

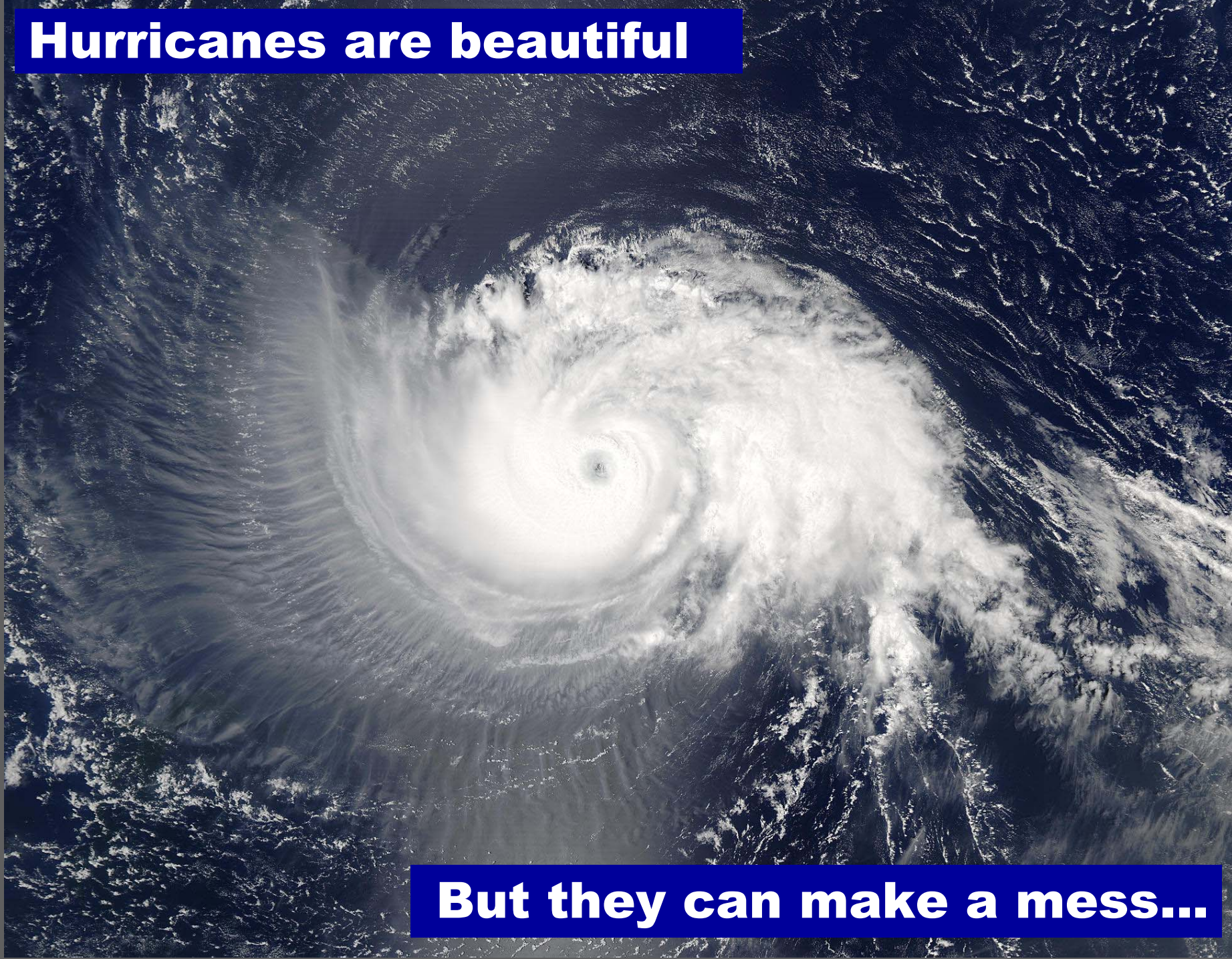
Hurricanes: Human and Economic Impacts



**Hugh E. Willoughby
International Hurricane Research Center at FIU**

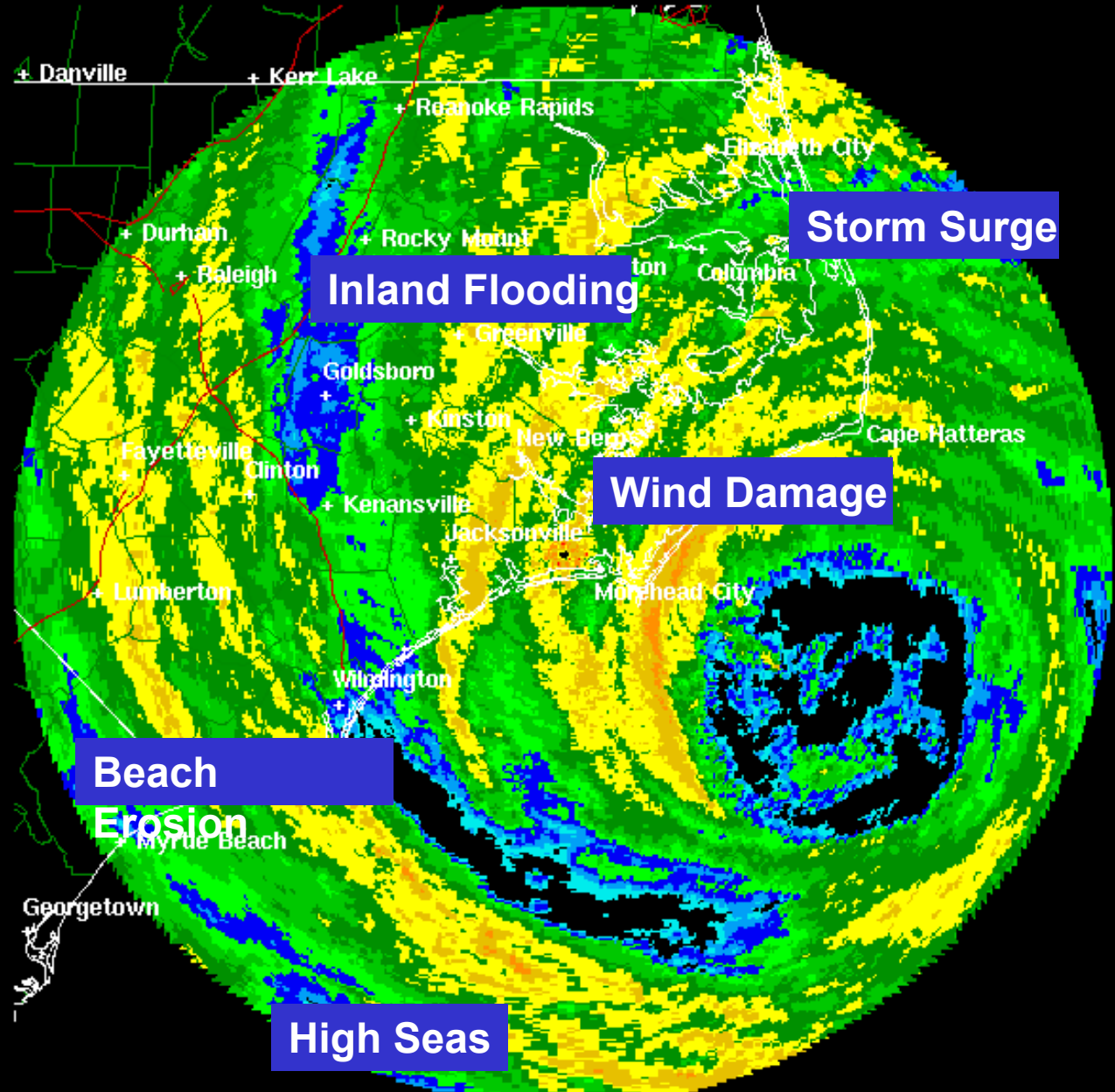


Hurricanes are beautiful



But they can make a mess...

