NAIC FEMA

NAIC AND FEMA REGION 1 RESILIENCE ROUNDTABLE

MAY 22, 2023

LEADERSHIP REMARKS

Commissioner Mais
Connecticut

Lori Ehrlich

FEMA Region 1 Regional Administrator

David Maurstad

FEMA Assistant Administrator, Federal Insurance

ATTENDEE INTRODUCTIONS

WHY ARE WE HERE TODAY

Aaron Brandenburg, NAIC

Jennifer Gardner, Center for Insurance Policy & Research, NAIC

Region 1 Resilience Roundtable

Federal Emergency Management Agency (FEMA)
National Association of Insurance Commissioners (NAIC)
State Departments of Insurance

Purpose and Desired Outcomes

1

Enhance regional FEMA flood insurance specialist and State Insurance Department/NAIC relationships to collaborate on ways to close the flood insurance gap and discuss Risk Rating 2.0

2

Identify best practices in State Insurance Department operational set-up and response before, during, and after disaster events including interactions with the NAIC and FEMA.

3

Identify opportunities for ongoing coordination on pre- and post-disaster consumer outreach and messaging.

4

Identify near-term disaster resilience priorities and a process for ongoing collaboration.

Build upon existing relationships and identify new partnership opportunities for all phases of disaster risk management.

U.S. Department of Homeland Security
Washington, DC 20472

FEMA

MEMORANDUM OF AGREEMENT
BETWEEN
THE U.S. DEPARTMENT OF HOMELAND SECURITY/
FEDERAL EMERGENCY MANAGEMENT AGENCY (DHS/FEMA)
AND
THE NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS (NAIC)

I. PARTIES

The parties to this Memorandum of Agreement (MOA, or agreement) are the Federal Emergency Management Agency within the U.S. Department of Homeland Security (DHS/FEMA, or the Agency), and the National Association of Insurance Commissioners (NAIC). Both parties are responsible for the goals and activities contained in this agreement and shall contribute to its success.


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Philadelphia
DE
MD
WV
VA
III
PUERTO RICO
U.S. VIRGIN ISLANDS
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AR
LA
TX
VI
KY
TN
NC
IV
MS
FL
AMERICAN SAMOA
GUAM
U.S. TRUST TERRITORY
OF THE PACIFIC ISLANDS

Federal Emergency Management Agency Regions

Region 1	Connecticut
	Maine
	Massachusetts
	New Hampshire
	Rhode Island
	Vermont

Region 2	New Jersey
	New York
	Puerto Rico
	Virgin Islands

Region 3	Delaware
	District of Columbia
	Maryland
	Pennsylvania
	Virginia
	West Virginia

Survey of States

. Has your state interacted with FEMA in the past five years?

More Details

Yes	3
No	2

. How many times has your state interacted with FEMA in the last 5 years?

More Details

1 to 5	0
6 to 10	2
More than 10	1

. When you have interacted with FEMA was it: (Choose all that apply)

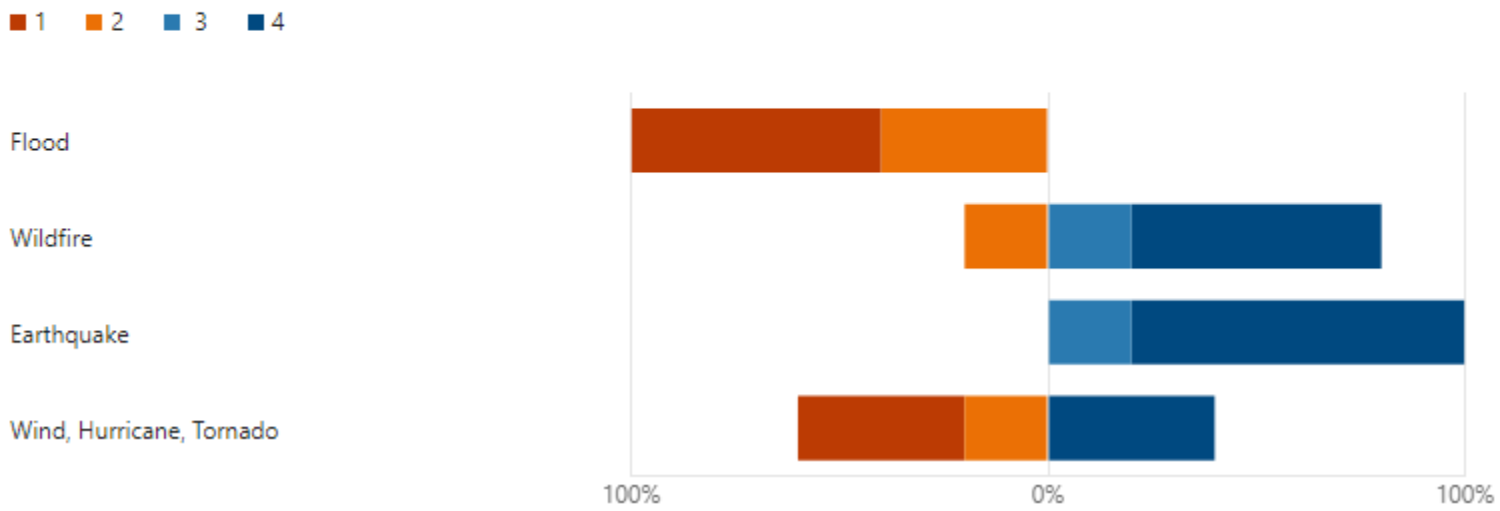
More Details

Before a disaster	2
During a disaster	1
After a disaster	1

Survey of States

22. Please rank the following perils facing your insurance department from most important to least important - 1 being most important and 4 being least important.

More Details

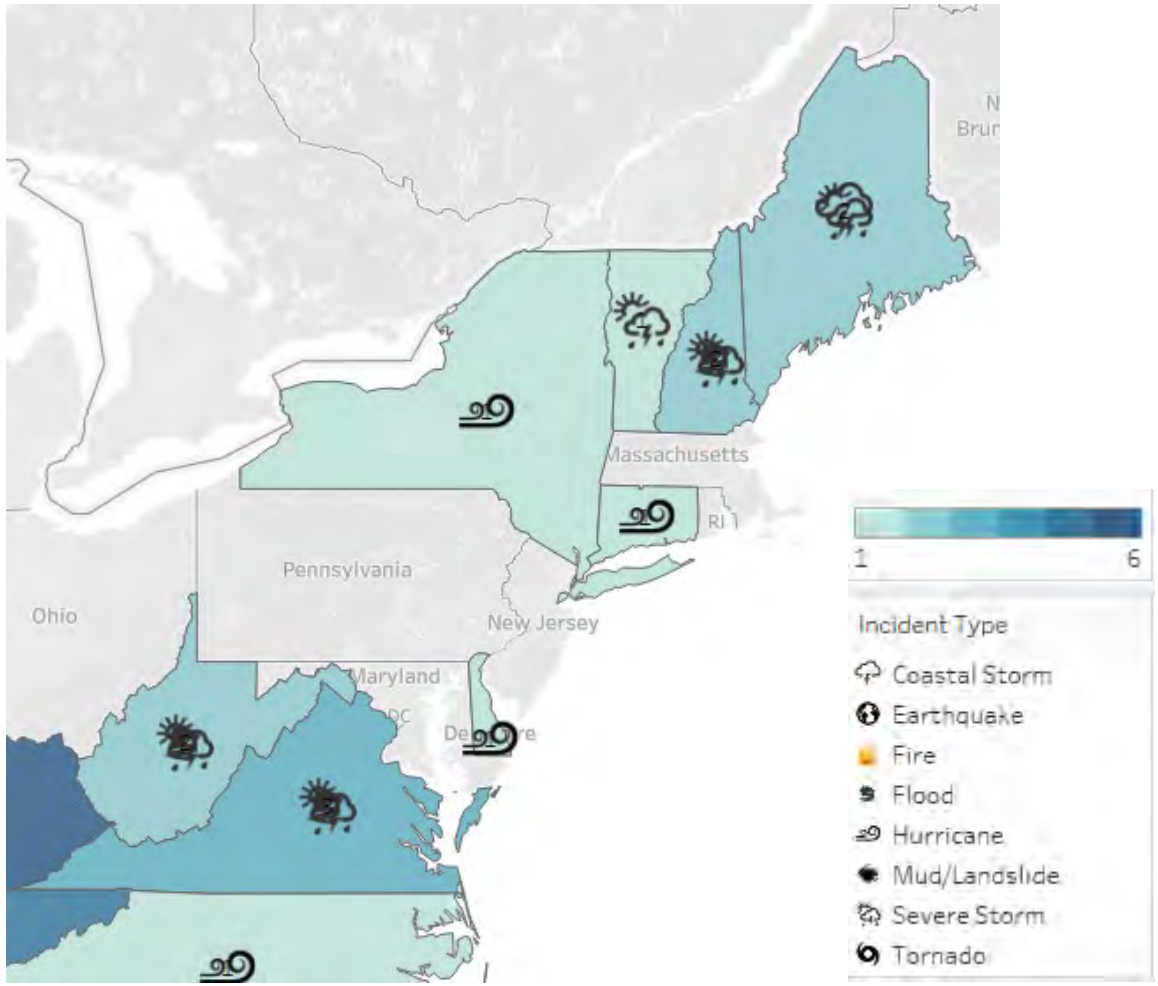


What Catastrophic Events Look Like in Region 1

Federal Emergency Management Agency (FEMA)
National Association of Insurance Commissioners (NAIC)
State Departments of Insurance

Major Disasters and Emergency Declarations

2022-2023



<u>Region 1</u>

Connecticut – 1 Hurricane
Maine – 1 Coastal Storm, 1 Severe Storm
New Hampshire – 1 Flood, 1 Severe Storm
Vermont – 1 Severe Storm

<u>Region 2</u>

New York – 1 Flood
Puerto Rico – 1 Flood, 2 Hurricane

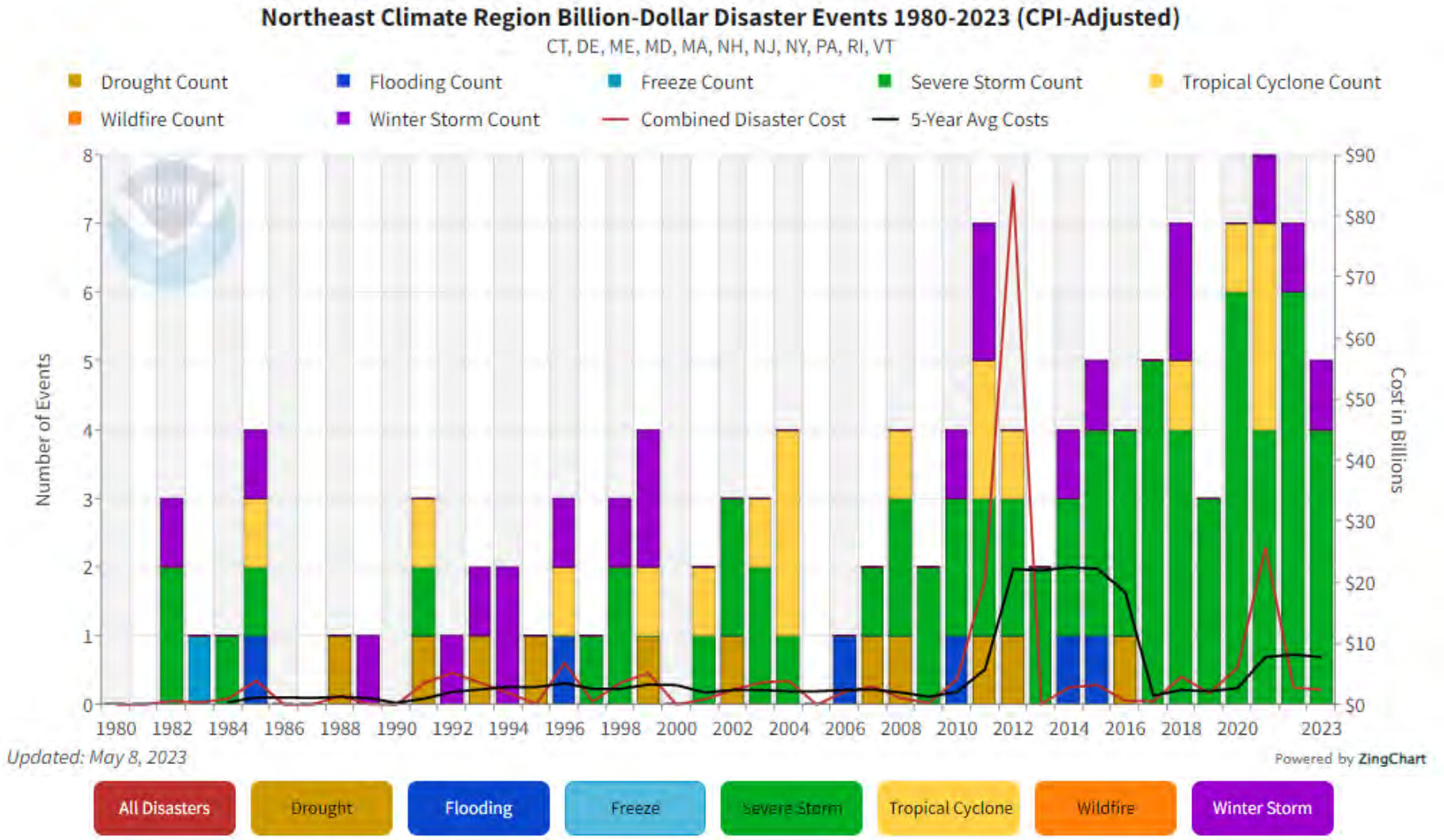
<u>Region 3</u>

Delaware – 1 Hurricane
Virginia – 1 Flood, 2 Severe Storm
West Virginia – 1 Flood, 1 Severe Storm

Loss Amount by Event Type

Billion-dollar events to affect the United States from 1980 to 2022 (CPI-Adjusted)									
	Events	Events/Year	Percent Frequency	Total Costs (in billions)	Percent of Total Costs	Cost / Event	Cost /Year	Deaths	Deaths / Year
Tropical Cyclone	60	1.4	17.60%	$1,333.60	53.90%	$22.20	$31.00	6,890	160
Severe Storm	163	3.8	47.80%	$383.70	15.50%	$2.40	$8.90	1,982	46
Drought	30	0.7	8.80%	$327.70	13.20%	$10.90	$7.60	4,275	99
Flooding	37	0.9	10.90%	$177.90	7.20%	$4.80	$4.10	676	16
Wildfire	21	0.5	6.20%	$133.10	5.40%	$6.30	$3.10	435	10
Winter Storm	21	0.5	6.20%	$84.90	3.40%	$4.20	$2.00	1,401	33
Freeze	9	0.2	2.60%	$35.30	1.40%	$3.90	$0.80	162	4
All Disasters	341	7.9	100.00%	$2,476.20	100.00%	$7.30	$57.60	15,821	368
Deaths associated with drought are the result of heat waves. (Not all droughts are accompanied by extreme heat waves.)									
Flooding events (river basin or urban flooding from excessive rainfall) are separate from inland flood damage caused by tropical cyclone events.									

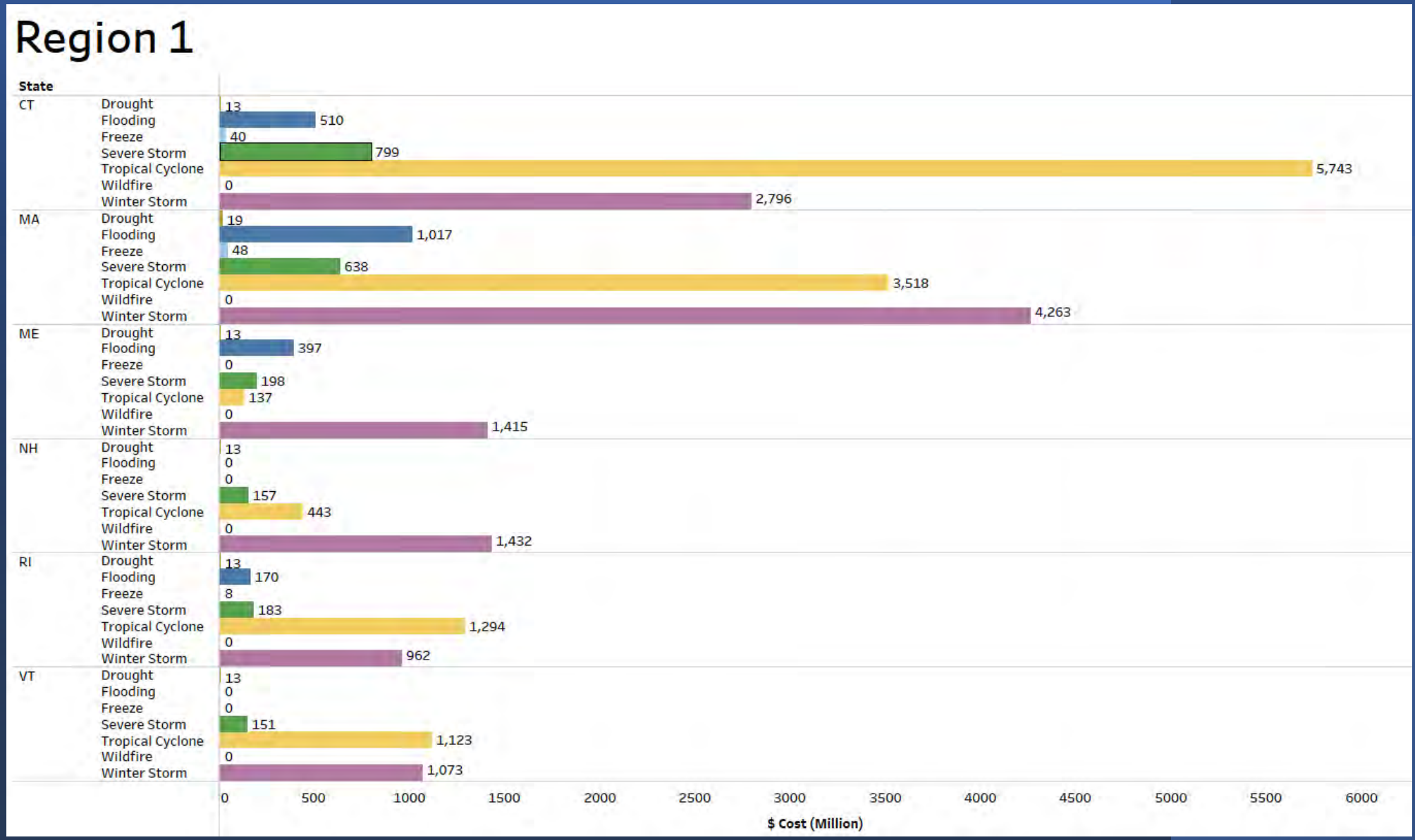
Billion-Dollar Disaster Events



Source: https://www.ncei.noaa.gov/access/billions/mapping

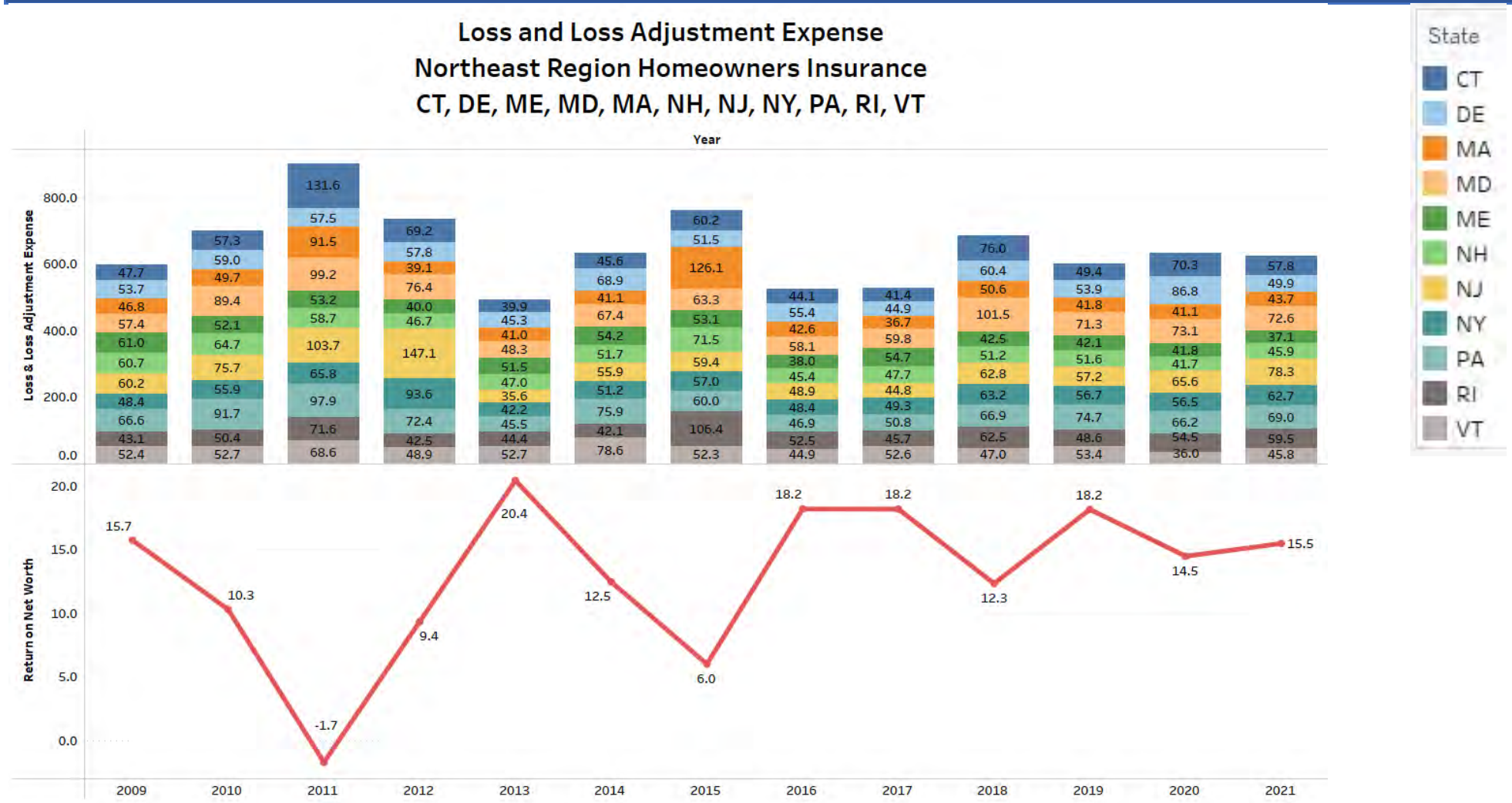
**as of May 8, 2023*

Region 1

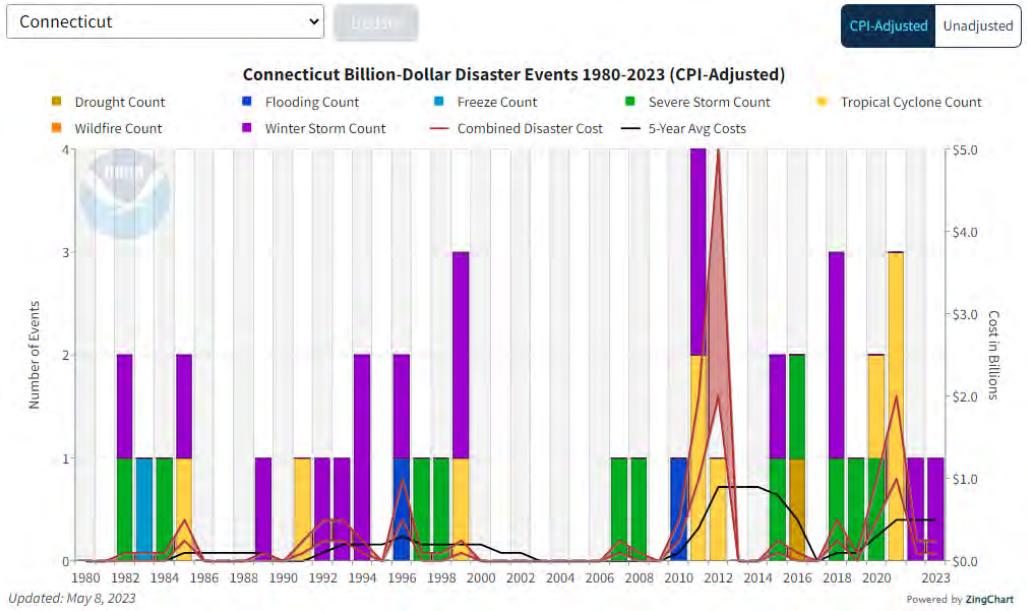


https://www.fema.gov/about/openfema/data-sets

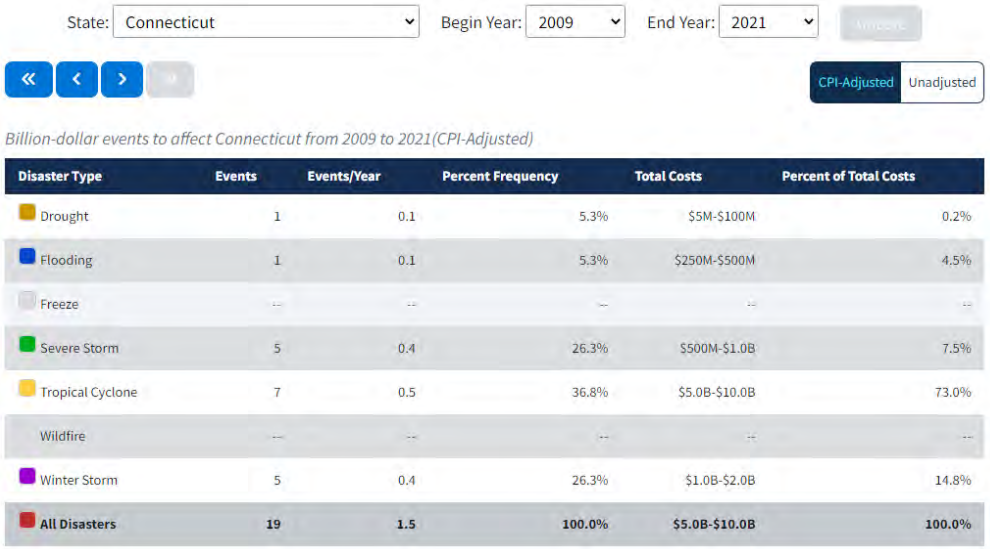
Homeowners Insurance Market Statistics



https://content.naic.org/article/naic-releases-2020-profitability-report

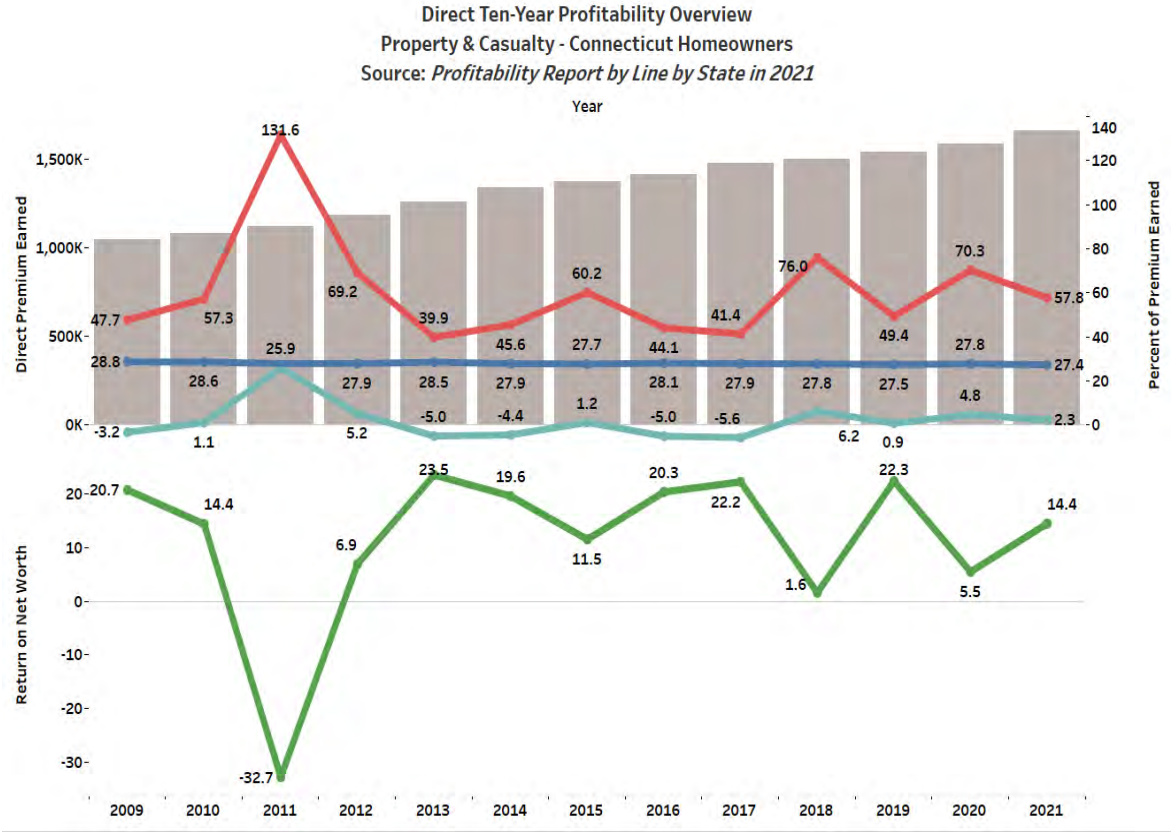


https://www.ncei.noaa.gov/access/billions/time-series



Disaster Type	Events	Events/Year	Percent Frequency	Total Costs	Percent of Total Costs
Drought	1	0.1	5.3%	$5M-$100M	0.2%
Flooding	1	0.1	5.3%	$250M-$500M	4.5%
Freeze	--	--	--	--	--
Severe Storm	5	0.4	26.3%	$500M-$1.0B	7.5%
Tropical Cyclone	7	0.5	36.8%	$5.0B-$10.0B	73.0%
Wildfire	--	--	--	--	--
Winter Storm	5	0.4	26.3%	$1.0B-$2.0B	14.8%
All Disasters	**19**	**1.5**	**100.0%**	**$5.0B-$10.0B**	**100.0%**

