

# Weather & Climate Trends

Jessica Spaccio

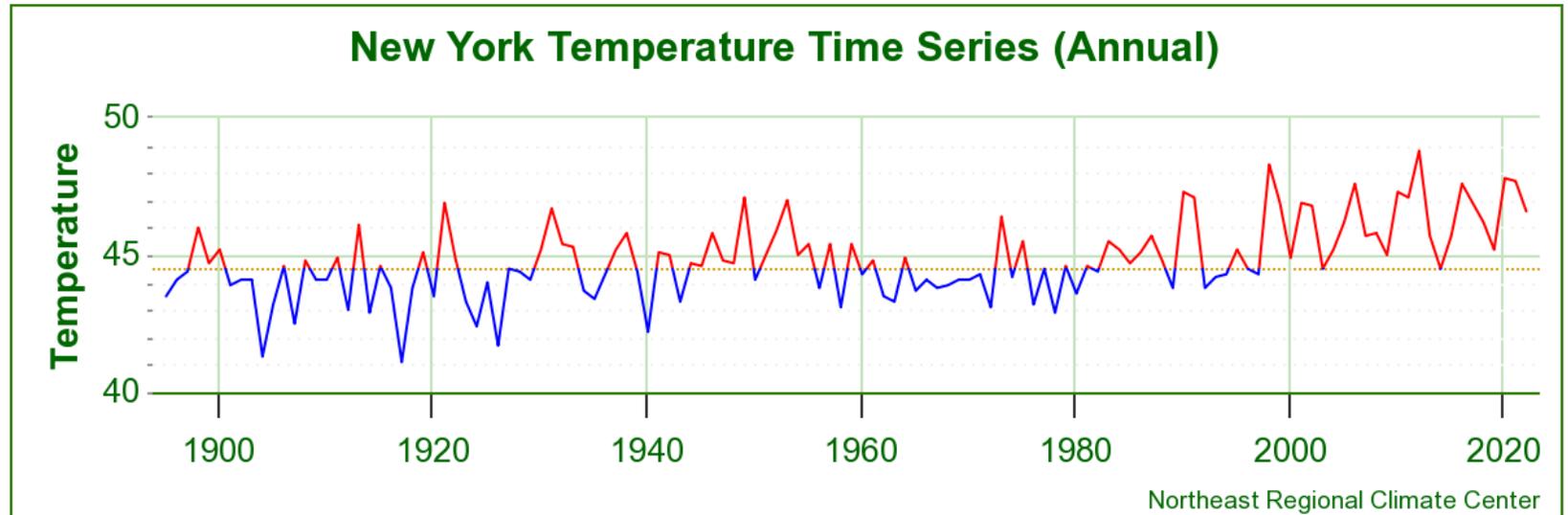
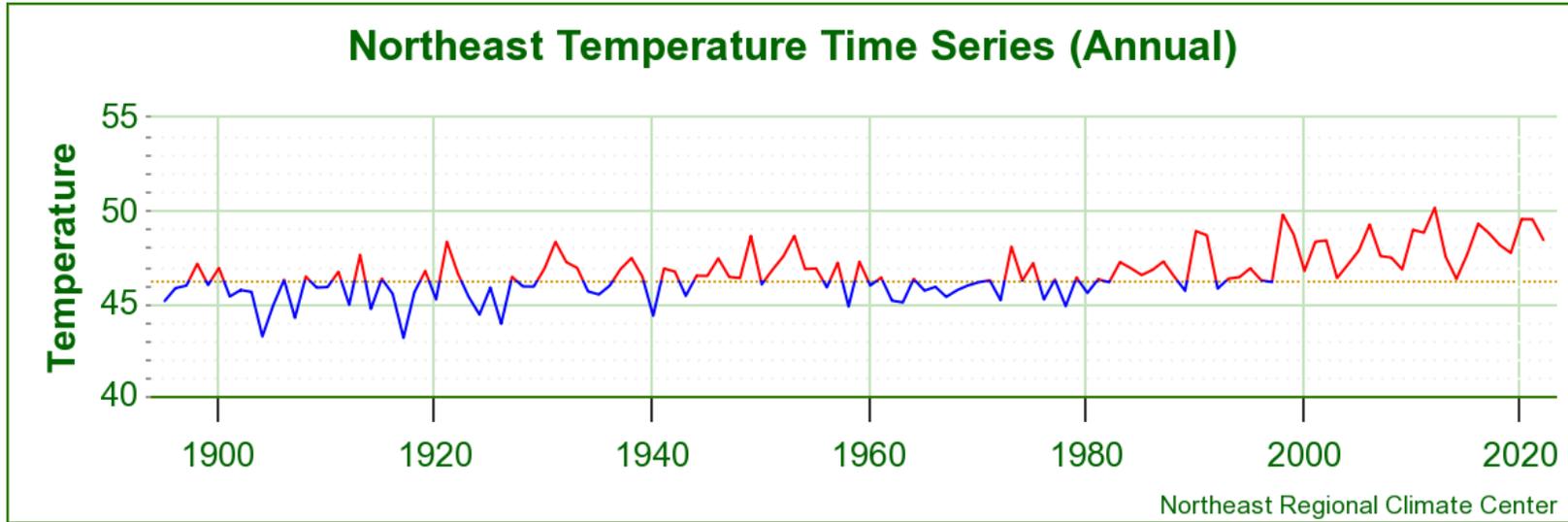
Climatologist

NOAA, Northeast Regional Climate Center at  
Cornell University

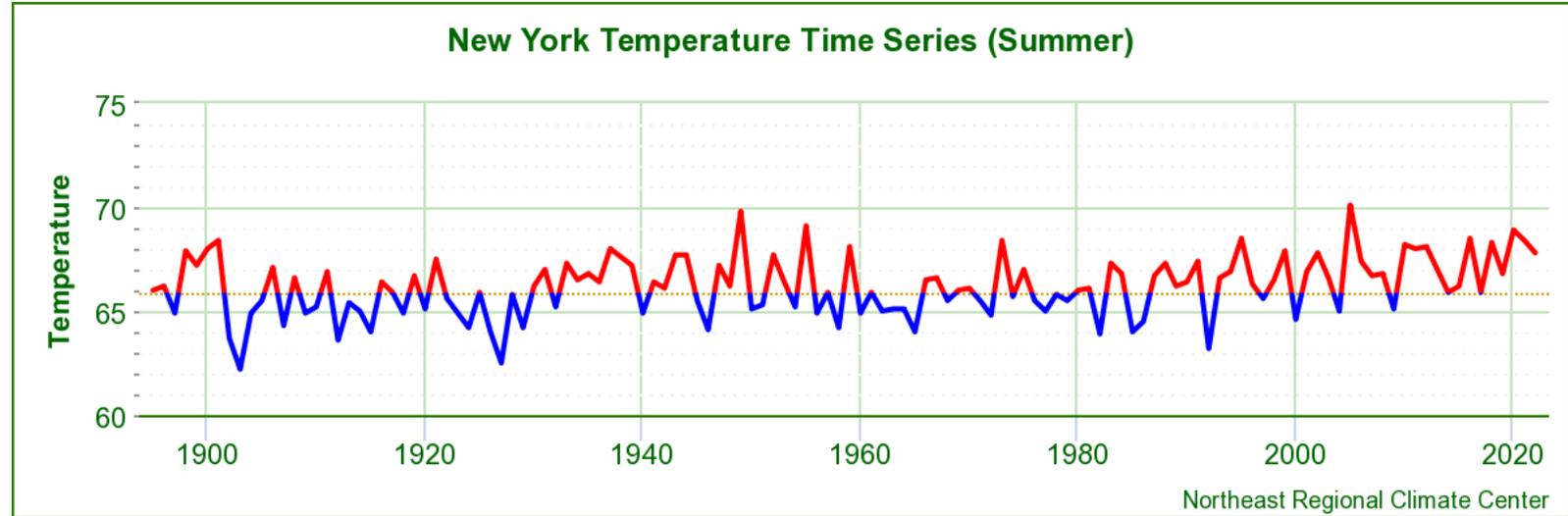
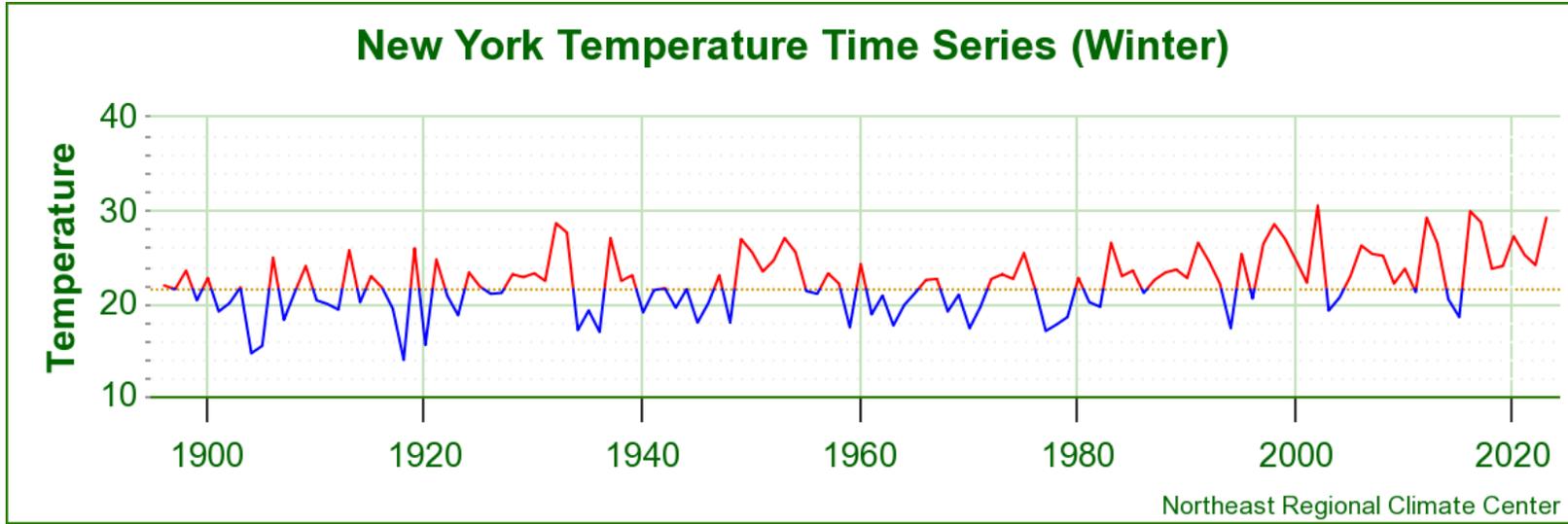