Hurricane Impacts at Landfall



Storm Surge

Inland Flooding

Wind Damage

Beach Erosion

High Seas

Disruption of Communication, Utilities, Transportation, Schedules & Infrastructure

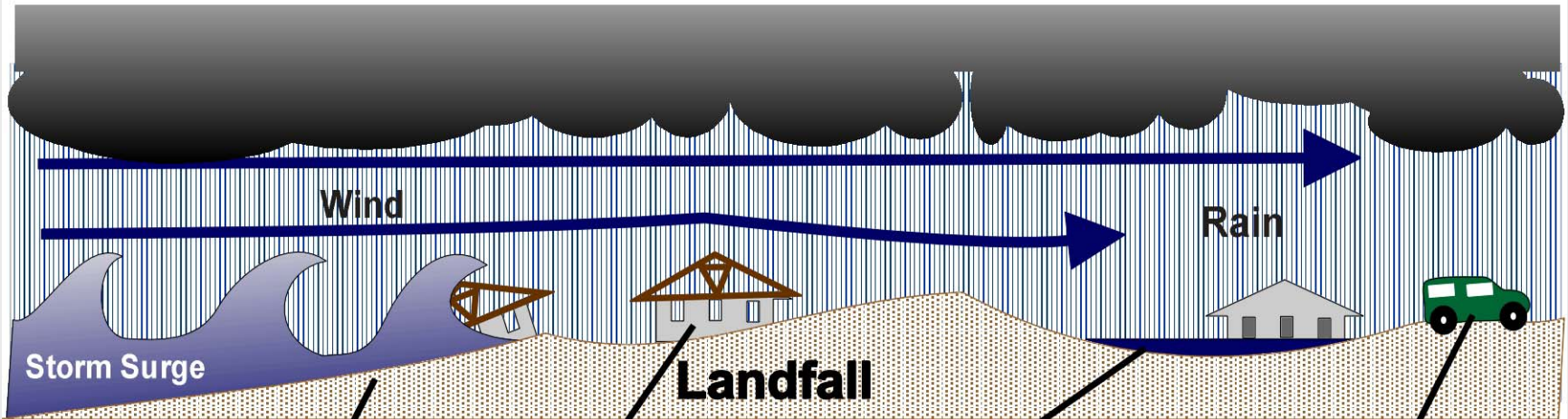
Building Standards
Land Use Regulations
Emergency Planning
Hurricane Research