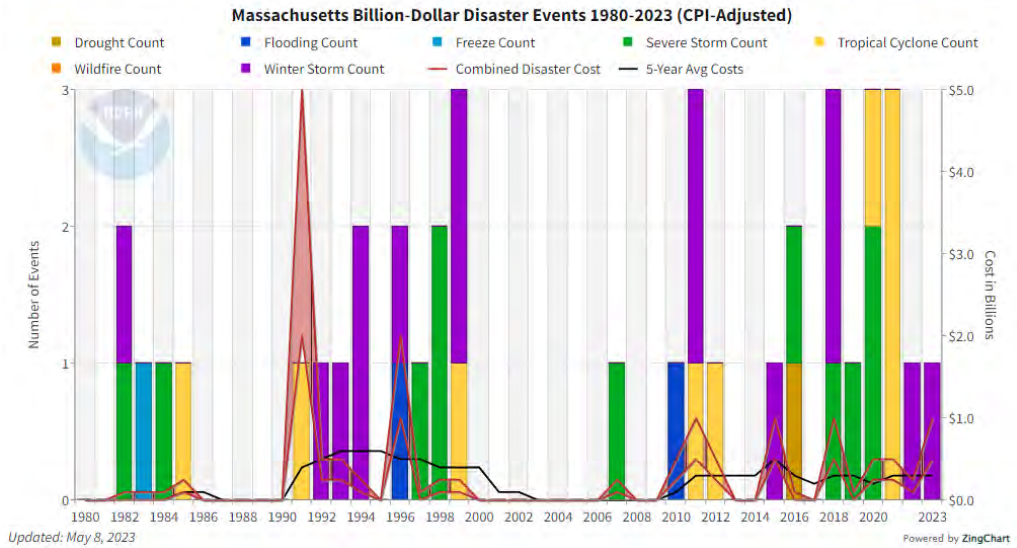
https://www.ncei.noaa.gov/access/billions/events



https://content.naic.org/article/naic-releases-2020-profitability-report

Massachusetts

CPI-Adjusted | Unadjusted

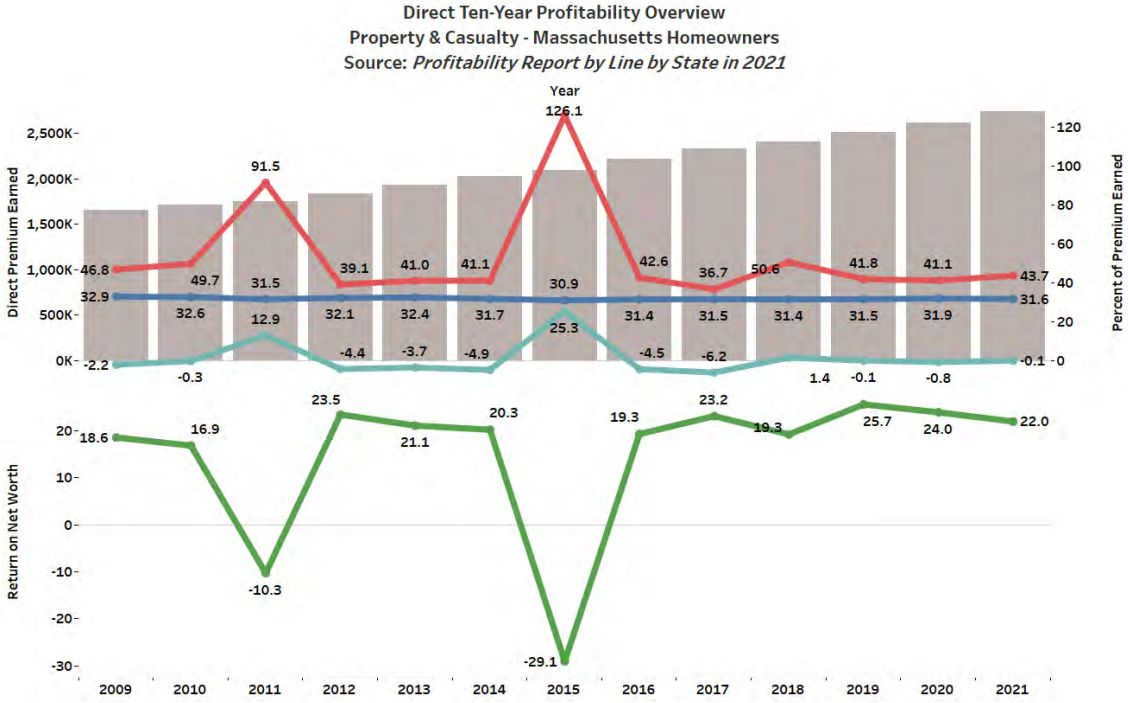


State: Massachusetts Begin Year: 2009 End Year: 2021

CPI-Adjusted | Unadjusted

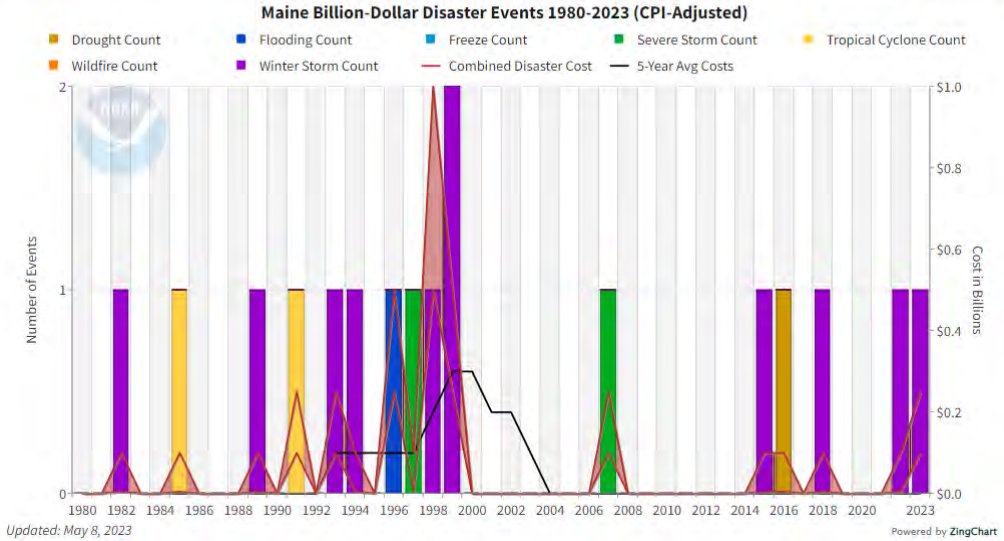
Billion-dollar events to affect Massachusetts from 2009 to 2021(CPI-Adjusted)

Disaster Type	Events	Events/Year	Percent Frequency	Total Costs	Percent of Total Costs
Drought	1	0.1	5.6%	$5M-$100M	0.5%
Flooding	1	0.1	5.6%	$250M-$500M	8.2%
Freeze	--	--	--	--	--
Severe Storm	5	0.4	27.8%	$250M-$500M	6.9%
Tropical Cyclone	6	0.5	33.3%	$1.0B-$2.0B	29.6%
Wildfire	--	--	--	--	--
Winter Storm	5	0.4	27.8%	$2.0B-$5.0B	54.8%
All Disasters	**18**	**1.4**	**100.0%**	**$2.0B-$5.0B**	**100.0%**



Maine

CPI-Adjusted | Unadjusted

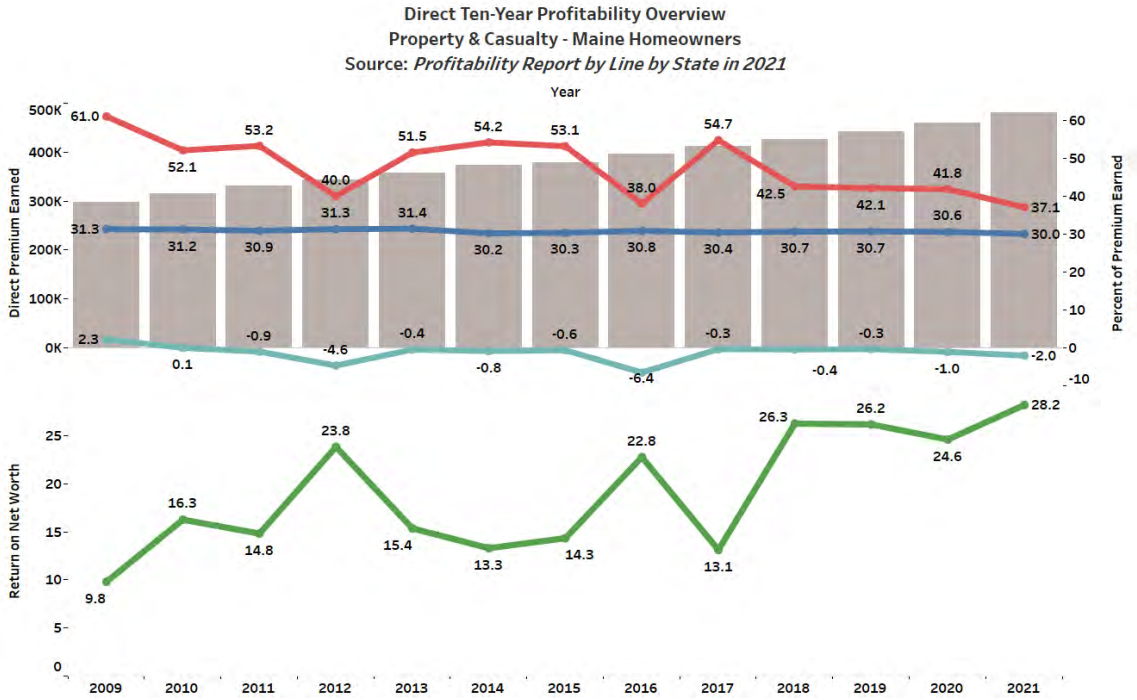


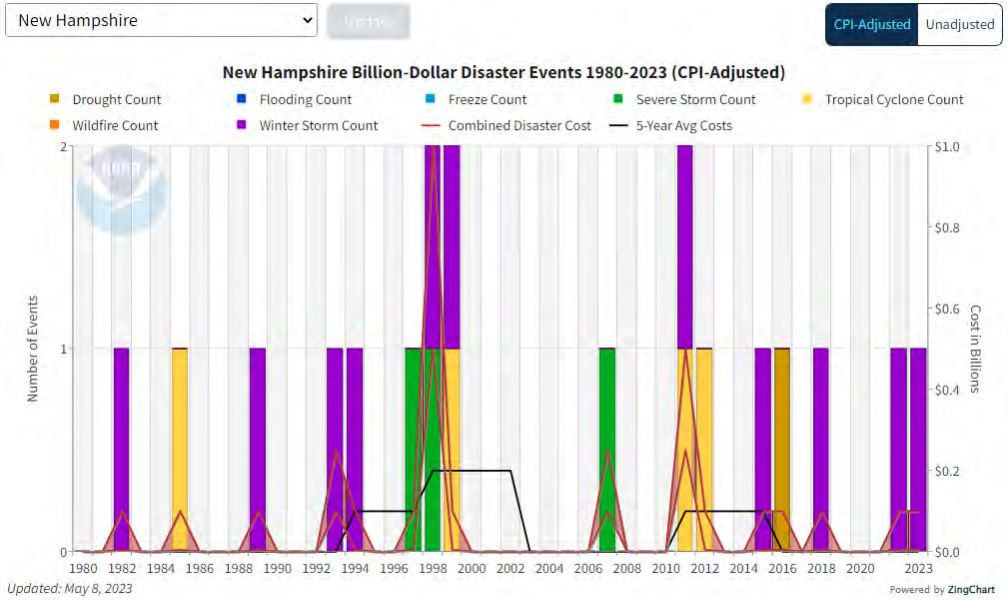
State: Maine | Begin Year: 2009 | End Year: 2021 | Update

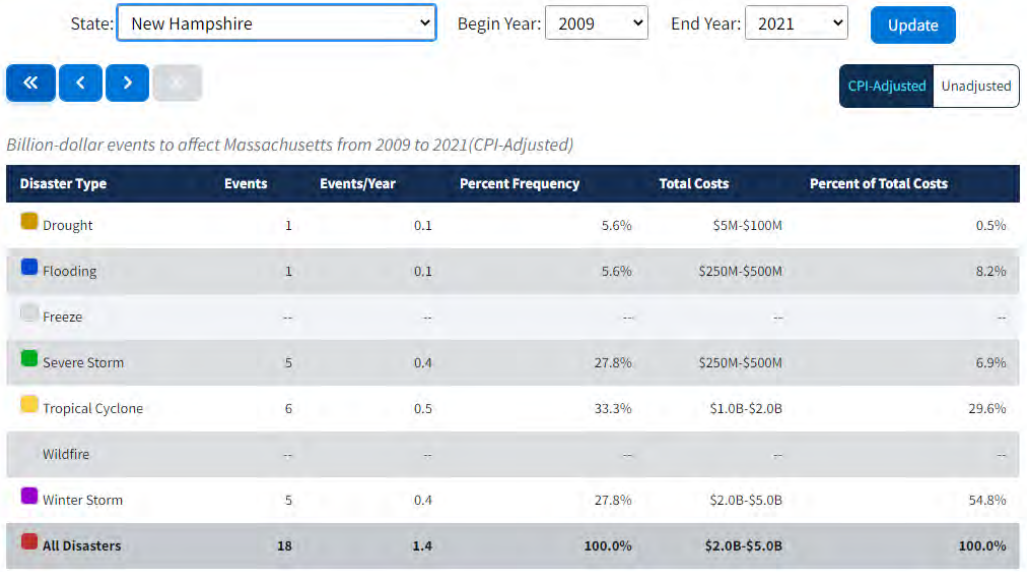
CPI-Adjusted | Unadjusted

Billion-dollar events to affect Massachusetts from 2009 to 2021(CPI-Adjusted)

Disaster Type	Events	Events/Year	Percent Frequency	Total Costs	Percent of Total Costs
Drought	1	0.1	5.6%	$5M-$100M	0.5%
Flooding	1	0.1	5.6%	$250M-$500M	8.2%
Freeze	--	--	--	--	--
Severe Storm	5	0.4	27.8%	$250M-$500M	6.9%
Tropical Cyclone	6	0.5	33.3%	$1.0B-$2.0B	29.6%
Wildfire	--	--	--	--	--
Winter Storm	5	0.4	27.8%	$2.0B-$5.0B	54.8%
All Disasters	**18**	**1.4**	**100.0%**	**$2.0B-$5.0B**	**100.0%**

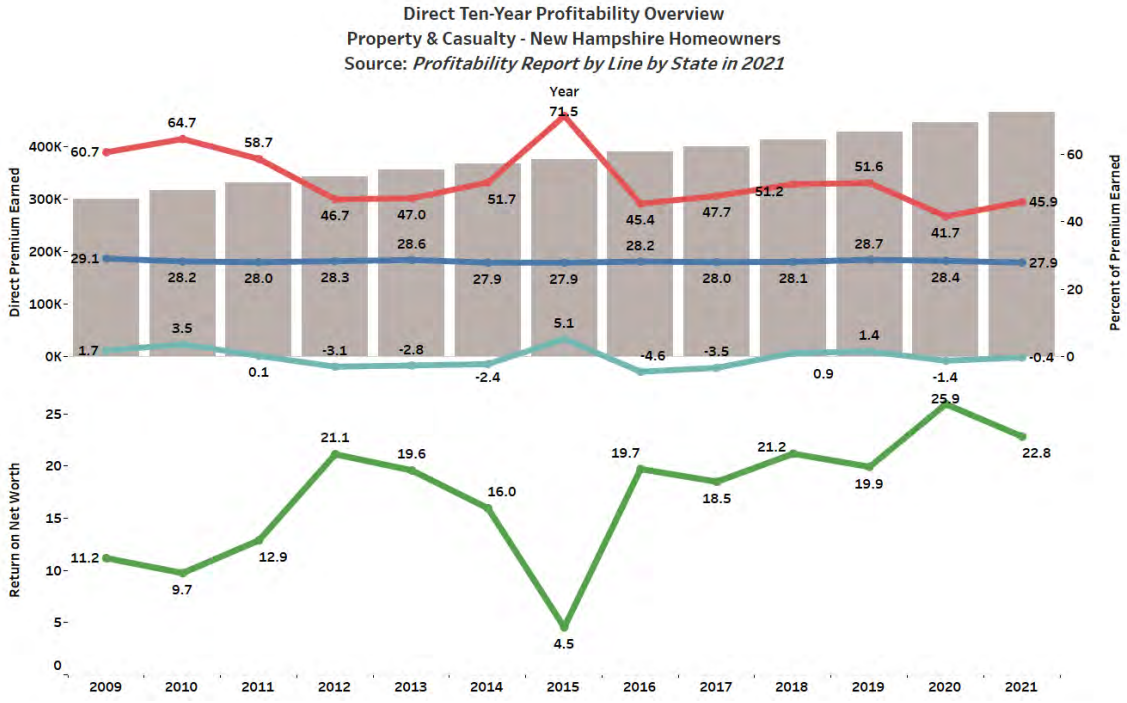






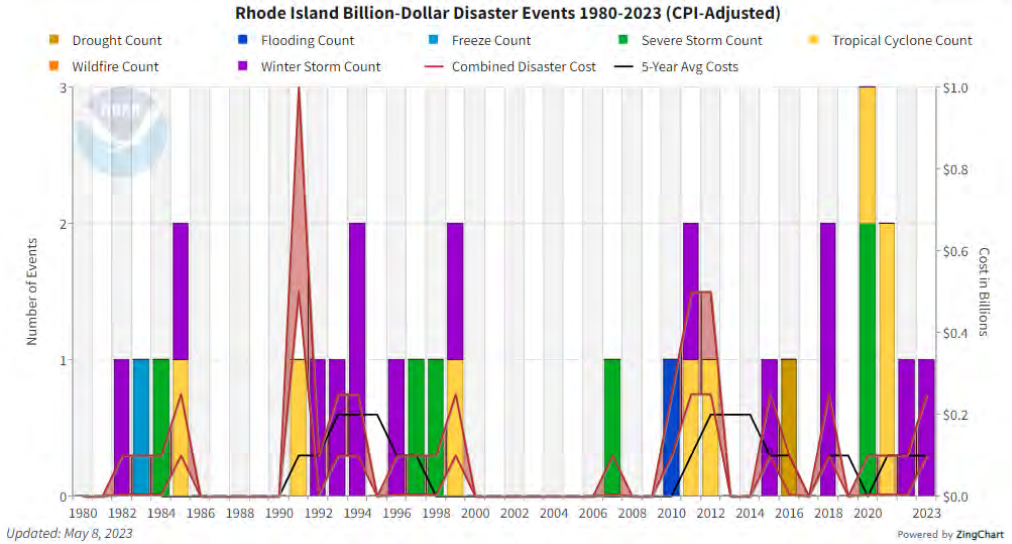
Billion-dollar events to affect Massachusetts from 2009 to 2021(CPI-Adjusted)

Disaster Type	Events	Events/Year	Percent Frequency	Total Costs	Percent of Total Costs
Drought	1	0.1	5.6%	$5M-$100M	0.5%
Flooding	1	0.1	5.6%	$250M-$500M	8.2%
Freeze	--	--	--	--	--
Severe Storm	5	0.4	27.8%	$250M-$500M	6.9%
Tropical Cyclone	6	0.5	33.3%	$1.0B-$2.0B	29.6%
Wildfire	--	--	--	--	--
Winter Storm	5	0.4	27.8%	$2.0B-$5.0B	54.8%
All Disasters	**18**	**1.4**	**100.0%**	**$2.0B-$5.0B**	**100.0%**



Rhode Island

CPI-Adjusted | Unadjusted

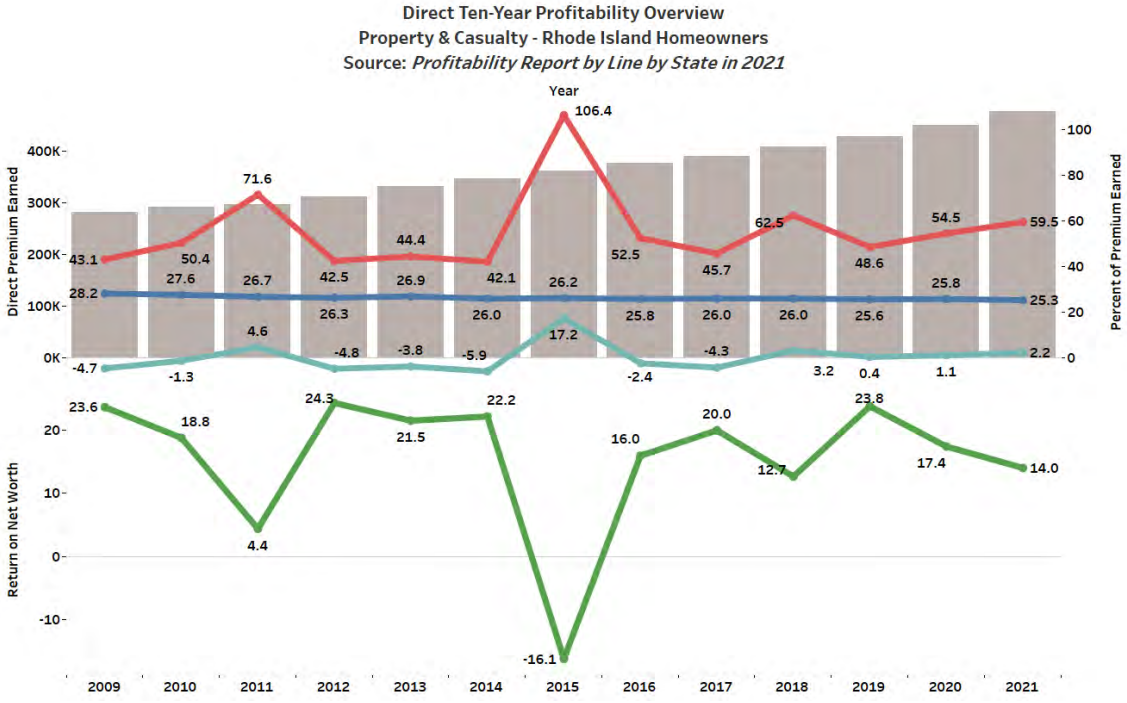


State: Rhode Island | Begin Year: 2009 | End Year: 2021

CPI-Adjusted | Unadjusted

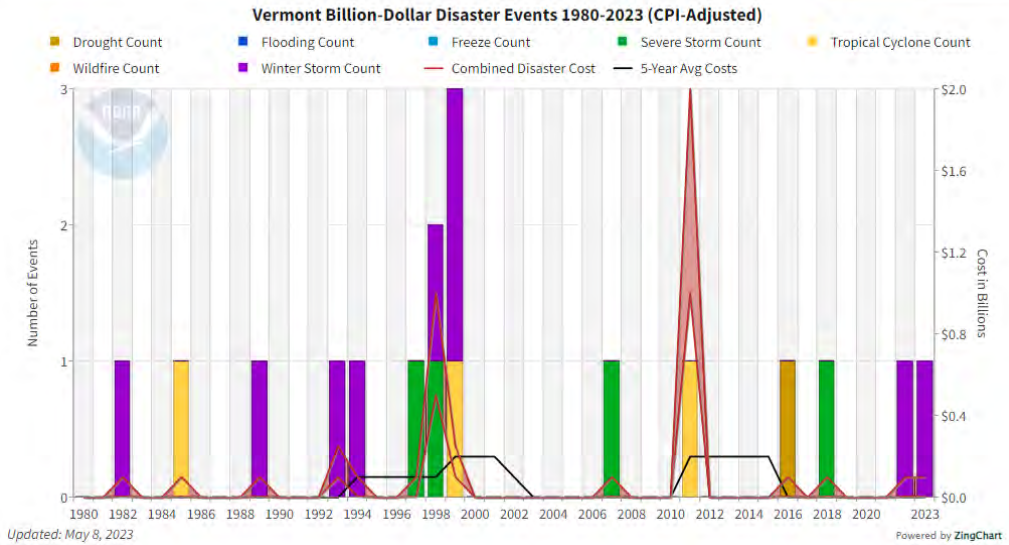
Billion-dollar events to affect Rhode Island from 2009 to 2021(CPI-Adjusted)

Disaster Type	Events	Events/Year	Percent Frequency	Total Costs	Percent of Total Costs
Drought	1	0.1	7.7%	$5M-$100M	1.0%
Flooding	1	0.1	7.7%	$100M-$250M	13.9%
Freeze	--	--	--	--	--
Severe Storm	2	0.2	15.4%	$5M-$100M	4.8%
Tropical Cyclone	5	0.4	38.5%	$500M-$1.0B	55.7%
Wildfire	--	--	--	--	--
Winter Storm	4	0.3	30.8%	$250M-$500M	24.7%
All Disasters	**13**	**1.0**	**100.0%**	**$1.0B-$2.0B**	**100.0%**