Northeast Regional  
Climate Center

# Temperature Trends



# Temperature Trends

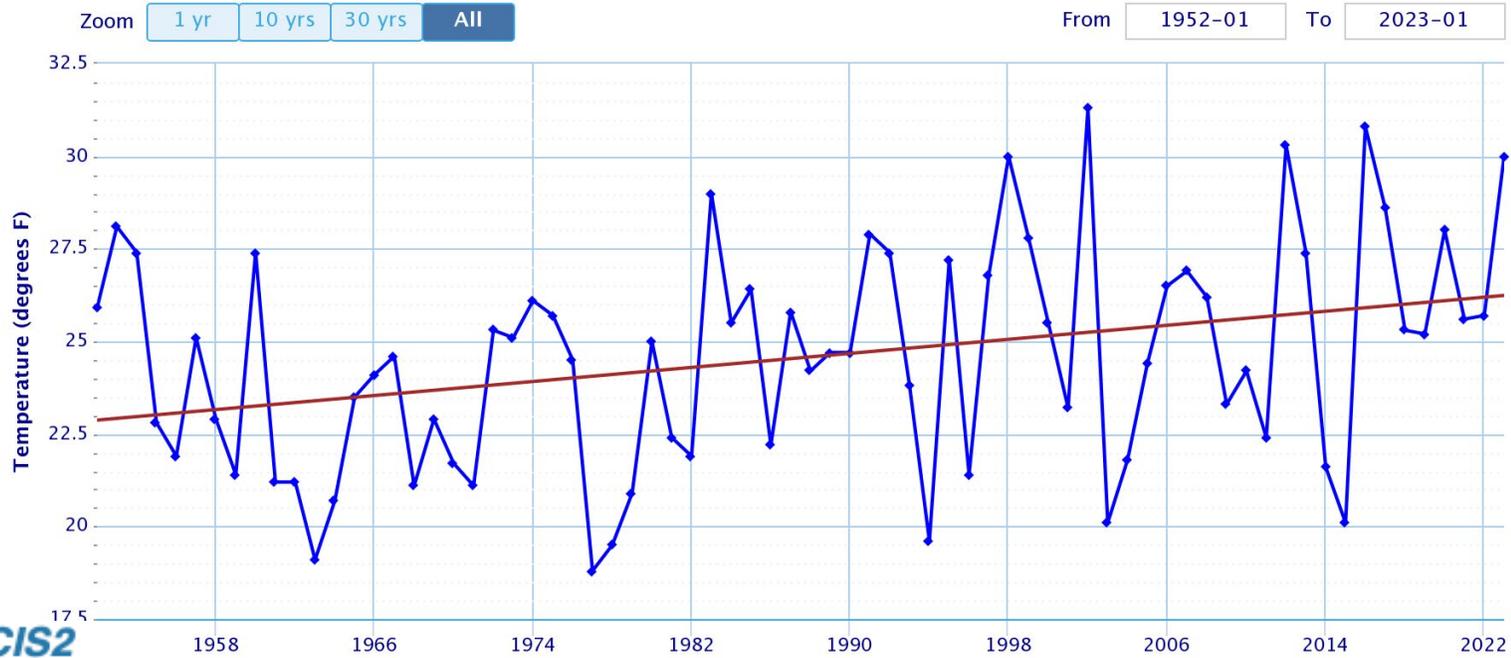


# Binghamton Winter Temperatures

## Dec/Jan/Feb

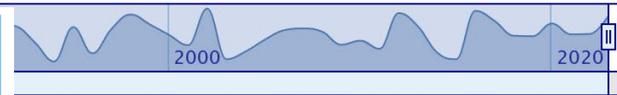
Mean Avg Temperature – Binghamton Area, NY (ThreadEx)

Use navigation tools above and below chart to change displayed range



xmACIS2

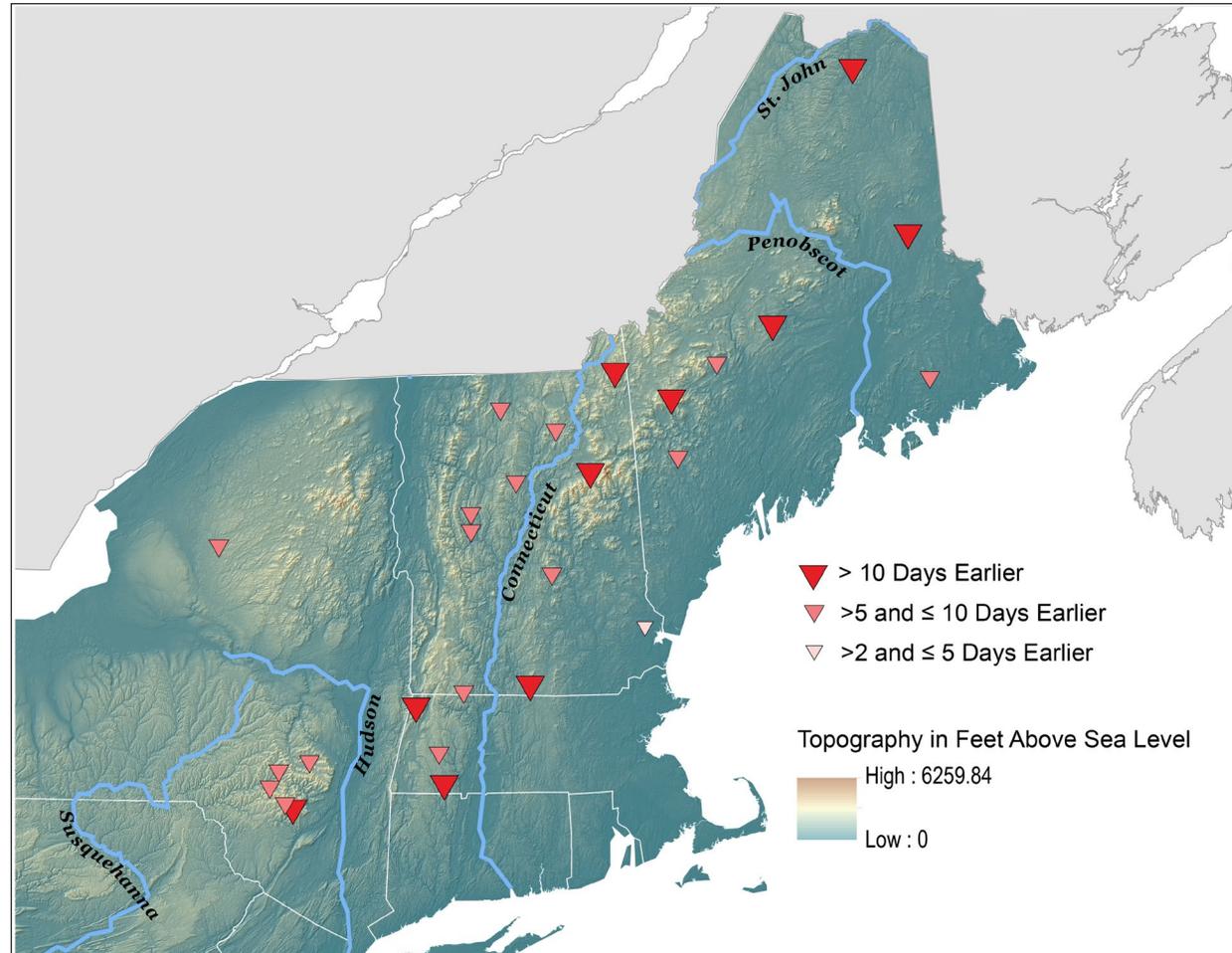
Rank	Season	Mean Avg Temperature	Missing Count
1	2001-2002	31.3	0
2	2015-2016	30.8	0
3	2011-2012	30.3	0
4	2022-2023	30.0	0
-	1997-1998	30.0	0
6	1982-1983	29.0	0
7	2016-2017	28.6	0
8	1952-1953	28.1	0
9	2019-2020	28.0	0
10	1990-1991	27.9	0



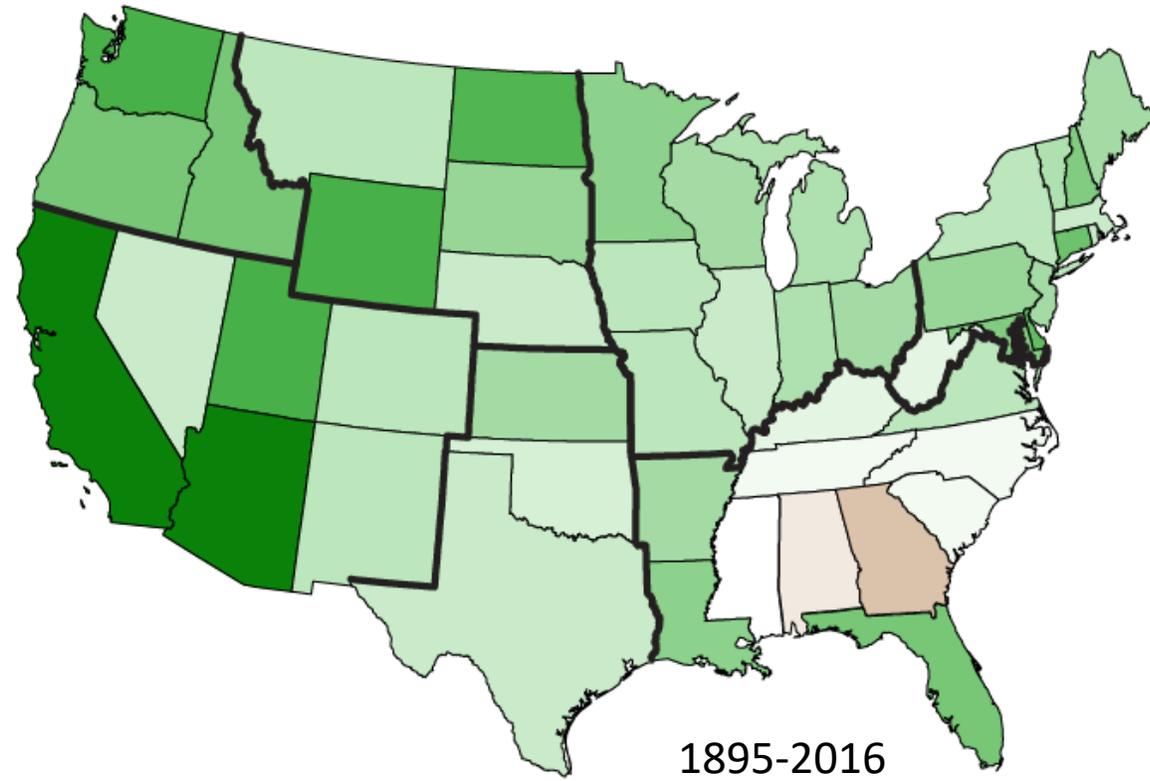
Powered by ACIS



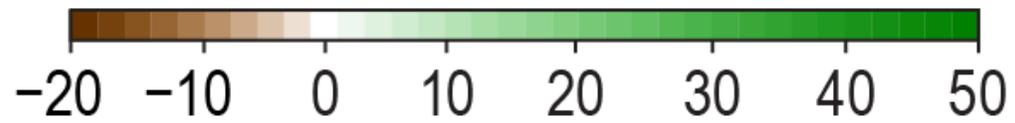
# Historical Changes in the Timing of Snowmelt-Related Streamflow



# Growing Season Trends



Change in Length of Growing Season (days)