Taxes — \$\$\$\$ —>
Insurance Premiums
Mortgage and Interest



Pre-Landfall



Wind

Rain

Storm Surge

Landfall

Beach Erosion

Wind Damage

Inland Flooding

Evacuation

Post-Traumatic Stress



Rebuilding

Insurance Payouts
Disaster Relief
Loss of Tax Base

\$\$\$



Post-Landfall

Environmental Degradation

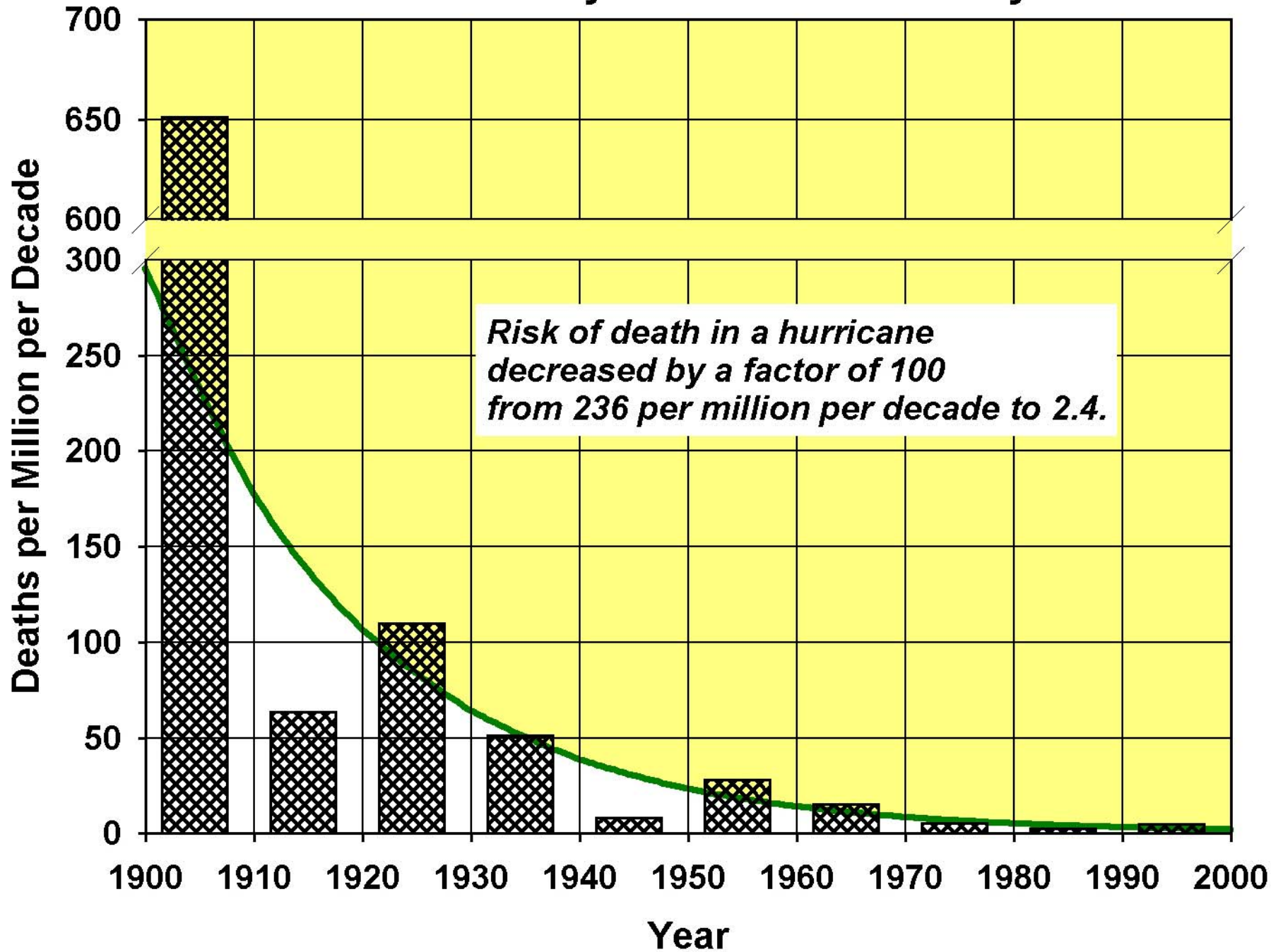
Debris Removal

20th Century Hurricane Experience



AFTER THE DISASTER

20th Century Hurricane Mortality



Storm Surge

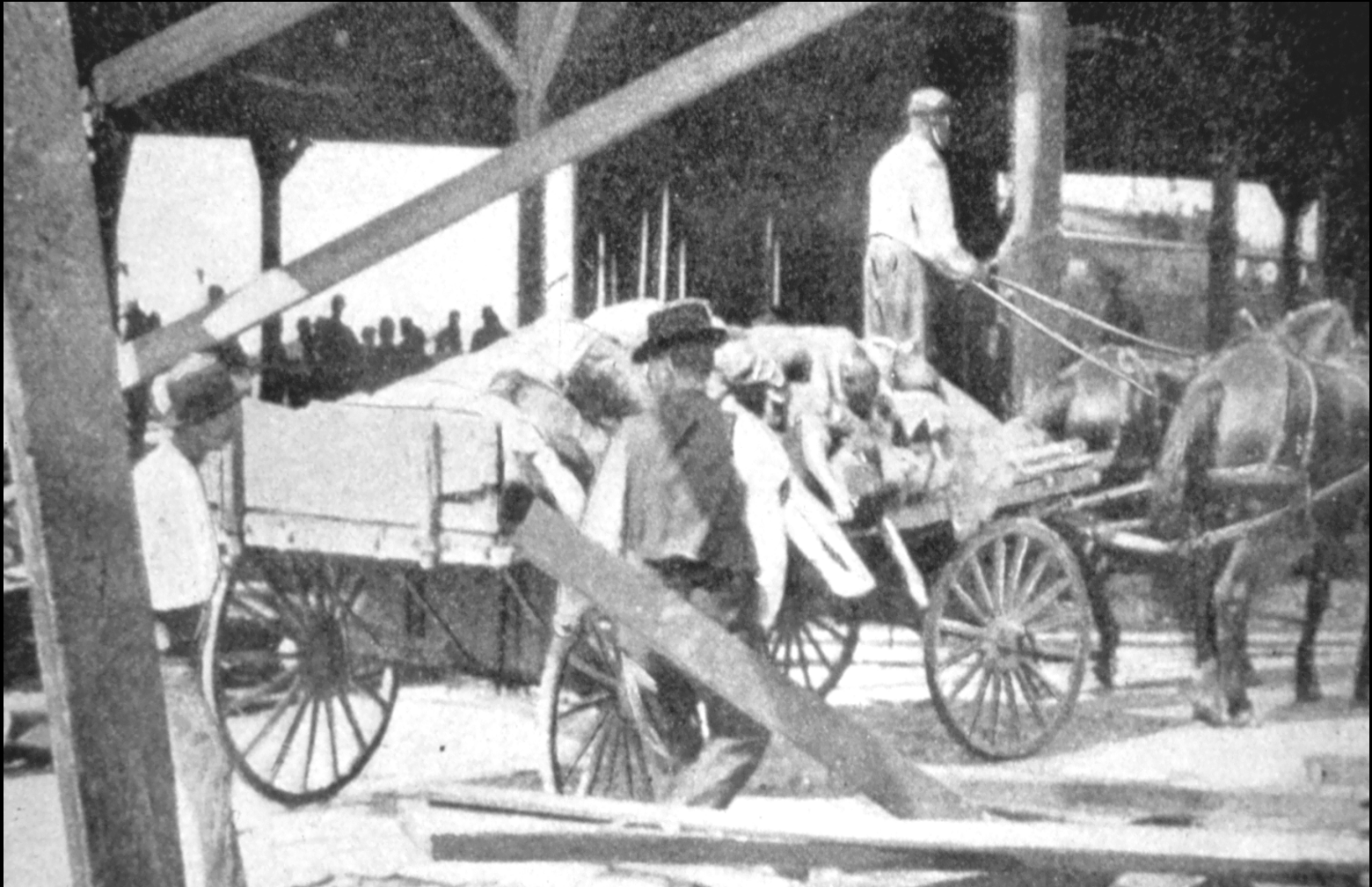


***Evacuation keeps
People from drowning in situations like this.***

Drowning in freshwater flooding



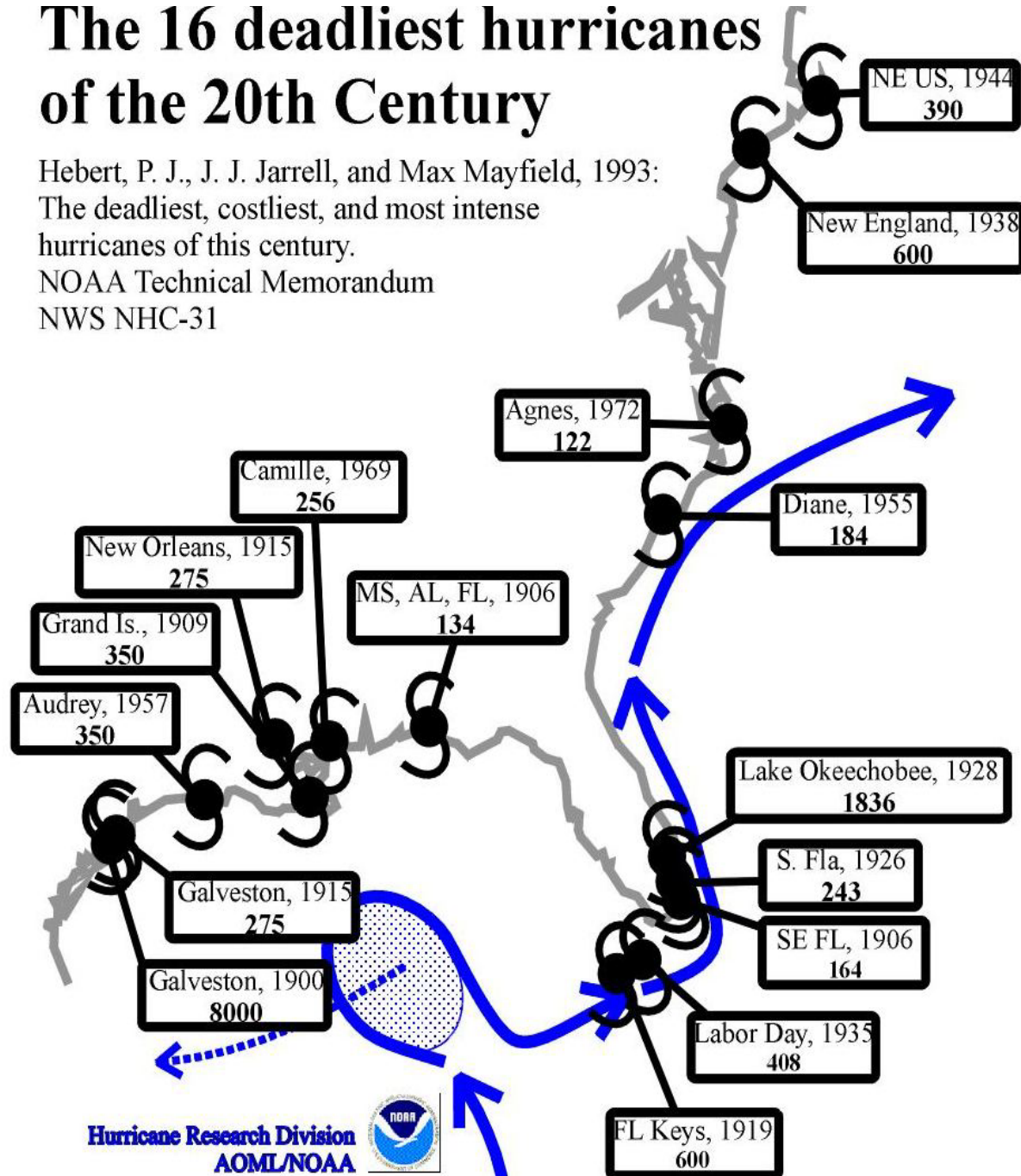
Caused by torrential hurricane rainfall has accounted for 60% of hurricane related deaths since 1970