Vermont

CPI-Adjusted | Unadjusted

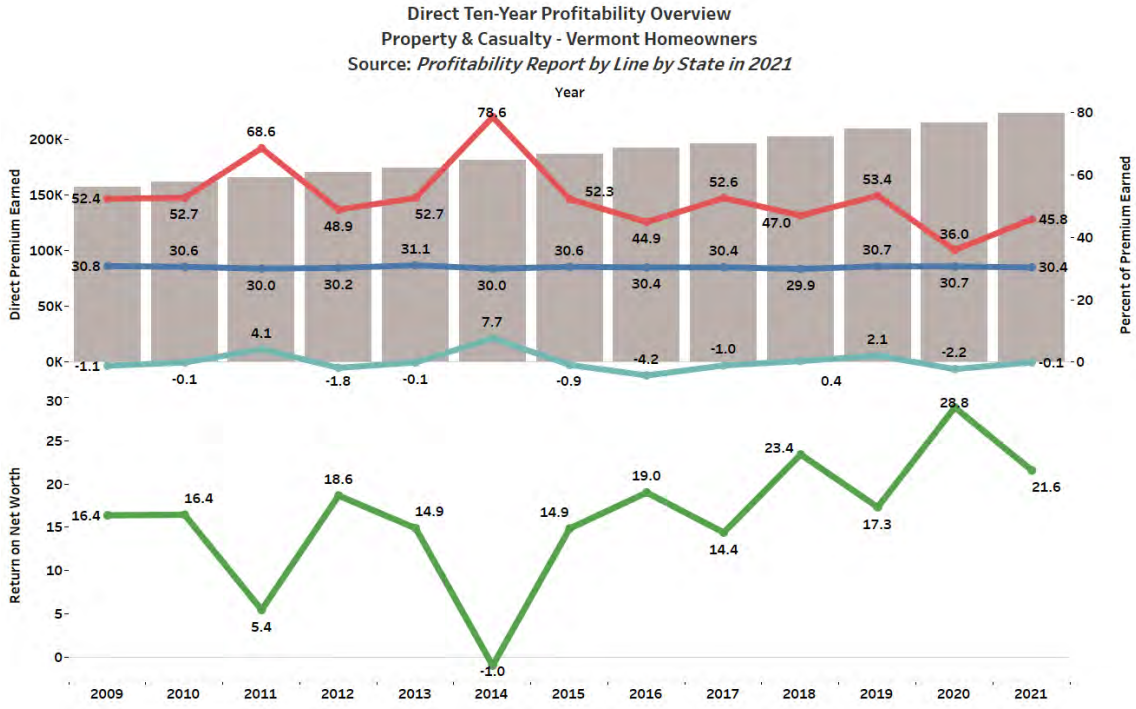


State: Vermont Begin Year: 2009 End Year: 2021

CPI-Adjusted | Unadjusted

Billion-dollar events to affect Vermont from 2009 to 2021(CPI-Adjusted)

Disaster Type	Events	Events/Year	Percent Frequency	Total Costs	Percent of Total Costs
Drought	1	0.1	33.3%	$5M-$100M	1.2%
Flooding	--	--	--	--	--
Freeze	--	--	--	--	--
Severe Storm	1	0.1	33.3%	$5M-$100M	1.2%
Tropical Cyclone	1	0.1	33.3%	$1.0B-$2.0B	97.6%
Wildfire	--	--	--	--	--
Winter Storm	--	--	--	--	--
All Disasters	**3**	**0.2**	**100.0%**	**$1.0B-$2.0B**	**100.0%**



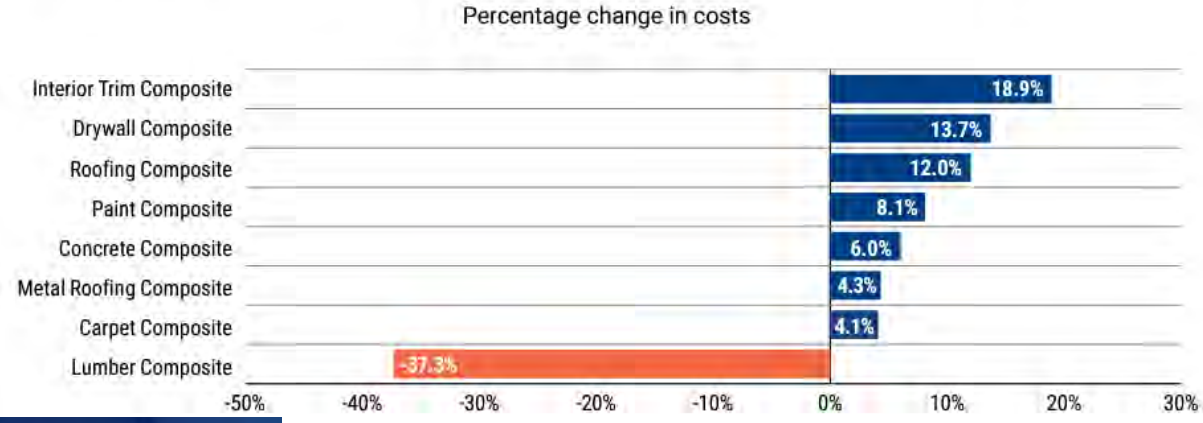
Additional Loss Drivers

- Fraud
- Inflation & Reconstruction Cost
- Demand Surge & Extended Additional Living Expense
- Litigation & Social Inflation

Material Cost Analysis

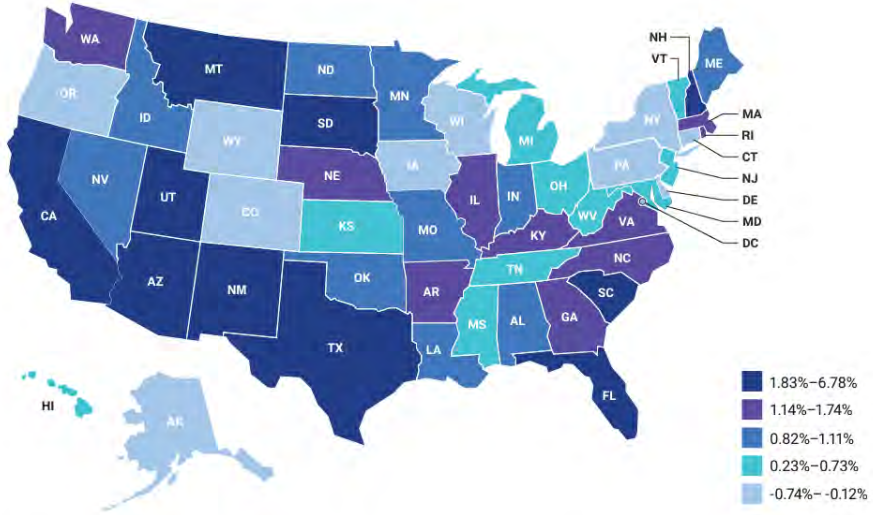
Combined costs for material composites decreased 4.2% from April 2022 to April 2023—a large dip following the 7.8% gain from January 2022 to January 2023. Interior trim was the primary driver of materials, increasing 18.9%. This is led by the costs of interior doors and crown molding. Drywall and roofing composites followed at 13.7% and 12.0%, respectively.

Lumber costs decreased consistently over the last year. The composite continues to stand as the only negative composite this quarter at 37.3%.



Residential Reconstruction Costs

Florida had the largest increase at 6.8%, followed by Utah (4.2%) and New Mexico (4.0%). California's rank changed most significantly, rising from the 33rd-highest cost increase in January 2023 to the seventh-highest in April 2023; costs were up 2.4% in the state. Delaware saw a decline year-over-year, at -0.7%. Residential costs, in total, increased 1.1% from April 2022 to April 2023 and 0.8% from January 2023 to April 2023.



Changes in reconstruction costs by state
States are grouped in quintiles; each range/color in the legend includes 20% of the total number of states.

Insurer Options to Remain Solvent

- Maintain a diversified portfolio.
- Increase premiums charged to policyholders.
- Reduce exposure through coverage restrictions.
- Purchase reinsurance, catastrophe bonds and insurance-linked securities/warranties
- Create non-standard coverage and write through surplus lines.
- Innovate to reduce expenses.
- Increase resilience to reduce losses.

Meeting Objectives

Post-Disaster

COLLABORATE TO ASSESS LOSS

- Claims and Loss Data

COORDINATE ON RECOVERY AND RESPONSE

- Disaster Resource Centers
- Debris Removal

COMMUNICATE CONSISTENT MESSAGE TO CONSUMERS

- Insurance Coverage
- FEMA Assistance

Blue Sky

COLLABORATE TO ASSESS RISK

- Hazard Mitigation Planning
- Protection Gap

COORDINATE ON RESIILIENCE IMPLEMENTATION

- Devise Mitigation Strategies
- Identify Funding Sources

COMMUNICATE CONSISTENT MESSAGE TO CONSUMERS

- Outreach and Education to Consumers

Response Planning - Flood Risk in New England

Lauren McLane, Response Division, Operational Planning Branch Chief

May 22, 2023

FEMA

National Planning Frameworks

- Integrated planning as defined by the National Planning System
- "These plans identify specific **roles and responsibilities**, **coordinating structures**, and **practices** for **managing incidents** that range from those managed locally to larger-scale incidents, including catastrophic natural disasters."
- Describes relationships between mission areas
- Provides ideas for applying the Frameworks

Web Link

FEMA

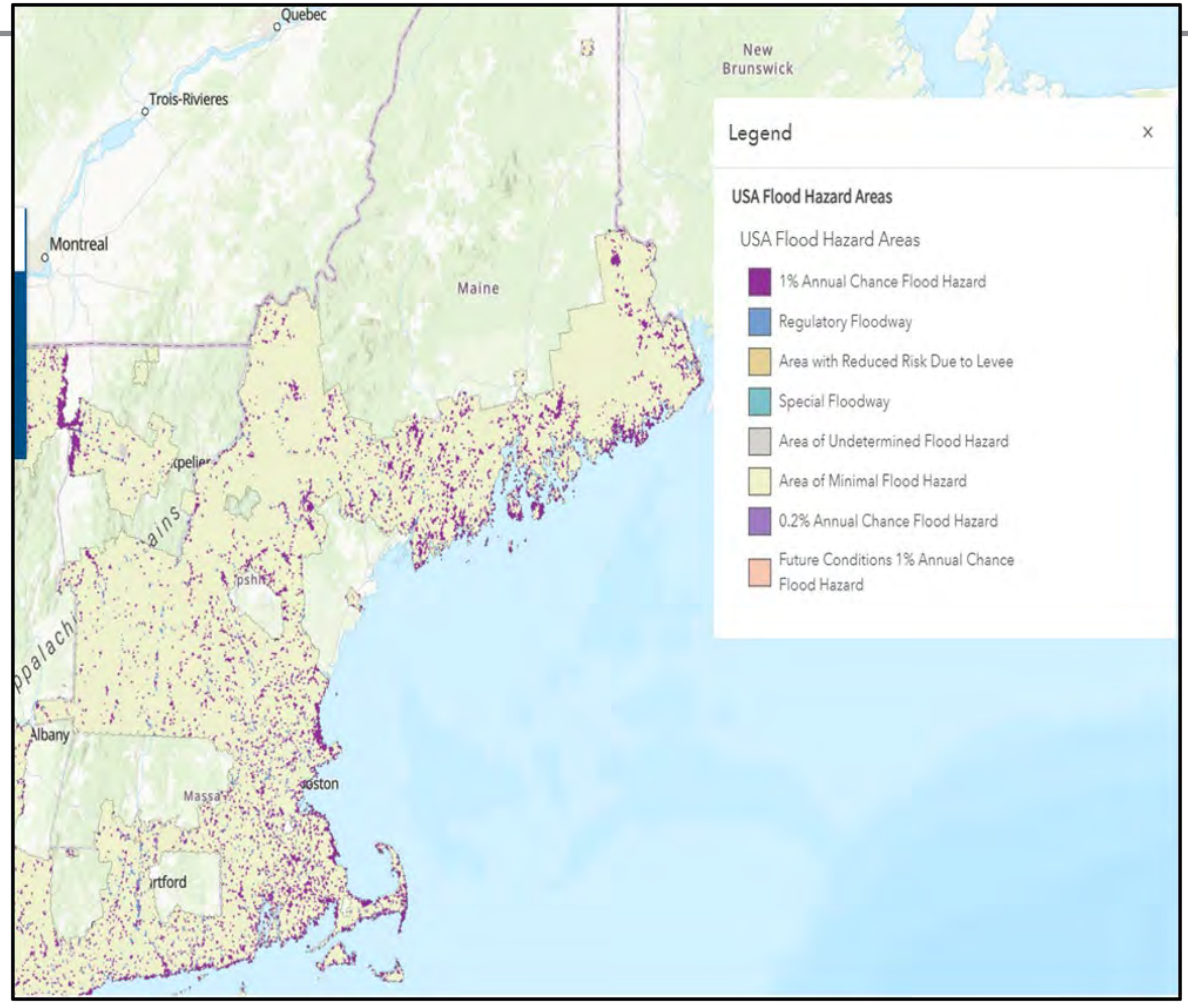
FEMA Operational Plans

- Describe how FEMA implements its responsibilities
- Operational planning is the process by which FEMA develops and produces plans that:
  - Express what one or more FEMA components intend to accomplish
  - Address the actual or potential consequences of one or more threats, hazards, or incidents
  - Drive risk-informed decision making
- Includes:
  - Federal Interagency Operational Plans (FIOP)
  - Response and Recovery FIOP Incident Annexes
  - Regional All Hazards Plans and Incident Annexes

FEMA

Flood Risk Profile (1 of 2)

- Flood events in New England are anticipated annually as a result of snowmelt.
- Typically, spring flooding in rivers, lakes and urban areas occurs when warm temperatures and heavy rain cause snow to melt rapidly.
- Historically, many of the most devastating spring floods have been associated with a combination of heavy rainfall, rapid snow melt and ice jams.
- Coastal flood may occur throughout the year as a result of storms and other meteorological events (e.g., nor'easters) or more rarely as a result of a geologic event (e.g., earthquake-caused tsunami).

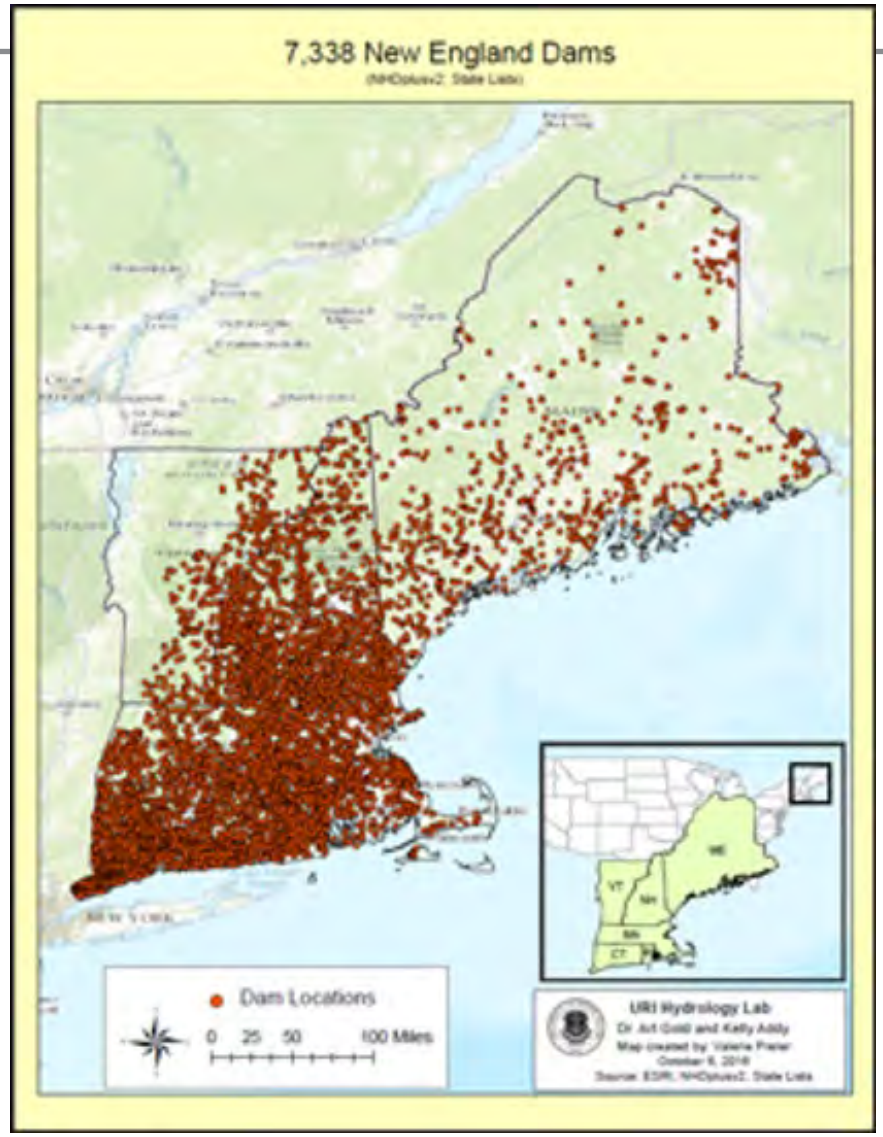


FEMA

Flood Risk Profile (2 of 2)

The region experiences riverine flooding from ice jams. This occurs when snow melt combined with heavy rains causes frozen rivers to swell, which breaks the ice layer on top of the river. The ice layer often breaks into large chunks, which float downstream and often pile up near narrow passages other obstructions, such as bridges and dams.

In past flooding events, potential or actual dam breaches have been of concern. There are more than 7,000 registered dams in southern New England, according to state records. Many privately owned dams are not properly maintained and are a hazard to the population in the event of a breach. Repairing these dams exceeds private and public budgetary constraints, resulting in a widespread risk to life and property in the event of a failure during a flooding incident.



FEMA

The Stafford Act is FEMA's Foundational Response and Recovery Authority

- The Stafford Act gives the President **authority and resources to deliver aid to the American people** – and **wide latitude** in making declaration decisions
- The Act authorizes the President to issue **Major Disaster Declarations or Emergency Declarations to provide aid** to states, tribes, and territories overwhelmed by disasters
- The FEMA **Administrator assists the President in carrying out the Stafford Act** and, under the Homeland Security Act, as amended, serves as the **principal advisor** to the President, the Secretary of Homeland Security, and the National Security Council for all matters relating to emergency management in the United States
  - FEMA is responsible for **coordinating the Federal Government's response efforts**, including authority to direct other Federal agencies to provide support
  - FEMA will **pre-deploy personnel and equipment** to reduce immediate threats to life, property, and public health and safety, and to improve the timeliness of its response

Other Federal Response Authorities

- U.S. Army Corps of Engineers (USACE) provides support to states for flood fighting under its own statutory authority through technical assistance, loans/issuance of flood-fighting supplies and direct flood fighting. *Public Law 84-89, Flood Control and Coastal Emergency Act*
- U.S. Coast Guard (USCG) to provide coastal search and rescue, including navigable rivers under its own statutory authority. *Title 14, Sections 102, 521 and 701 of U.S. Code*

Region 1 All Hazards Plan – Mission and Intent

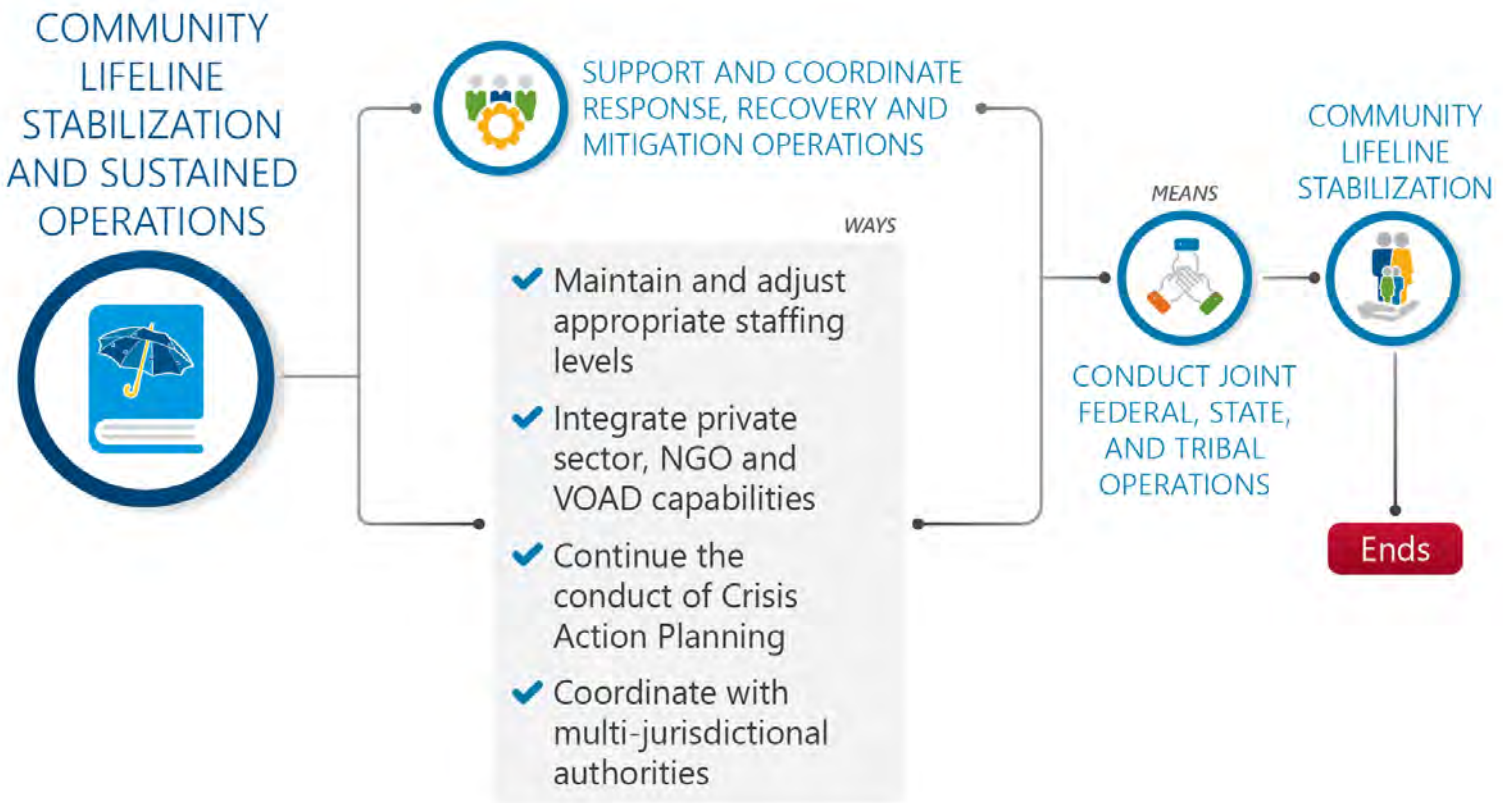
Mission

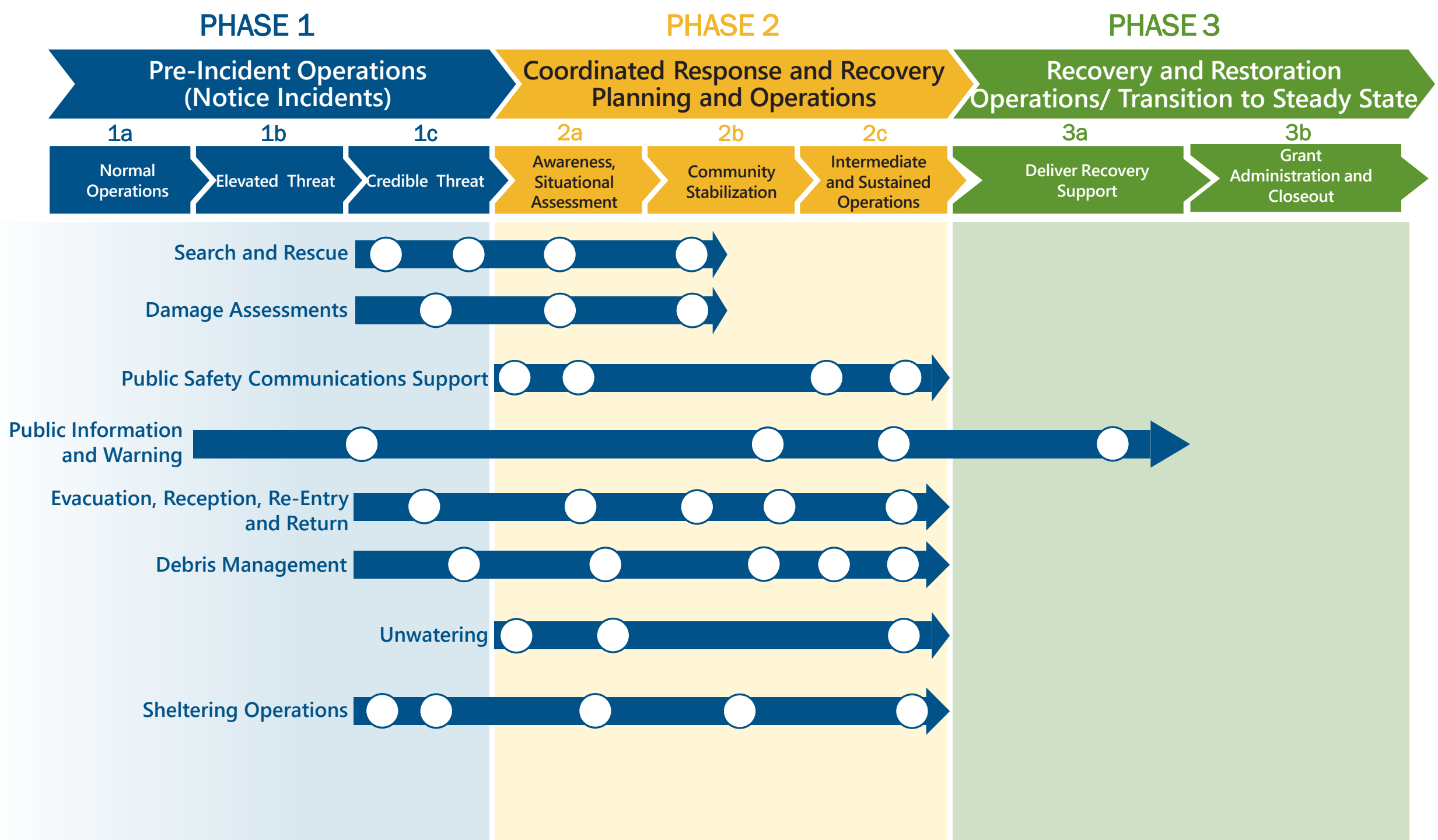
- Help people before, during, and after disasters by ensuring unity of federal effort in support of affected state, tribal, and local governments.

Regional Administrator's Intent

- Save and sustain lives.
- Stabilize the situation.
- Minimize damage.
- Protect property and the environment.
- Create conditions conducive to reentry, repopulation, sustained recovery, and hazard mitigation.
- Provide for basic human needs; and initiate and sustain program delivery in support of New England states, tribal governments, and other federal agencies (OFAs).

