



# Local Extreme Weather Events Potential for Societal Disruption

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# Speaker

- Warning Coordination Meteorologist:
- Responsible for weather related decision support services to emergency managers and first responders
- For evaluating forecast office products and services
- For ensuring that people in the Albany forecast area are aware of local weather hazards by conducting hazardous weather preparedness and education.



### Overview



- What is a disaster?
- Local Weather related disaster declarations/FEMA.
- NWS Warning Process.
- What is a credible threat?
- Local Examples.







- Definition:
- Wikipedia: A disaster is a serious disruption, occurring over a relatively short time, of the functioning of a community or a society involving widespread human, material, economic or environmental loss and impacts, which exceeds the ability of the affected community or society to cope using its own resources.
- Various phenomena like earthquakes, landslides, volcanic eruptions, floods, hurricanes, tornadoes, blizzards, tsunamis, and cyclones are all natural hazards that kill thousands of people and destroy billions of dollars of habitat and property each year.



- FEMA Mission Statement: Helping people before, during, and after disasters.
- The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) is a United States federal law designed to bring an orderly and systemic means of federal natural disaster assistance for state and local governments.
- Stafford Act, signed into law November 23, 1988
- This Act constitutes the statutory authority for most Federal disaster response activities especially as they pertain to FEMA and FEMA programs.
- <u>https://www.fema.gov/media-library-data/1519395888776-af5f95a1a9237302af7e3fd5b0d07d71/StaffordAct.pdf</u>





# WFO Albany Forecast Area Weather Related Disaster Declarations

- Types of weather and hydrologic events that cause disaster declarations (NY, VT, MA, CT declarations since 1953):
- Tropical Storms/Hurricanes, Thunderstorms, Tornadoes, Blizzards, Snow Storms, Winter Storms, Ice Storms, Heavy Rains/Flooding, Flash Flooding, Land Slides, Ice Jams, Fire Suppression Authorization, Fire Complex, Water Shortage (drought)





# National Weather Service (NWS) Warning Process

#### **1. Detection of the Threat**

- Computer models and pattern recognition (days in advance)
- Radar, Satellite and Observations (as happening)
- Reports or observations sent to NWS from partners, HAMS, spotters

#### 2. Warn on the Threat/Forecast with Message to Take Action

- Decision Support Briefings
- Emergency Alert Messages
- NWS warning products

#### 3. Message is Received and Understood

- Warning message received by radio, TV, mobile device, siren?
- Is the threat message understood enough to take necessary actions?

#### 4. Appropriate Action is Taken

- Actions are taken in a timely fashion to protect life and property



National Weather Service Warning Process



- The NWS has concentrated on sections 3 and 4 above: Did the general public get the message? And did they take action?
- Social scientists have been employed to help the NWS craft the message.
- However: The warning process is also highly dependent on forecasters recognizing the scale or severity of an event.





# National Weather Service Warning Process

- There is a breakdown in the warning process when the scale of an event is not recognized by forecasters.
- Much work has been done on forecasters using meteorological field anomalies (eg. GEFS/SREFS/HREF) to help recognize a potential high-impact event.
- What happens when an event is so large, it dwarfs previous high impact events in scale?
- This work makes the case for historical research into past weather, water and climate events as a method for scaling events, highlighting impacts and determining credible threats.





# Weather Ready Nation – Cataloging High Impact Events

- Goals:
  - Provide Credible Threats (Models say it will rain 20" Can this happen?)
  - Assign a probability to the threat
  - Manage high-impact events more effectively
  - Separate high-impact events from *Disasters*
  - Historic Storms Can Shed Light On Possible Impacts





# What is an Extreme Event - Rainfall?





• What happens to rivers and streams when you get 15-20 inches of rainfall from one storm?



### **Peak River Flows**



 Schoharie Creek at Prattsville, New York – Irene 2011 – 18+ inches of rainfall in Catskills



120,000cfs/237 sq mi = 506 cfs/sq mi





# Catskills – August 2011 - Irene



Windham, NY



Tannersville, NY



# Catskills/Mohawk – August 2011 - Irene





Schoharie Valley, NY Amy Colyer Fogerty Schenectady, NY Times Union







• Naugatuck River at Beacon Falls, CT – Diane 1955





### Northwest Connecticut-1955 Rainfall





# Mad River – Winstead, Litchfield County, CT





Reproduction information available from the Connecticut State Library, State Archives File name: 55flood09