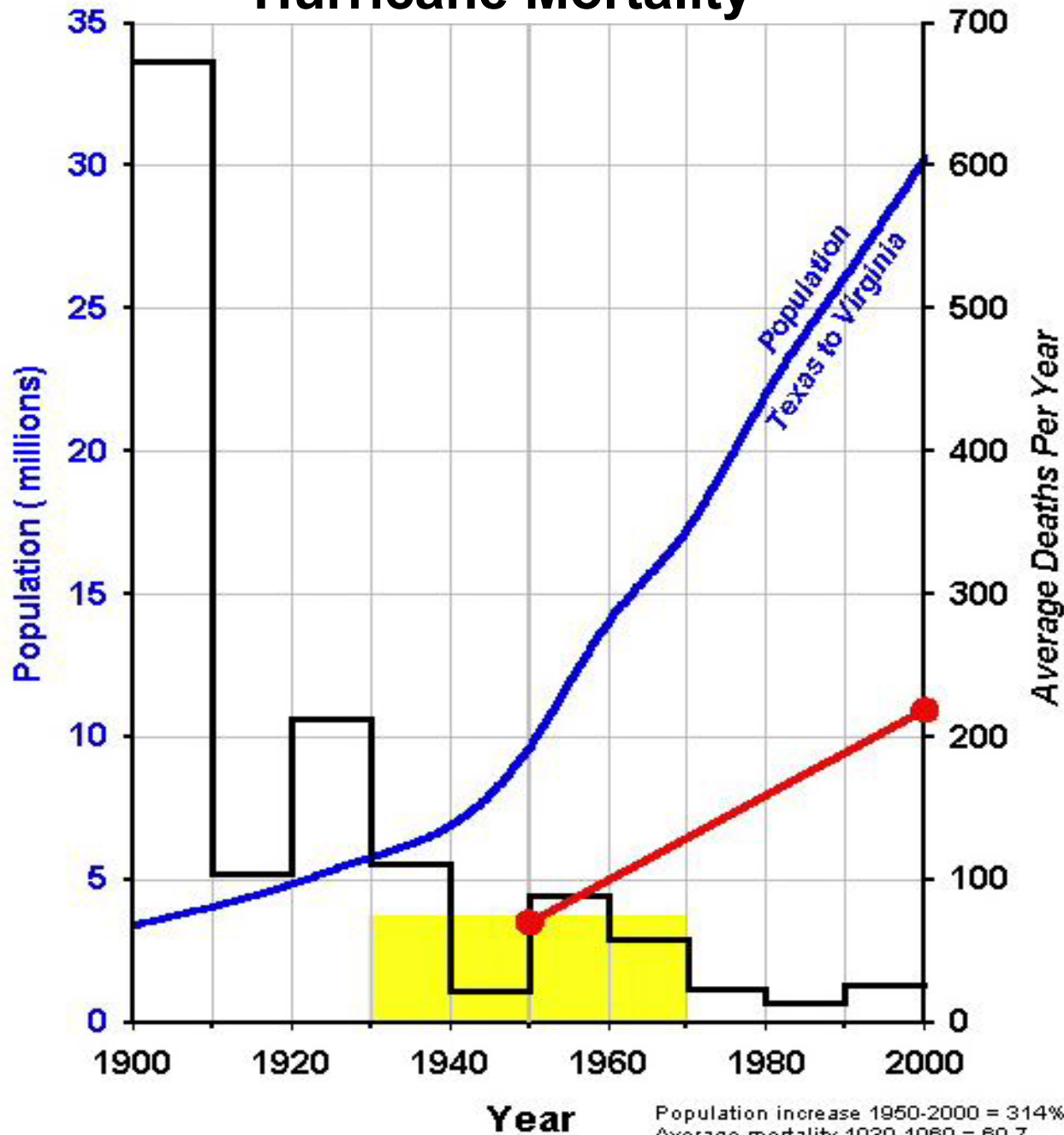
What is the probability of a large (~1000 souls) loss of life in a 21st century hurricane?

The 16 deadliest hurricanes of the 20th Century

Hebert, P. J., J. J. Jarrell, and Max Mayfield, 1993:
The deadliest, costliest, and most intense
hurricanes of this century.
NOAA Technical Memorandum
NWS NHC-31



Hurricane Mortality



We would lose an average of 218 people a year if we were forecasting with the same skill that we had in 1950.

Population increase 1950-2000 = 314%
Average mortality 1930-1969 = 69.7
Extrapolated mortality = $69.6 \times 3.14 = 219$

Value of a Human Life

Based upon premium paid to workers in hazardous occupations divided by number of deaths