Stabilization and Sustained Operations




PHASE 1
PHASE 2
PHASE 3
Pre-Incident Operations (Notice Incidents)
Coordinated Response and Recovery Planning and Operations
Recovery and Restoration Operations/ Transition to Steady State
1a
1b
1c
2a
2b
2c
3a
3b
Normal Operations
Elevated Threat
Credible Threat
Awareness, Situational Assessment
Community Stabilization
Intermediate and Sustained Operations
Deliver Recovery Support
Grant Administration and Closeout
Search and Rescue
Damage Assessments
Public Safety Communications Support
Public Information and Warning
Evacuation, Reception, Re-Entry and Return
Debris Management
Unwatering
Sheltering Operations

Typical Resources for Flood Response

- Food and potable water
- Generators and temporary power installation personnel
- Tarps
- Cots, Blankets, Commonly Used Shelter Items (CUSI)
- Situational awareness and damage assessment teams
- Medical teams
- Unwatering teams and pumps
- Veterinary support

Lauren McLane
FEMA Region 1 Response Division
Operational Planning Branch Chief
Lauren.mclane@fema.dhs.gov

FEMA

BREAK UNTIL 3:30

NOAA WEATHER AND CLIMATE SERVICES, WORKING TO MEET THE NEEDS OF THE INSURANCE SECTOR

Climate Sciences and Services, Ellen Mecray, NOAA Climate Services

Hurricane Forecasting and Risks in New England, Donald Dumont, ME National Weather Office

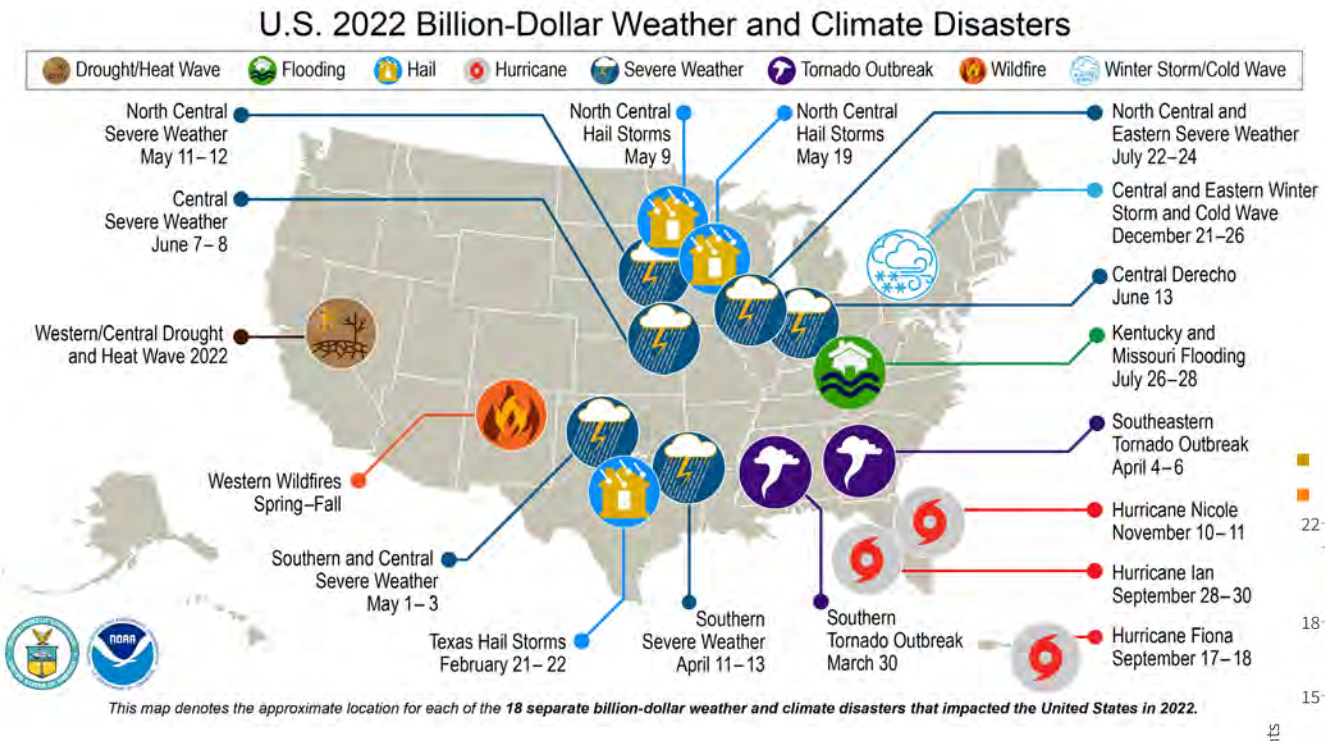
NOAA Climate Services: Working to Meet the Needs of the Insurance Sector

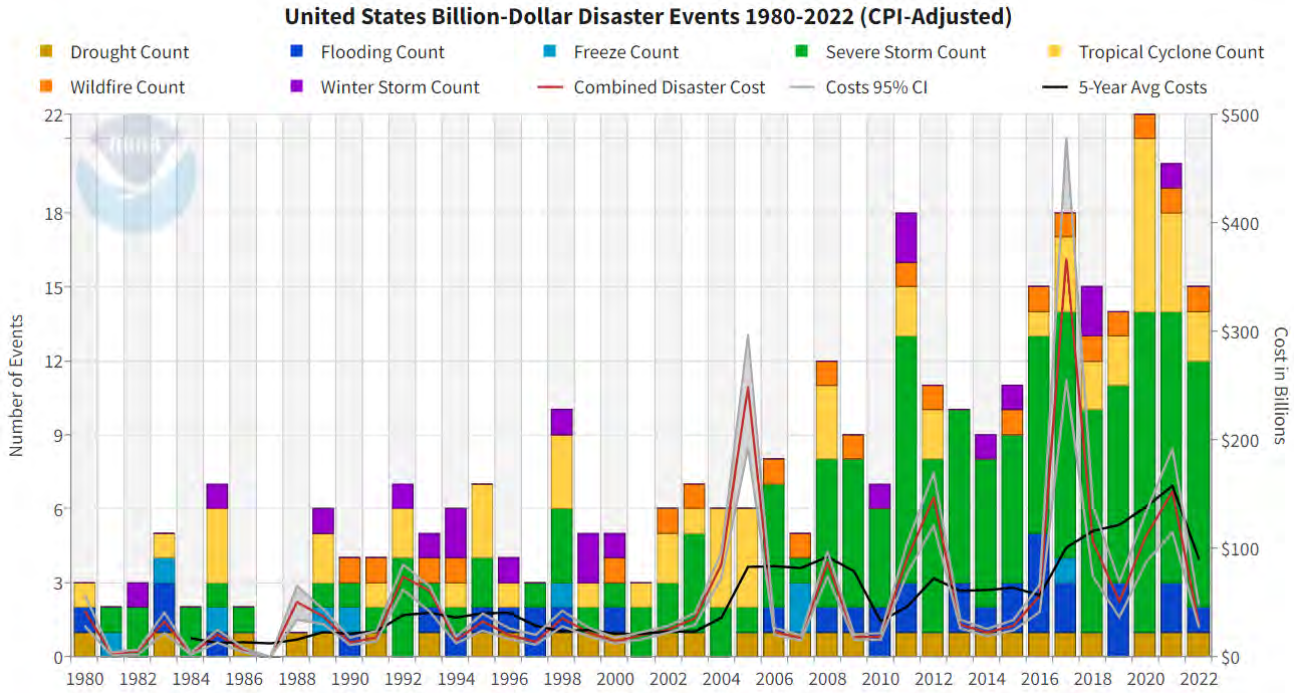
Ellen Mecray, NOAA Regional Climate Services Director-Eastern Region

National Centers for Environmental Information (NCEI)

May 22, 2023

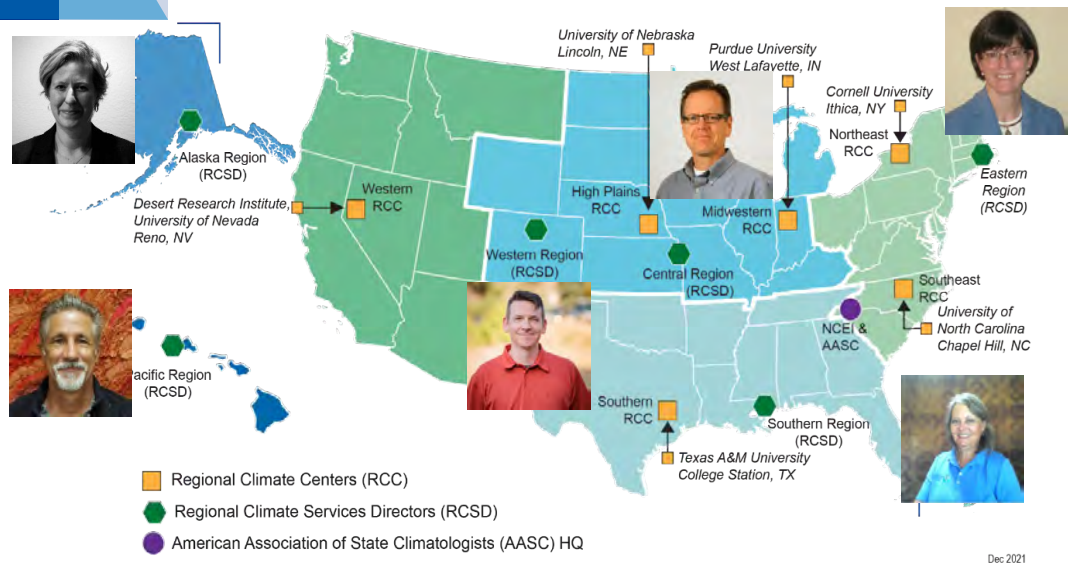
Disaster Trends and Why Our Work Matters





NOAA's Authoritative Products and Services

NCEI National Climate Services Partnership

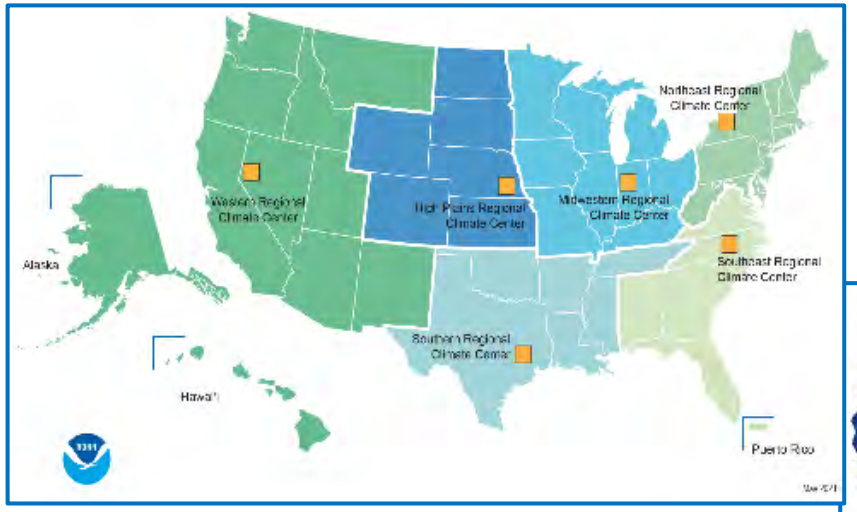


National Scope

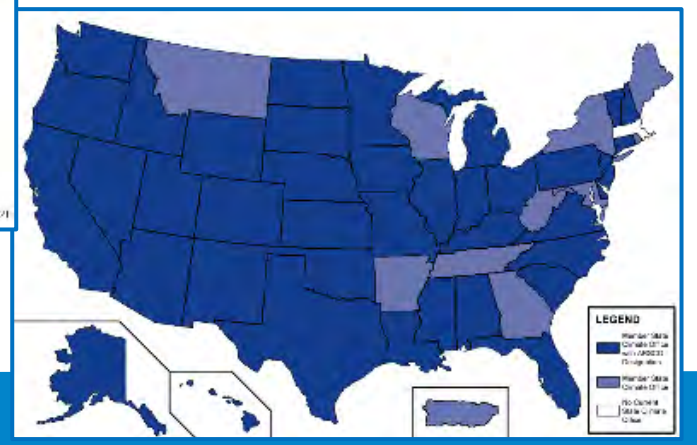
- 6 Regional Climate Service Directors
- *Voice of NOAA Climate* in each region
- NOAA and cross-Agency engagement and coordination

Implemented Regionally

- 6 Regional Climate Centers (RCC)
- Regional themes
- Regional partners in NOAA and with other Federal and tribal partners
- Inter-state coordination



https://www.ncei.noaa.gov/regional

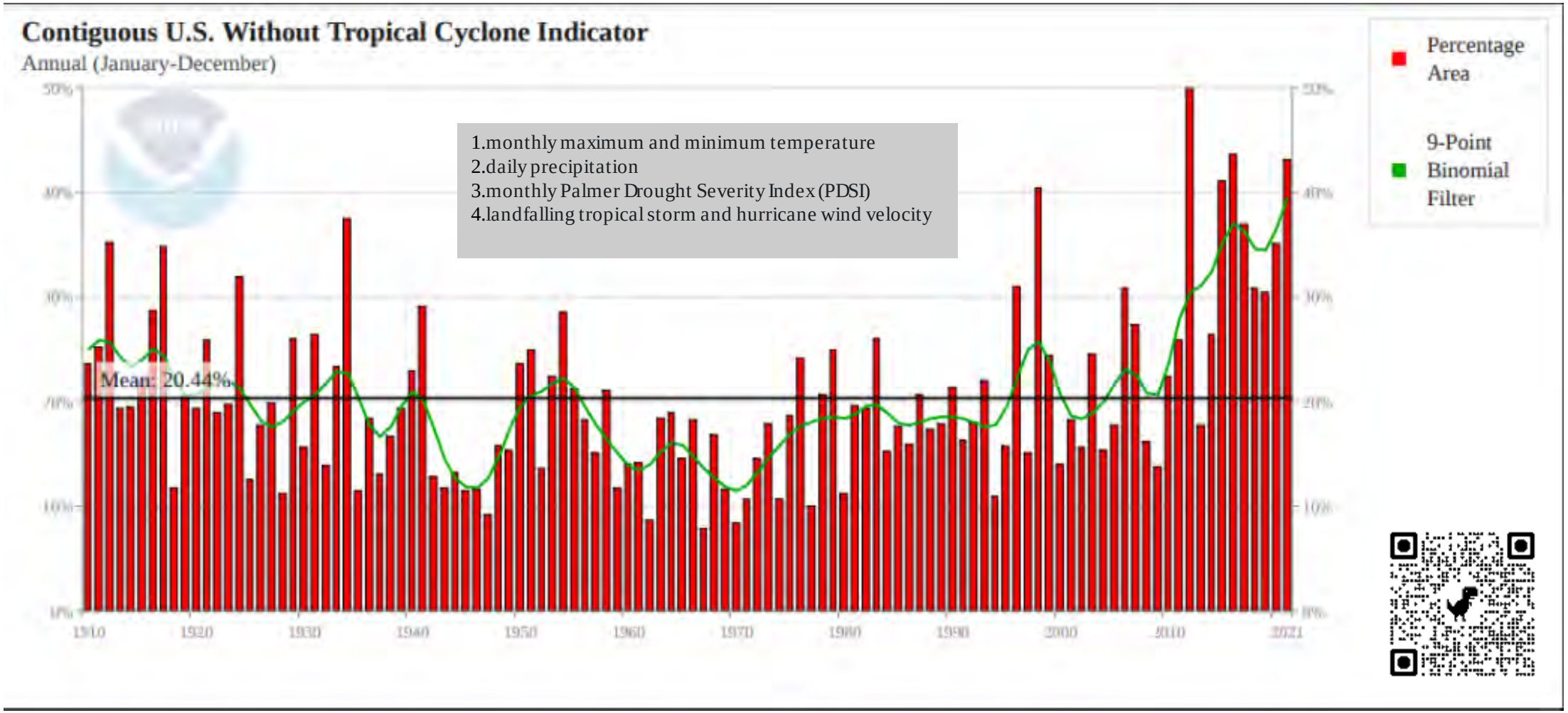


and at the

State level

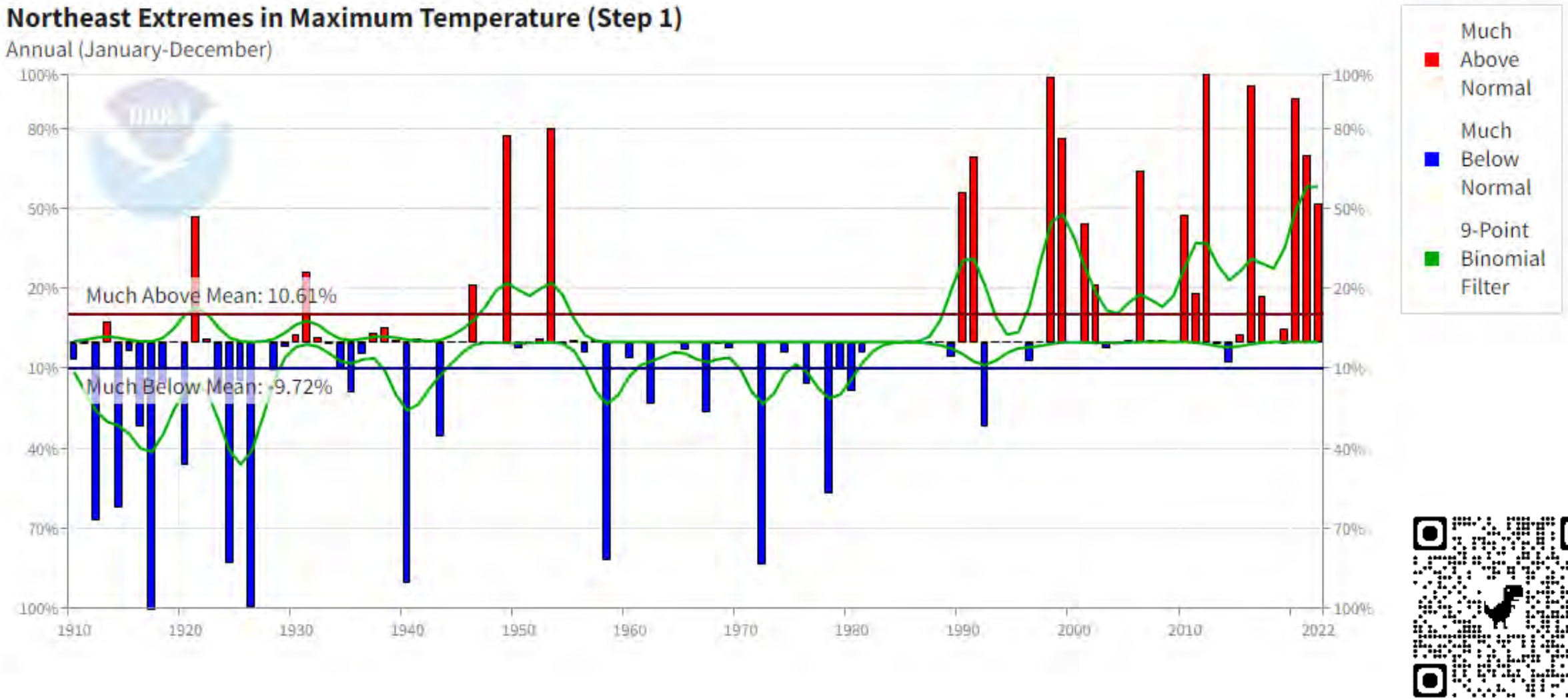
- State climatologists

Climate Extremes on the Rise in the U.S.



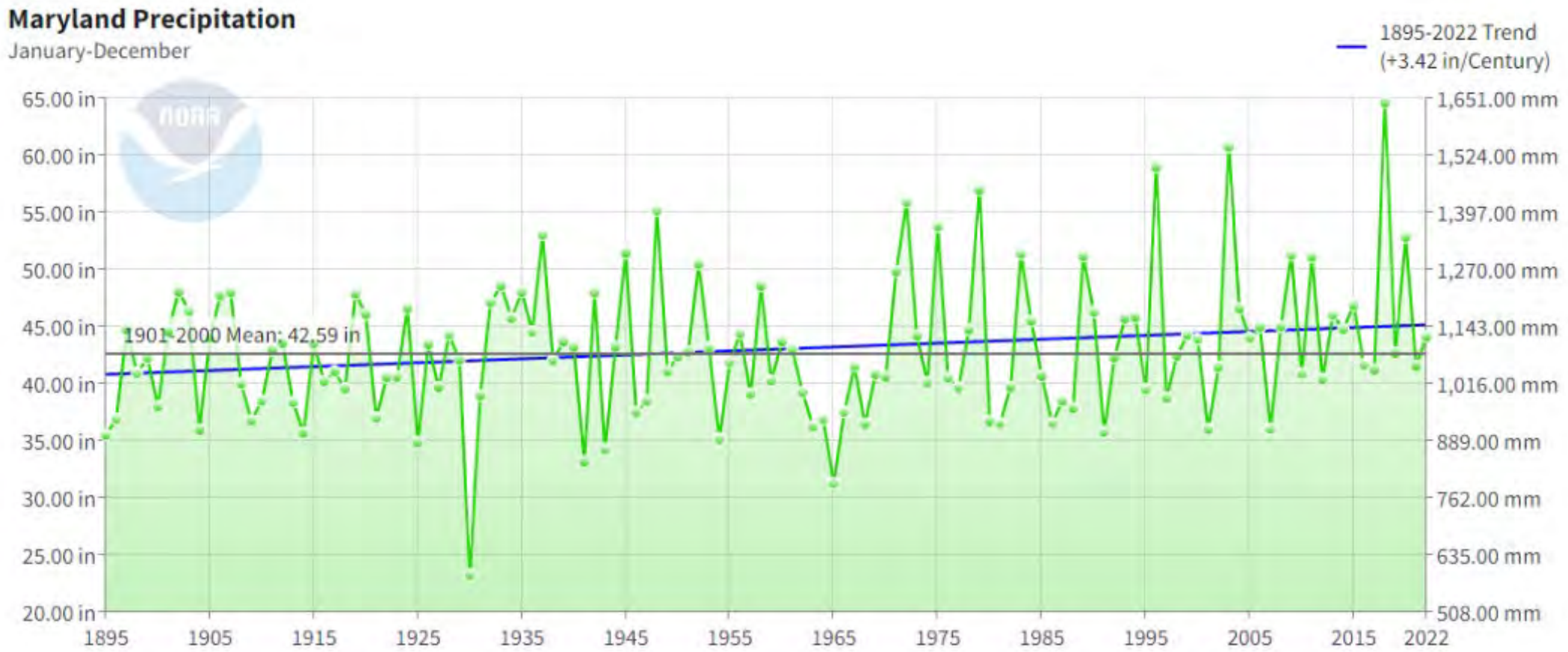
https://www.ncei.noaa.gov/access/monitoring/cei/graph

Temperature Extremes for the Northeast



Precipitation Trends

Maryland



https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/

Demand for Information with Sectoral Perspectives

Hazard Areas with NOAA Focus

COASTAL INUNDATION
Community Resilience

CLIMATE
Extremes

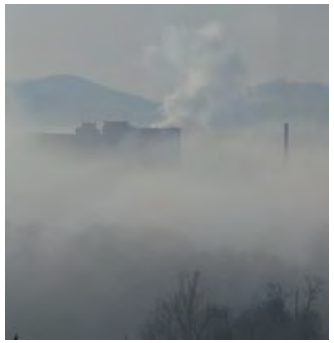
WATER
Drought and Flooding

SUB-SEASONAL to SEASONAL
Icing, wind, heat

Application of NOAA's Information by Sector

Agriculture

Energy



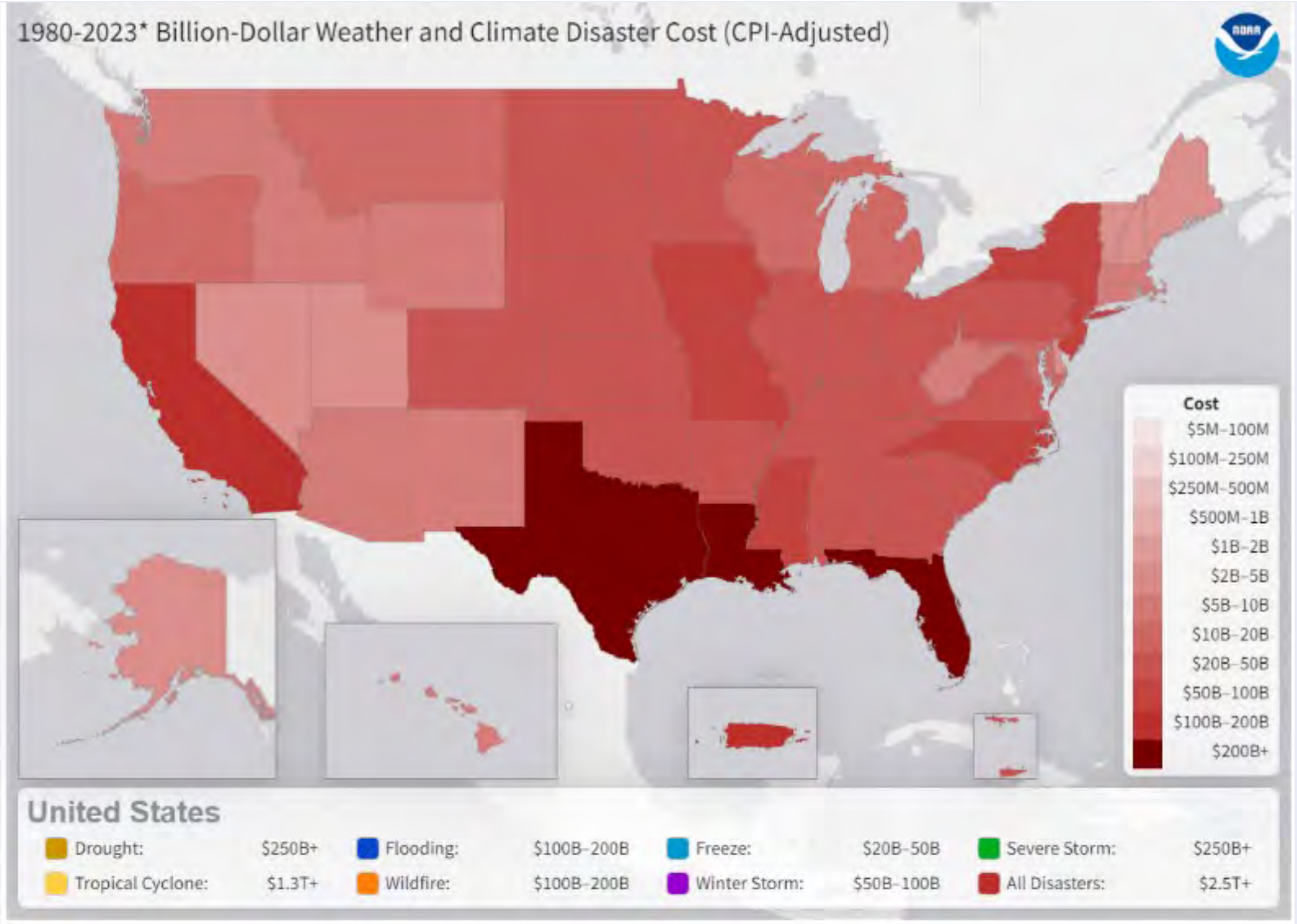
Health

Transportation

Marine Ecosystems

Insurance/Reinsurance

From 1980–2023*, the U.S. **South, Central** and **Southeast** regions experienced a higher cost from billion-dollar disaster events. CA, NY, NJ, PR and V.I. as well.



Please note that the map reflects a summation of billion-dollar events for each state affected (i.e., it does not mean that each state shown suffered at least $1 billion in losses for each event).

**as of April 10, 2023*

- Reflects the **severity, vulnerability and exposure** of weather and climate events impacting different regions

- The **top 3 most impacted states:**
  Texas
  Louisiana
  Florida

- The **relative costs are more acute in Louisiana**, as its population and economic size is much smaller than Texas or Florida.

- Louisiana also has a high frequency of disaster events, which can leads to compounding, cascading socioeconomic impacts.