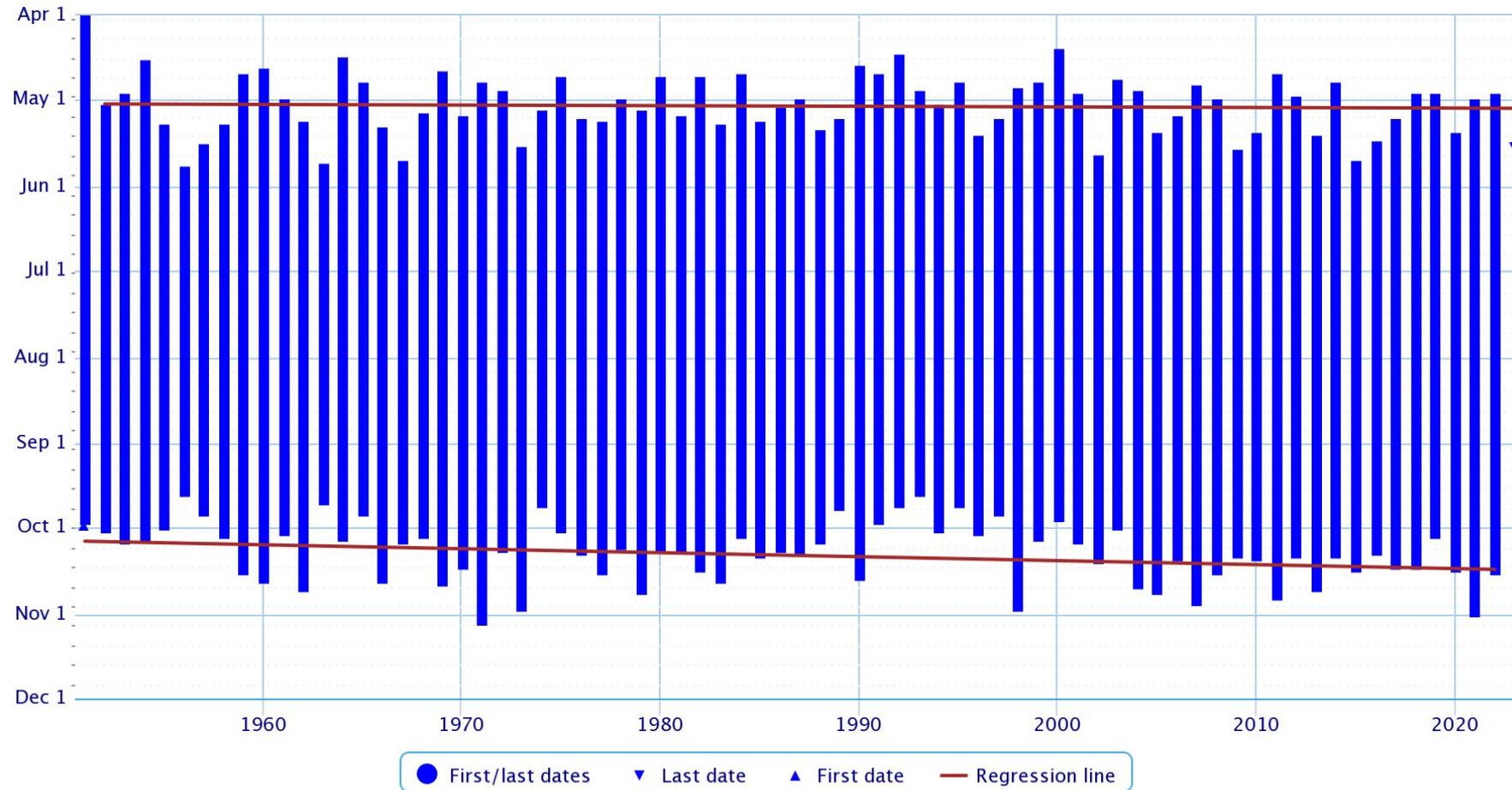


# Growing Season Trends

xmACIS2

Frost/Freeze Dates for Binghamton Area, NY (ThreadEx)

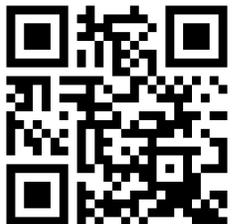
Min Temperature  $\leq$  32 Aug 1 to Jul 31



