

Coastal Storms of the New Jersey Shore

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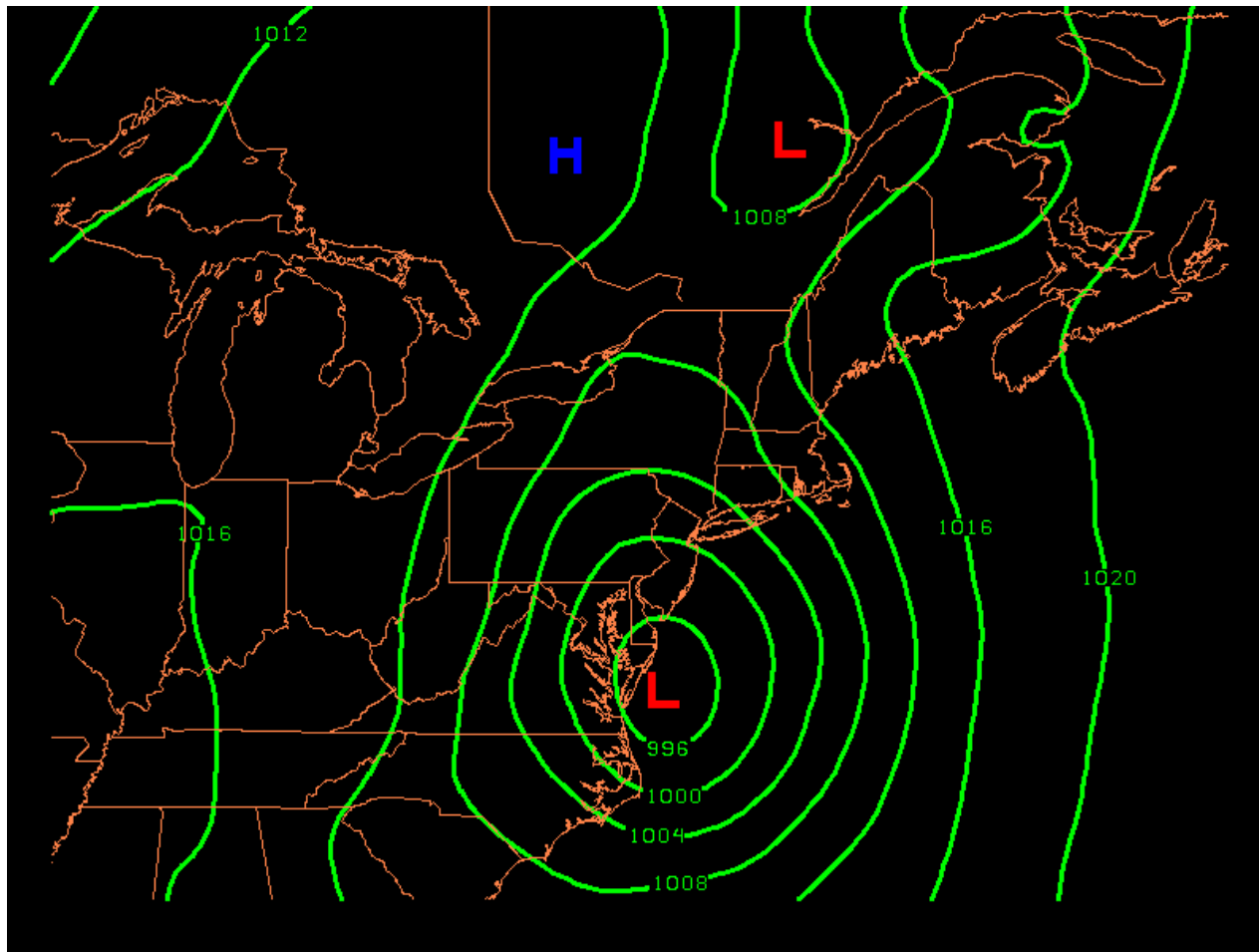
Overview

- Threats
- Historical Examples
 - Nor'easters
 - Tropical Cyclones
- Prospects for the Future