# Naugatuck River, Torrington, CT – August 1955





Reproduction information available from the Connecticut State Library, State Archives File name: 55flood02





Reproduction information available from the Connecticut State Library, State Archives File name: 55flood05



# Peak River Flows -Winooski River, Montpelier, VT



**≥USGS** USGS 04286000 WINOOSKI RIVER AT MONTPELIER, VT 60000 feet 50000 cubic 40000 Ŀ, Streamflow, per second 30000 20000 Peak o Ó Ó 0,0 Annual o o 10000 <u>~0 0</u> 000 <u>6</u>00 æ ଫ୍ର Ó o Й 1916 1928 2000 2012 1940 1952 1964 1976 1988

57,000 cfs/397 sq mi = 143 cfs/sq mi



# 1927 Flood Rainfall Winter Rainfall Event





October rainfall was 150% of normal.



# Montpelier, VT 1927













Overturned railroad engine in Barre, 1927.



### Winter - Impacts of Snow





Blizzard, Albany, March 14, 2017

#### Impacts of Snow:

- Transportation issues: Slippery driving and walking conditions, airport closures, rail lines shut down.
- High Snowfall Rates: Rapid accumulation and near zero visibility ( 2"/hr = ¼ mile visibility or less).
- Early/Late Season Snows (Oct/Nov/May) : 3+" of snow with leaves on trees = downed trees and widespread power outages.
- Wind Driven Sticky Snow: 6" of heavy, wet snow with strong winds can lead to downed trees and power outages (March 2018 Nor'easter).
- Snow squalls: Biggest cause of pileups in interstate highways(NWS now issues snow squall warnings).
- Blowing Snow: Drifting snow blown back onto previously cleared and treated roads causing slippery driving conditions.
- Prolonged accumulation periods (1-2 months) can lead to weight buildup on roofs and roof collapses.





### **Snow With Leaves On Trees**

• May 10, 1945 Snowstorm:







# May 10, 1945 Snowstorm

#### • May 10, 1945 Snowstorm:

- The 5.4 inches of snow recorded at Albany is the largest May snowstorm to date.
- 60,000 power outages were reported across the Capital District of NY from downed trees and wires. Some locations were without power for a few days.
- Largest number of power outages since ice storm of 1929.
- In the City of Albany alone, 10 DPW trucks were assigned to debris removal.
- Also, devastating fall snowstorms with leaves on trees in Oct 1987 and Oct 2011



## Winter – Impacts of Freezing Rain (Glaze)



#### Impacts of Ice:

- A trace of ice will cause slippery driving and walking conditions.
- One quarter inch of ice glaze accumulation on trees will start to bring down small branches.
- One half inch of ice glaze accumulation on trees and wires will cause numerous power outages (outages last a day or two).
- One Inch or more of ice glaze accumulation on trees and wires causes widespread power outages (outages may last a week – Dec 2008).
- Any wind with the ice will make matters worse.



Ice Storm, North Colonie, NY, Dec 2008



### **Ice Storms**









# Winter Hazards – Impacts of Wind





February 2017 High Winds

#### **Impacts of Wind:**

- Winter storms are usually large and powerful.
- Winter storms have the potential to cover large areas with strong winds and cause widespread power outages.
- Summer wind storms (on average) tend to be more localized and isolated.



### Severe Weather



**Damaging Winds:** *Usually* isolated from individual thunderstorm downbursts, but can be more widespread (May 4 and May 15, 2018).

**Impacts:** Power outages and debris removal. Some structural damage possible from stronger wind gusts.





# Historic Storms – July 15, 1995 Derecho



#### • July 15, 1995 Derecho:

- Widespread wind damage
- Large timber blowdown in Adirondacks
- At the Syracuse Airport, a wind gust of 76 mph was measured at 5:30 AM EDT. Less than an hour later, a gust of 77 mph was recorded at the Albany airport. Several hundred thousand people lost electrical power due to the powerful derecho winds.







# Historic Storms – Labor Day, 1998 Derechos



#### • September 7, 1998 Derechos:

- Widespread wind damage.
- Three people were killed and 10 were injured in Syracuse.
- Measured wind gusts of 89 mph at the Rochester Airport and 77 mph at the Syracuse airport were recorded. Several hundred thousand people lost electrical power due to the powerful derecho winds some remaining without power for a week.