Powered by ACIS

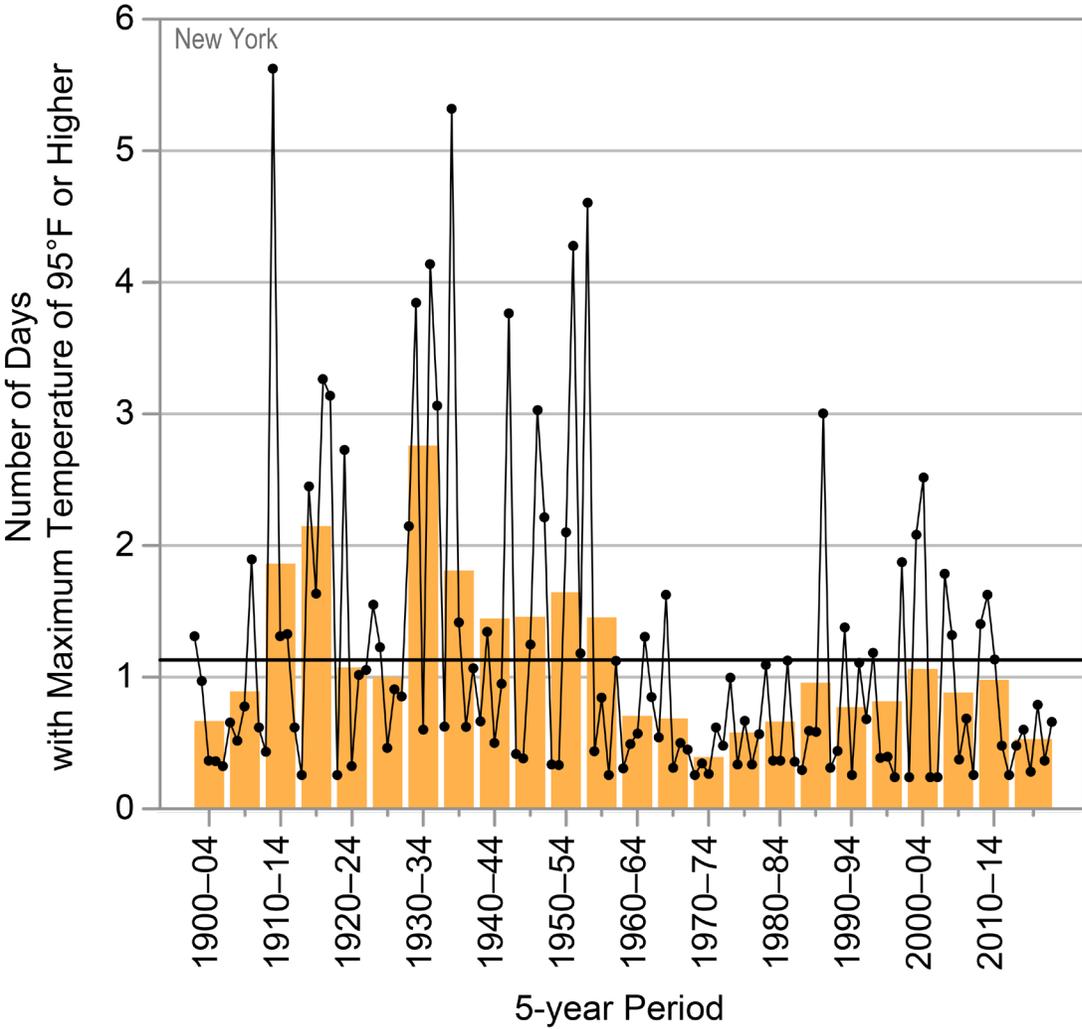
Last Spring Frost: May 2 => May 4

First Fall Frost: Oct 5 => Oct 15

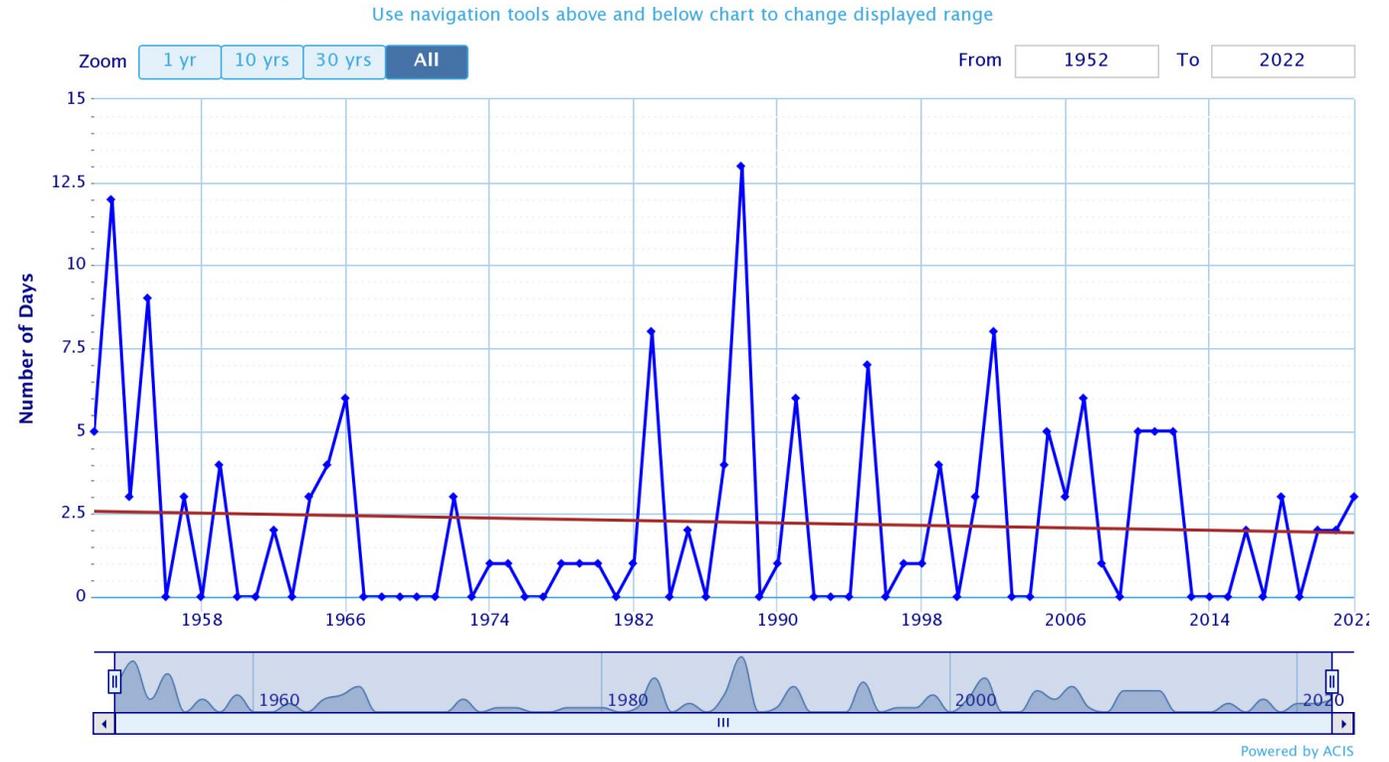


# Extreme Heat

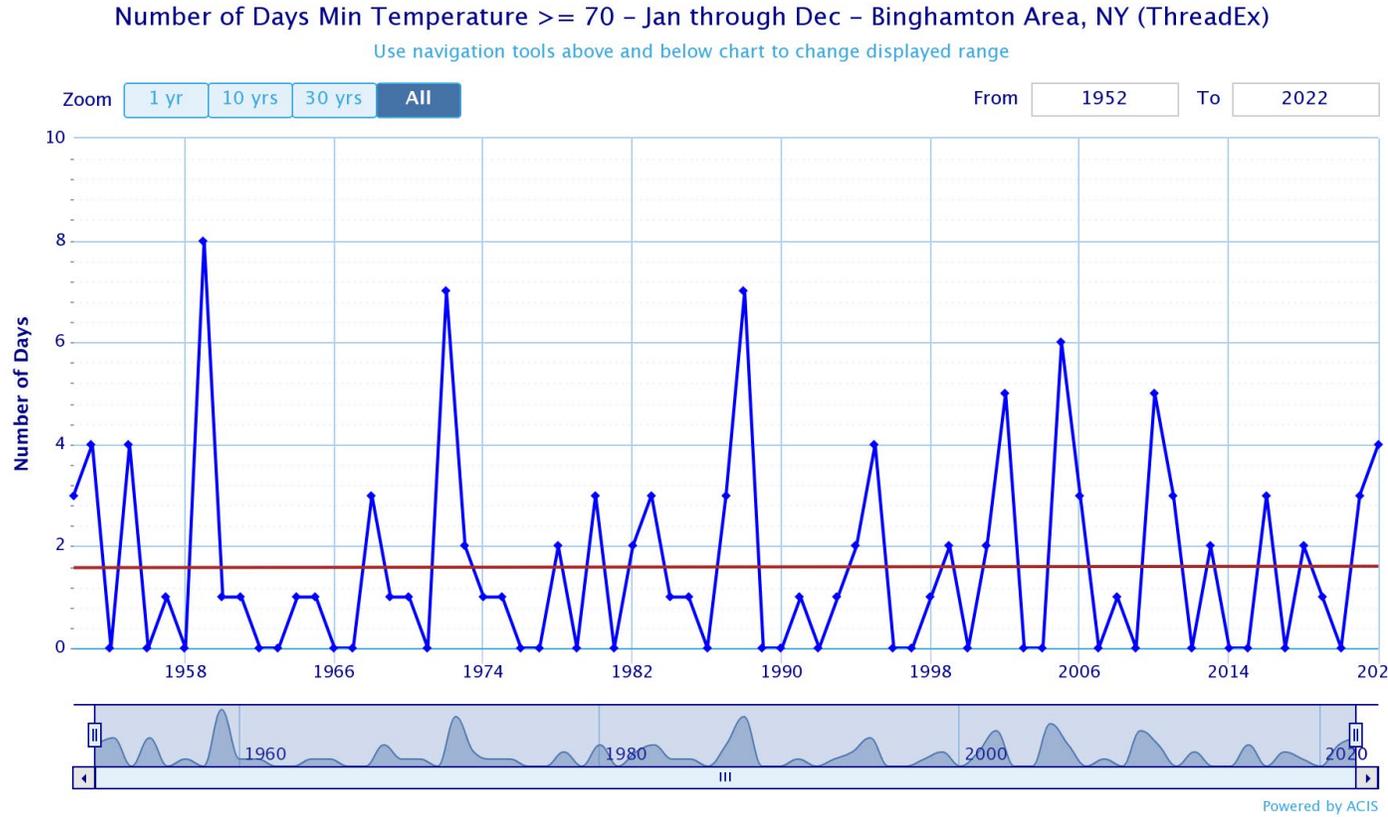
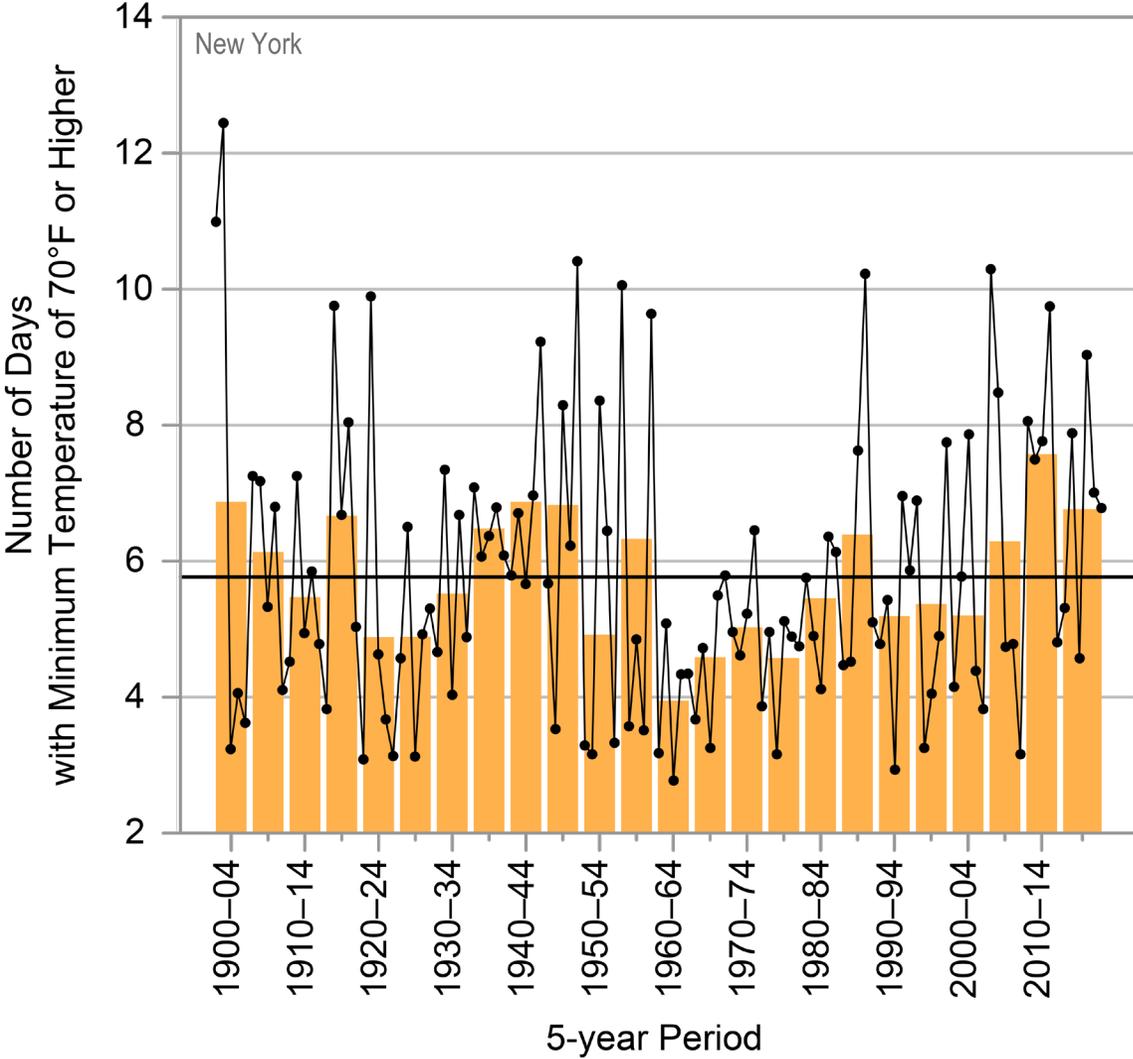
## Observed Number of Very Hot Days



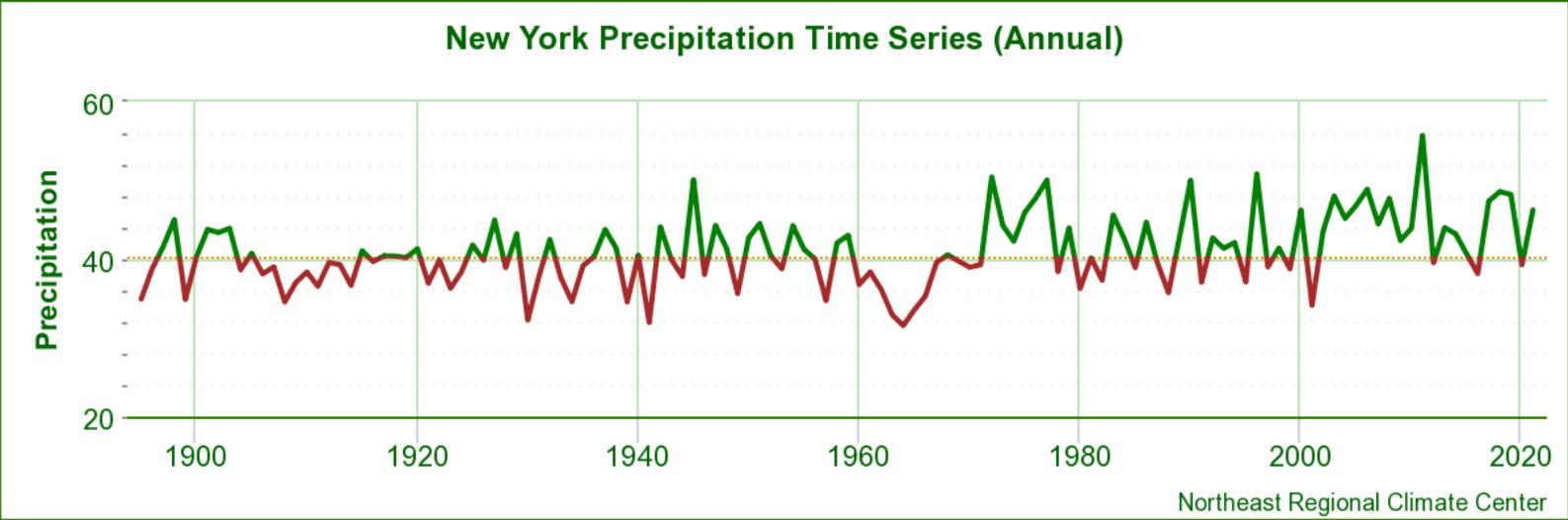
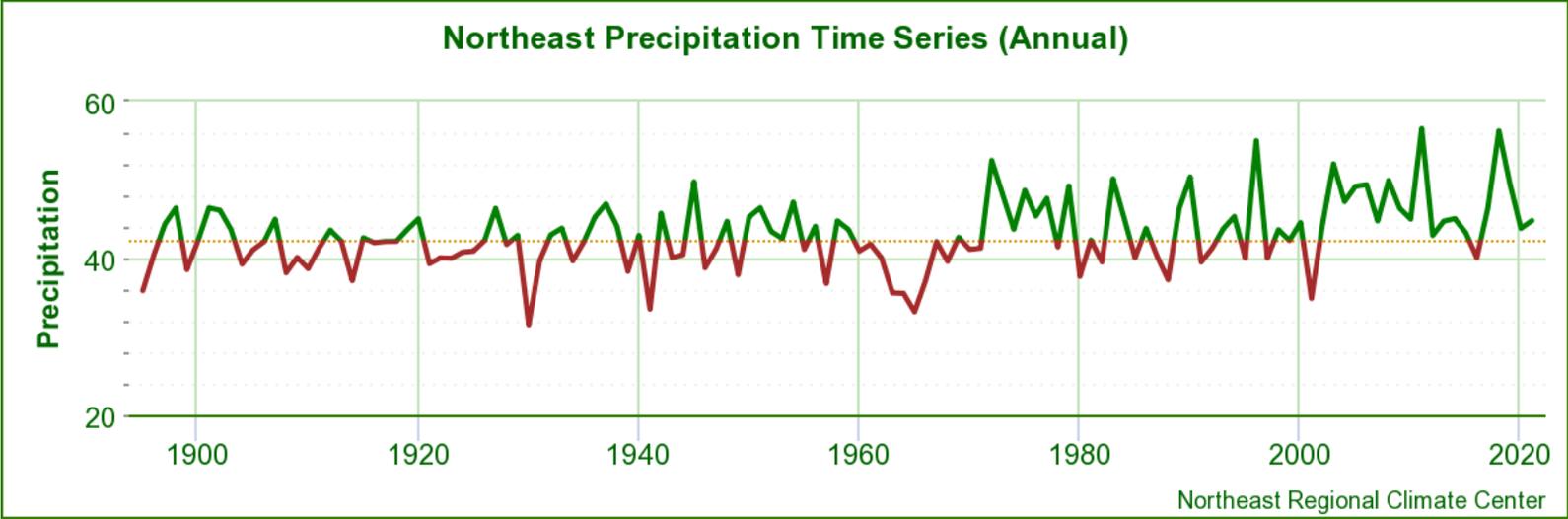
## Number of Days Max Temperature $\geq 90$ - Jan through Dec - Binghamton Area, NY (ThreadEx)