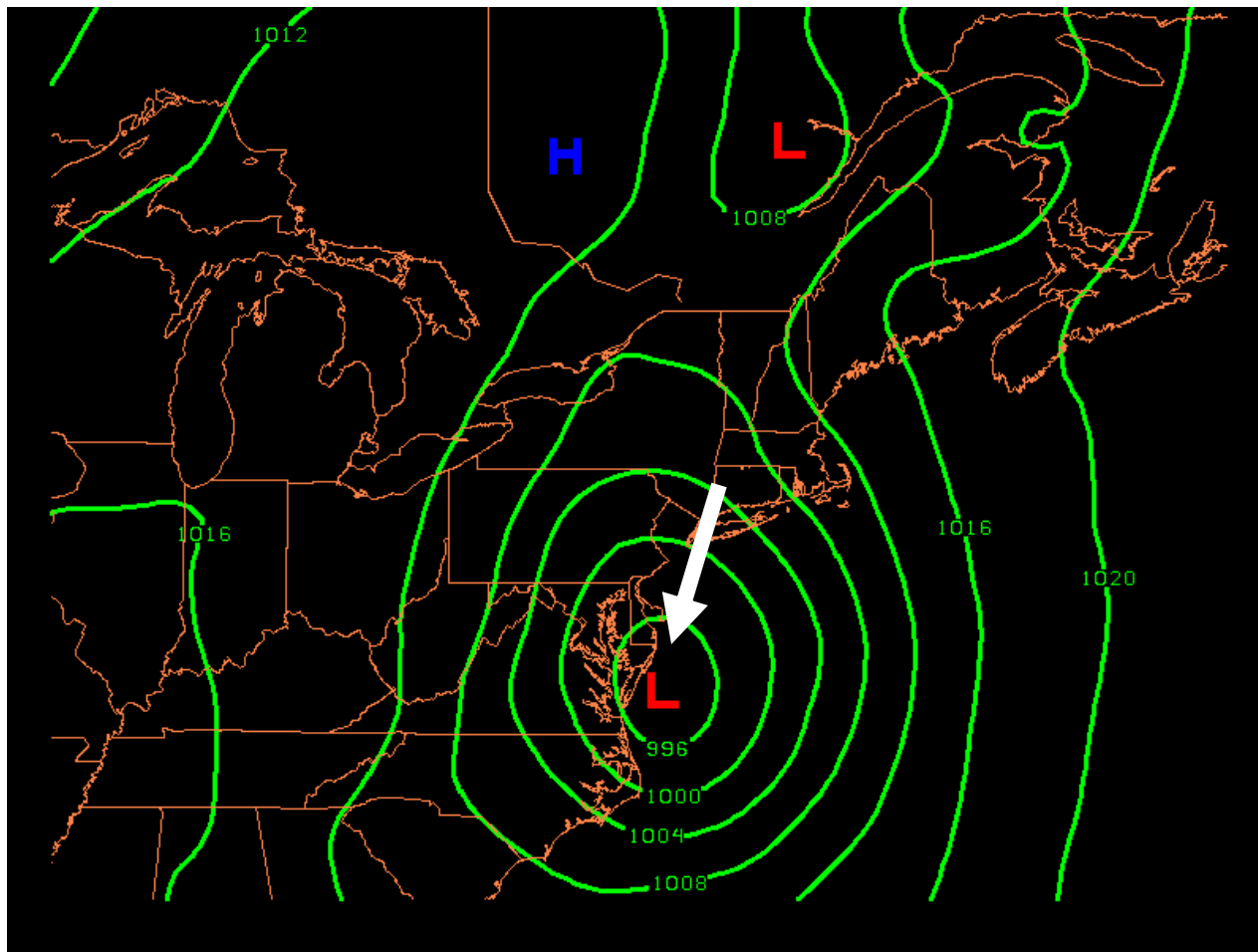
Threats

- Wind damage
 - From cyclones
 - From thunderstorms

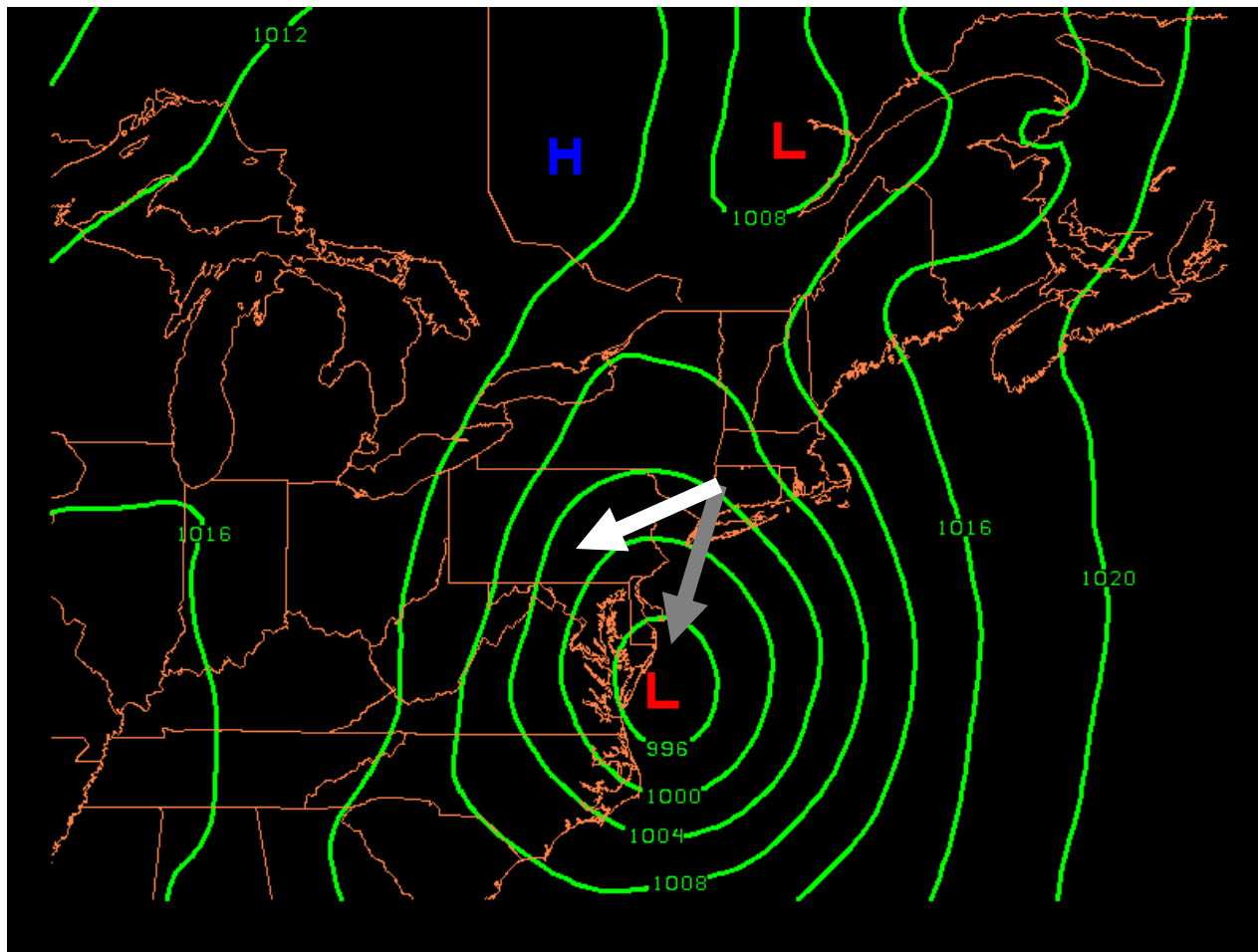
What Drives the Winds? (Cyclone)



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What Drives the Winds? (Thunderstorm)