**Council Meeting** 

ir case on Formosa. Appa

there was no mention of Kor

TrumanUnderFire

the President and Acheson can fter Philip C. Jessup, Acheson

chief adviser, told a Philadel audience last night that s

GOP criticisms of the admir

tion's polices "point straight the direction of a policy of e

### Historic Storms – **Great Appalachian Storm 1950**







## Historic Storms – Great Appalachian Storm

- Great Appalachian Storm, November 24-27, 1950:
- Winter Storm
- Mainly a wind storm for the Albany Forecast Area although heavy rain fell in the eastern Catskills. Snow in southwestern NY.
- Sustained winds of 50-60 MPH with a gust to 83 MPH here at Albany. Measured gust of 94 MPH at New York City and Hartford, Connecticut gusted to 100 MPH.
- Wind damage was extensive with many trees and power lines were blown down across New York State and the region.





### Historic Storms – Hurricane Hazel - 1954

In New York, power was knocked out and trees were downed. Wind gusts throughout the area reached 99 mph. A gust of 113 mph was recorded in Battery Park, the highest wind speed ever recorded within the municipal boundaries of New York City.



Track of Hurricane Hazel – October 1954





# Multihazard Storm 1948-1949



- "Precipitation ranging from 5 to 12 in. in depth fell on a 4,500 square-mile area in eastern New York and southwestern New England during the period December 29, 1948 to January 1, 1949."
- "Most of this precipitation fell as rain. On the morning of December 31 the rain began to freeze; later in the day the rain changed to snow."



Liquid Equivalent Precipitation Dec 29, 1948 - Jan 1, 1949



- Norfolk, CT: 10.63"
- Slide Mountain, NY: 8.92"
- Conklingville Dam, NY: 8.61"
- Pittsfield, MA: 8.35"
- Mohonk Lake, NY: 7.56"
- North Creek, NY: 6.70"
- Glens Falls, NY: 6.36"
- Albany, NY: 5.80"
- Poughkeepsie, NY: 4.47"
- Westfield, MA: 4.47"







Rescue was rushed for about 100 families in Western Massachusetts today and evacuees were being moved out in Vermont and Connecticut as streams boiled to flood stage in many regions.

In Greene County, a mountain sleet storm was in progress and all mountain roads were covered by an inch of solid ice, with driving very hazardous: Route 23-A one mile west of Route 32 in the Town of Catskill was washed out. One death was reported as rail and highway traffic and telephone communication were cut by a 24-hour rain which brought out National Guardsmen and emergency units.

At mid-morning the rain in rural areas changed to sleet, bending trees and causing telephone and power wires to sag.





### 1948-1949 Storm Impacts





A least six families were forced out of their homes in Pleasant Valley, near Poughkeepsie, when the Wappinger River overflowed. Firemen used canoes to rescue marooned persons.

Other evacuations were ordered at Bennington, Vt., and Farmington, Conn.

The Westfield River Valley, starting at the eastern Berkshires in Massachusetts, reported roads under water and minor landslides at Russell and Blandford. B. & M. maintenance crews were rushed out as tracks were reported underwater at Petersburg Junction and Hoosick Falls. North Pownal, Vt., and North Adams, Mass.

WEATHER Freezing rain changing to snow and ending early to n i g h t. Temperatures well below freezing by morning. Saturday partly cloudy and much colder.

BOSTON - (AP) - The 500 persons living in Risingdale, two miles north of Great Barrington, were ordered evacuated today when Police Chief James McCarthy said a 60-foot power dam on the Housatonic river was in "a very weakened condition."



### 1948-1949 Storm Impacts













• *Timeline* can be useful to message multihazard storm impacts?







### Historic Storms – Forest Fires

Adirondack Fires, 1903.



### **Forest Fire**



- The Camp Fire in 2018 was the deadliest and most destructive wildfire in California history to date. It covered an area of 153,336 acres (62,053 ha) (almost 240 sq. miles)
- Adirondack NY Fires, 1903: Fires began in April and lingered into June. Between April 20 and June 8, 1903, over 600,000 acres of timberland in northern New York were burned over.
- Winter snow was less than normal and valleys were bare of snow by early March. Rain in March was plentiful, but from April 17th through June 7th, average precipitation over the area was only 0.2 inches. The fires were extinguished by heavy rains in June.
- <u>https://archive.org/details/forestfiresinadi26sut</u> <u>e/page/n4</u>







### Conclusion

- Goal of NWS warning process is to communicate impacts/hazards that will result from weather events so that people can take protective measures.
- Extreme events can cause serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental loss and impacts
- Information about impacts from past significant/extreme weather events can shed light on possible impacts from future events.



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