# Observed Number of Warm Nights

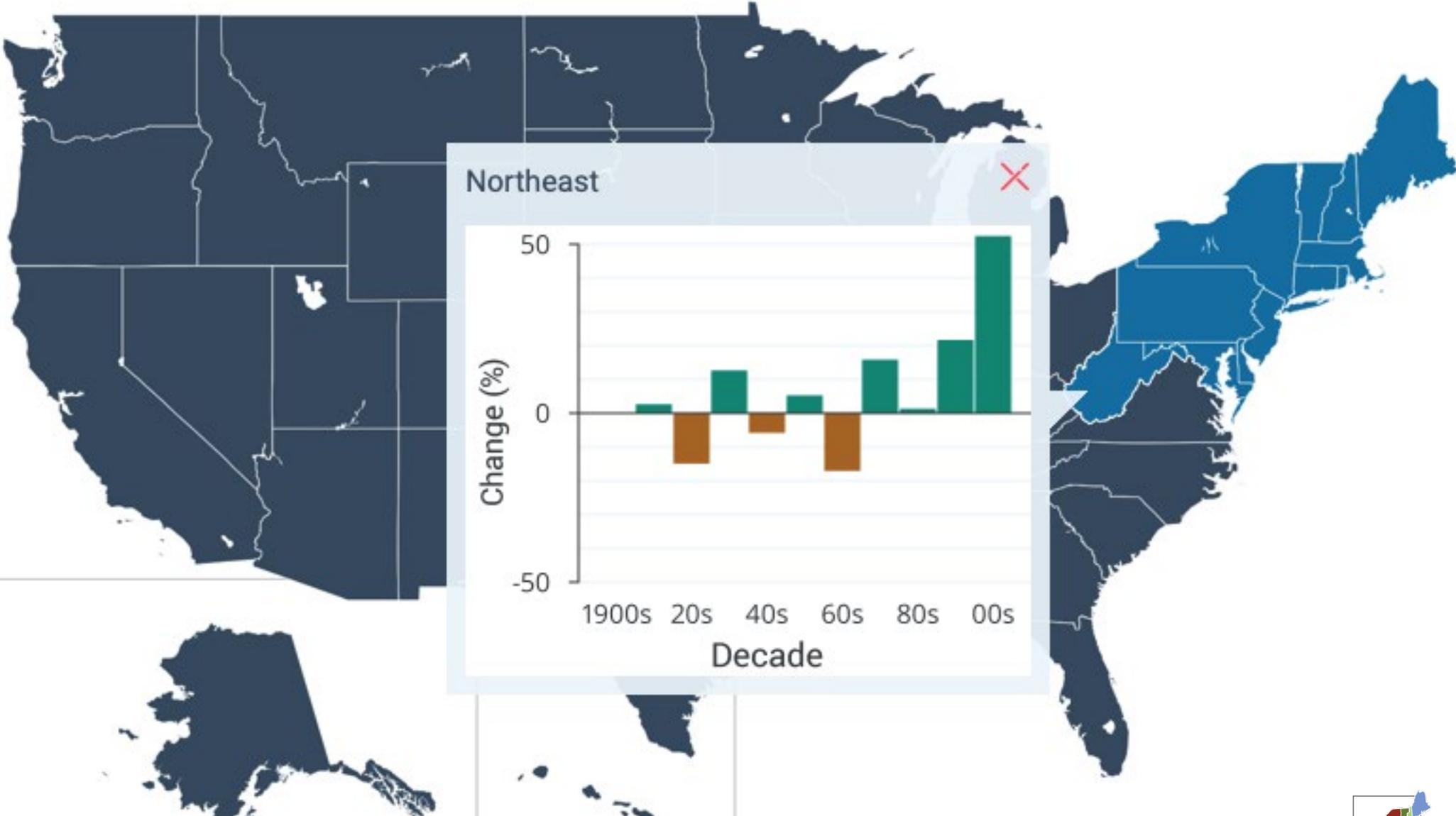


# Precipitation Trends

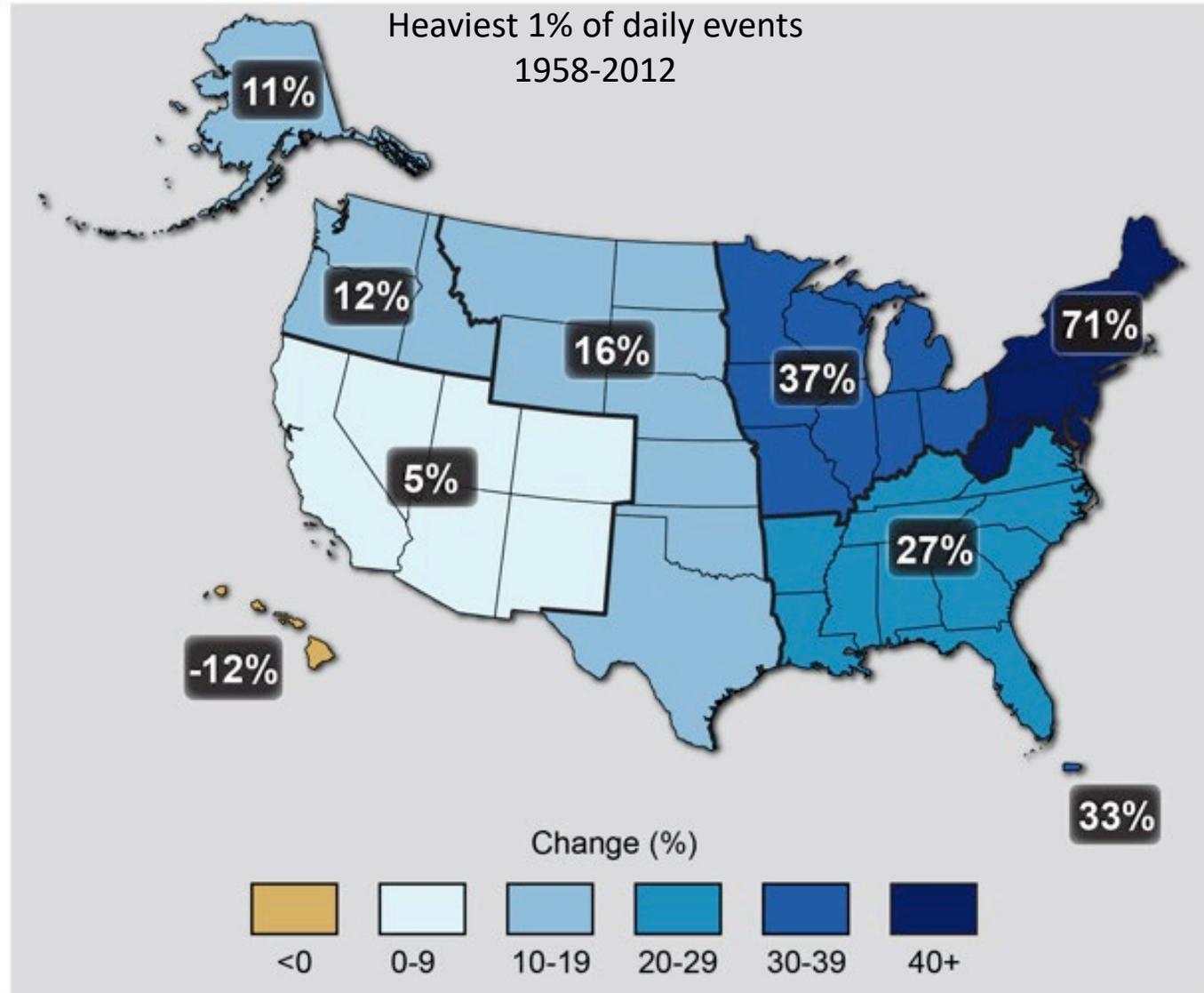


# Heavy Downpours Increasing

Heaviest 1% of daily events

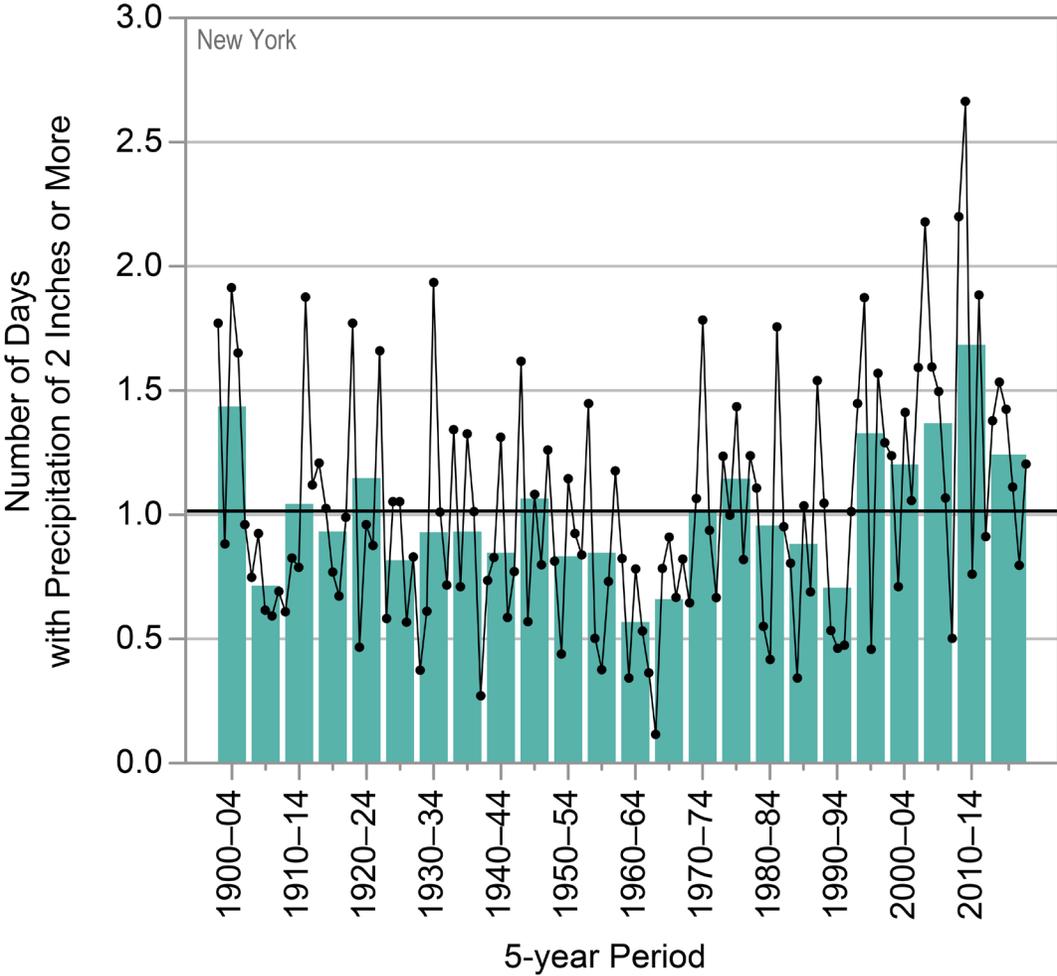


# Observed Change in Very Heavy Precipitation

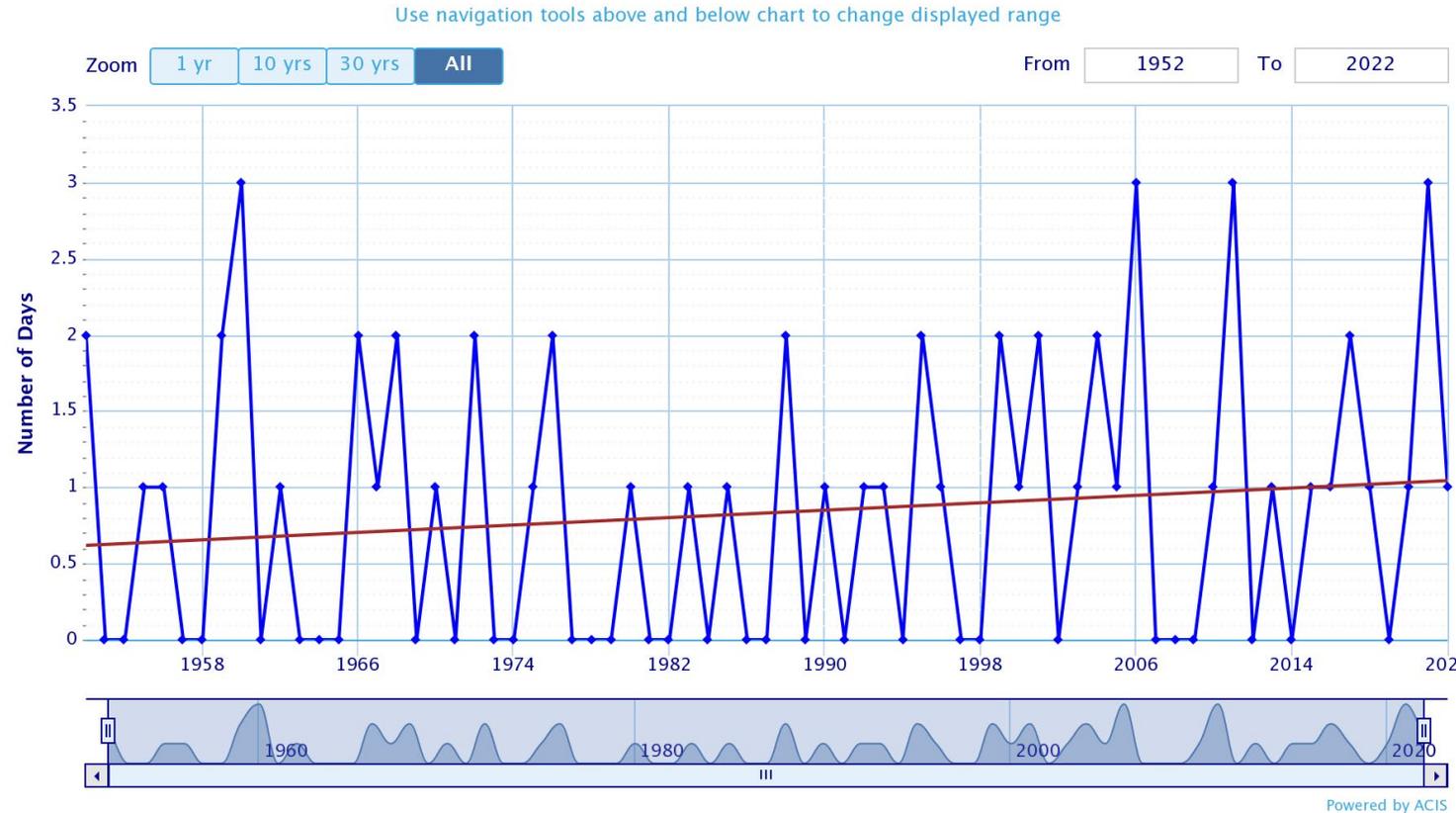


# Extreme Precipitation

## Observed Number of 2-Inch Extreme Precipitation Events



## Number of Days Precipitation $\geq 2$ - Jan through Dec - Binghamton Area, NY (ThreadEx)



# Climate and Hazard Mitigation Planning (CHaMP) Tool

Selection Panel

Themes

Extreme Rainfall/Flooding

Hazards

Days w/ Pcpn >1in

Time Range:

1981

REGIONAL  
OVERVIEW

COUNTY DETAILS

## Broome County, NY

In Broome County, NY, data on past number of days with more than 1 inch of precipitation show a trend of increasing by 1.56 days per decade between 1981 and 2022.