Biased toward blue collar workers, male, young

\$1.6-8.4M in 1986

Or \$2.4-12.7M currently assuming 150% inflation

A conservative value is \$5M



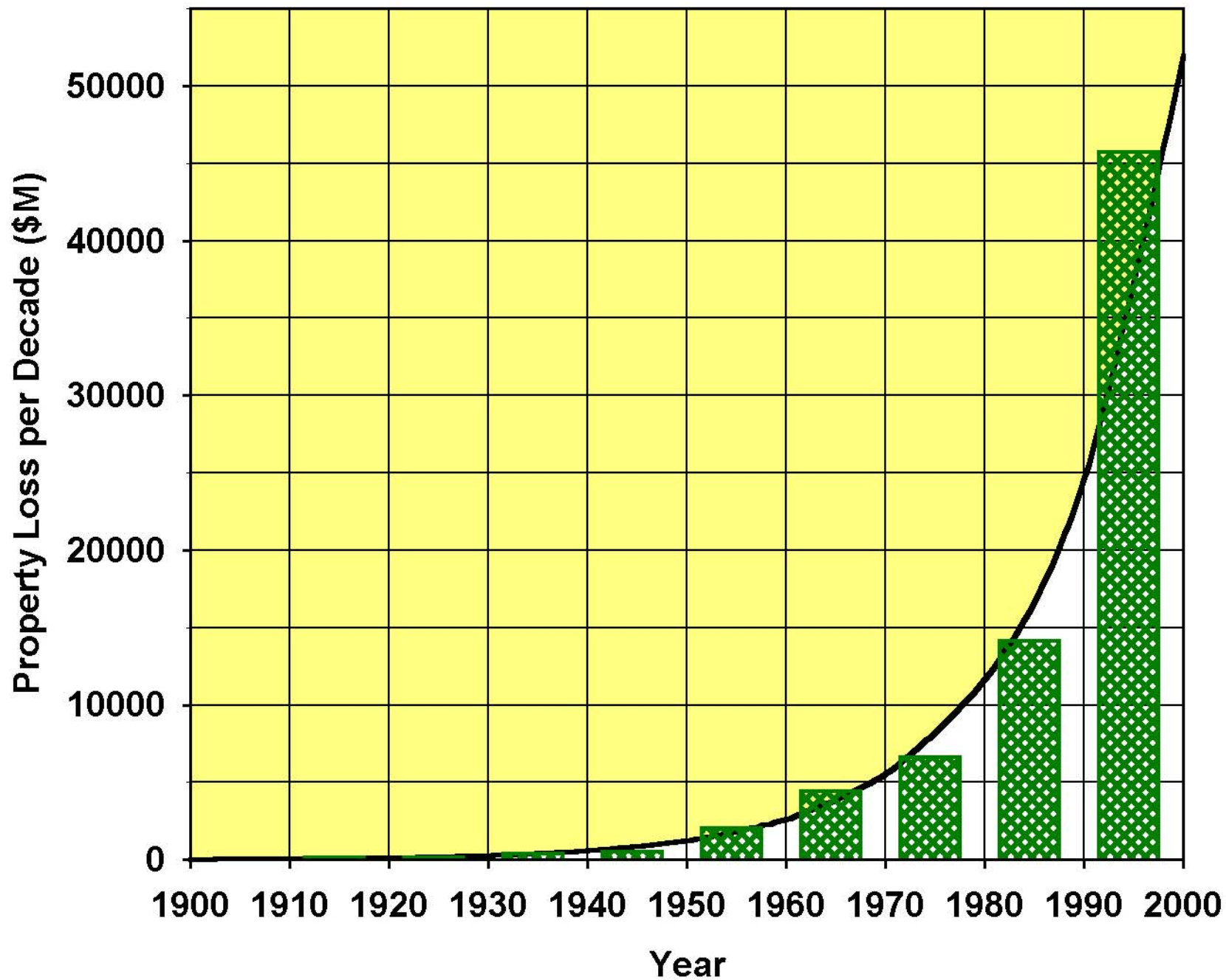
Value of Prevented Mortality

$\$5\text{M} \times (218-25) = \965M saved
in impacts of mortality

Property Damage



20th Century Raw Hurricane Property Loss



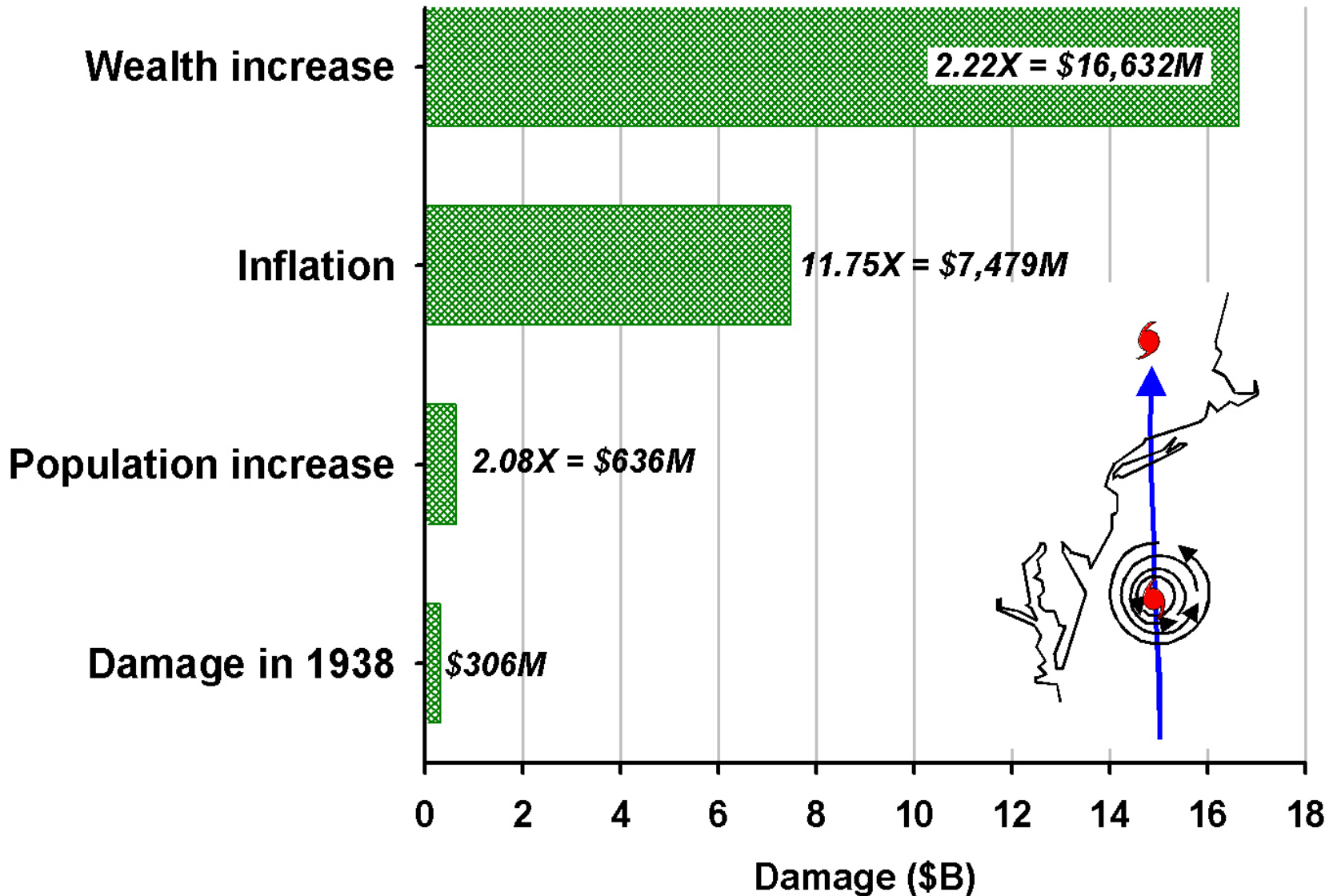
**Everybody wants a view
like this**