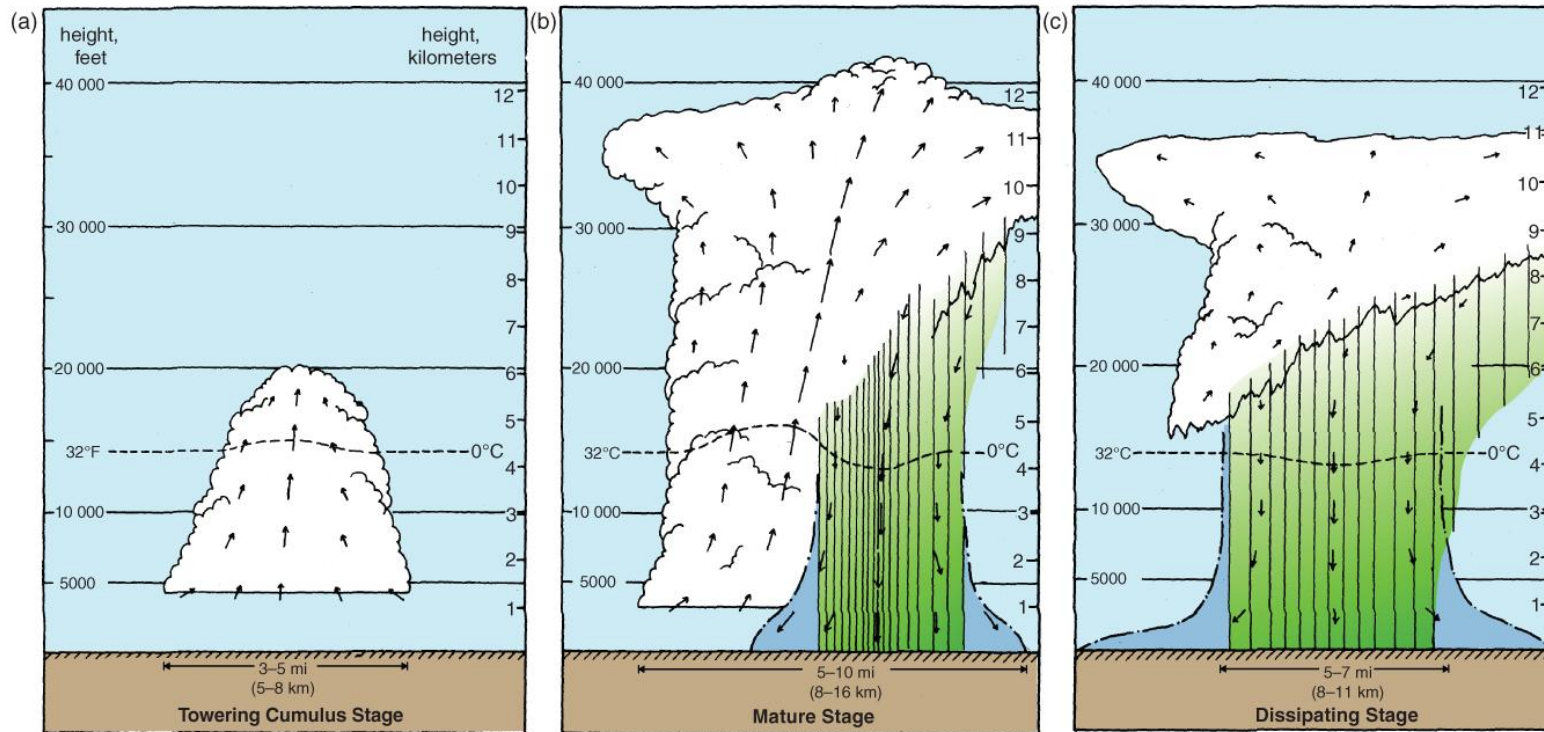


Figure 8.8

The three stages of an ordinary cell: (a) towering cumulus stage, (b) mature stage, and (c) dissipating stage. (Adapted from Byers and Braham [1949] and Doswell [1985].)

Temperature decreases with height faster

Wind changes with height faster

→ Stronger storm

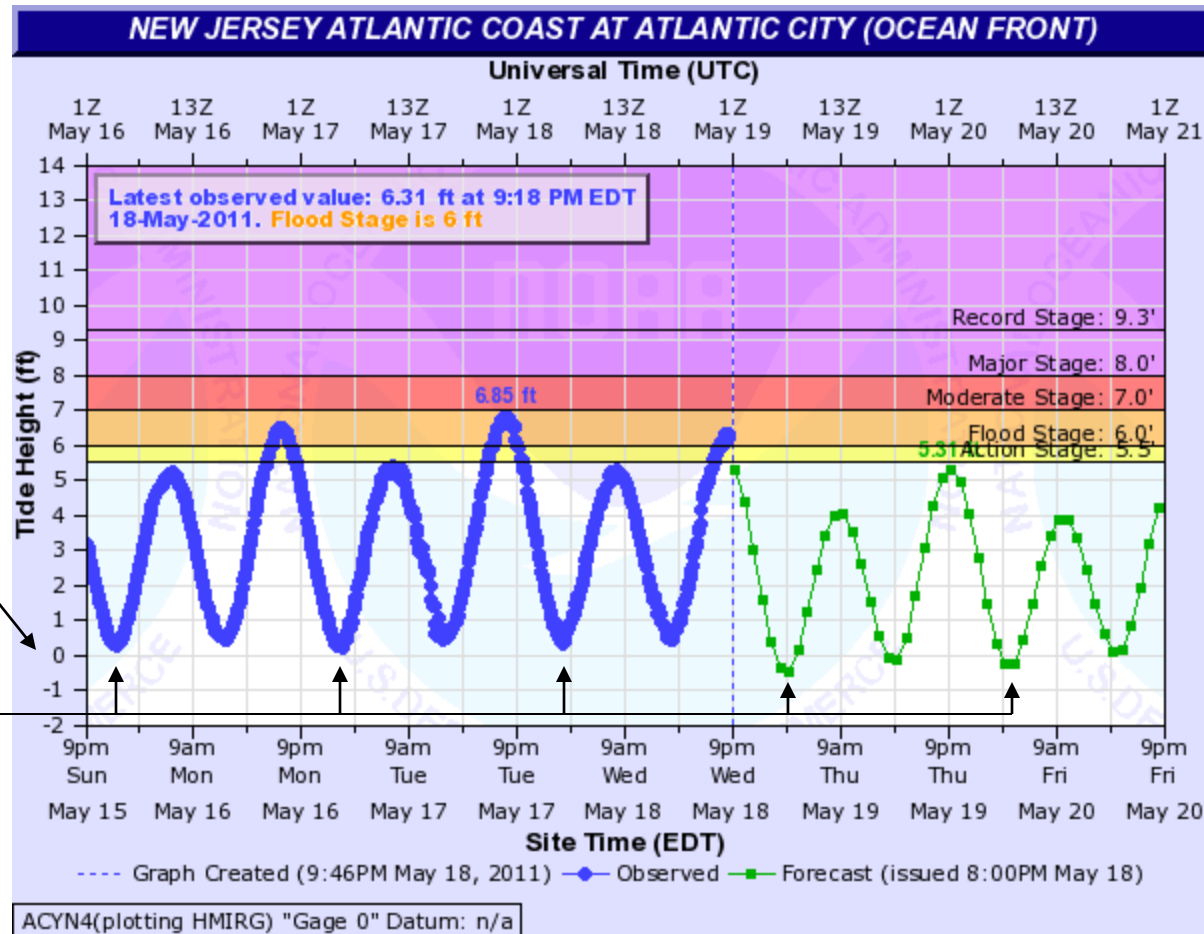
Threats

- Wind damage
 - From cyclones
 - From thunderstorms
- Coastal flooding from storm surge
 - From tropical cyclones
 - From nor'easters

Coastal Flooding

Mean lower
low water
(MLLW)