SHOW  
HISTORICAL DATA

SHOW  
PROJECTED DATA

In **Broome County** the Number of Days with Precipitation >1 Inches has changed by **1.56** days per decade between **1981** and **2022**.

Trend (Days/Decade)

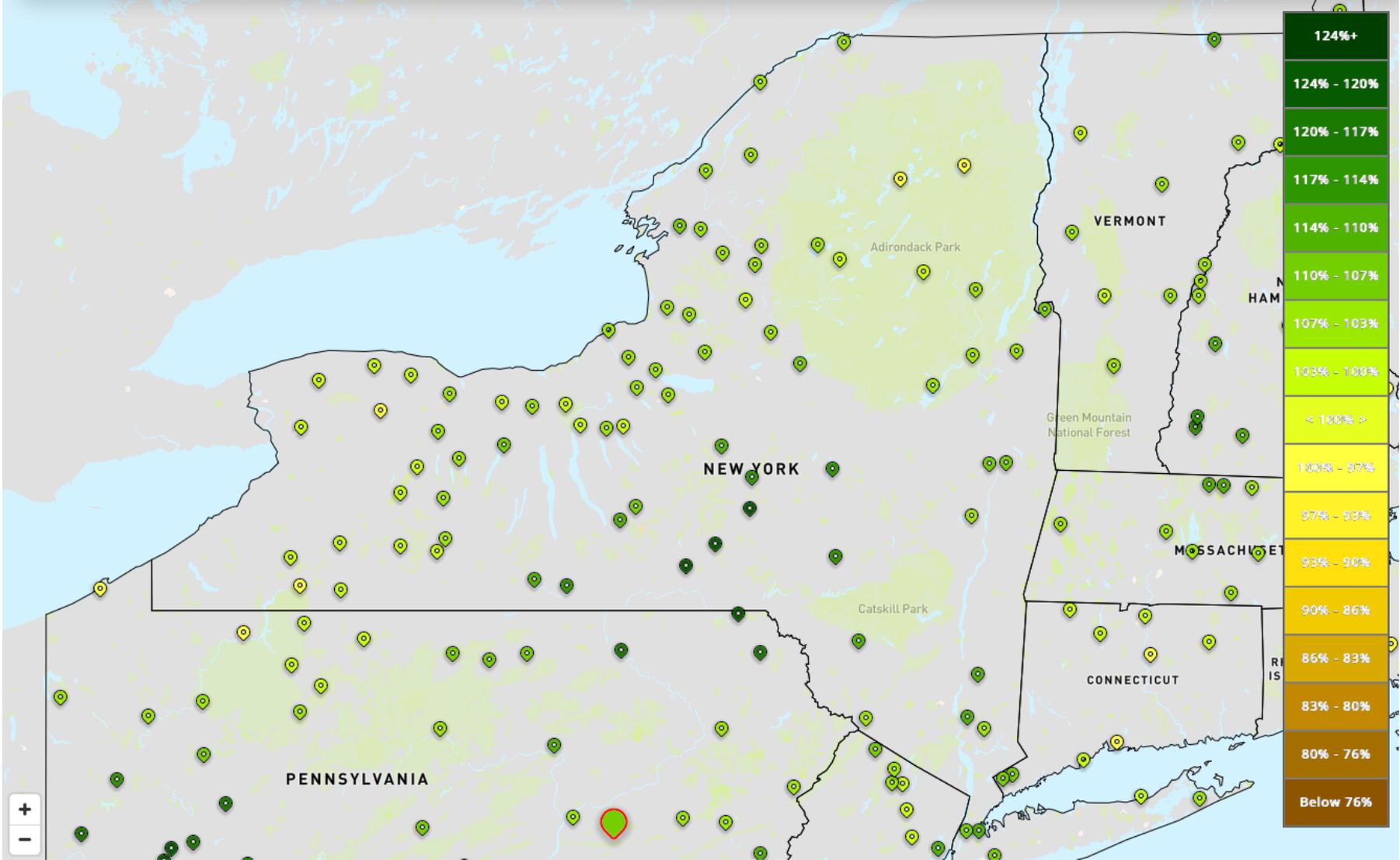
-2.37

0

2.37

# Recent Extreme Precipitation Changes in the Northeast U.S.

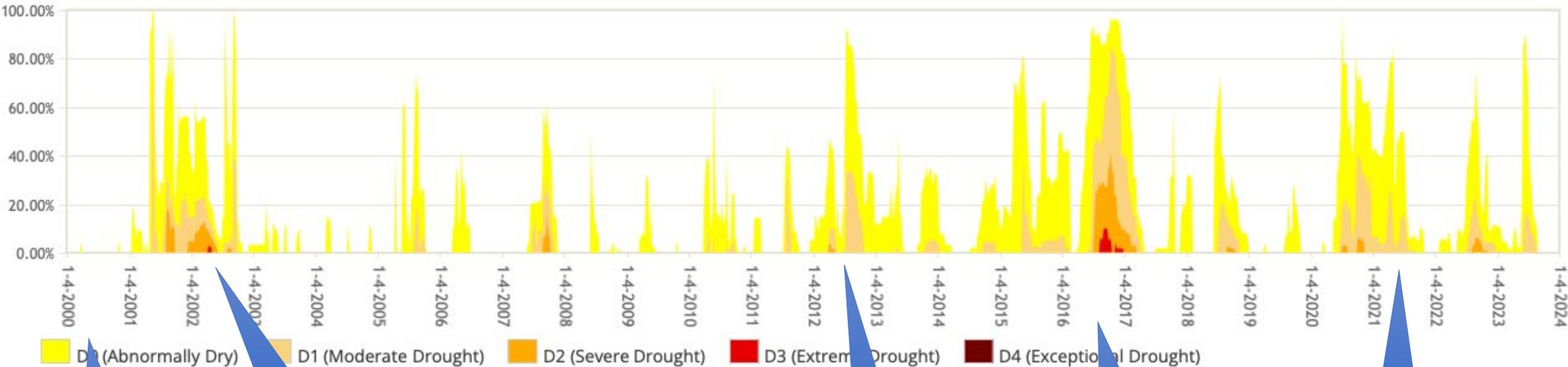
**Options** Color Code: Percent of 2021 Return Period Amount Relative to 2000 Amount Reference Year: 2000 Duration: 1 day Recurrence: 100yr (1%)



# History of Drought

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)
- No Data

New York Percent Area in U.S. Drought Monitor Categories



DM began  
in 2000

Drought of 2002

2012

2016-2017

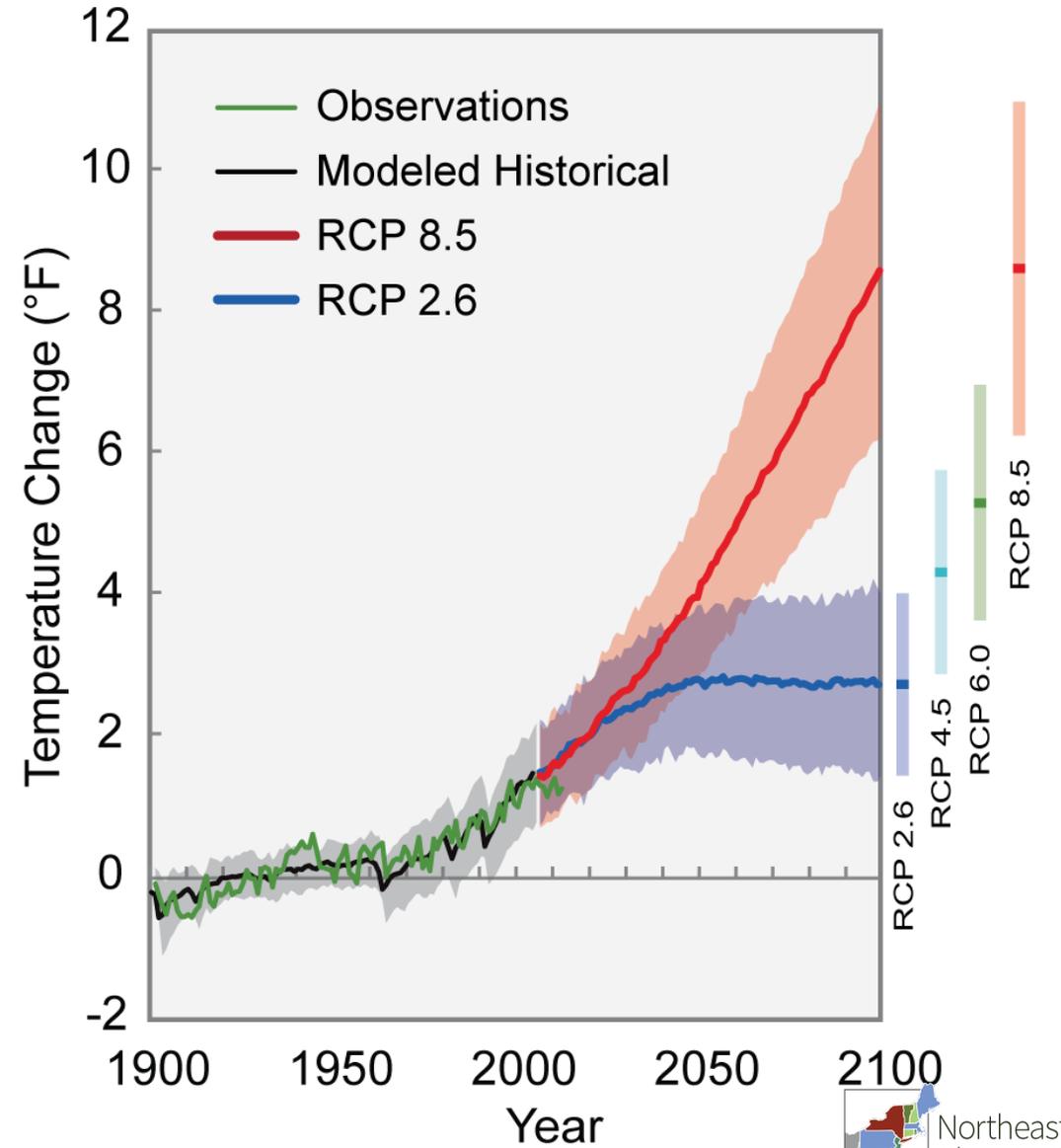
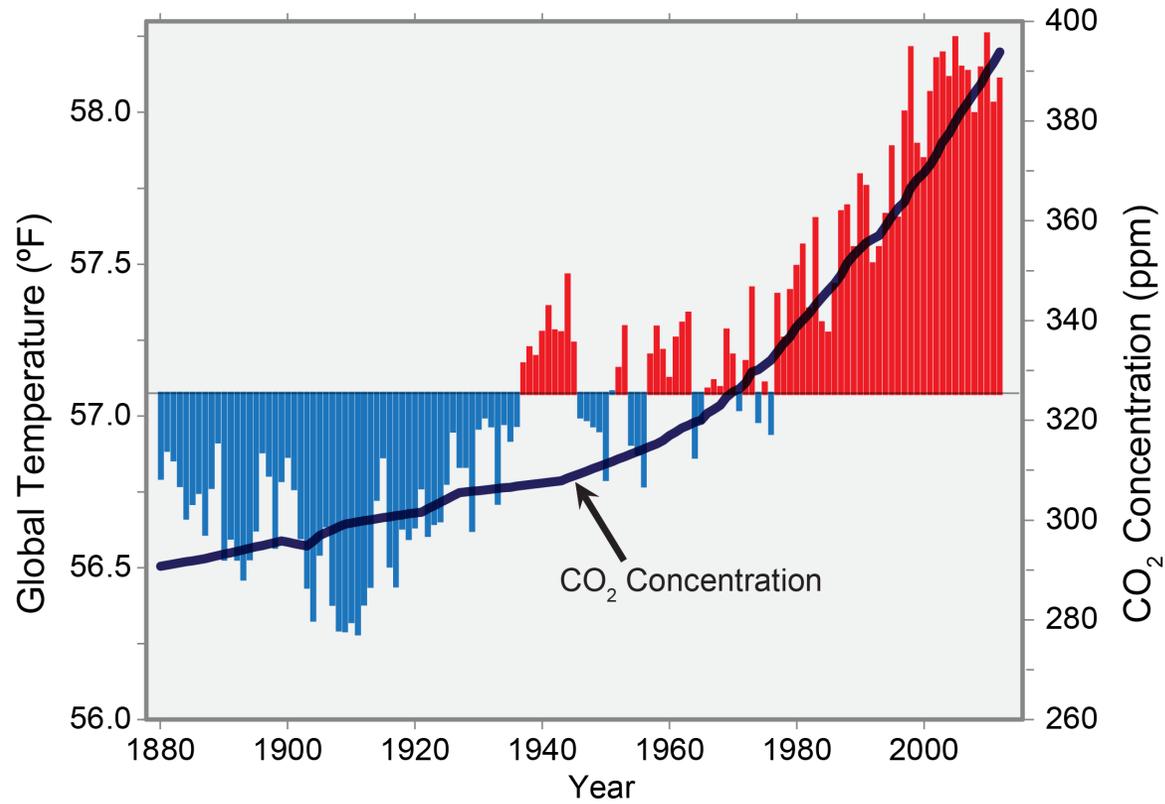
2021