Department of Commerce/NOAA Workplan

1) Census-level Data Release for Billion-dollar Weather and Climate Disaster Mapping Tool *(POC: Adam Smith)*

2) What's Available from NOAA for the Insurance Industry? *(POC: Ellen Mecray)*

- July 26, 2022, Drought and Wildfire; Sept 29, Extreme Precipitation;
- Nov 15, Severe Convective Storms; Jan 26, 2023, Hurricanes and Tropical Cyclones

3) Cat/Climate Modeling Partnership/Incubator *(POC: Ellen Mecray)*

- Opportunity for industry to partner with academic climate modelers (Feb 2023)
- Connecting the communities: March 20, 2023, Insurance Industry perspective; April 17 Focus on catastrophe modeling; and May 15, Focus on climate modeling

4) DEI/ESG Partnership

Webinar Recordings

NSF 23-106

Insurance & Reinsurance Sector Highlights

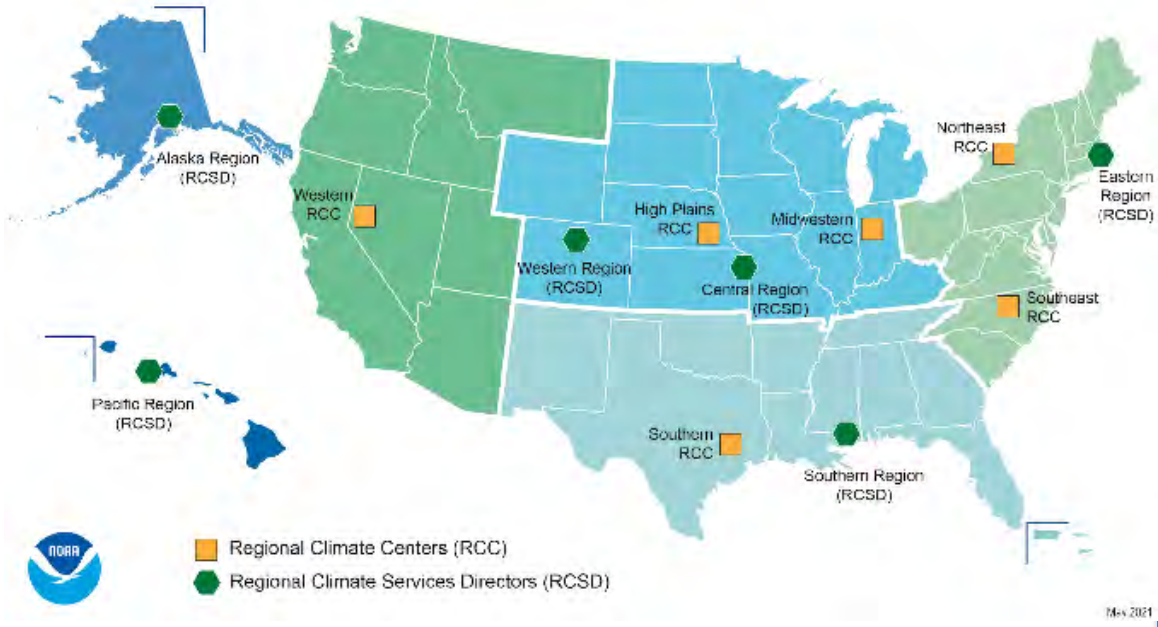
Needs	NOAA Response
Learn what's on the NOAA 'menu'	Webinar series, by peril (2022-23)
Cat model/climate model blending to capture physical and economic risks together	NOAA/NSF partnership, webinar series, upcoming competition
Climate predictions (1-5yrs) from authoritative source	GFDL working on prediction and projection timescales
Inland flooding models, and wind- or flood-related	National Water Model?
Gridded data, GIS-compatible	NCEI and partners (RCCs)
Better prediction of short-term, high-impact events	
Sectoral web pages, for finding relevant information	OAR/CPO Toolkit
Intensity AND frequency of extreme events	

Questions?

Ellen L. Mecray
NOAA National Centers for Environmental Information
Regional Climate Services Director- Eastern Region
Ellen.L.Mecray@noaa.gov

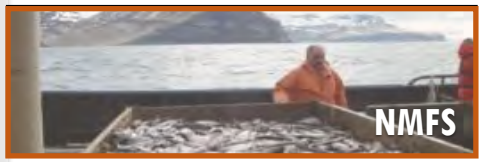
https://www.ncei.noaa.gov/regional/regional-climate-services-directors/eastern

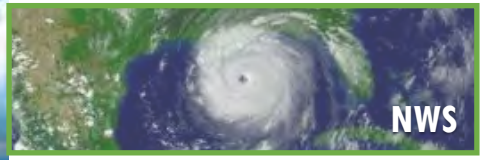
May 22, 2023
NAIC Engagement
NOAA's Insurance Focus, for New England Commissioners
FEMA Region I Bunker



NOAA's Mission

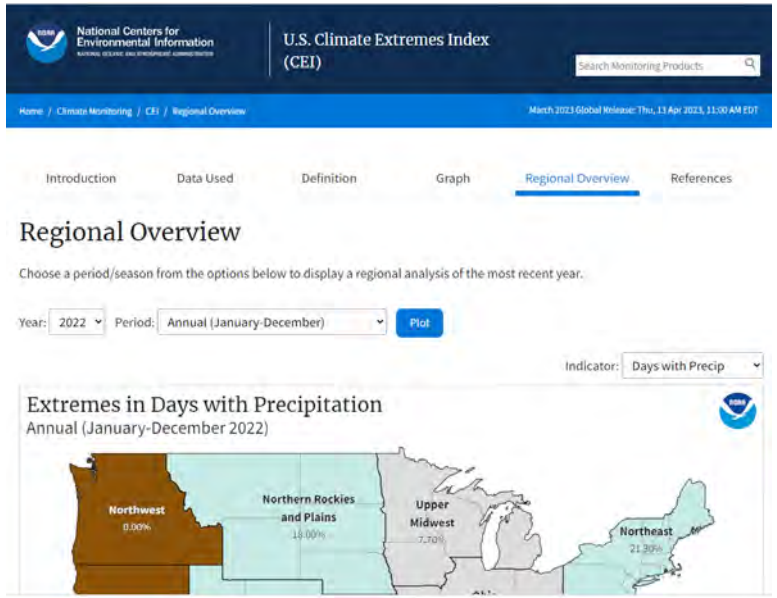
To understand and predict changes in climate, weather, oceans, and coasts; to share that knowledge and information with others; and to conserve and manage coastal and marine ecosystems and resources.





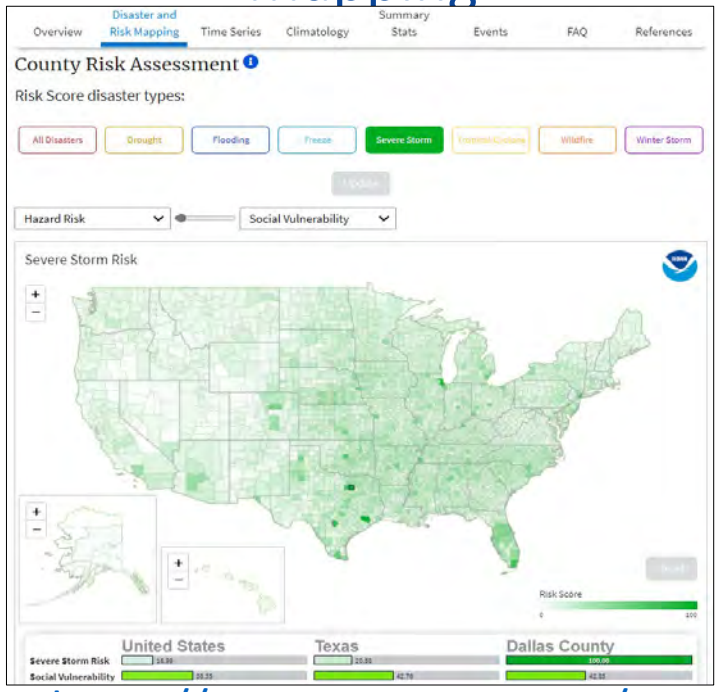
NCEI - Authoritative Climate Products & Services

US Extremes Index



https://www.ncei.noaa.gov/access/monitoring/cei/

B$D County Hazard Mapping

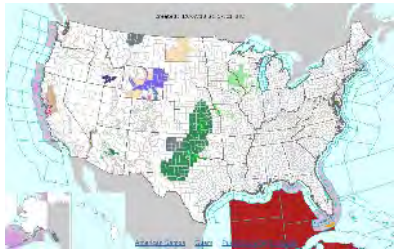


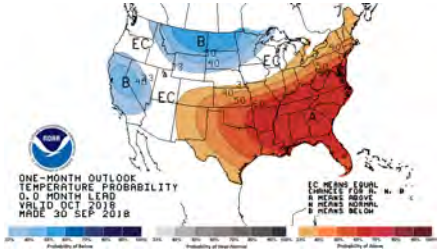
https://www.ncei.noaa.gov/access/billions/

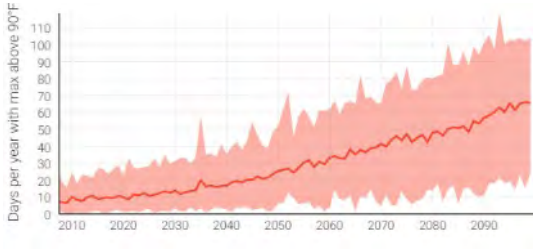
Climate at a Glance

https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/

Understanding Decision Timescales







Tropical Cyclone Forecasting & Threats in New England

Donny Dumont
Warning Coordination Meteorologist
NWS Gray/Portland

Discussion Topics

Storm Types

- Understanding Tropical Cyclone Types
- Hybrid Storms

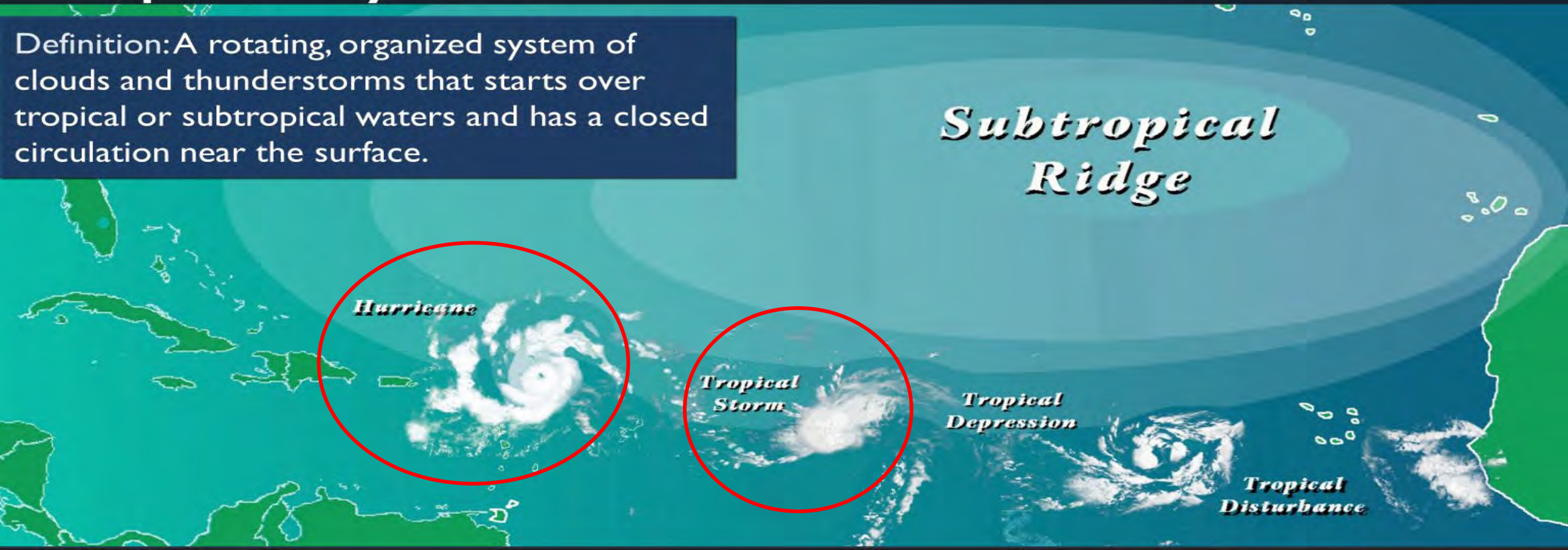
Understanding/Ranking Tropical Threats

- Wind, Storm Surge, Inland Flooding, Tornadoes

Forecasting Tropical Cyclones

Tropical Cyclones

Definition: A rotating, organized system of clouds and thunderstorms that starts over tropical or subtropical waters and has a closed circulation near the surface.



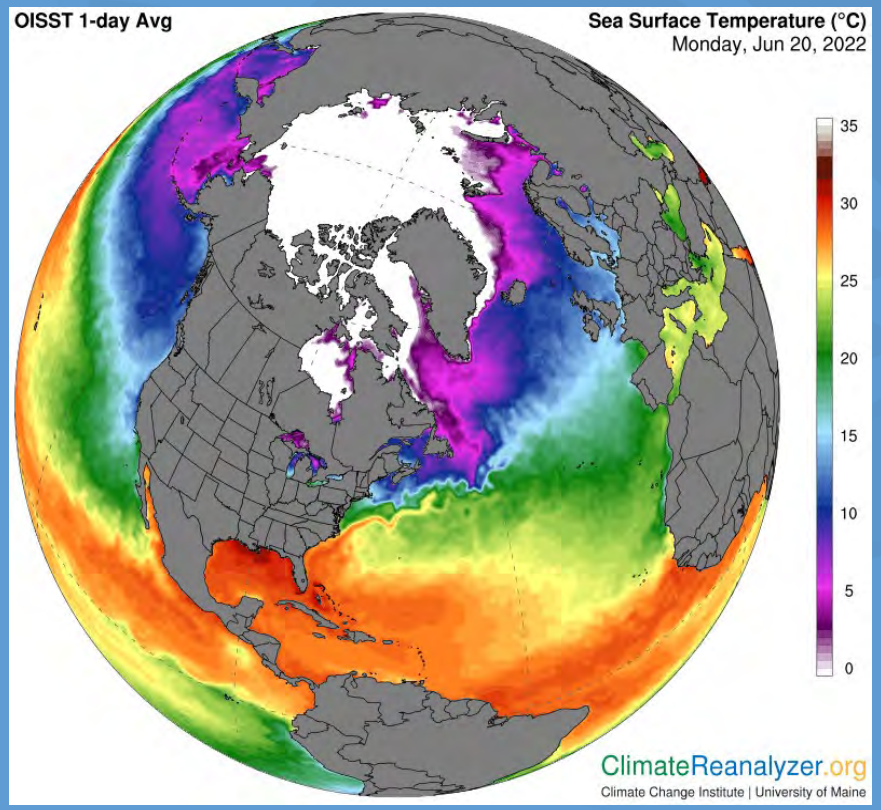
Storm Strength Classifications

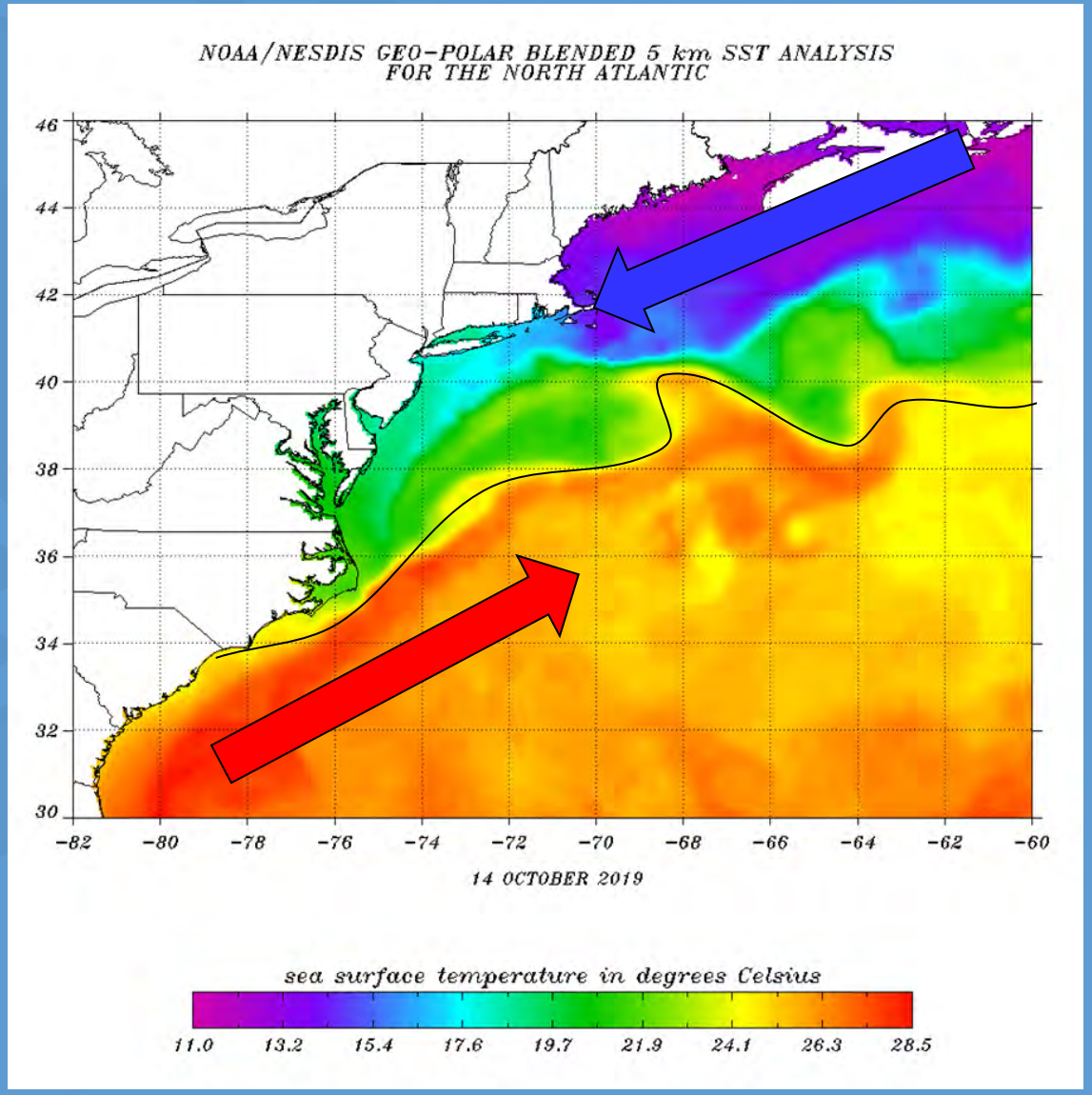
TD	TS	CAT 1	CAT 2	MAJOR CAT 3	MAJOR CAT 4	MAJOR CAT 5
< 39 MPH	39-73 MPH	74-95 MPH	96-110 MPH	111-129 MPH	130-156 MPH	157+ MPH
< 63 KM/H	*63-118 KM/H*	*119-153 KM/H*	*154-177 KM/H*	*178-208 KM/H*	*209-251 KM/H*	*252+ KM/H*

Sources: Storm data provided by the National Hurricane Center, a division of the National Weather Service

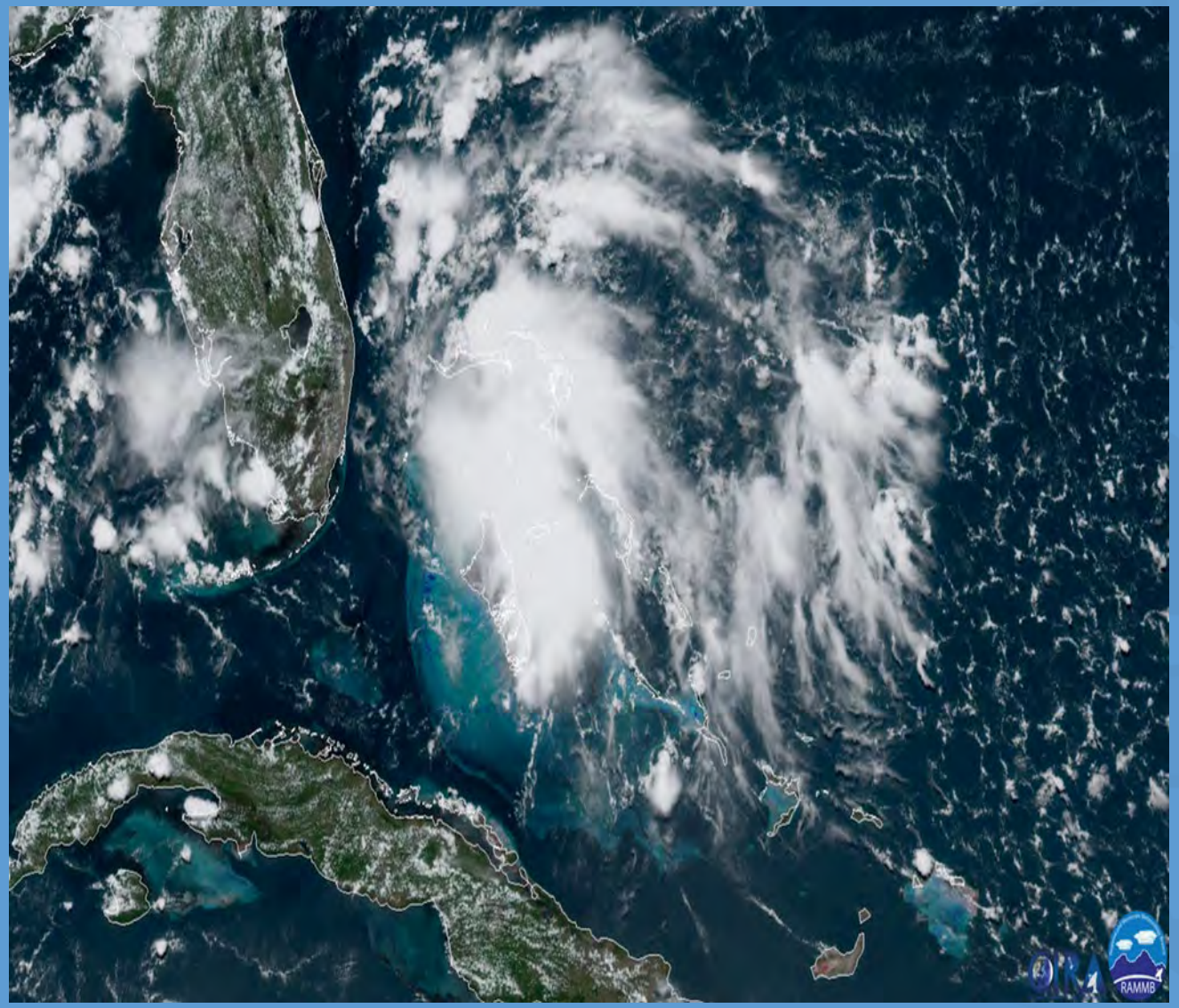
Gulf of Maine Influence

1. Hurricanes need sea surface temperatures of 26C or 79F to maintain strength.
2. Storms that are hugging the eastern seaboard are always weakening north of the outer banks due to the Labrador Current

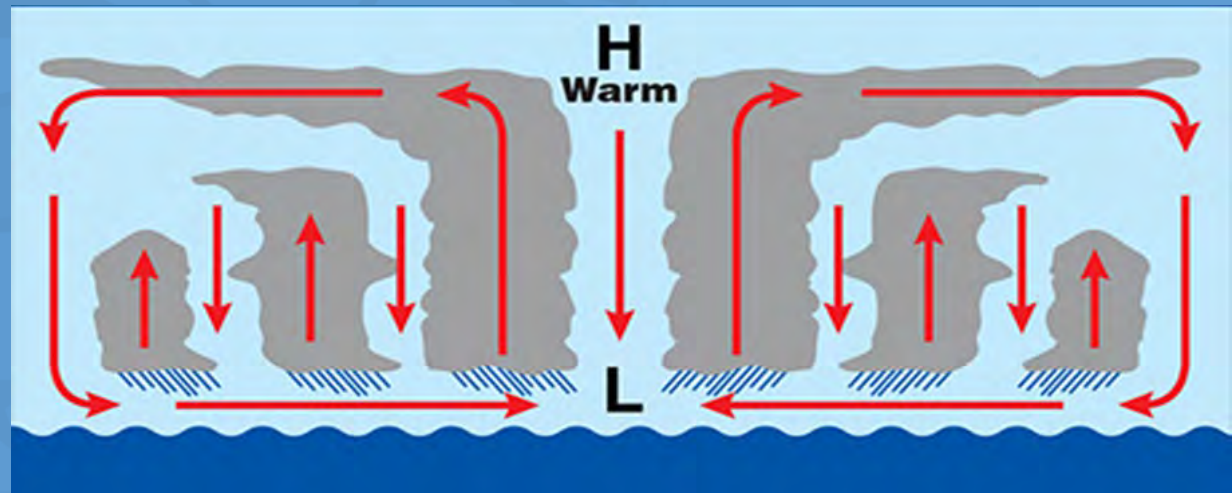




Tropical Cyclone Development

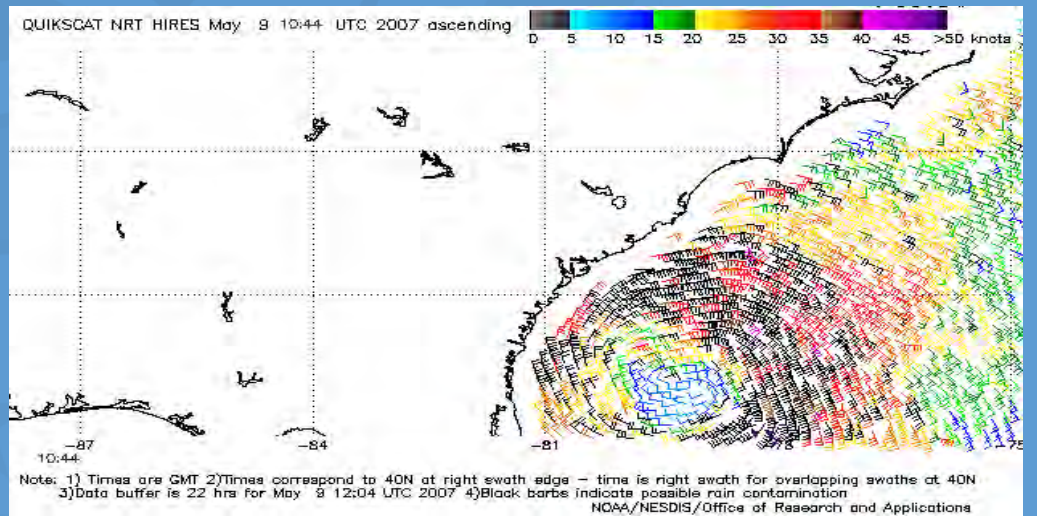


- Thunderstorms develop over the tropics due to evaporation from the ocean
- Sometimes the storms cluster together causing a complex of storms
- Thunderstorms release latent heat (fuels the storm) during their development causing the atmosphere to warm
- Low wind shear aloft needed
- No Sahara Desert dust



Sub-Tropical Cyclone

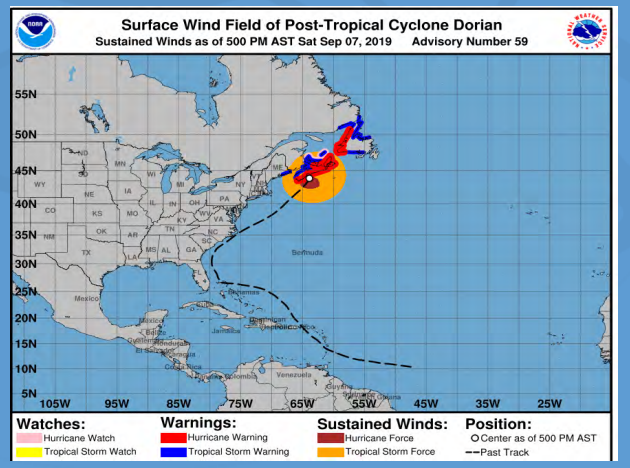
- Sub-tropical storms have both tropical and extra-tropical storm characteristics
- Convection and strongest winds are normally 100 miles removed from the center.
- Normally form off the Eastern Seaboard and not the tropics in June/October

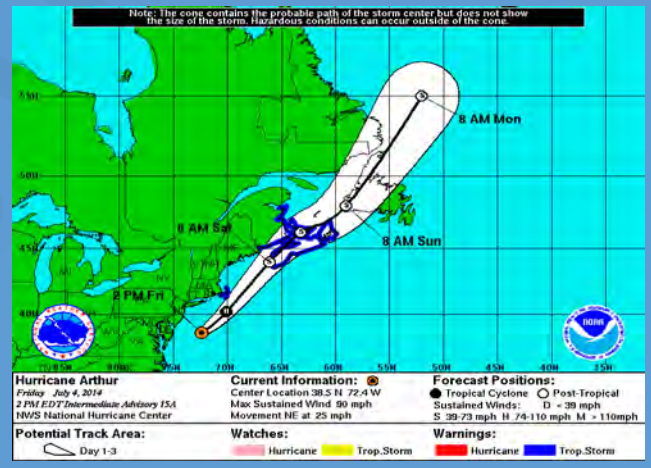


Post-Tropical Cyclone (Hybrid)

John Morris / Reuters

- A former tropical cyclone. Storms that have transferred from a tropical cyclone characteristics to extra-tropical characteristics (Nor'easter)
- Example storms, Post-tropical Fion, Dorian, Arthur, Sandy, Perfect Storm
- Majority of storms become Post-Tropical over or near the Gulf of Maine.