Lower low
water



Cyclone Track and Position

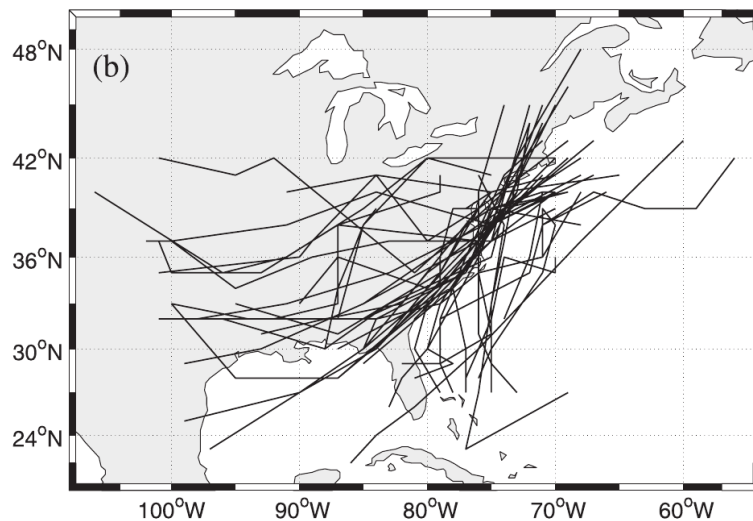


FIG. 11. (a) Cyclone tracks from 48 h before the time of maximum minor surge (0.8–1.0 m) at the Battery to 24 h after maximum surge, every 6 h. (b) As in (a), but for the moderate-surge (>1.0 m) events. The NYC area is denoted by the white box.

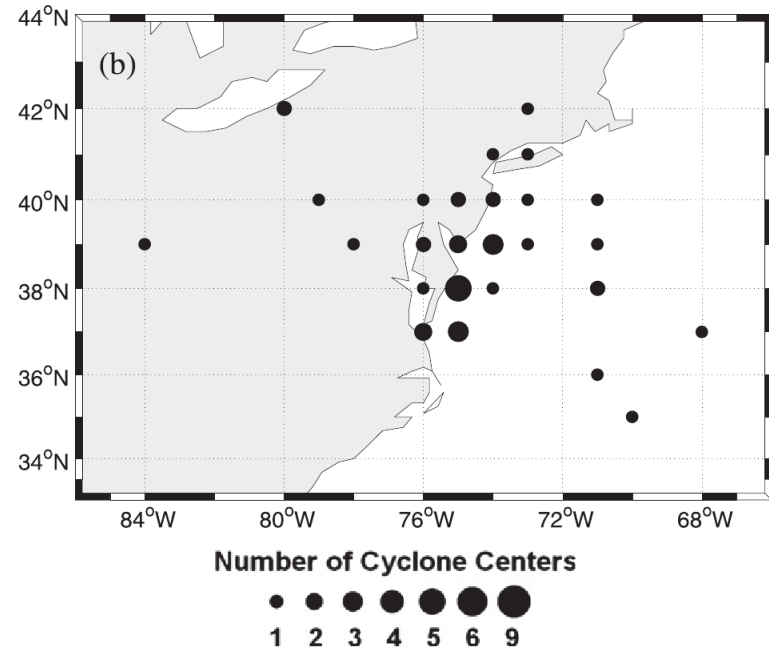
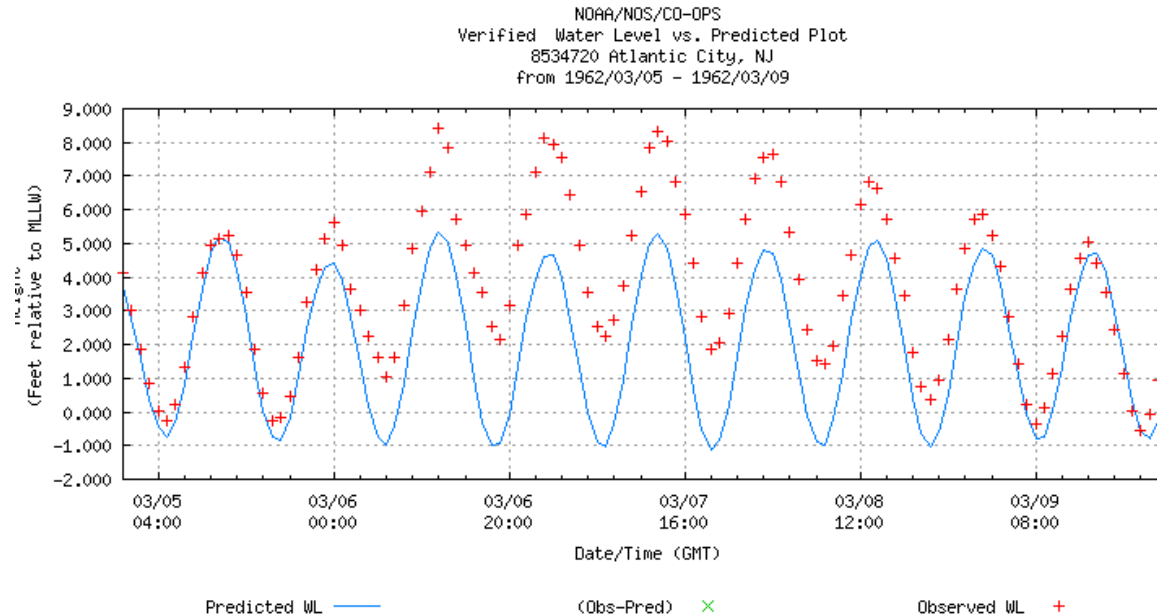


FIG. 12. (a) Surface cyclone position at the time of maximum surge for the surge events between 0.6 and 1.0 m. The number of cyclones every 1.0° of latitude and longitude is given by the filled-circle sizes in the bottom key. (b) As in (a), but for the moderate-surge (>1.0 m) events.

Threats

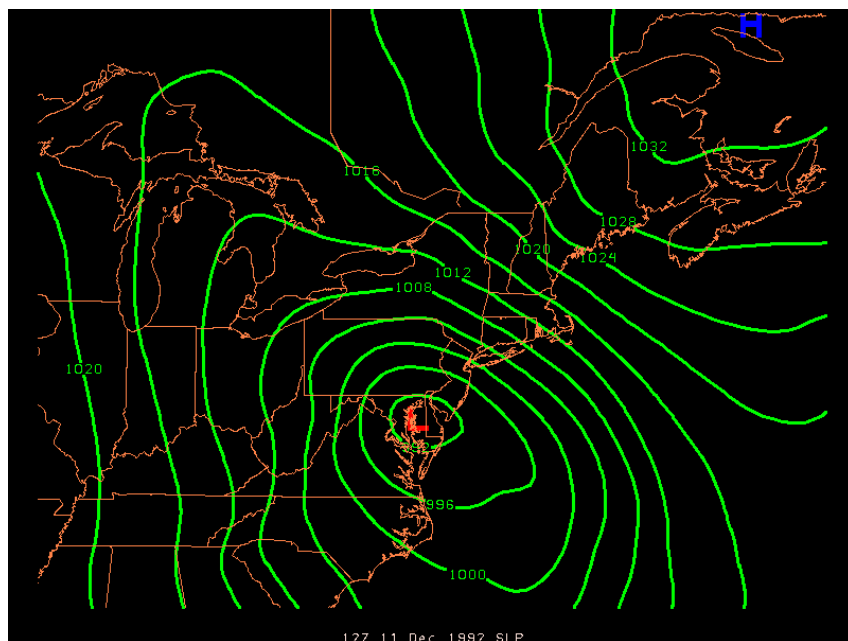
- Wind damage
 - From cyclones
 - From thunderstorms
- Coastal flooding from storm surge
 - From tropical cyclones
 - From nor'easters
- Flooding from heavy rain