# So What Does the FUTURE Hold ?



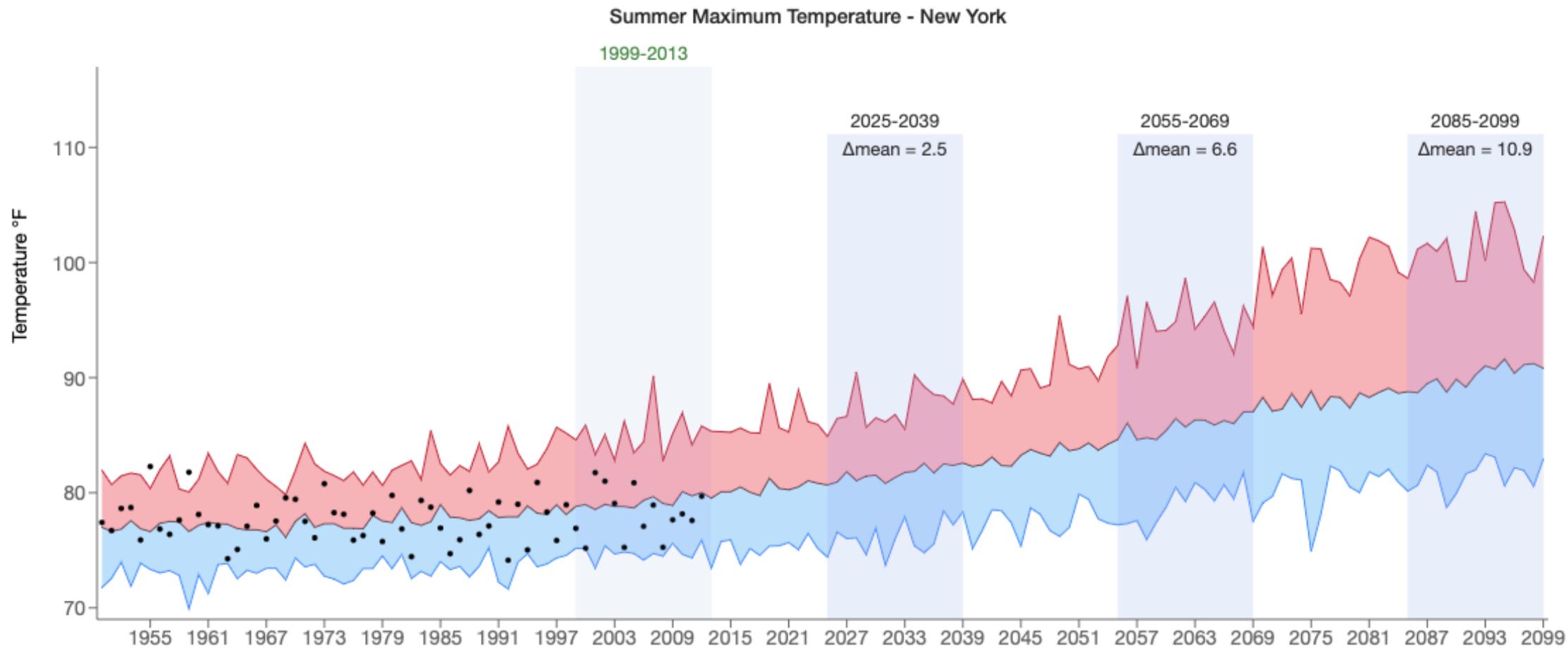
# Projected Global Temperature Changes

## Global Temperature and Carbon Dioxide



# Temperature Projections

## Higher Emissions

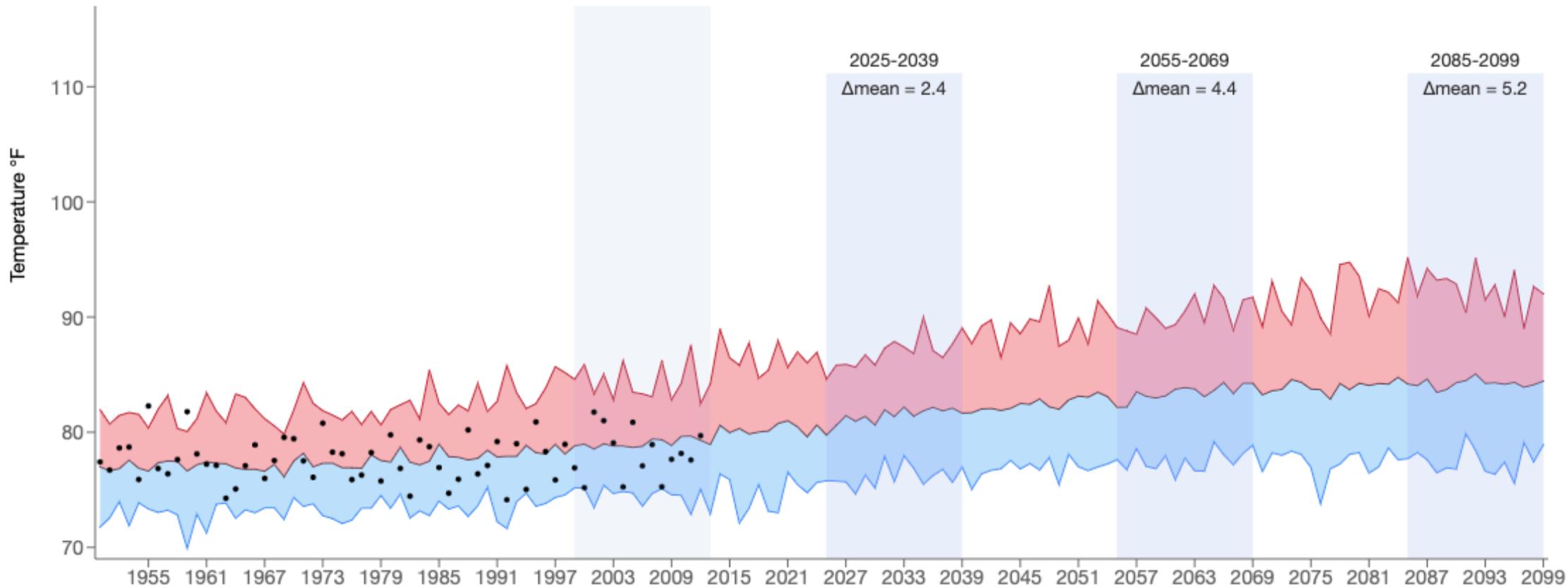


# Temperature Projections

Lower Emissions

### Summer Maximum Temperature - New York

1999-2013

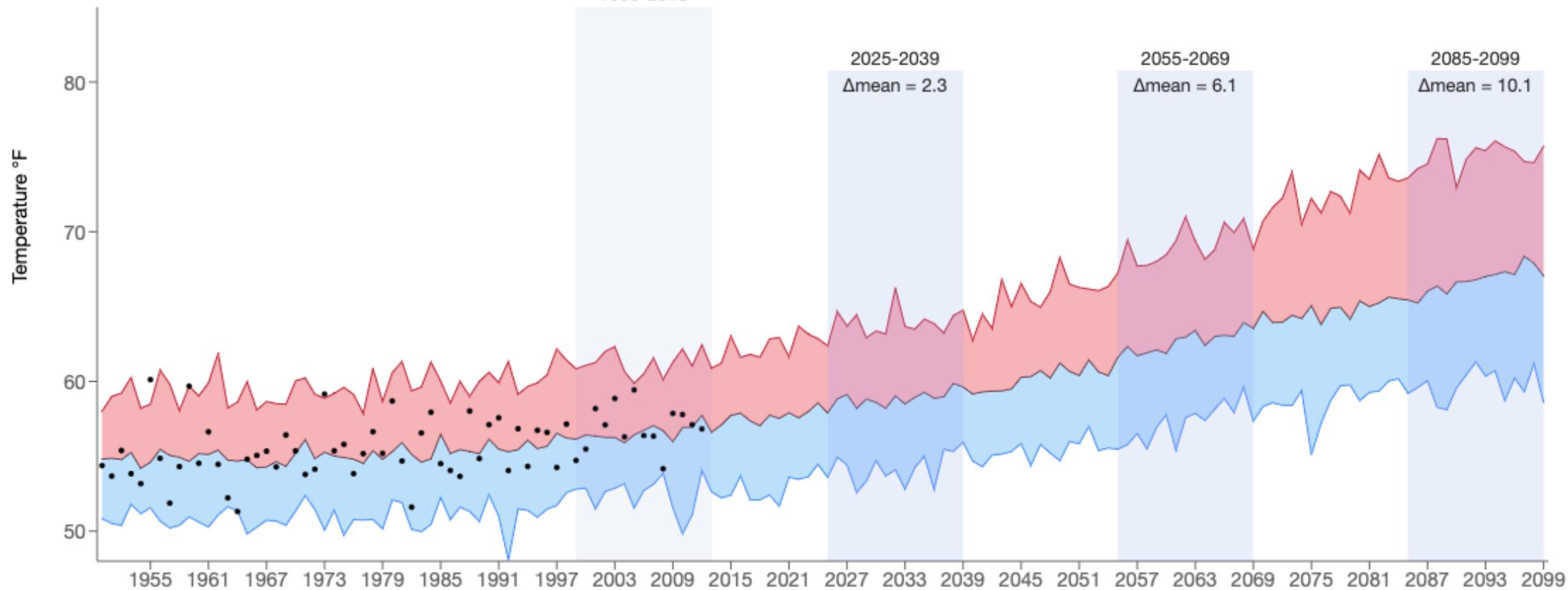


# Temperature Projections

Higher Emissions