APPEND PART 2 HERE

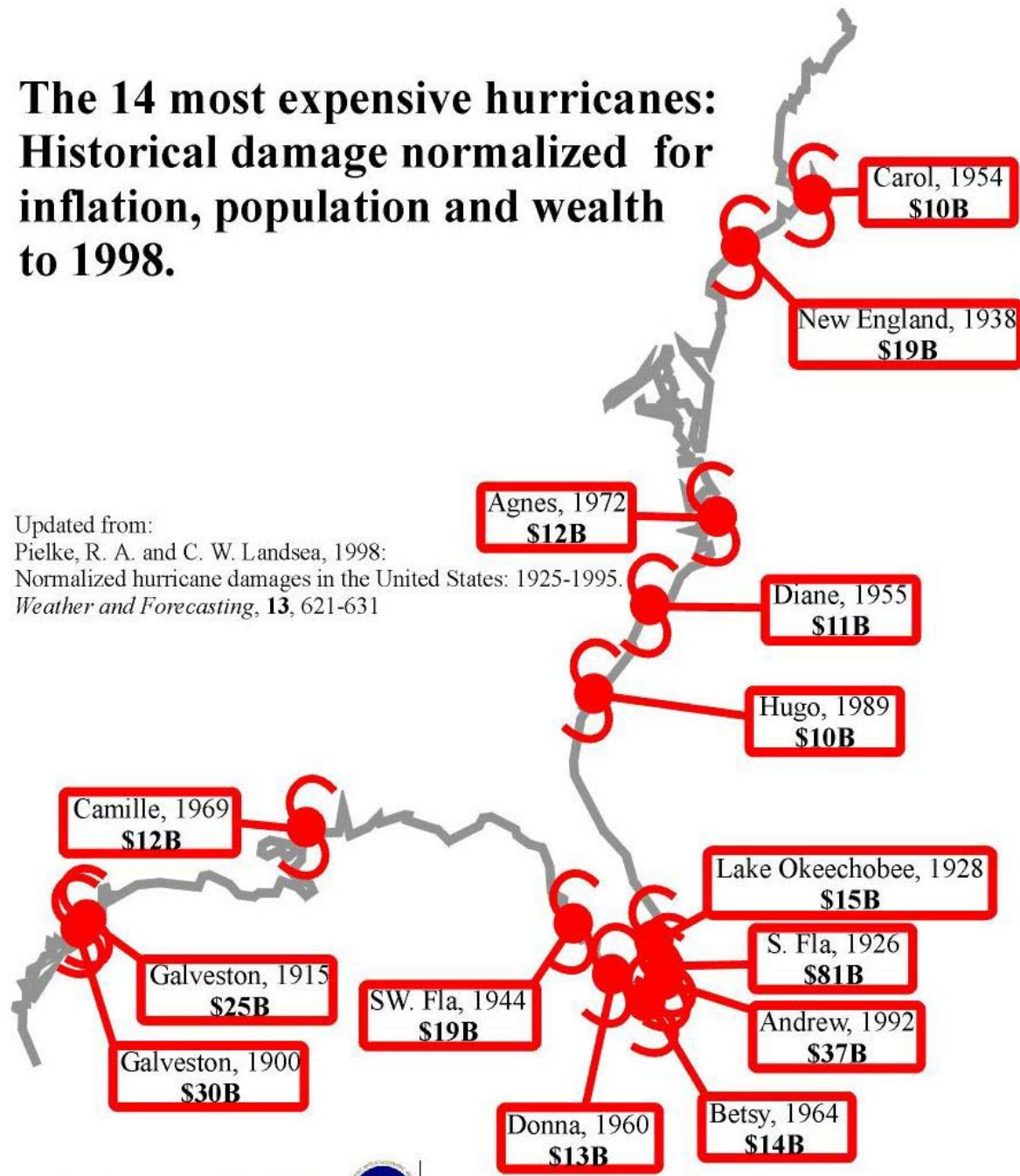
APPEND PART 1 HERE

Damage From the 1938 New England Hurricane Normalized to 1995

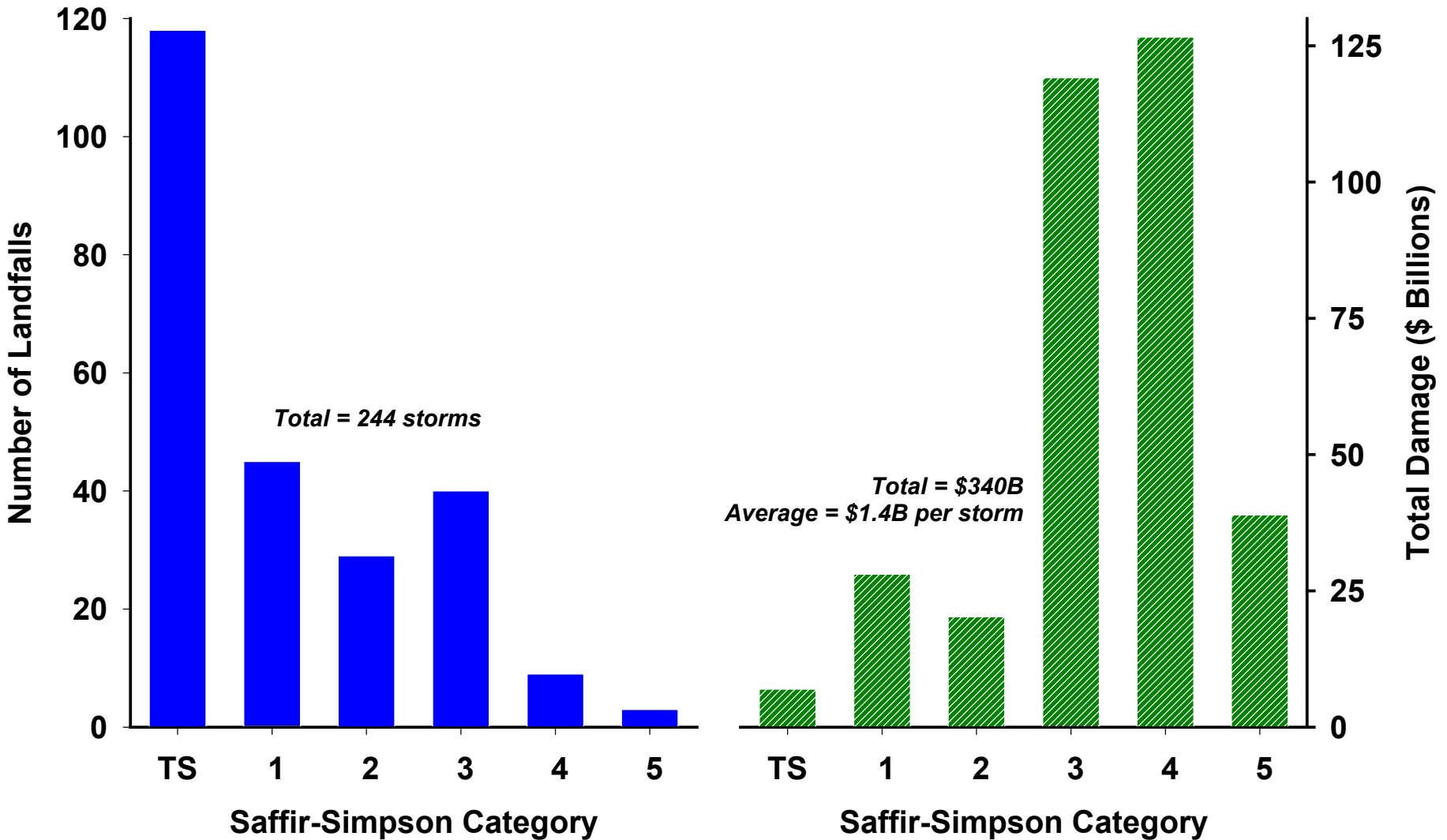


The 14 most expensive hurricanes: Historical damage normalized for inflation, population and wealth to 1998.

Updated from:
Pielke, R. A. and C. W. Landsea, 1998:
Normalized hurricane damages in the United States: 1925-1995.
Weather and Forecasting, 13, 621-631