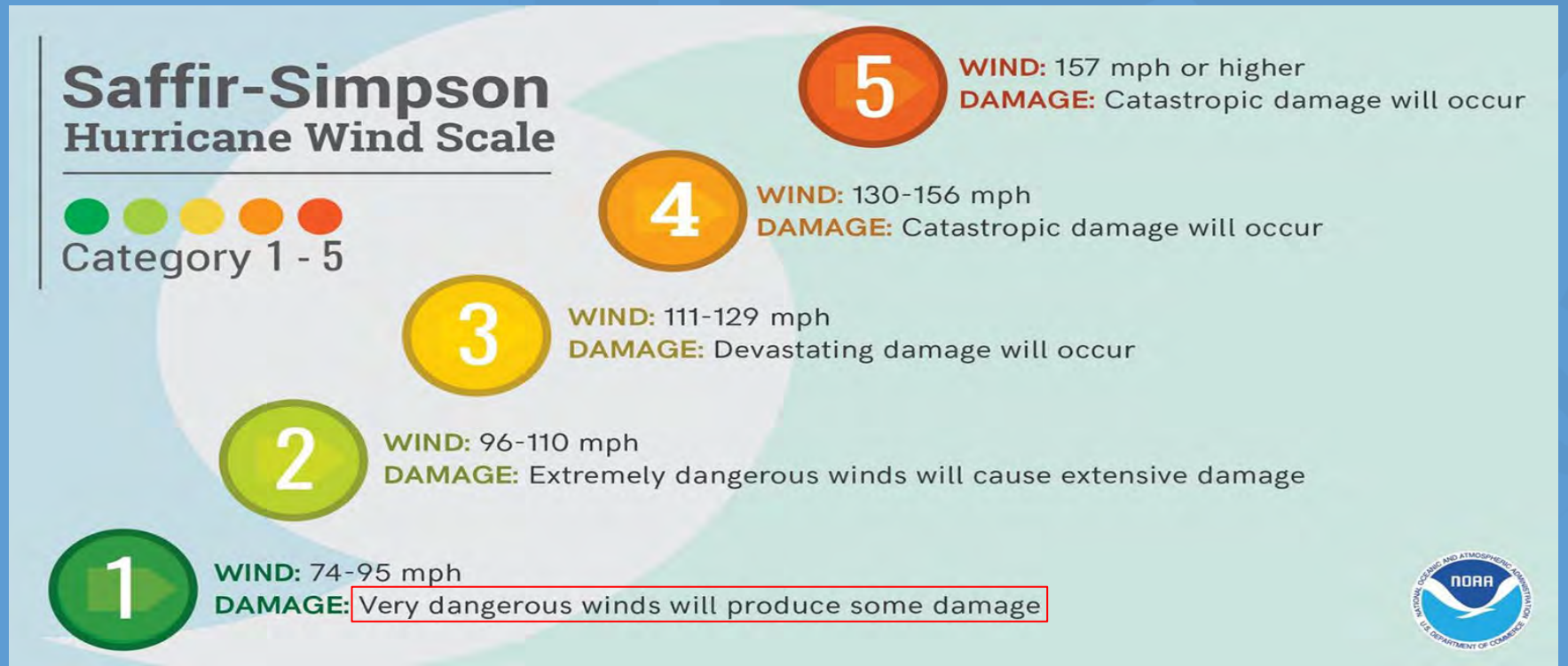


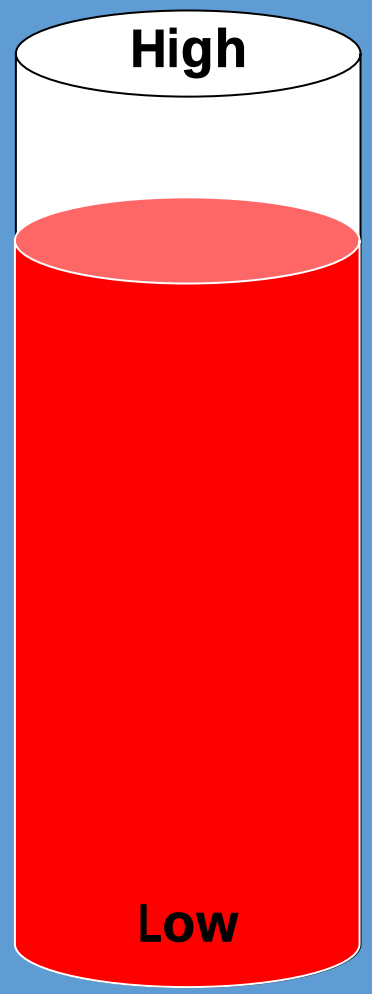


Tropical Threats - Wind

Northern New England historical Category 1 Hurricanes

Southern New England Coast Historical Category 1, 2 and 3 Hurricanes





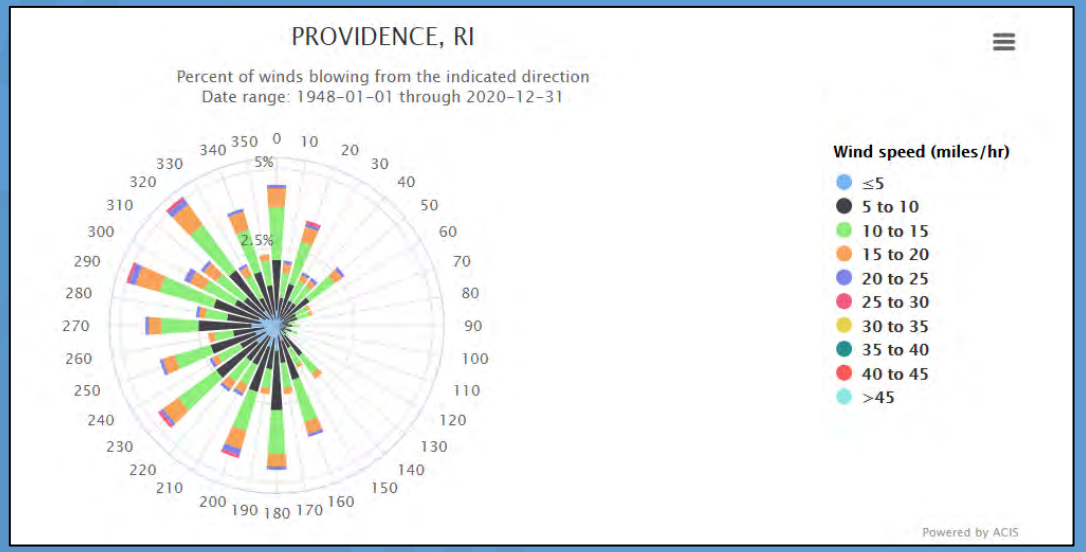
Wind Threats

Be careful of “boilerplate” wind hazard threat assessments, impacts are different in different parts of country!

A category 1 direct hit will be devastating to our power grid

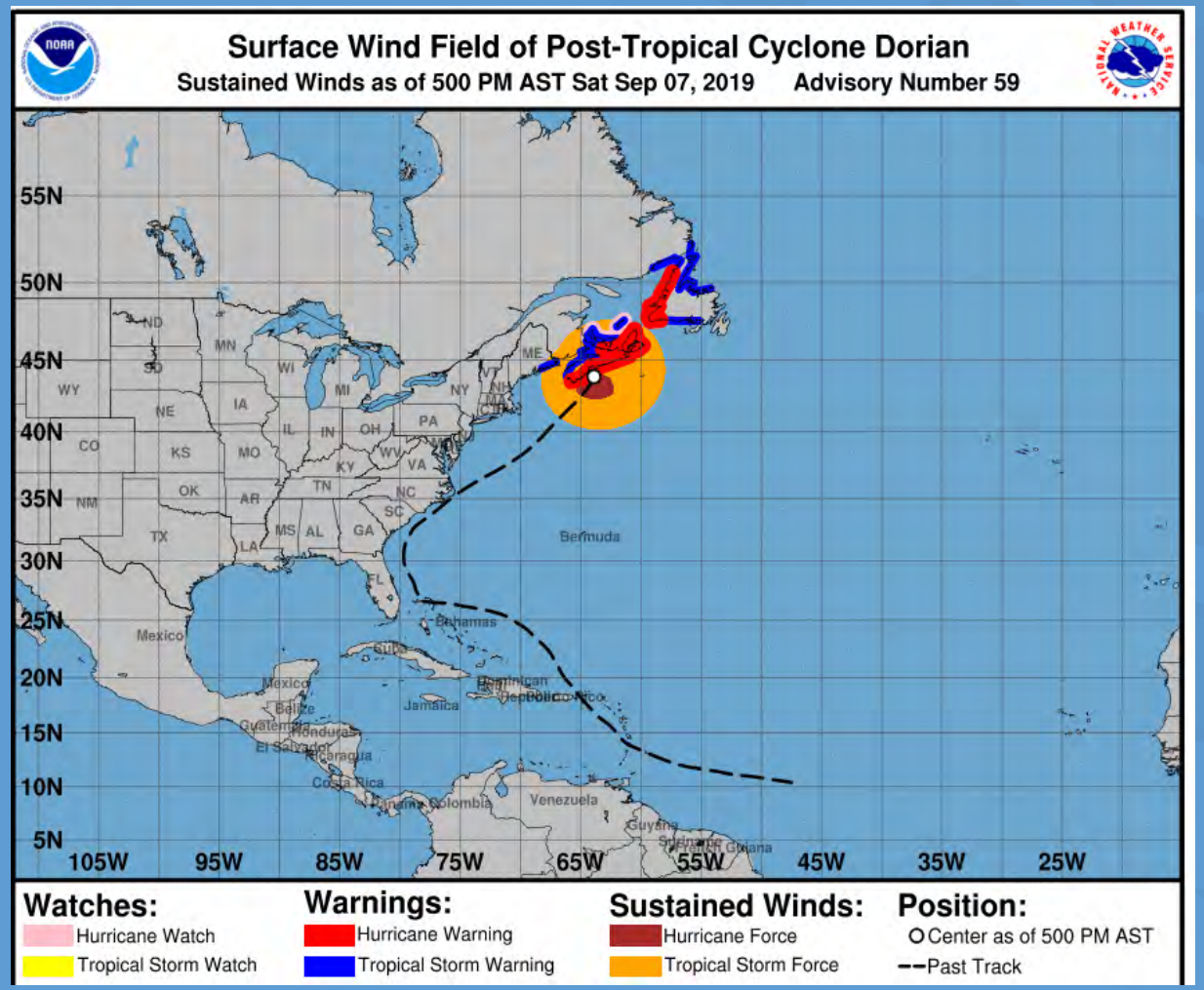
Too many trees that aren’t acclimated to high winds during the summer months (rocky ledge, leave out)

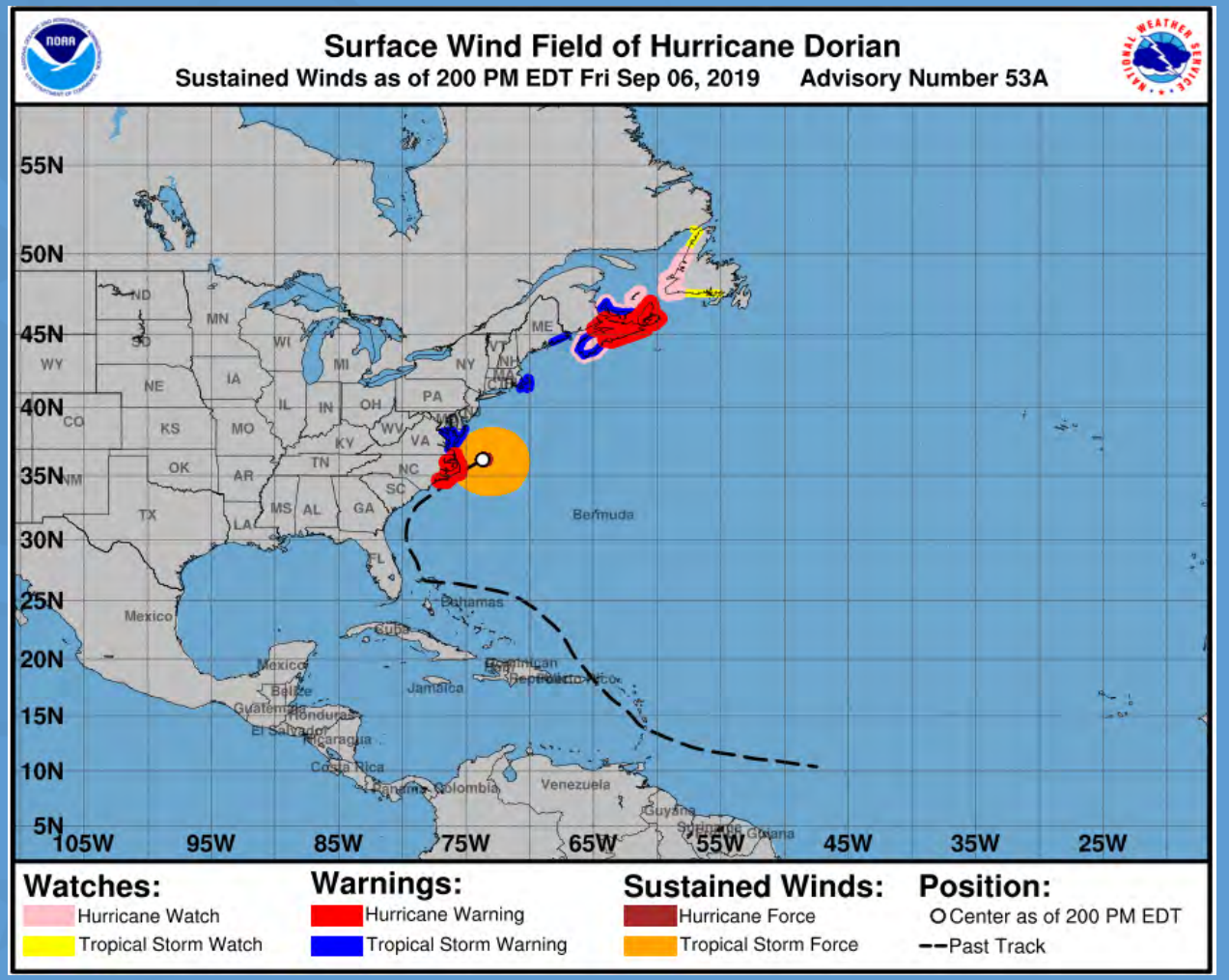
Rural nature of our power grid (Northern New England) and most forested in the country



Post-Tropical Storm Winds

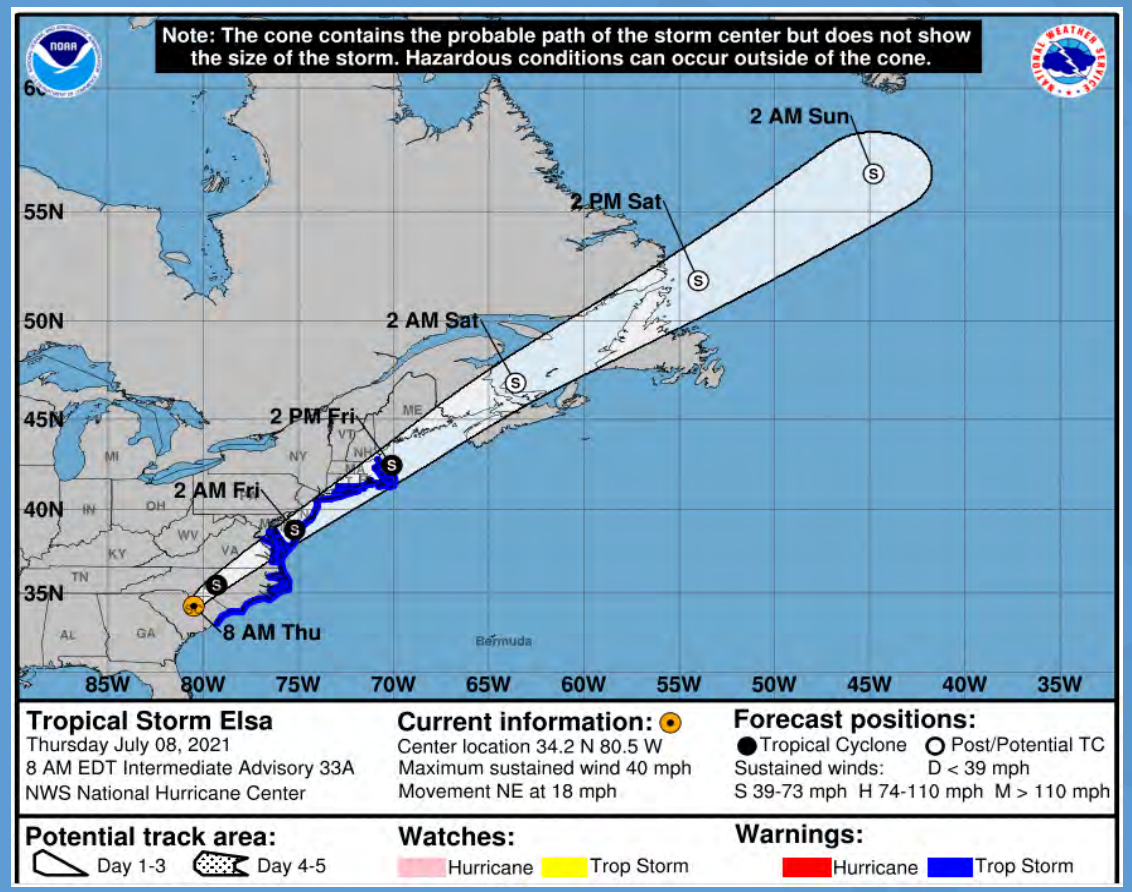
Most storms wind field expands and storm strength increases!



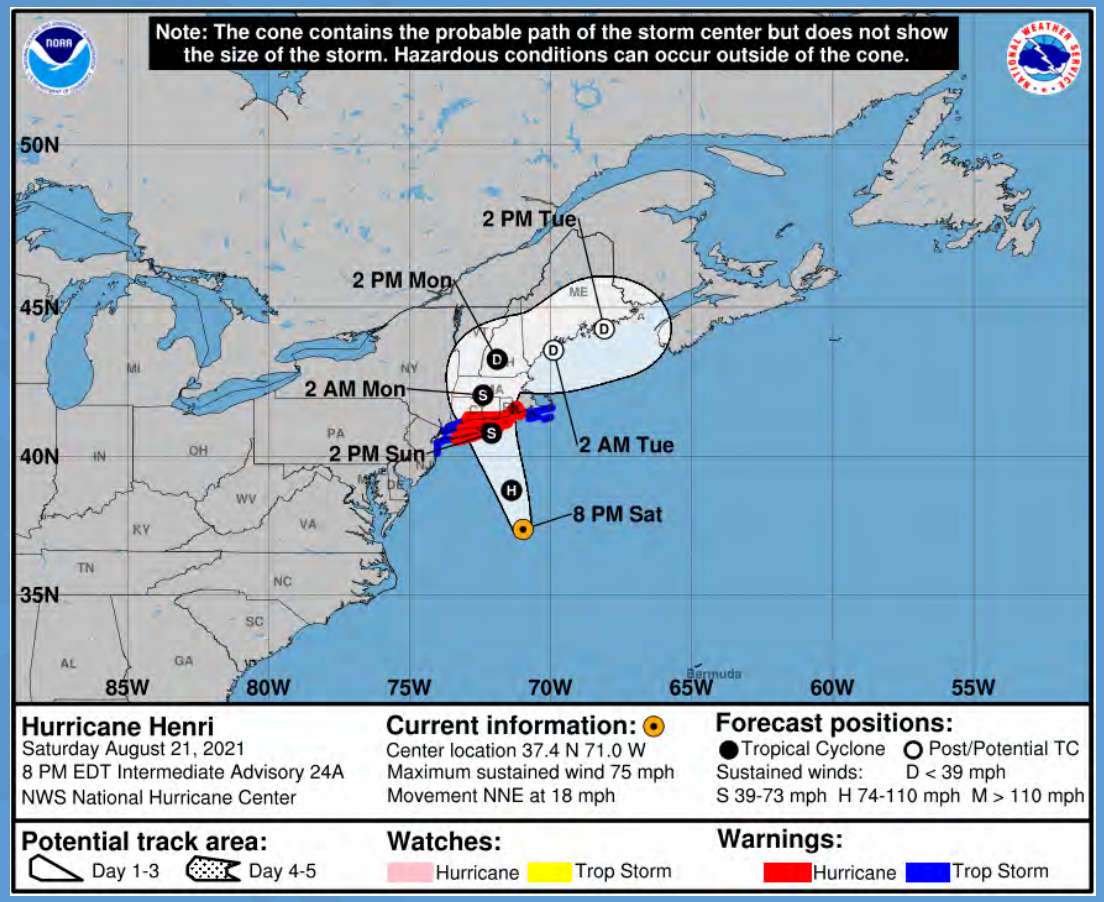


When to Worry About Impacts

Proximity of low center and strength/size of storm!



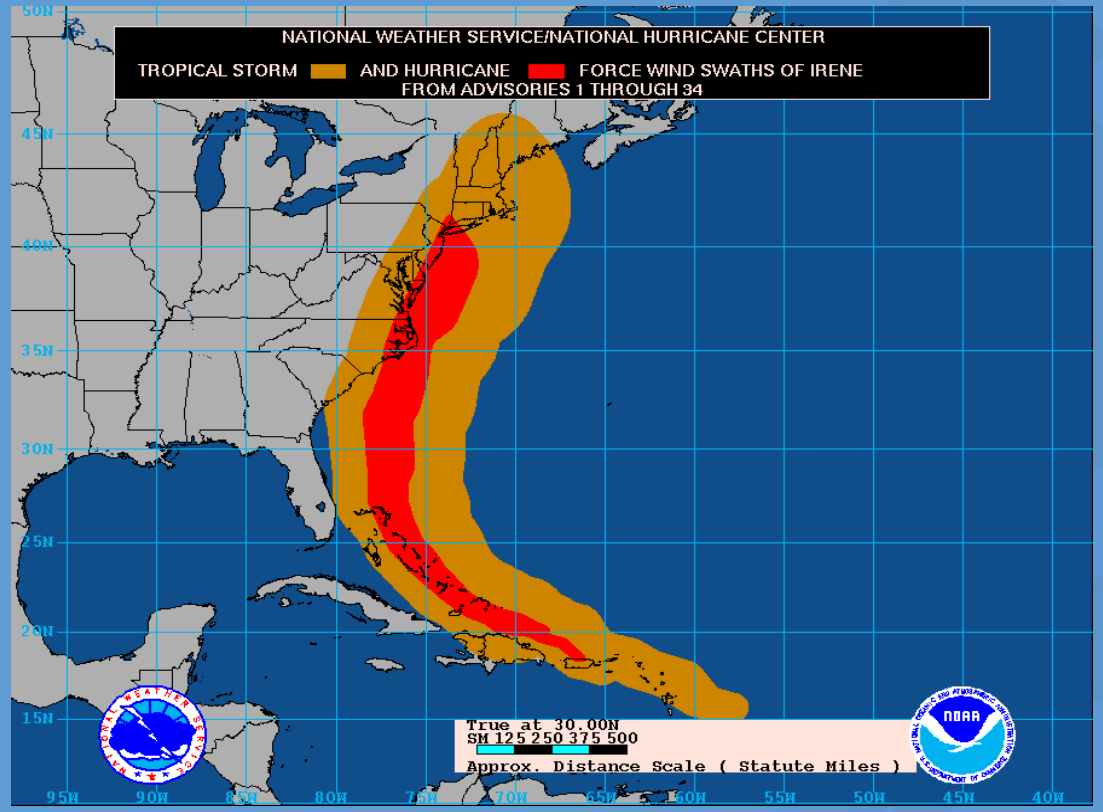
Weak storms in the Carolinas or over land will not strengthen!



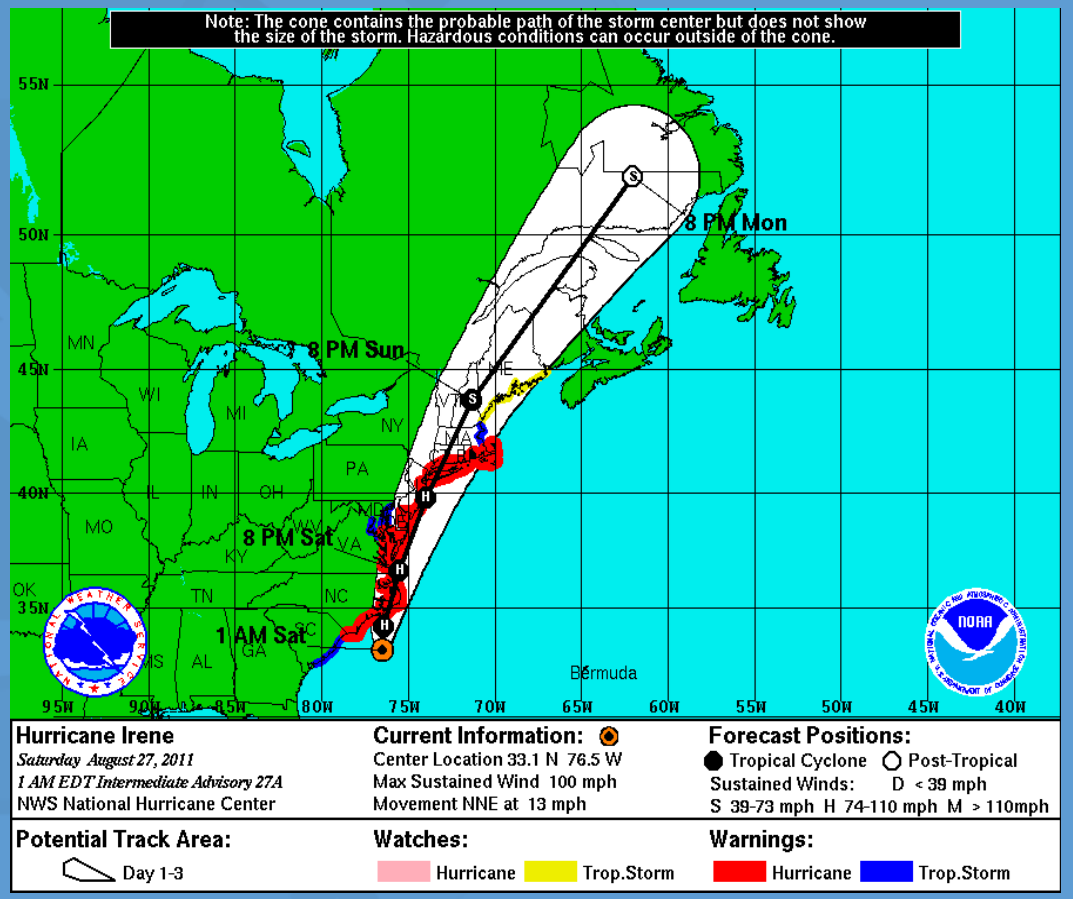
Small compact storms can have limited wind fields in areal extent

When to Worry About Impacts

Worry about Strong Tropical Storms and Hurricanes tracking over head or to the west!