Notable Nor'easters



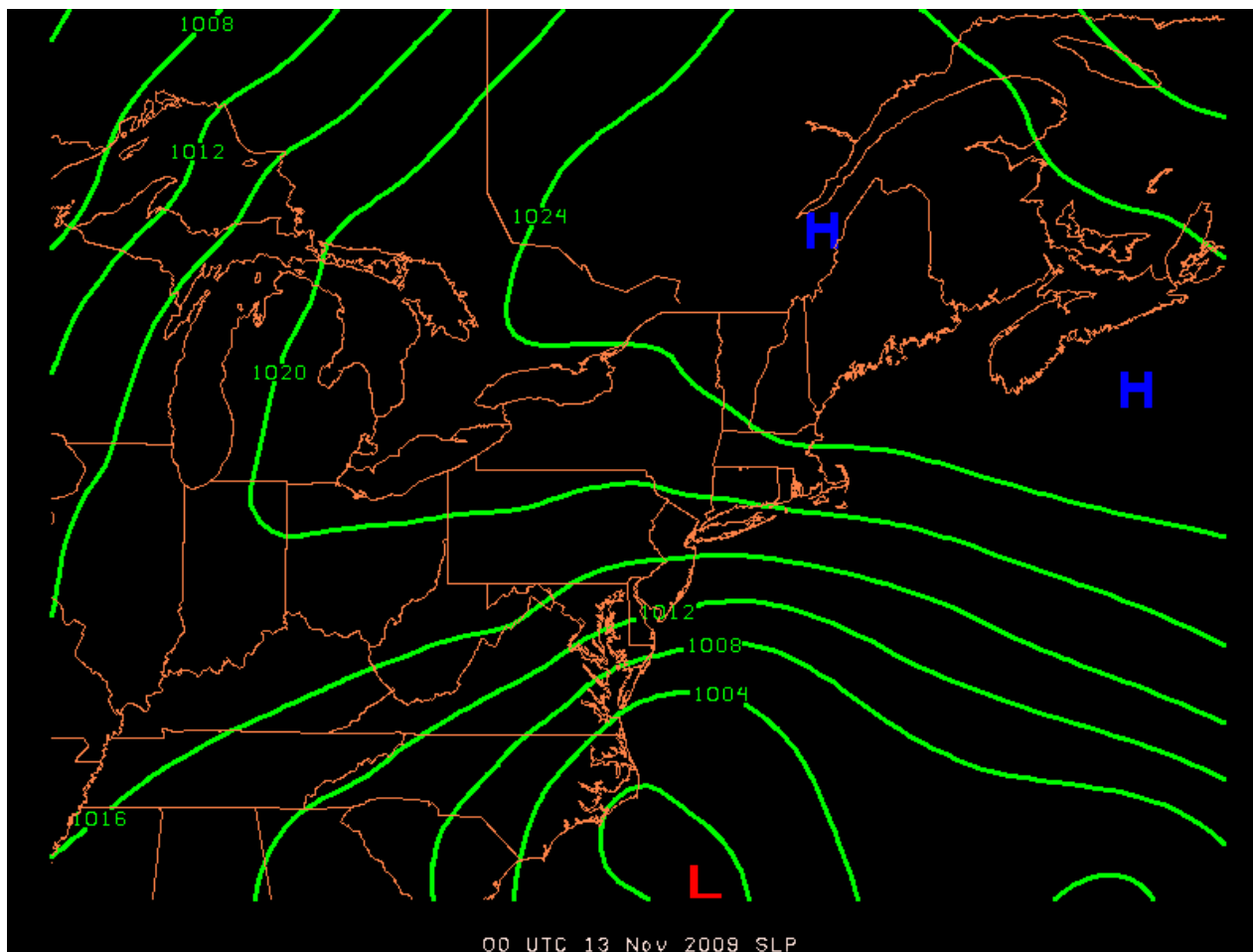
- Ash Wednesday Storm (1962)
- Five high tides
- Extensive damage from Outer Banks to Rhode Island
- Fifth highest tide at Atlantic City