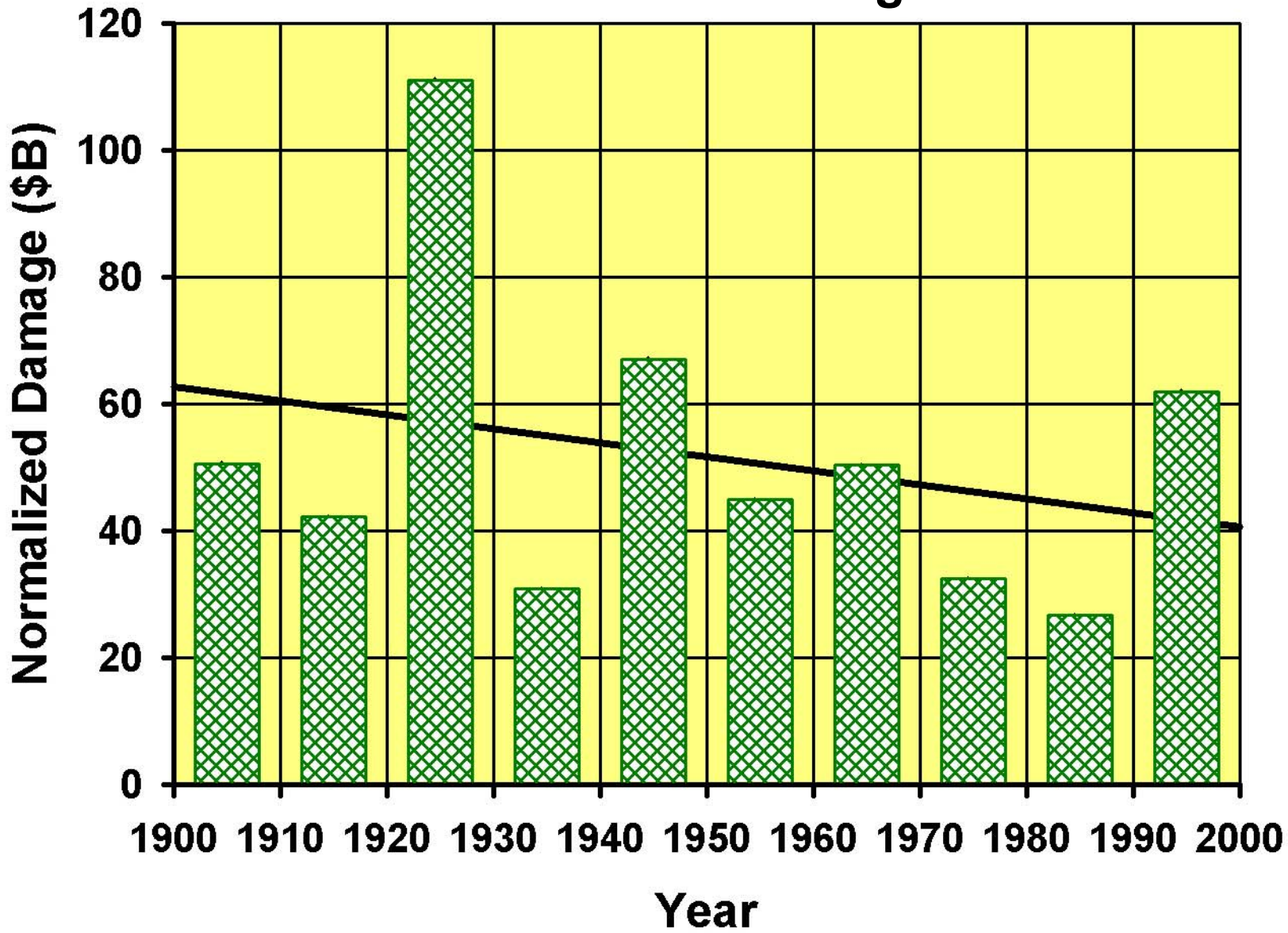


U. S. Landfalls 1925-1995

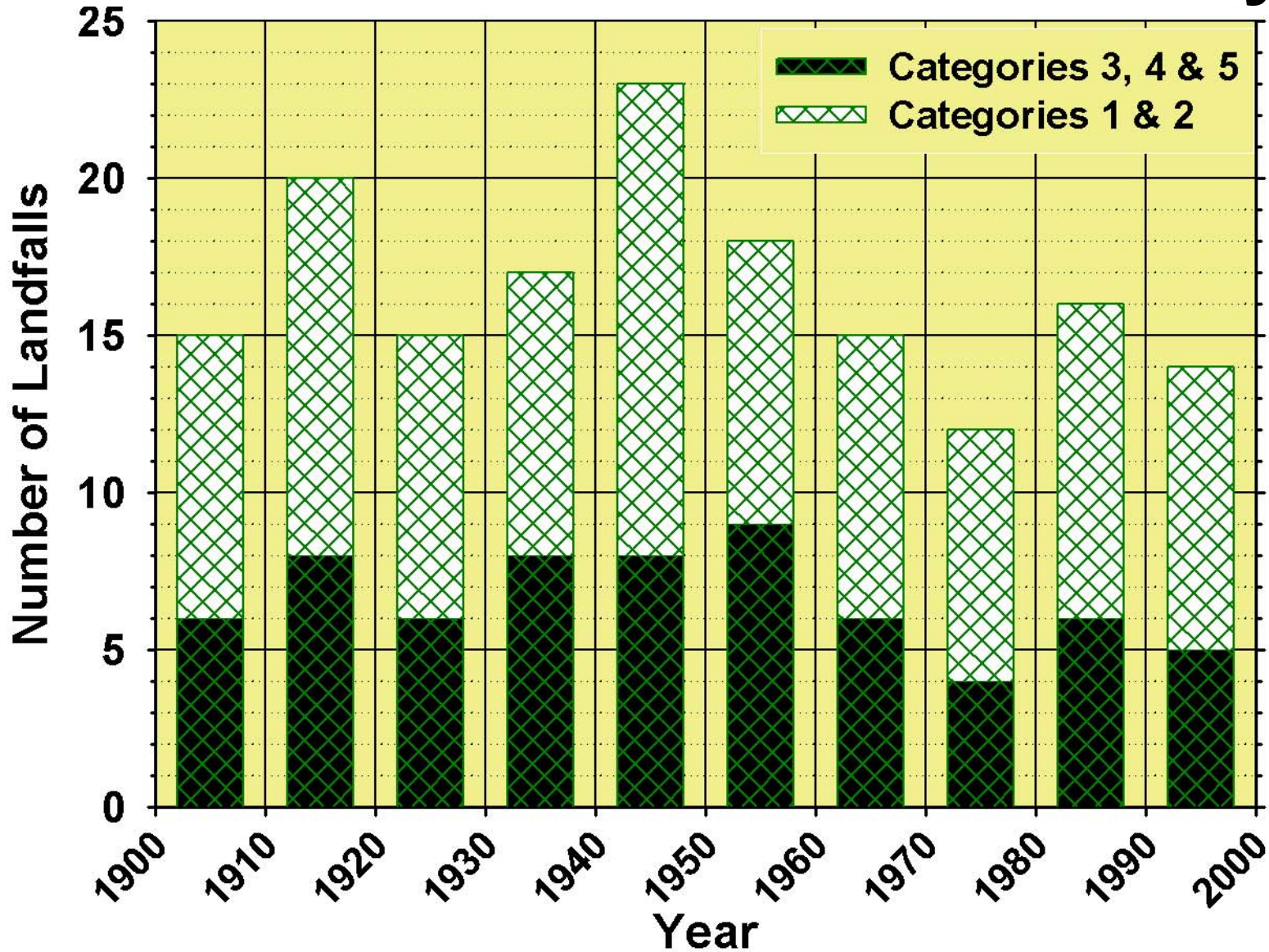


Source: Pielke, R. A. and C. W. Landsea, 1998:
Normalized hurricane damages in the United States: 1925-95
Weather and Forecasting, **13**, 621-631

Normalized Hurricane Damage 1900-1999



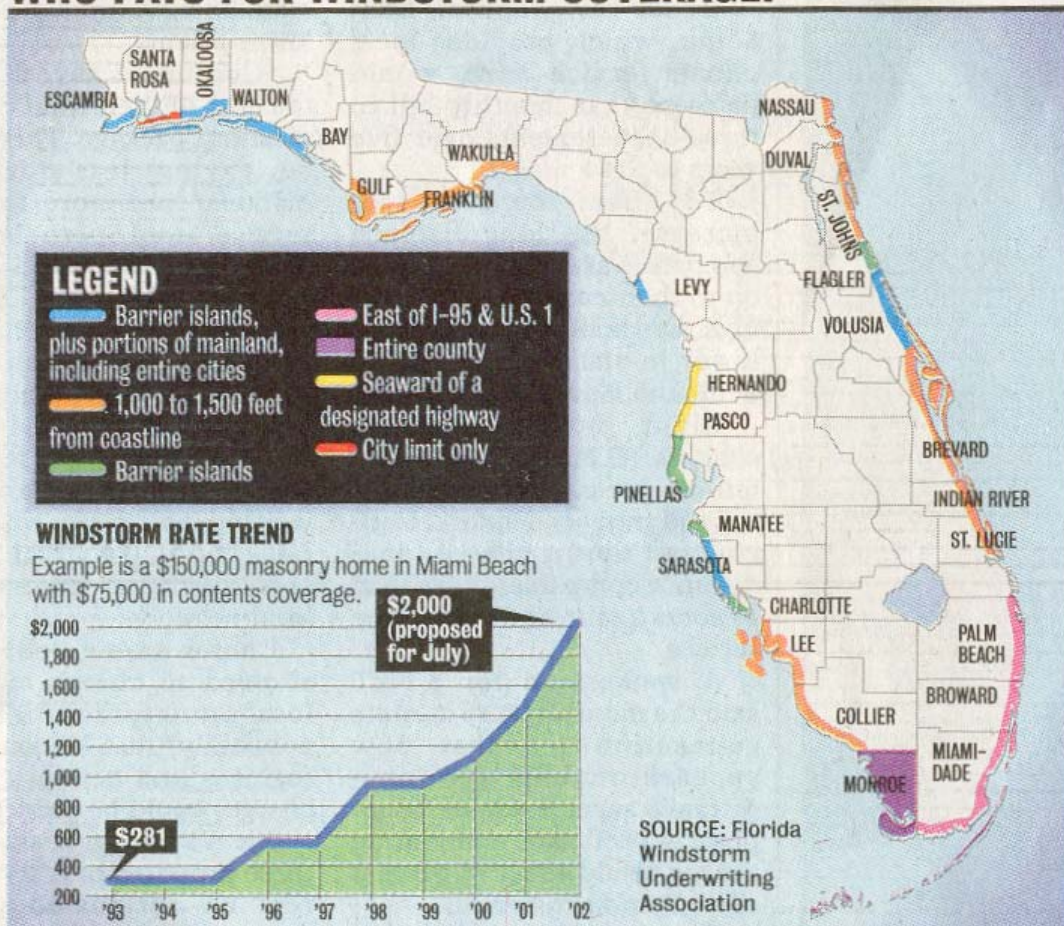
US Landfalls in the 20th Century



Hurricane insurance stirring a fight

WHO PAYS FOR WINDSTORM COVERAGE?

BY MICHELE CHANDLER
AND JACQUELINE CHARLES
mchandler@herald.com



Politicians in Tallahassee have big changes in mind for the state's hurricane coverage.

One South Florida-friendly bill would allow homeowners to challenge rate increases in court. Another would kick some of those homeowners out of the windstorm pool altogether, to save other Floridians money.

It all comes down to who wins the state hurricane legislative duel.

Lawmakers have submitted more than a dozen proposals on the subject this year, driven in part by spiraling windstorm rates scheduled to rise another 40 percent in July.