Storms with large windfields are something to watch

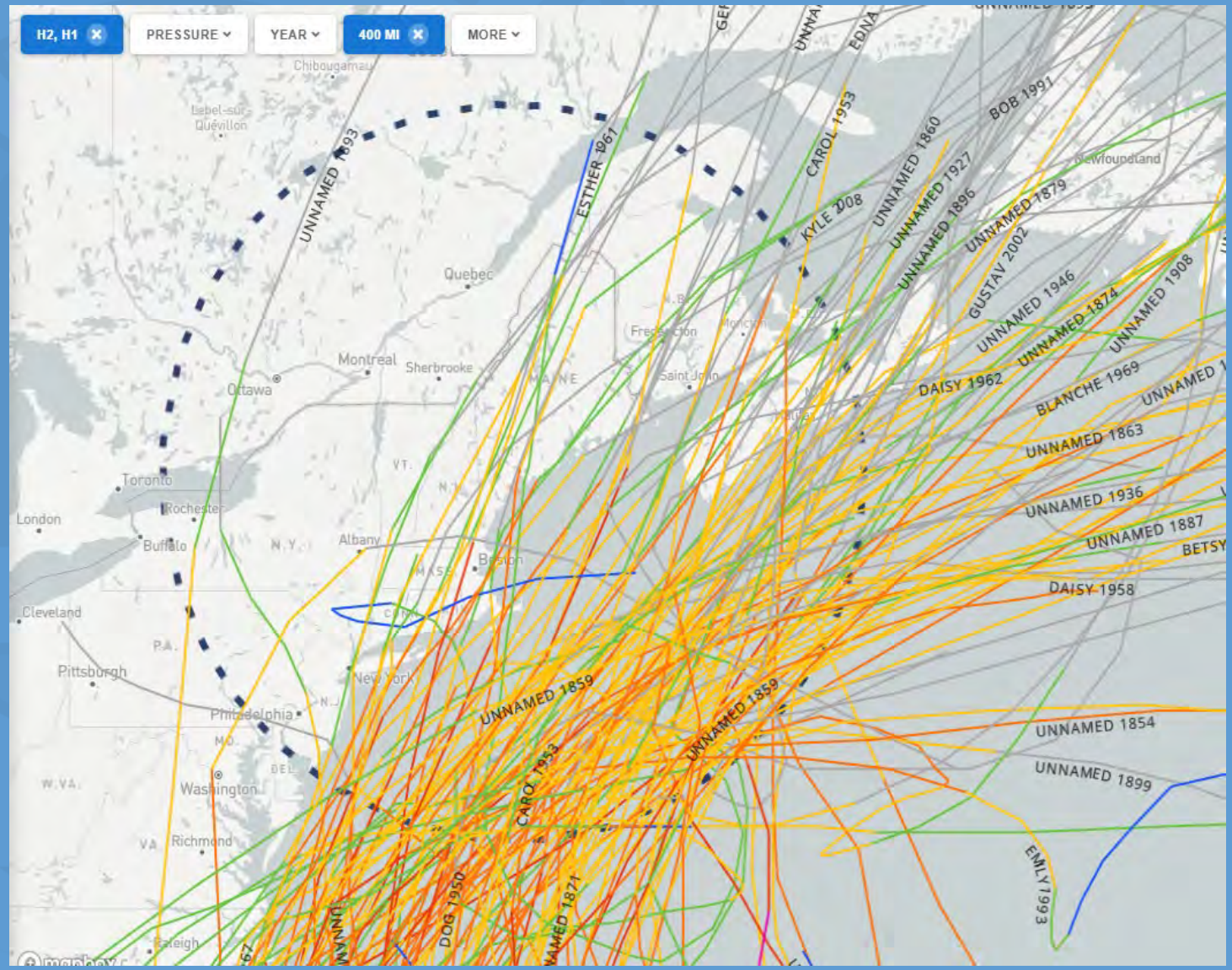


Cat 2 or stronger over Cape Hatteras are dangerous storms

Angle of Approach

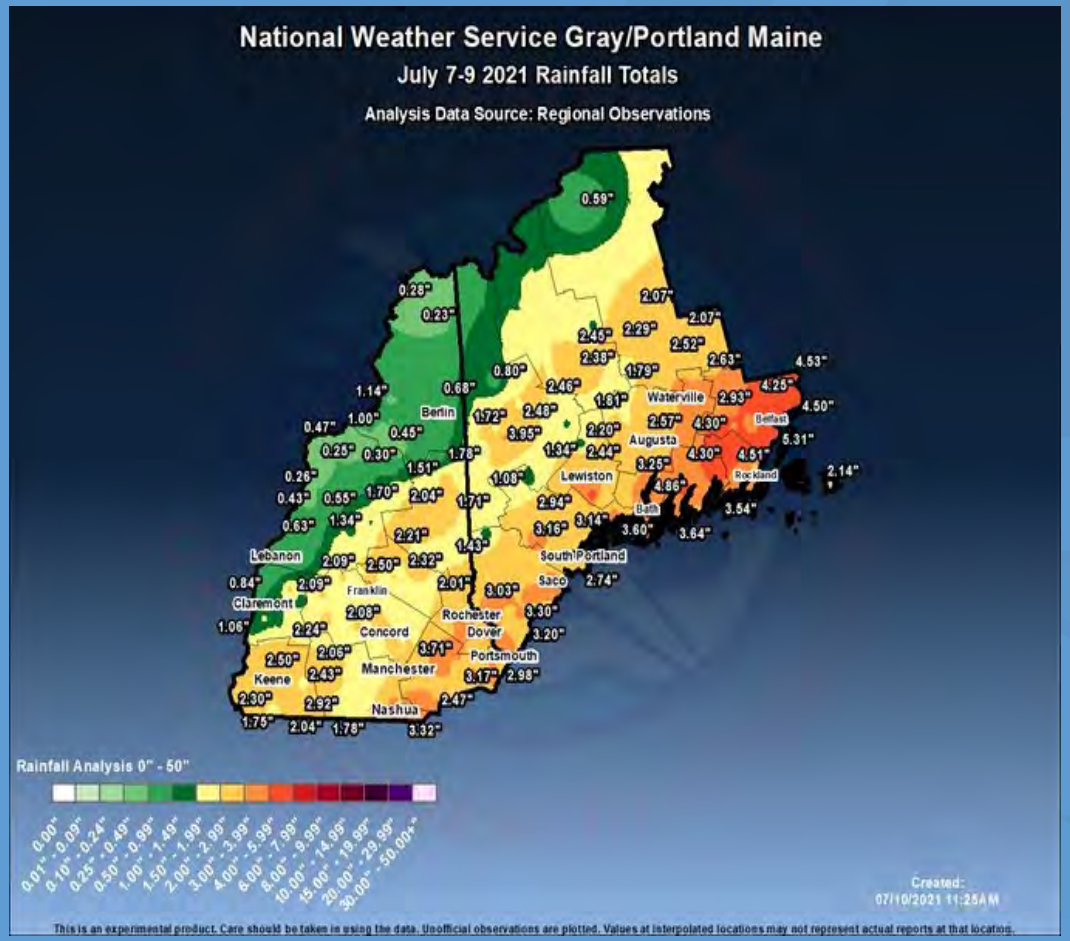
History shows the vast majority of storms re-curve east of New England.

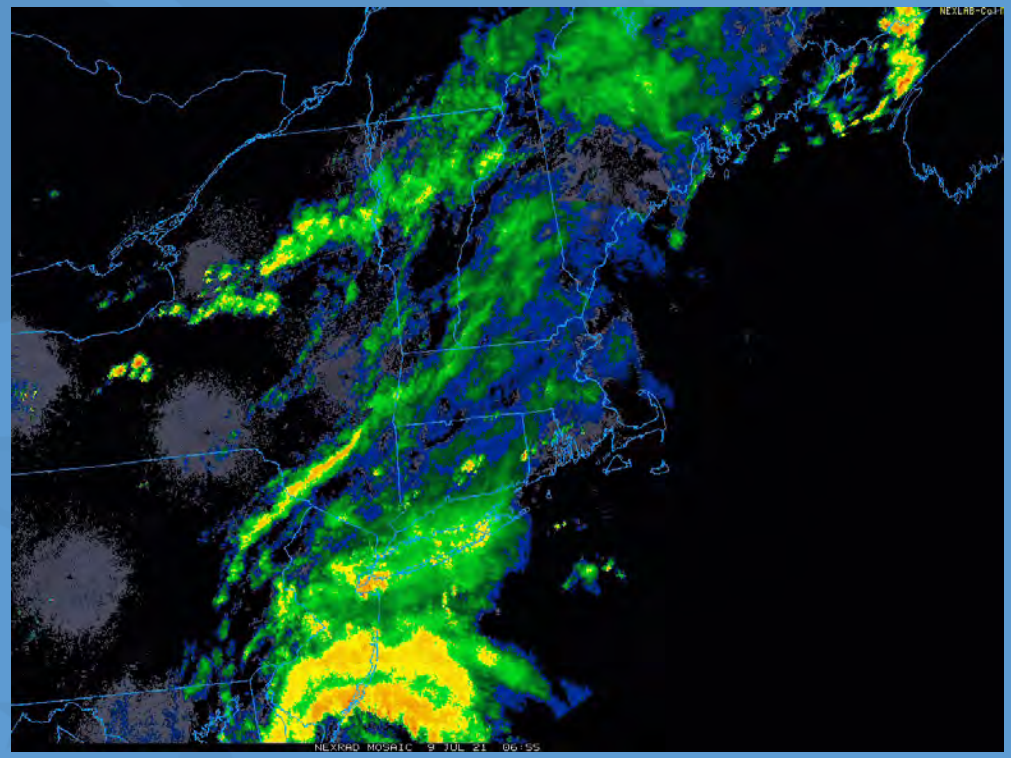
Close approach recurving storms normally impact the Cape & Downeast the most



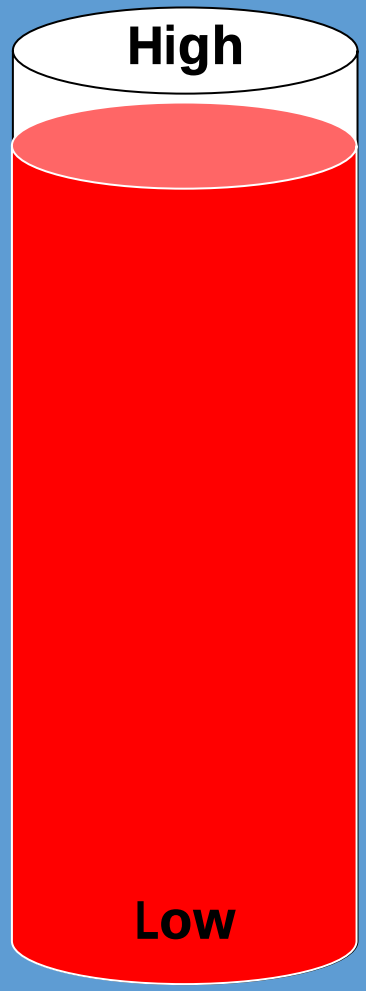
Flood Threats

Unlike wind threats, flood threats can occur in all types of tropical cyclones, even weak ones!





Threat Scale



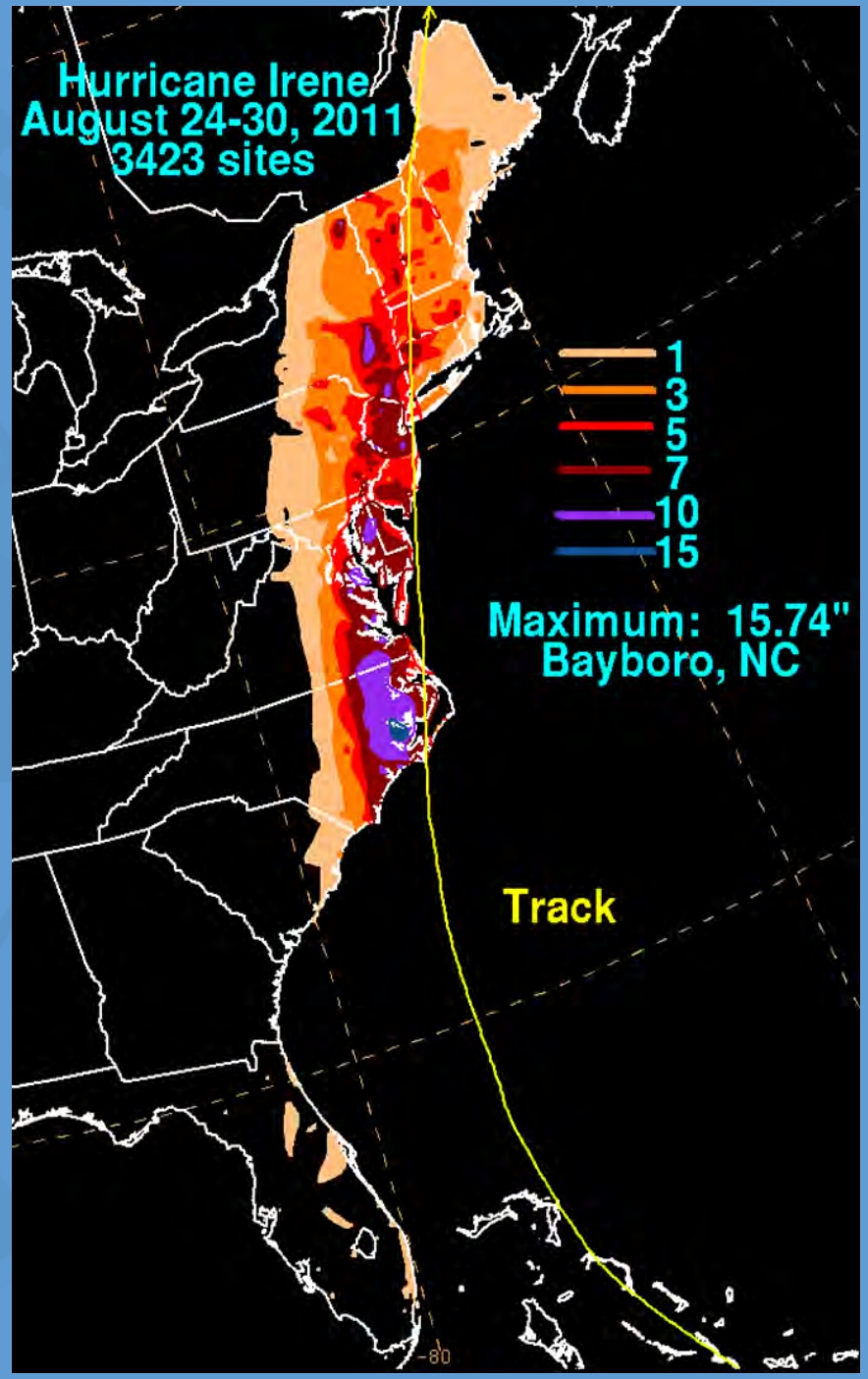
Flood Threats

Inland flooding is the greatest threat to life for tropical cyclones in most of New England

Pemi Historic Crests includes 2 events in the top 10

Historic Crests

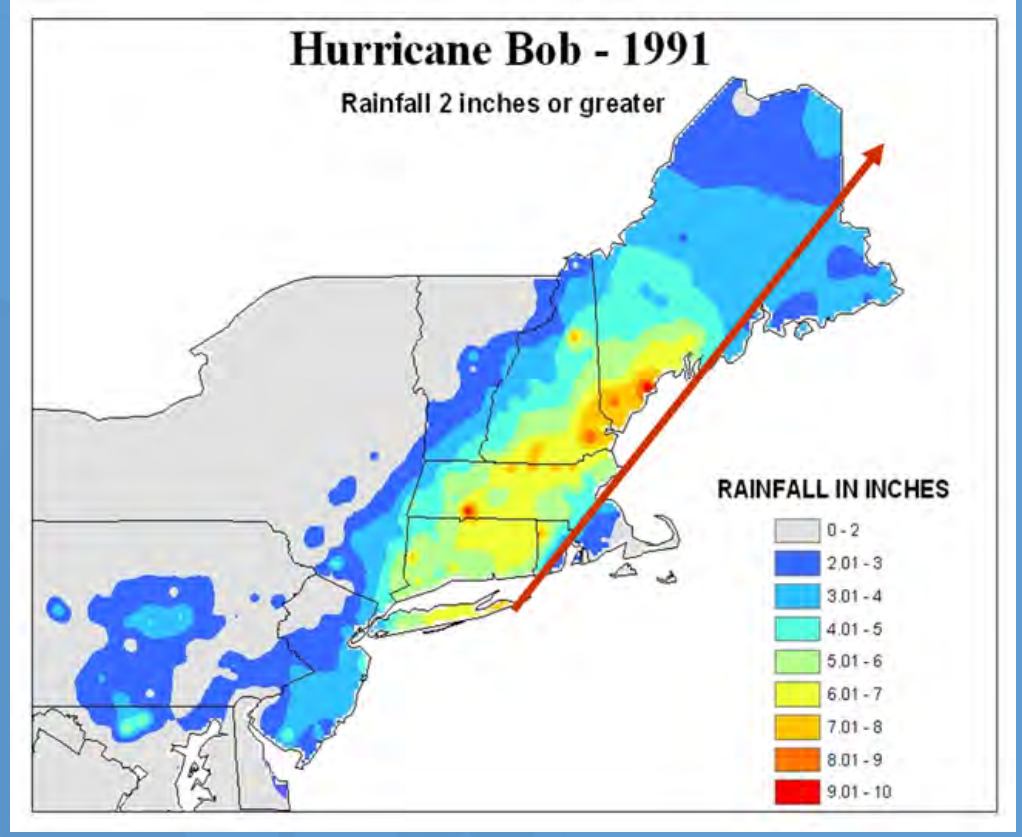
(1) 29.00 ft on 03/19/1936
(2) 27.40 ft on 11/04/1927
(3) 23.62 ft on 09/21/1938
(4) 23.43 ft on 04/01/1987
(5) 22.68 ft on 10/25/1959
(6) 22.33 ft on 07/01/1973
(7) 21.69 ft on 08/29/2011
(8) 21.20 ft on 03/27/1953
(9) 20.61 ft on 12/22/1973
(10) 20.28 ft on 01/27/1986

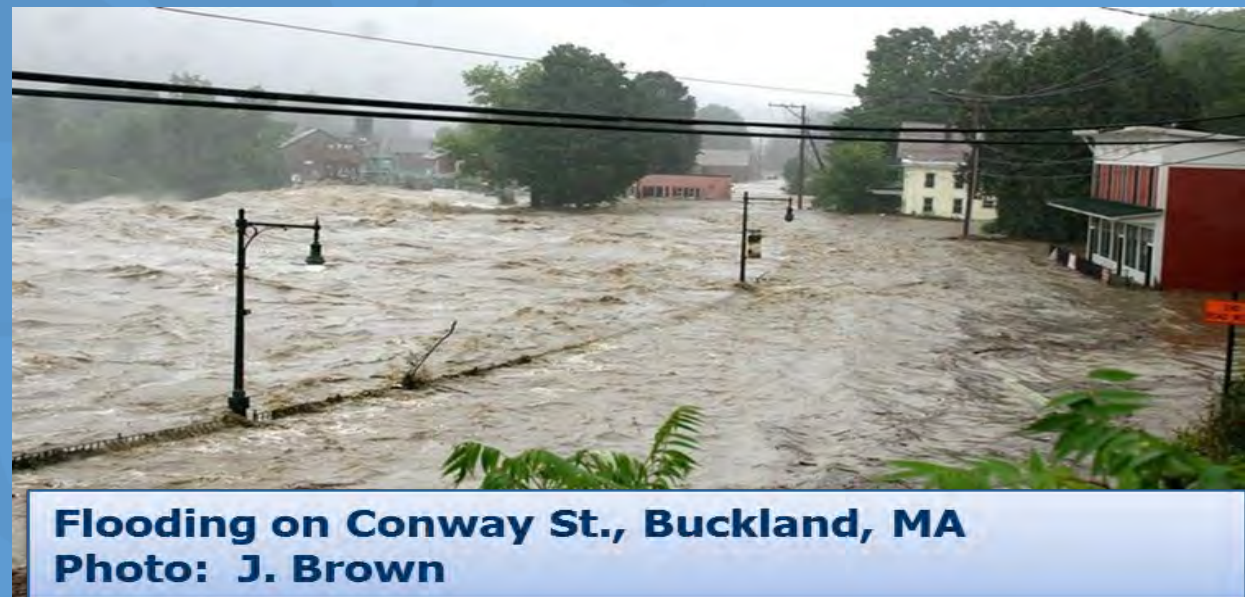


Flood Threats

Heaviest rainfall usually falls on the west side of the storm track

More significant impacts occur over the mountains and foothills of interior New England due to tropical rainfall rates in hilly and mountainous terrain





Flooding on Conway St., Buckland, MA
Photo: J. Brown

Storm Surge Threat

Across the U.S., storm surge is the number one threat for hurricanes, but history shows North of the Cape the threat is low, but higher across Southern New England Coast!

1 out of the top 10 surge events is tropical in Portland (higher if you count hybrid storms)

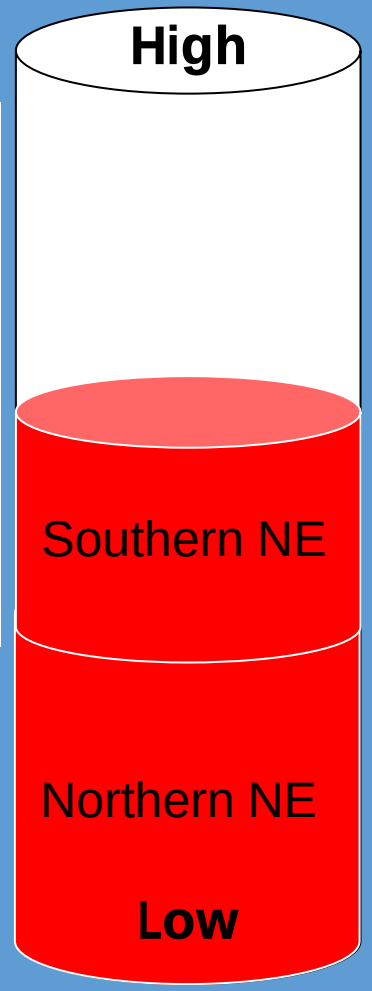
Different story in Rhode Island

ALL TIME HIGHEST STORM SURGES (AT HIGH TIDE) AT PORLAND, ME 1912-2022 (MLLW)		
Rank	Height (MLLW)	Date
1	4.3'	March 3, 1947
2	4.1'	March 1, 1914
3	3.9'	Dec 14, 1917
4	3.6'	Feb 19, 1972
5	3.5'	Nov 26, 1950
	3.5'	Feb 7, 1978
	3.5'	Oct 30, 1991
8	3.3'	Nov 30, 1945
	3.3'	Aug 31, 1954
10	3.2'	Dec 2, 1942
11	3.1'	Mar 16, 1956
12	3.0'	Jan 15, 1940
	3.0'	Feb 7, 1951
14	2.9'	Nov 13, 1925
15	2.8'	Oct 30, 2017
14	2.8'	Dec 9, 2009
15	2.7'	Apr 16, 2007
16	2.7'	Feb 25, 2010

Historic Crests

(1) 13.30 ft on 09/20/1938
(2) 10.60 ft on 08/30/1954
(3) 8.07 ft on 10/29/2012
(4) 7.83 ft on 08/19/1991
(5) 7.80 ft on 09/13/1944
(6) 7.45 ft on 01/08/1978
(7) 7.25 ft on 12/23/2022 **(P)**
(8) 7.12 ft on 10/30/1991
(9) 7.11 ft on 02/05/1978
(10) 7.10 ft on 12/01/1974

Threat Scale

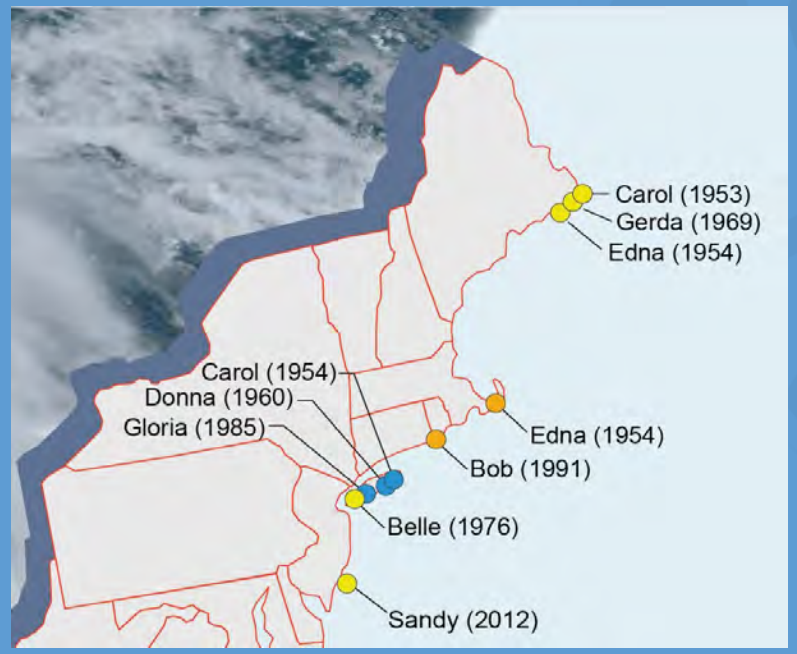


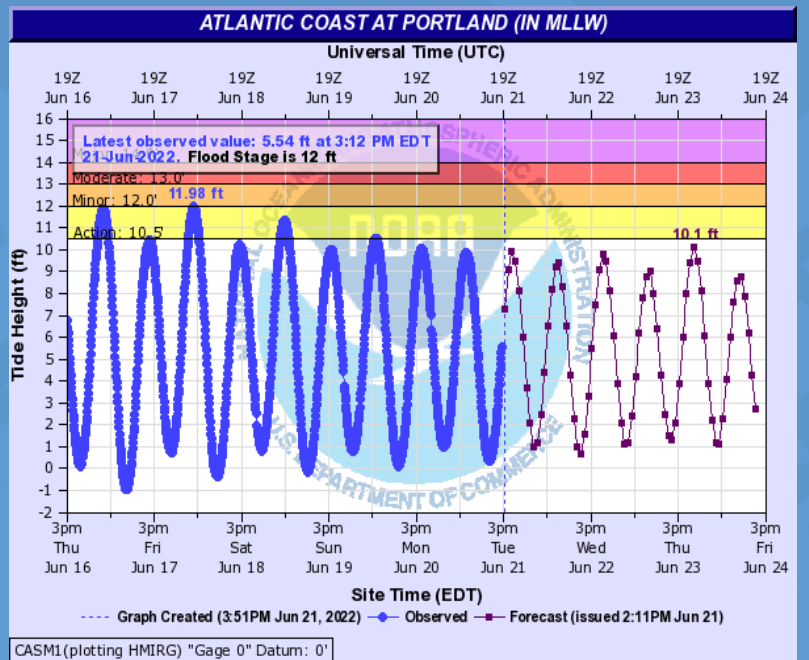
Storm Surge Threat Factors

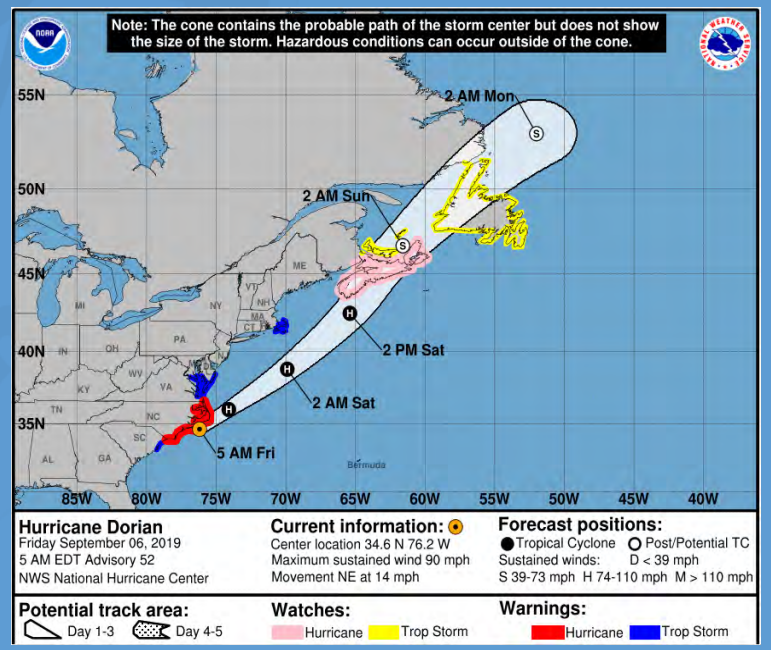
#1 Reason - We don't get hit by Cat 1 or higher storms often, very rare!