December 1992

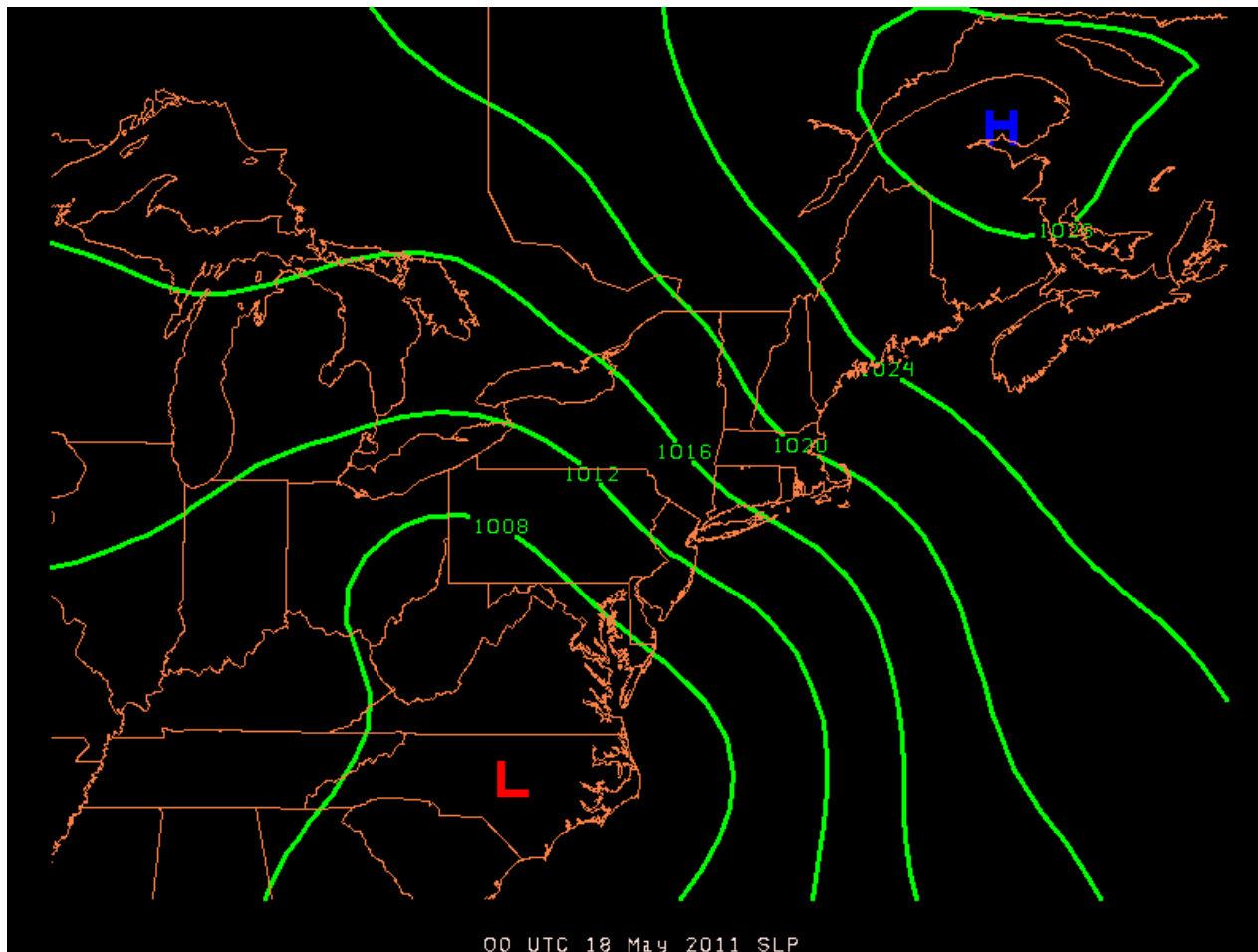


- Preceded by “Perfect Storm”
- Gusts to hurricane force
- Billions in damages

November 2009



Last Week

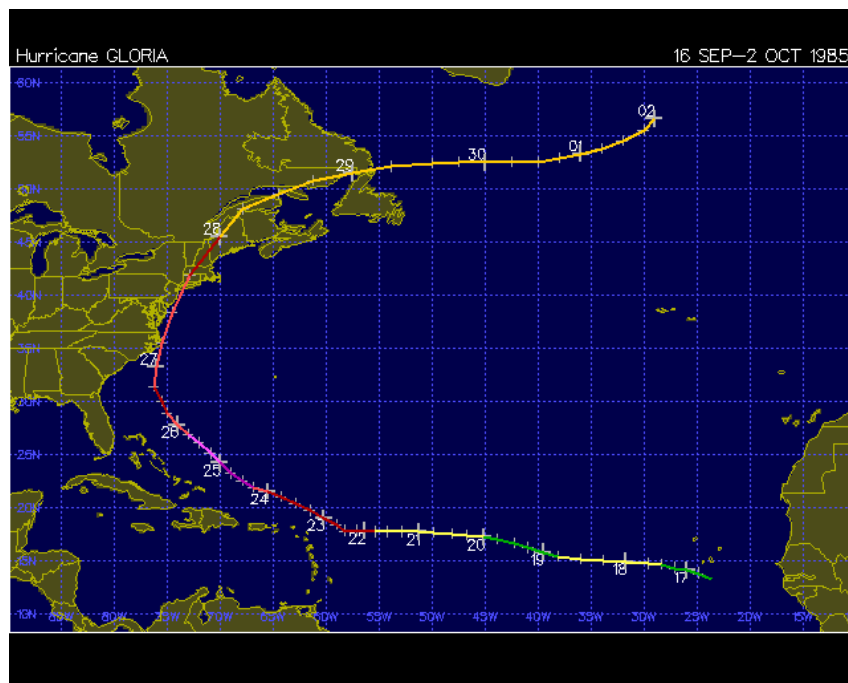


Stationary
Full Moon (Spring Tide)

Hurricanes from the Distant Past

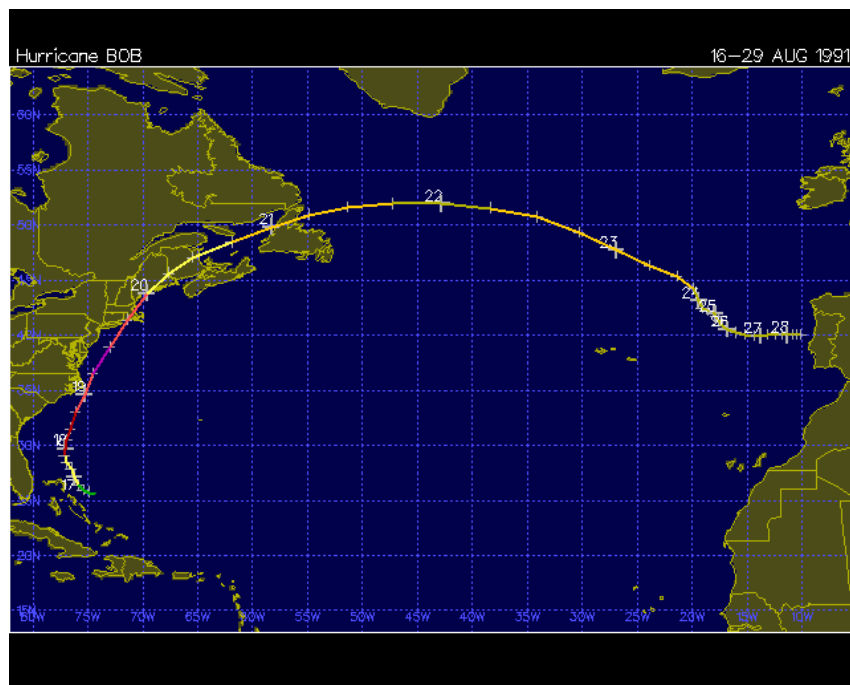
- September 1821
 - Estimated at Category 3
 - Flooded a large portion of southern Manhattan
- September 1903
 - Most recent hurricane to make landfall in NJ
 - Most piers and pavilions in Atlantic City destroyed
- September 1944
 - Remained offshore
 - Extensive damage from Barnegat Bay to Cape May
 - Boardwalks in Atlantic City and Ocean City heavily damaged
 - Many homes on LBI swept out to sea
 - Second-highest storm surge at Atlantic City

Gloria (1985)



