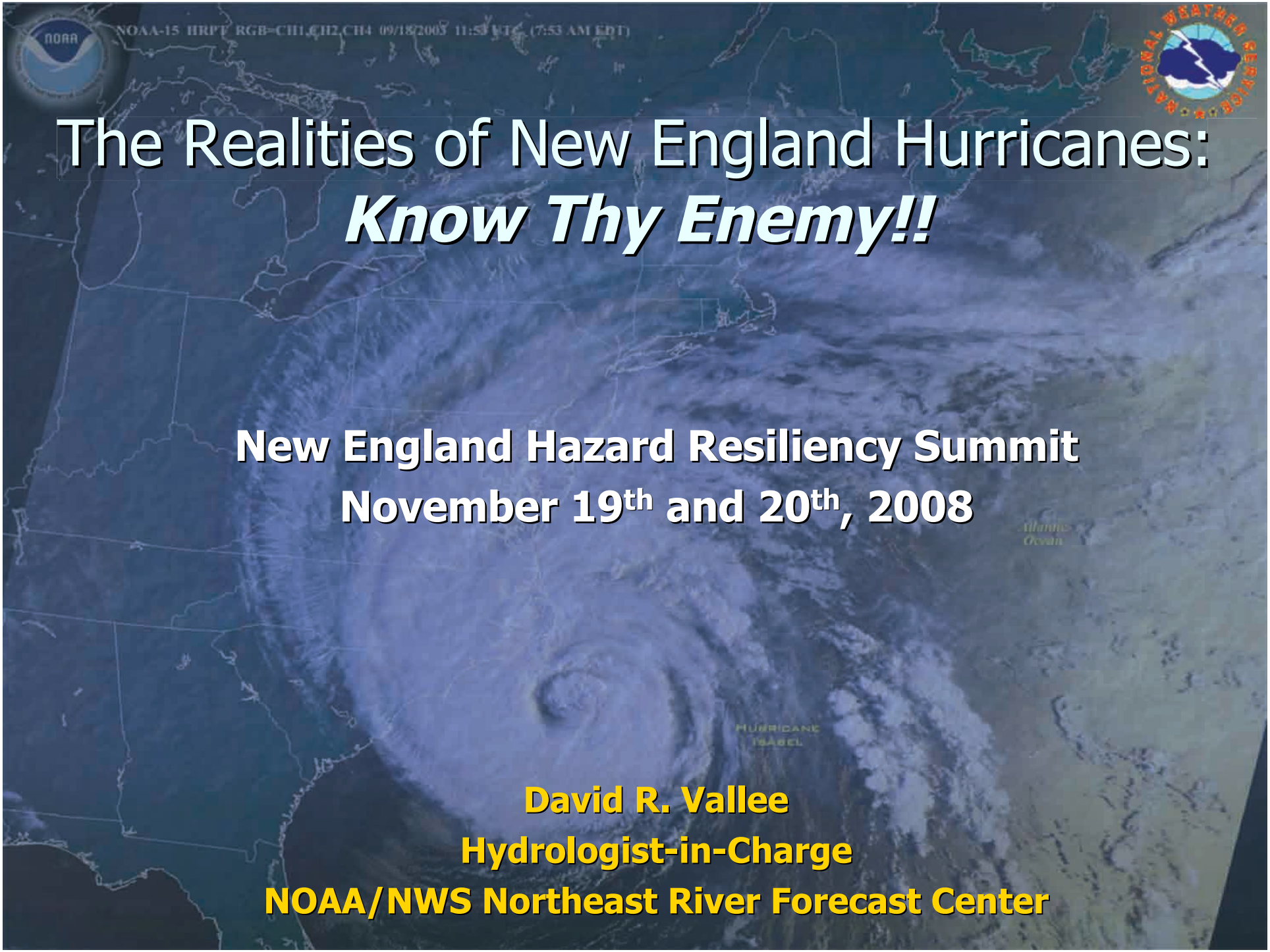
Perhaps our greatest obstacle:
An inexperienced & complacent population…





Summary

- New England Tropical Cyclones have a particular behavior of their own
  - Driven by interaction with the westerlies
  - Desire to become Extra-tropical
- Rapid Acceleration drives the distribution of hazards
- Potential for widespread severe wind damage
- Potential for devastating storm surges
  - 20 feet or more in the upper Sakonnet River and upper Buzzards Bay
- Potential for widespread riverine flooding and flash flooding
  - Damage to neighborhoods, roadways, infrastructure



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