#2 Reason - We have large tidal variation - unlike winter Nor'Easters, surge is quick and only lasts one tide cycle with tropical cyclones

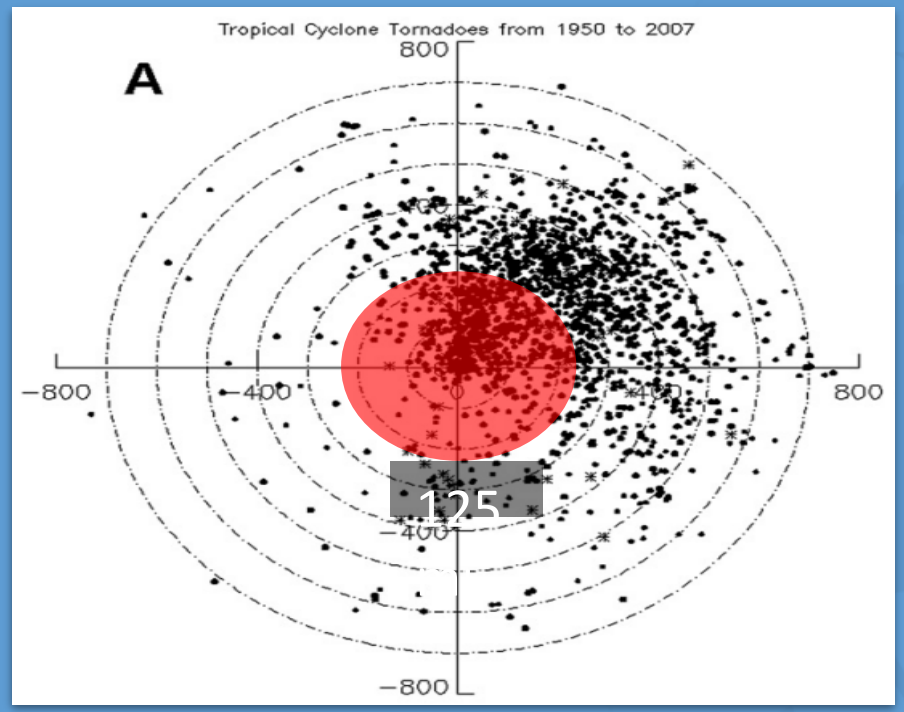
#3 Reason - Angle of approach - most storms are curving out to sea







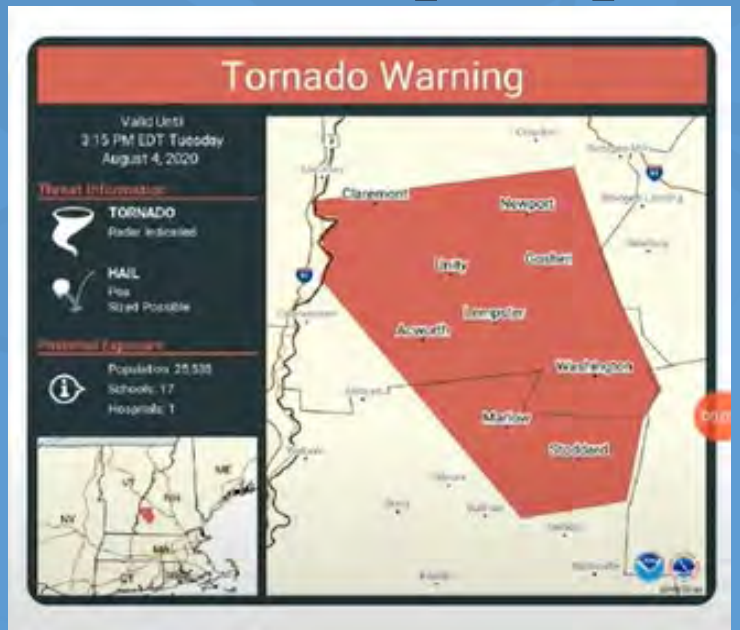
Tornado Threat



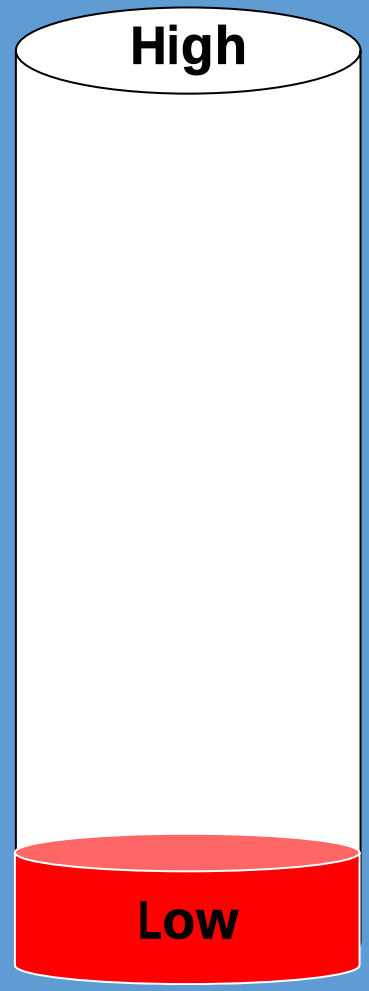
Right Front Quadrant
Main tornado formation zone

Tornadoes are common in the outer feeder bands of approaching tropical cyclones

Weak and brief spin ups



Threat Scale



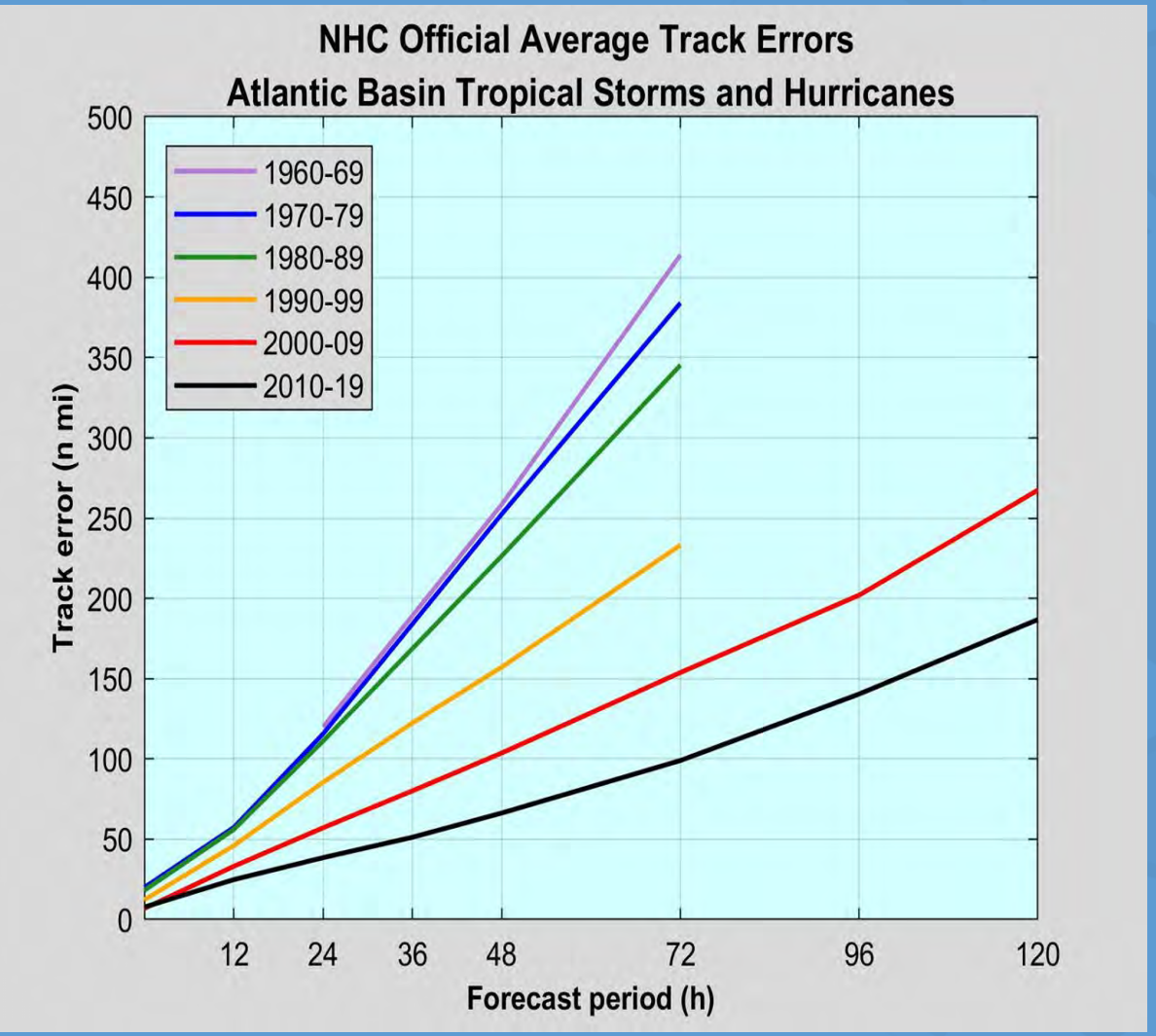
Forecasting Hurricanes

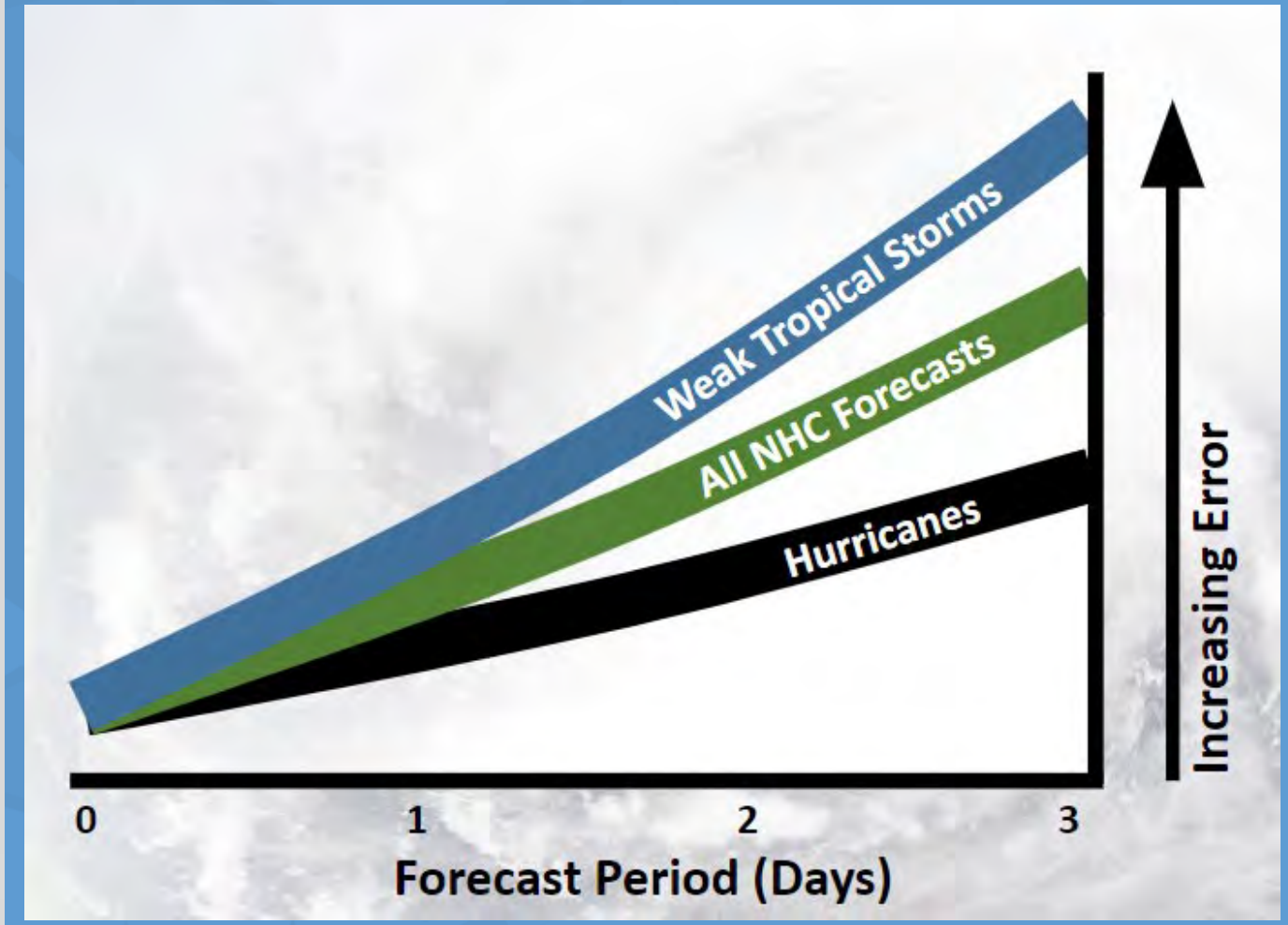
nhc.noaa.gov

https://www.weather.gov/box/tropical

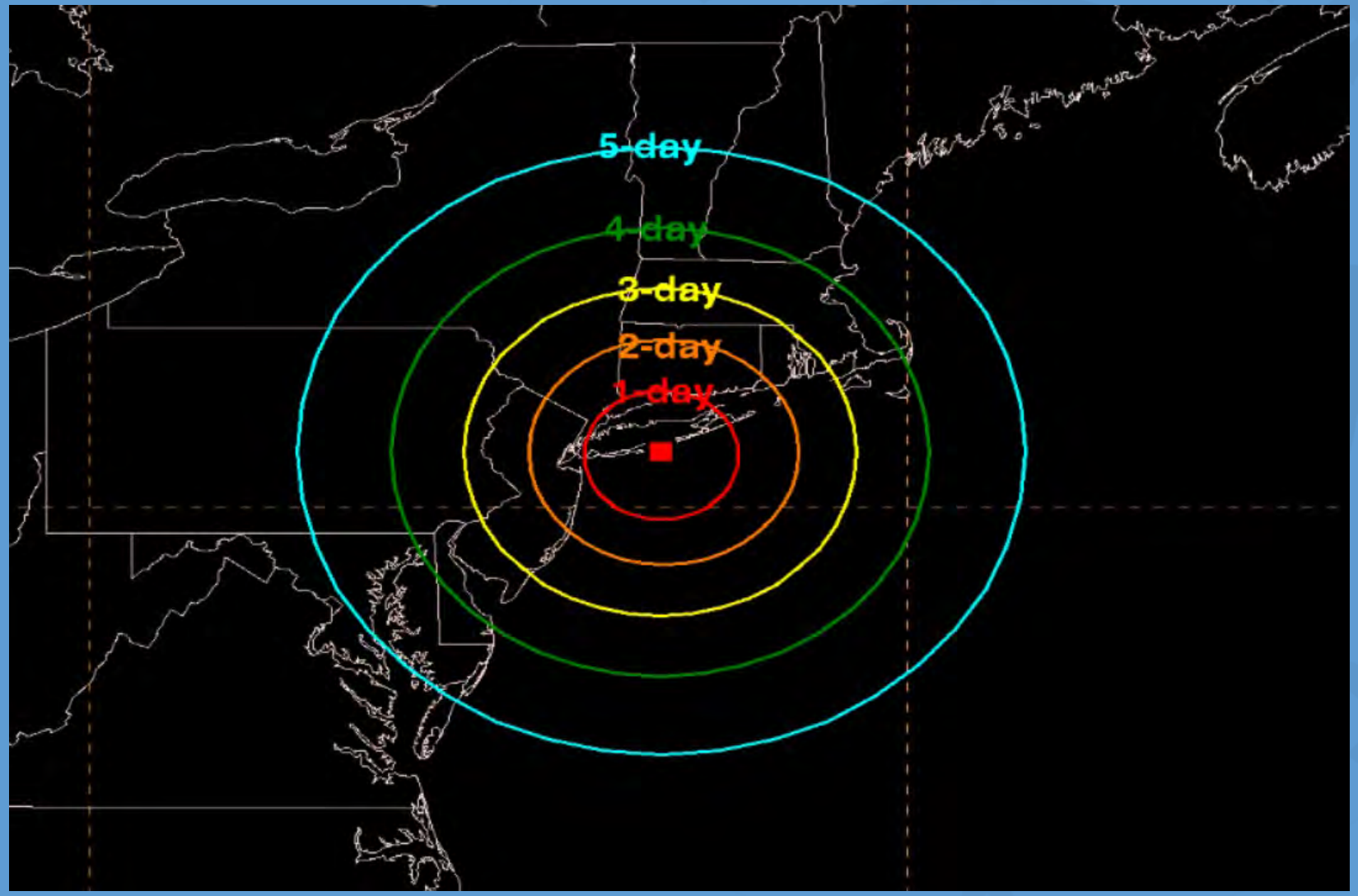
gyx or car or btv

Track Errors



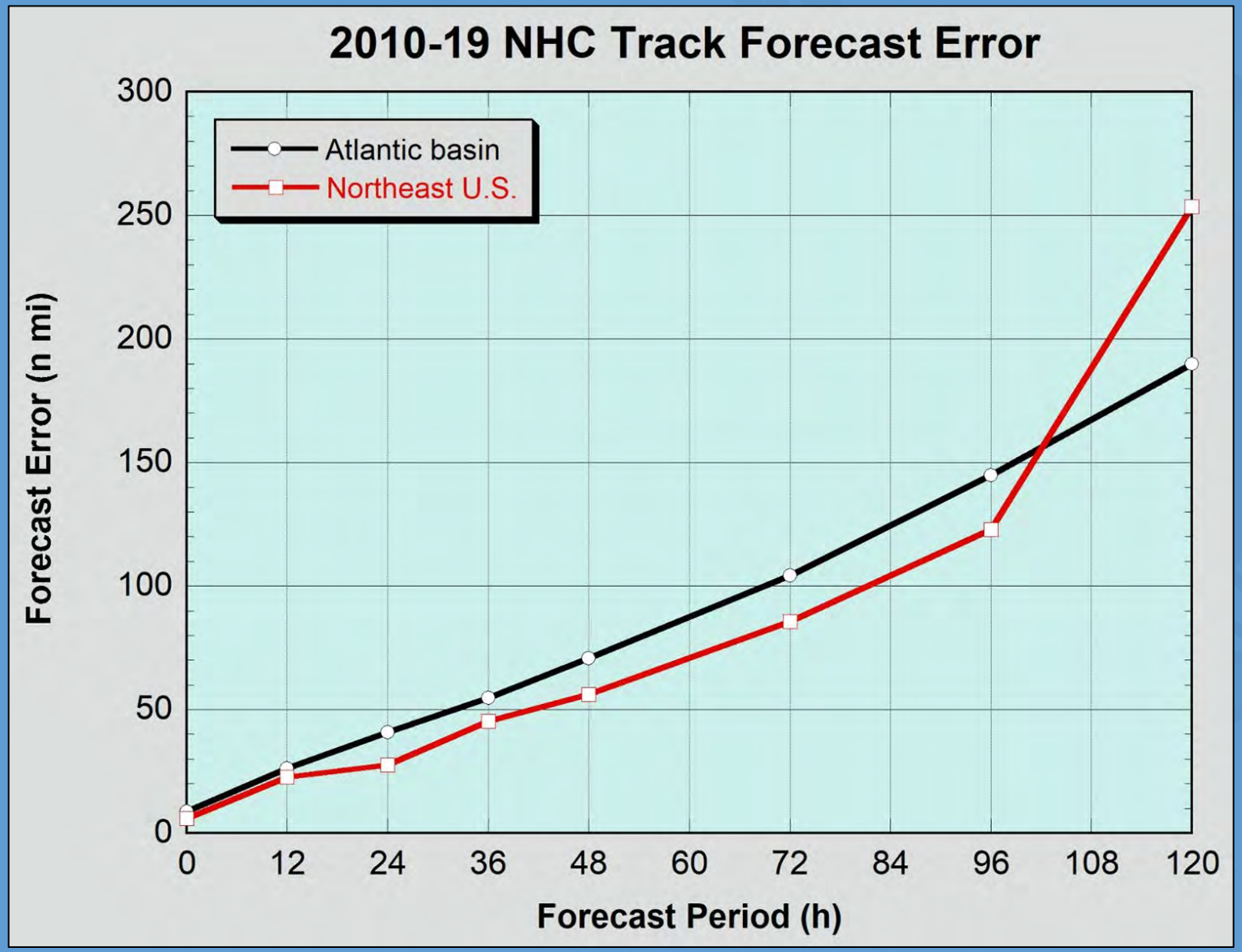


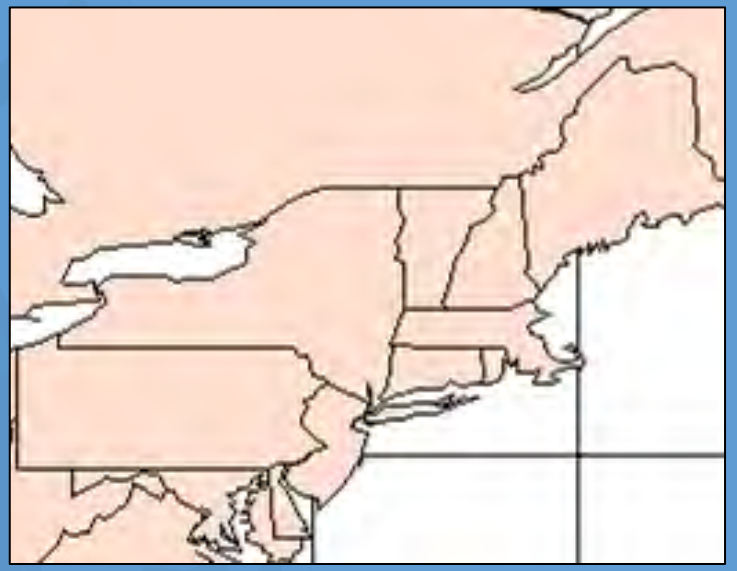
Track Error



Error for center of the circulation only!

NHC 2010-19 Forecast Track Error

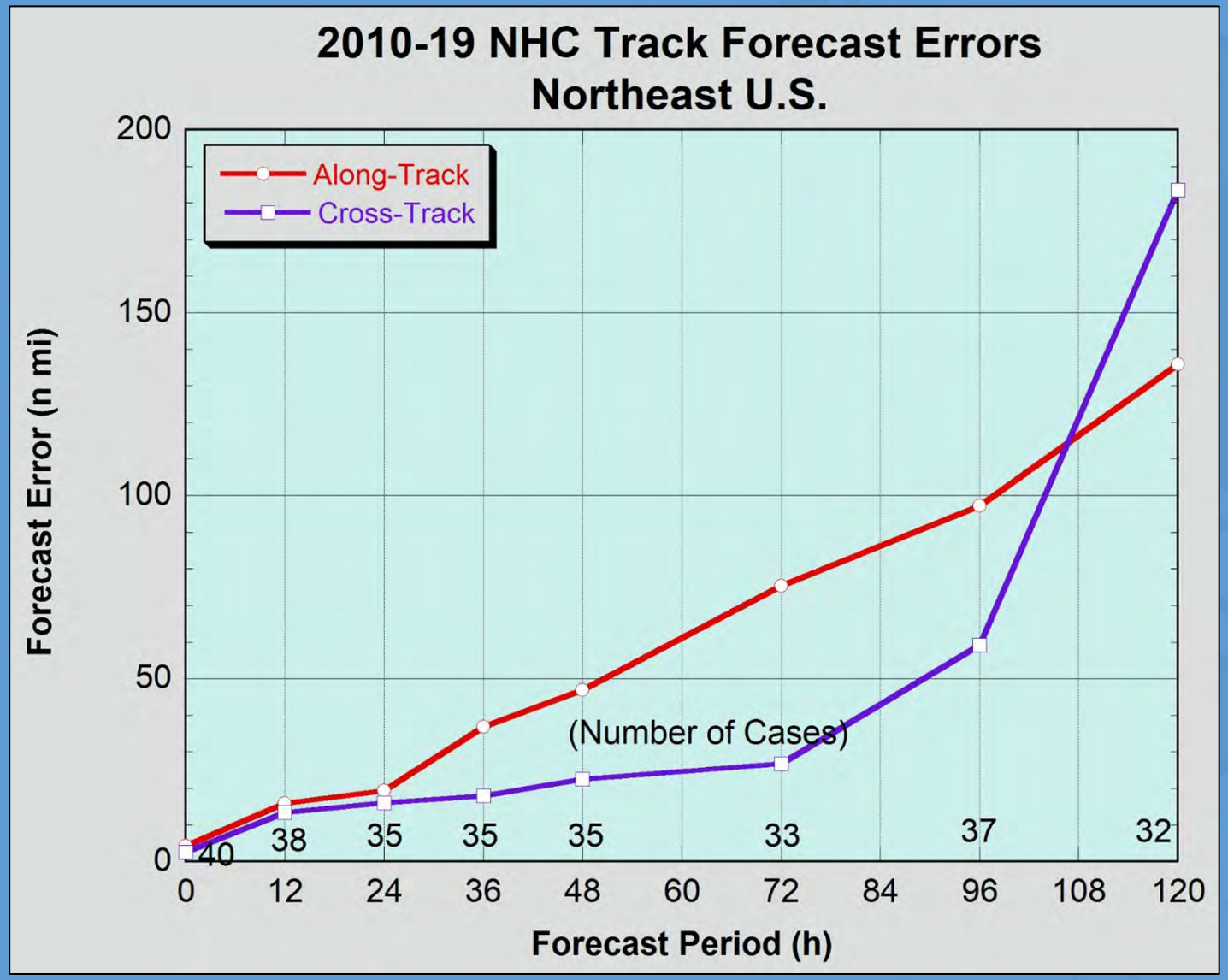


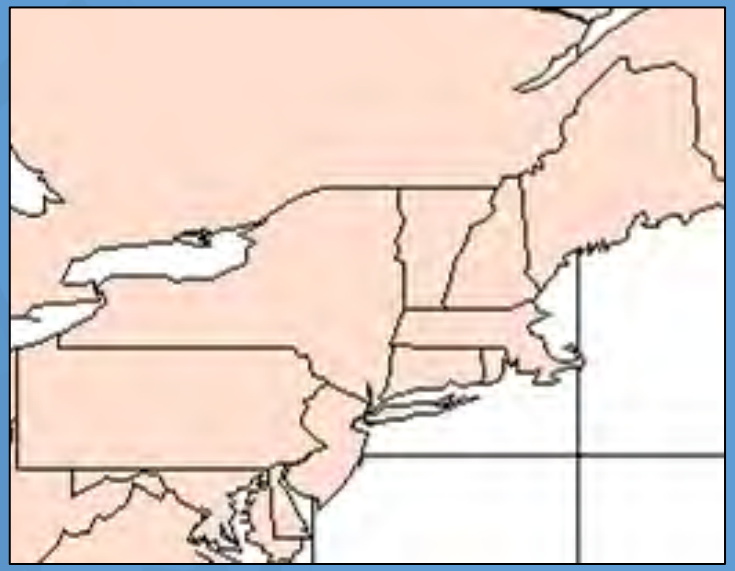


Northeast U.S. box
37N-48N,65W-80W

NHC track errors for the NE U.S. are slightly lower than the basin mean, except at 120 h

NHC 2010-19 Forecast Track Error





Northeast U.S. box 37N-48N,65W-80W

Along-track errors (timing) are notably larger than cross track, except at 120 h.

Timing Errors?

- Average forward motion for storms impacting New England is 33 mph
- Great New England Hurricane of 1938 make the trip from Cape Hatteras to Providence in 8 hours (forward land speed estimated around 60 mph)

Storm	Forward Motion
Atlantic Hurricane of 1944	29 mph
Carol – August 1954	35 mph
Edna – September 1954	46 mph
Diane – August 1955	15 mph
Donna – September 1960	24 mph
Gloria – September 1985	45 mph
Bob – August 1991	32 mph
Irene – August 2011	20 mph

"In for breakfast and gone by dinner"

Forecasting Considerations

- Timing and location of extra-tropical transition across New England
  - Coordinate early on if the storm will be tropical or not for weather messaging headlines
  - All New England (Burlington) can now issue tropical headlines!
- Storms move parallel to the coast, small changes in track equal big impact differences for entire coastline
- Decreasing familiarity with tropical watches and warnings the further north you go!

Thank you for your attention!!!

Questions?

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CLOSING AND PREVIEW OF EVENING