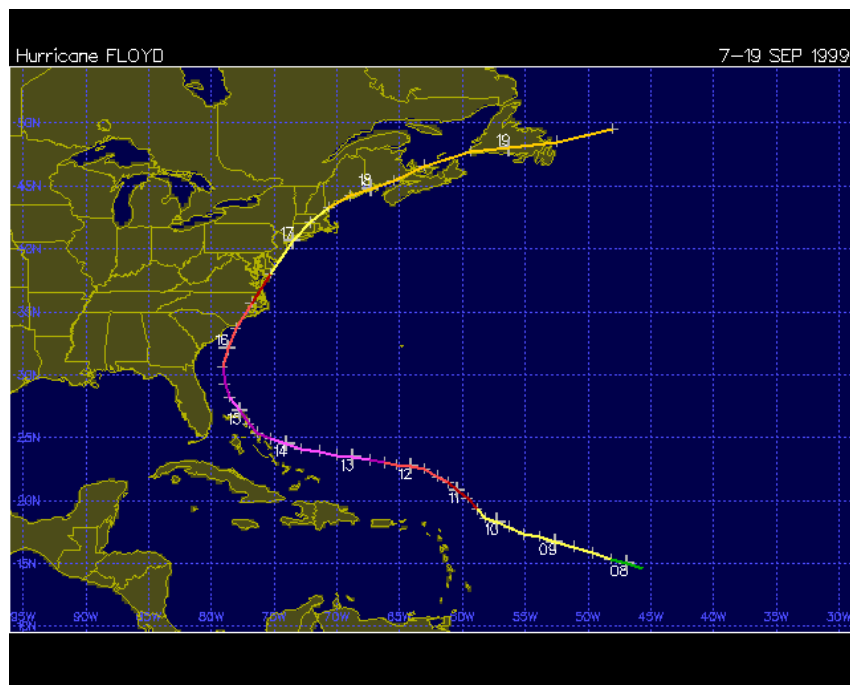
- Paralleled coast just offshore as Category 2 hurricane
- Severe coastal flooding (8 ft above MLLW at Atlantic City)
- Quick movement

Bob (1991)



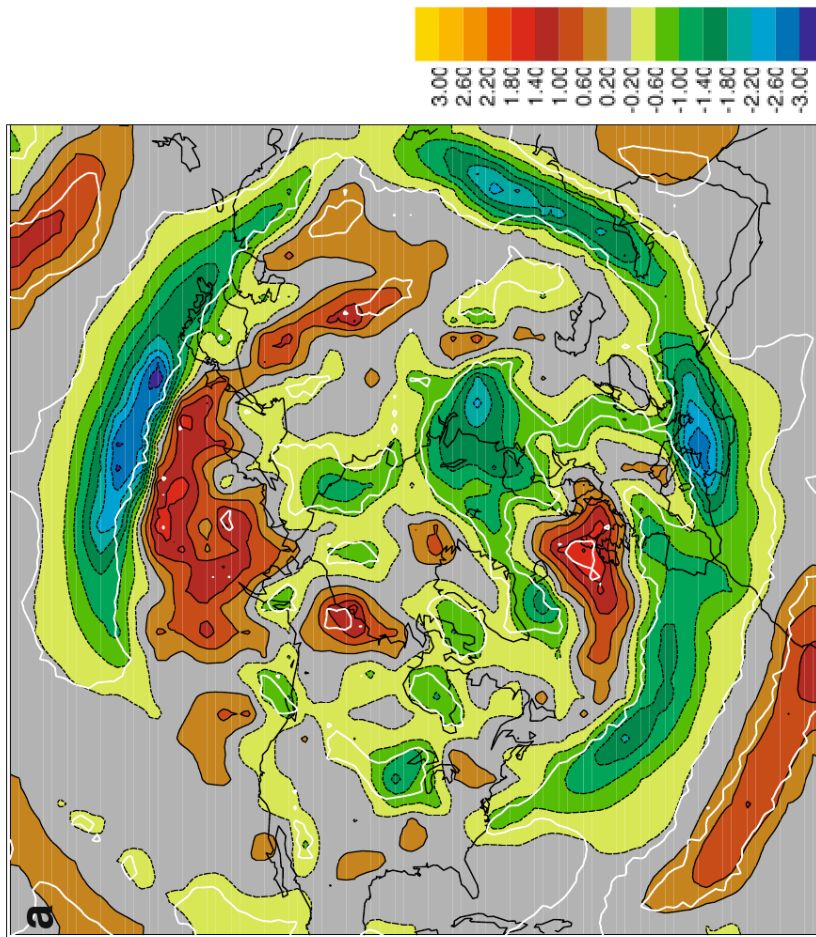
- Offshore track limits impact on NJ
- Last year's Earl even further east

Floyd (1999)



- 5 to 10+ inches of rain across NJ
- Extreme river flooding inland
- Tidal flooding minimal

Prospects for the 21st Century (Nor'easters)



- Development favored when horizontal temperature change is large
- Many studies consider hemisphere
- Midlatitude cyclones are complex
 - Different techniques applied to same data produce different results
- Consensus: Slight decrease

Ulbrich et al. (2009)

Prospects for the 21st Century (Hurricanes)

- Natural Variability
 - 70 year cycle?
 - Active period from 1995 to about 2020
- Climate Change
 - No significant trend over last 100 years
 - SST expected to increase
 - Wind shear expected to increase
 - Fewer tropical cyclones, but 2x Category 4+??
- Caveat: Studies typically focus on Atlantic basin, not NJ