The 27-member Miami-Dade delegation has unanimously declared windstorm insurance reform its top priority this session, though its favored bill — which would give the public more ways to challenge rate increases — seems to be idling in the Legislature. Meanwhile, lawmakers outside South Florida are balking at helping to pay for coverage for

Cost of Property Damage

\$5B a year

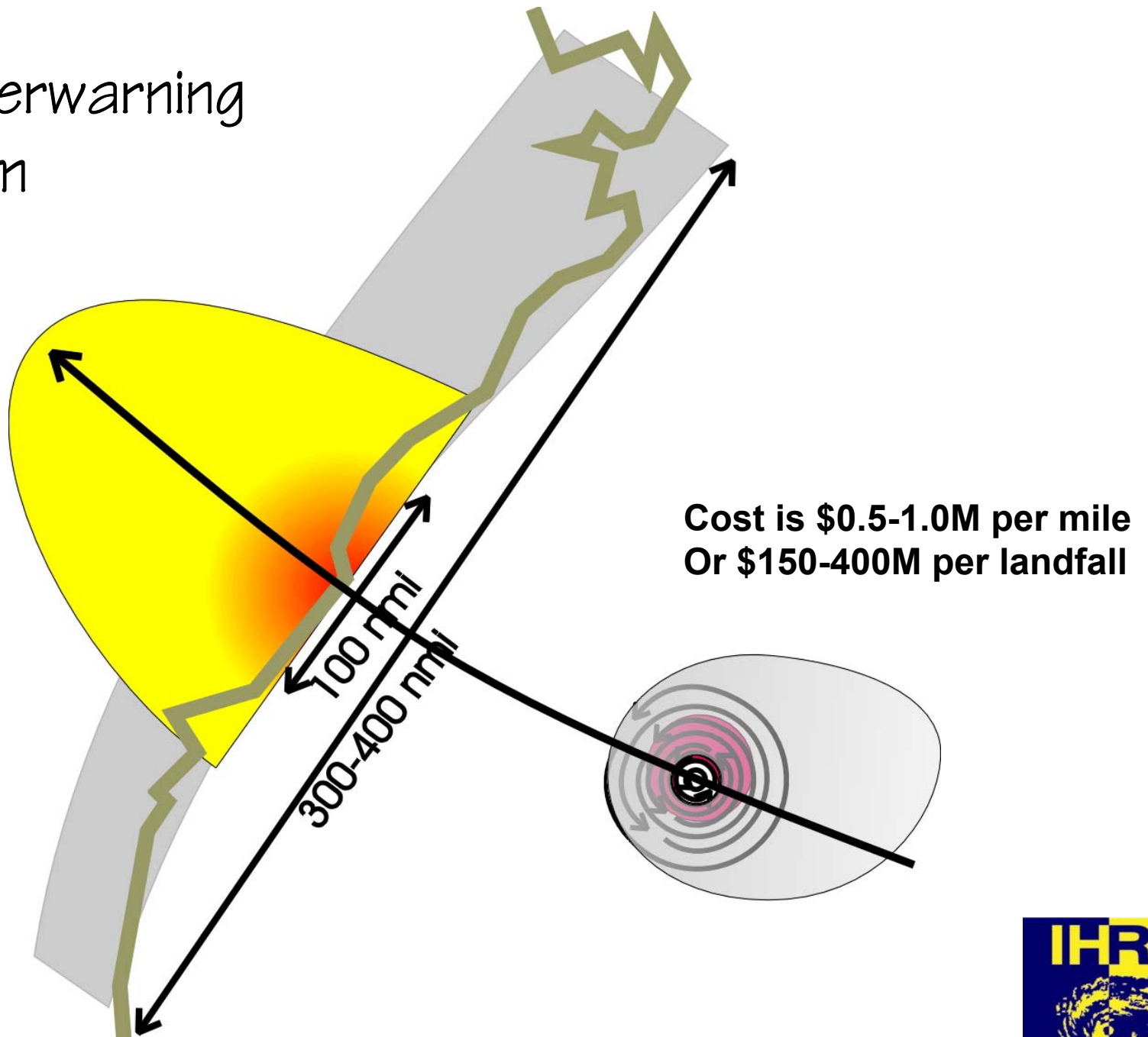
Extremely variable

Expect \$100B hit once a century

No discernable trend after correction for economic factors

Does concentration of wealth along the coast mask real progress in damage mitigation?

The Overwarning Problem





Evacuation



Cost of Warnings

400 miles of coastline warned for each landfall

3 landfalls a year

Cost of preparations average \$750K/mile

Annual cost is \$800M

This figure is pure guesswork; numbers as low as \$400M and as high as 1200M are plausible.

Cost of the Forecasting Enterprise

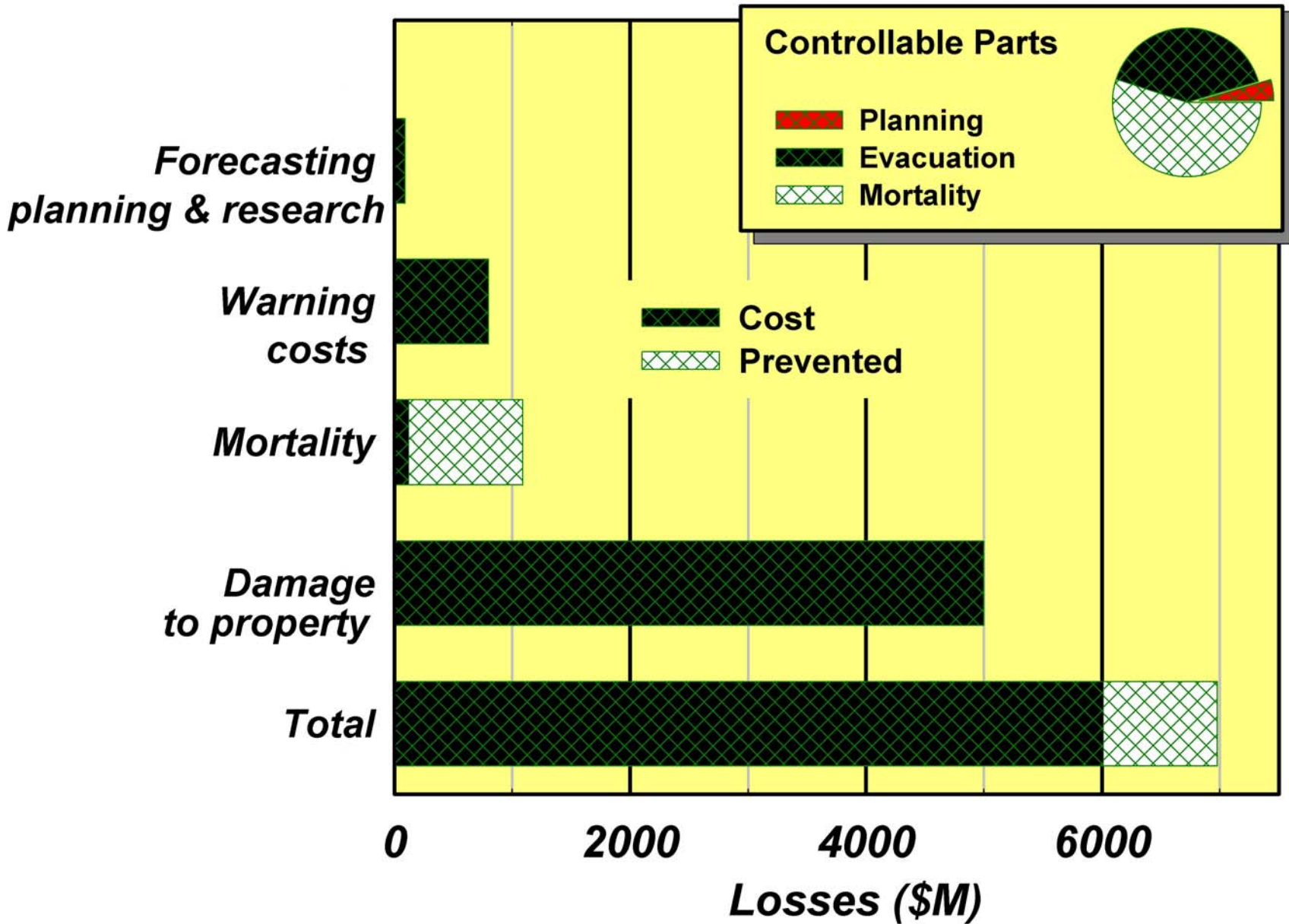
Inventory of:

- National Hurricane Center
- NOAA Research Labs
- University research
- Research and Reconnaissance Aircraft
- Local forecast offices
- Local emergency management
- Computer Forecasting Operations
- Pro-rata share of satellites
- Federal Emergency Management Administration

Total ~ \$90M



Hurricane Balance Sheet



Nightmare scenarios are still possible--



Longport, NJ

AP Photo

perhaps inevitable...



**Thank you for your attention.
Questions?**

FINIS