Sea Level Rise Is Main Threat

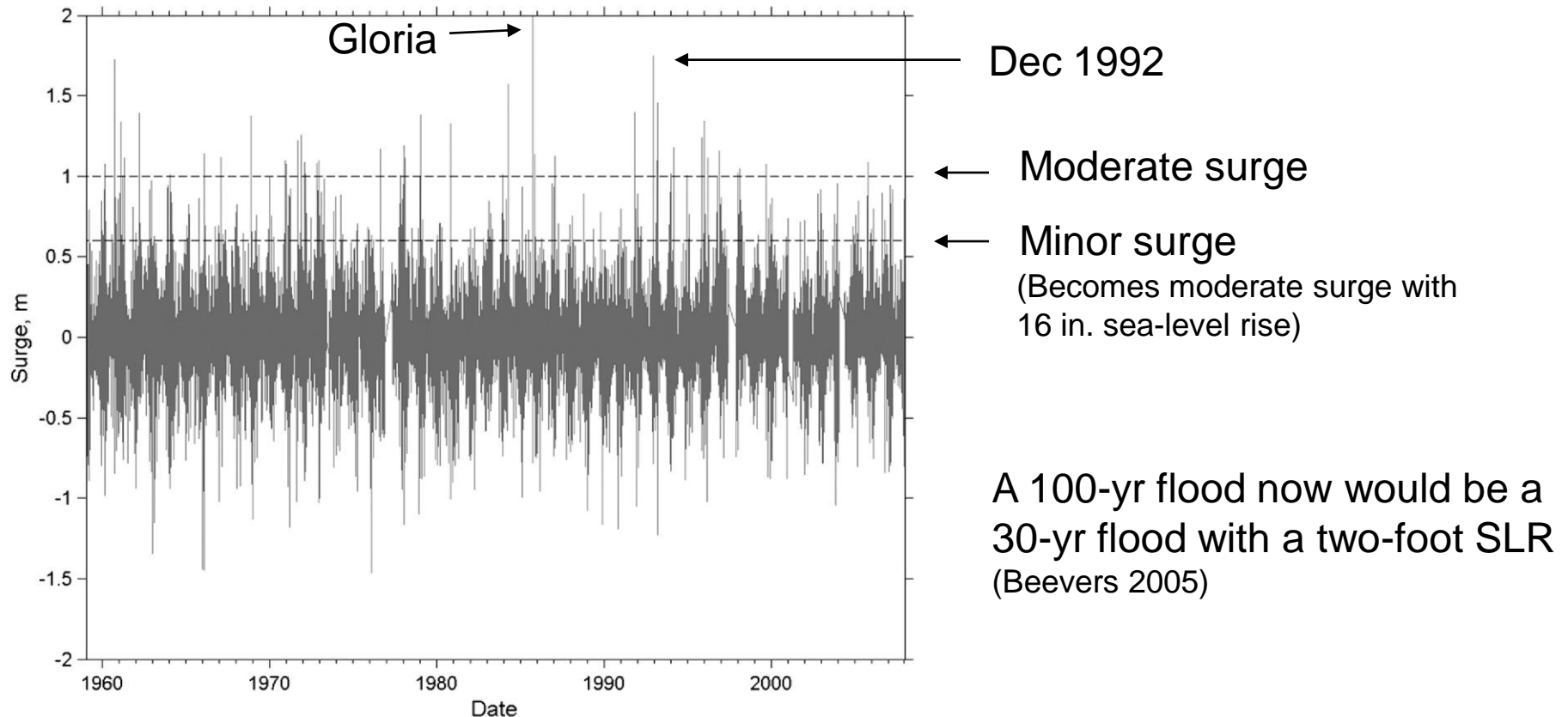
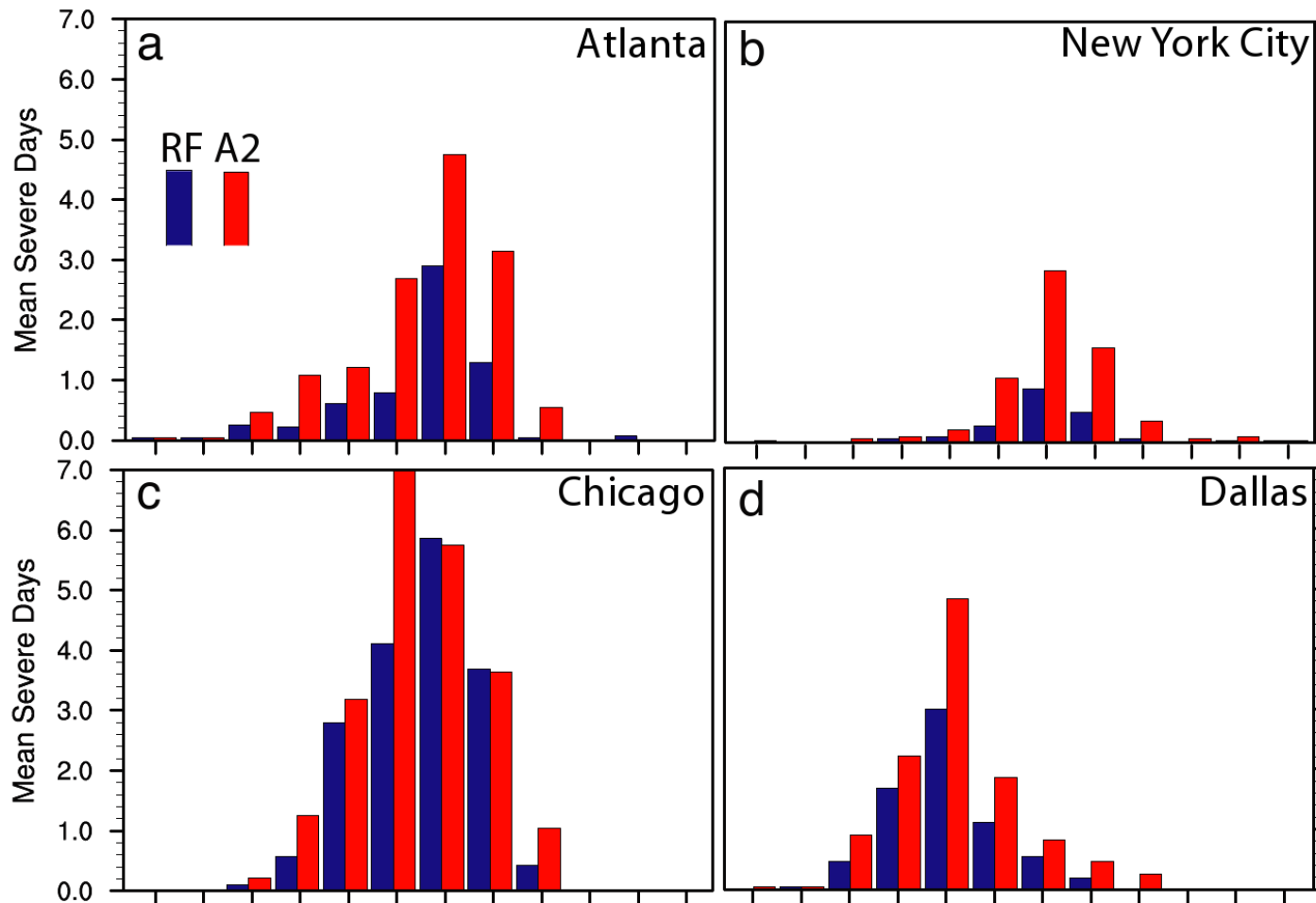


FIG. 2. Time series of the daily maximum positive surge (water level minus astronomical tide) at the Battery (see Fig. 1 for location) between 1959 and 2007. The two dashed lines represent the minor (0.6 m) and moderate (1.0 m) surge thresholds used in this study.

Thunderstorm Severity Could Increase



Conclusions

- Many historical examples demonstrate the Shore's vulnerability to cyclone activity
- Thunderstorms present smaller threat
- Trends in storm activity are uncertain
- Even without changes in storm characteristics, sea level rise will increase impacts