### Summer Minimum Temperature - New York

1999-2013

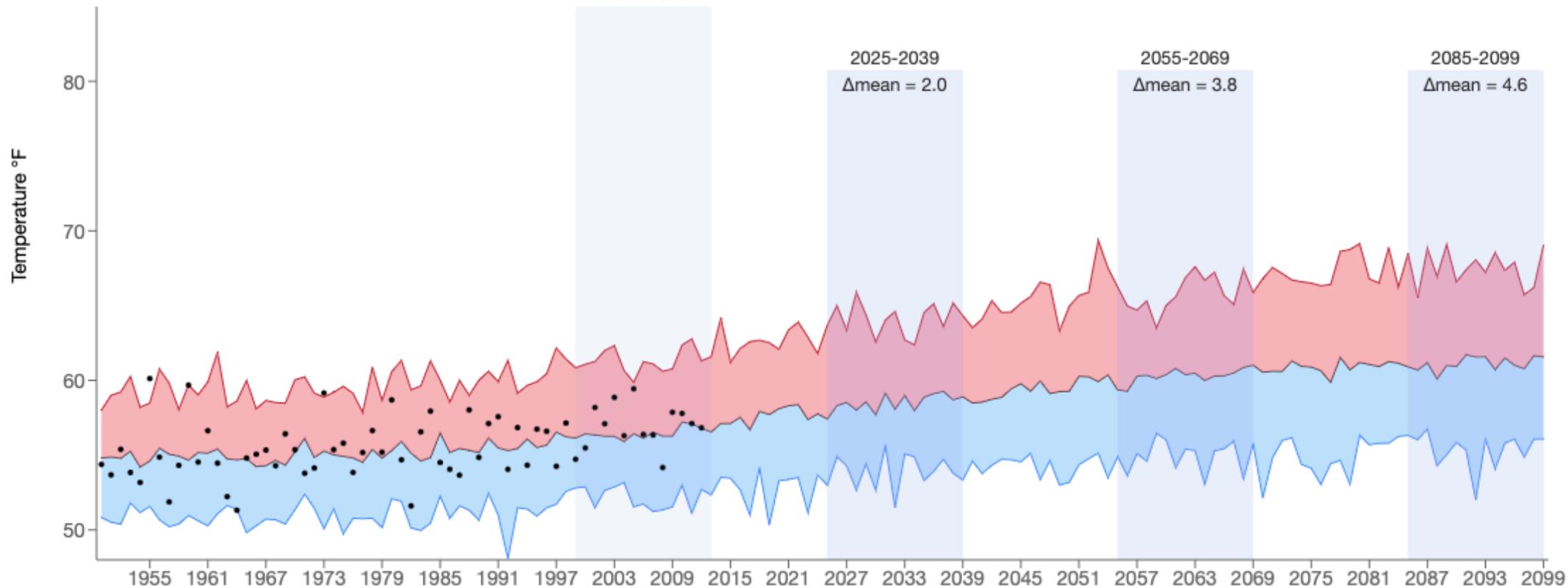


# Temperature Projections

Lower Emissions

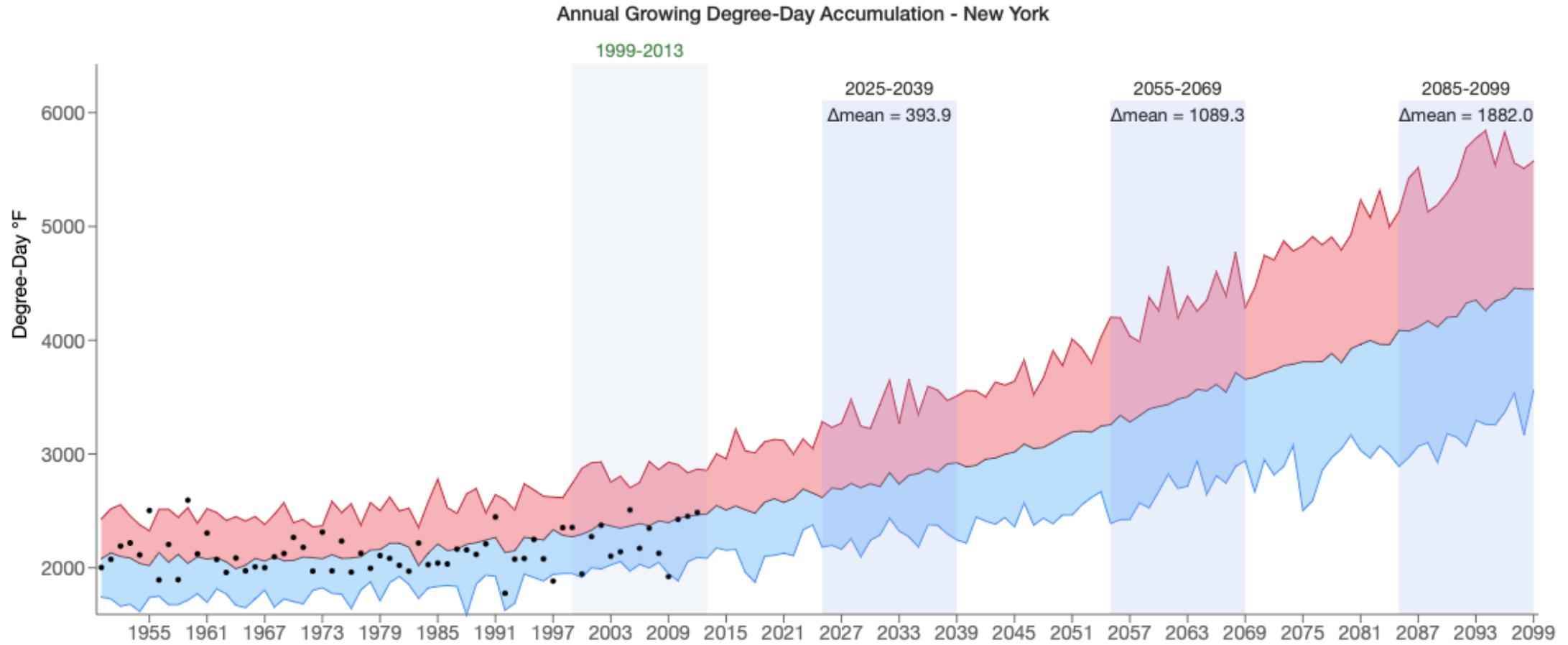
### Summer Minimum Temperature - New York

1999-2013

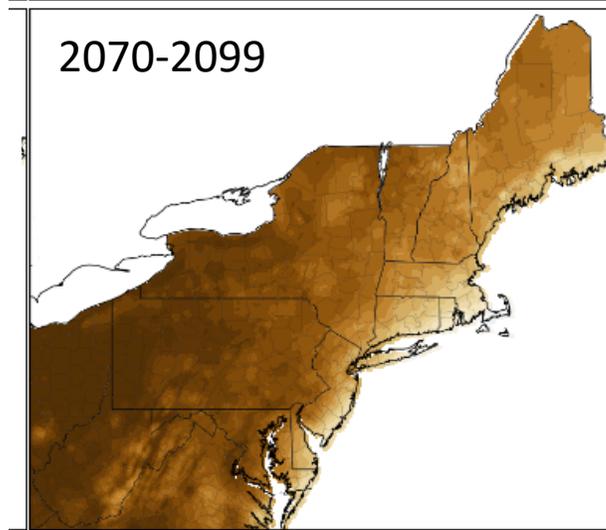
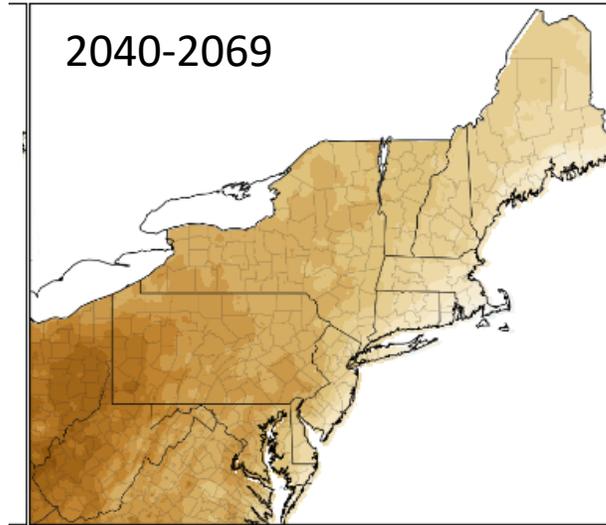


# GDD Projections

## Higher Emissions

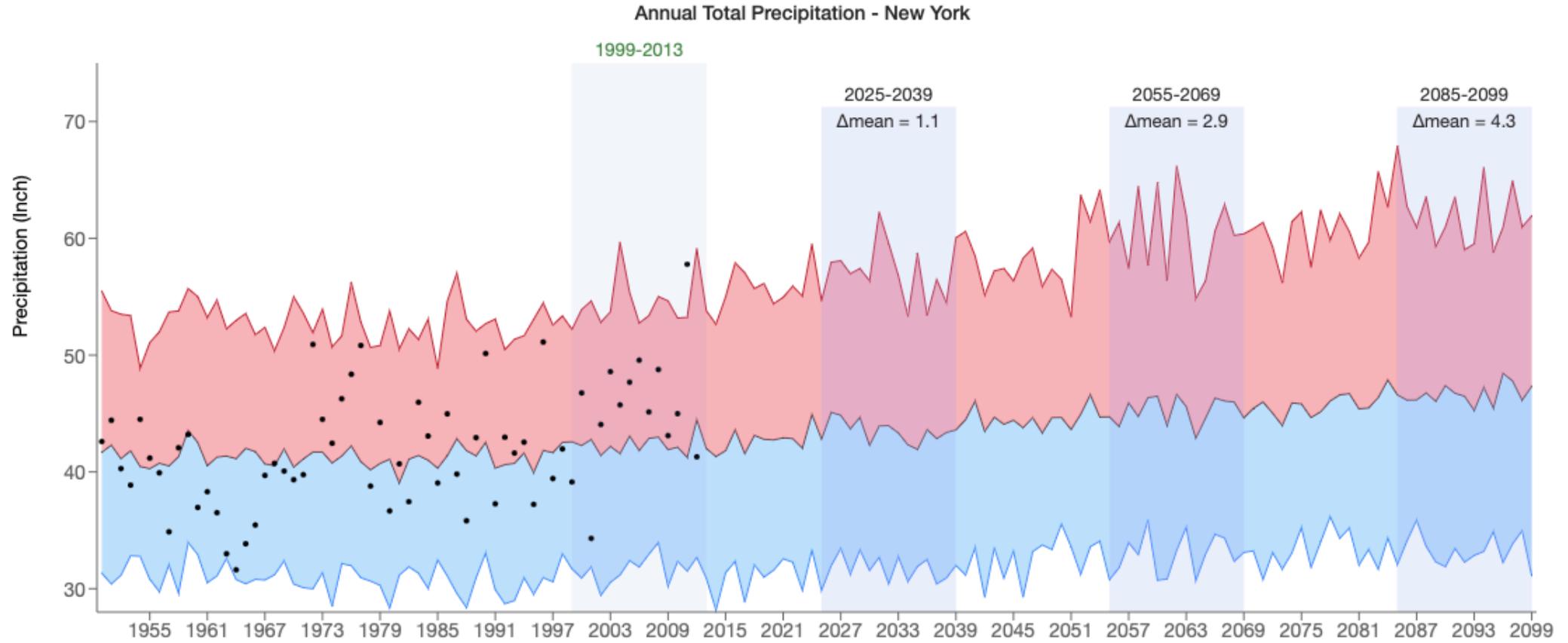


# Summer RH High Emissions

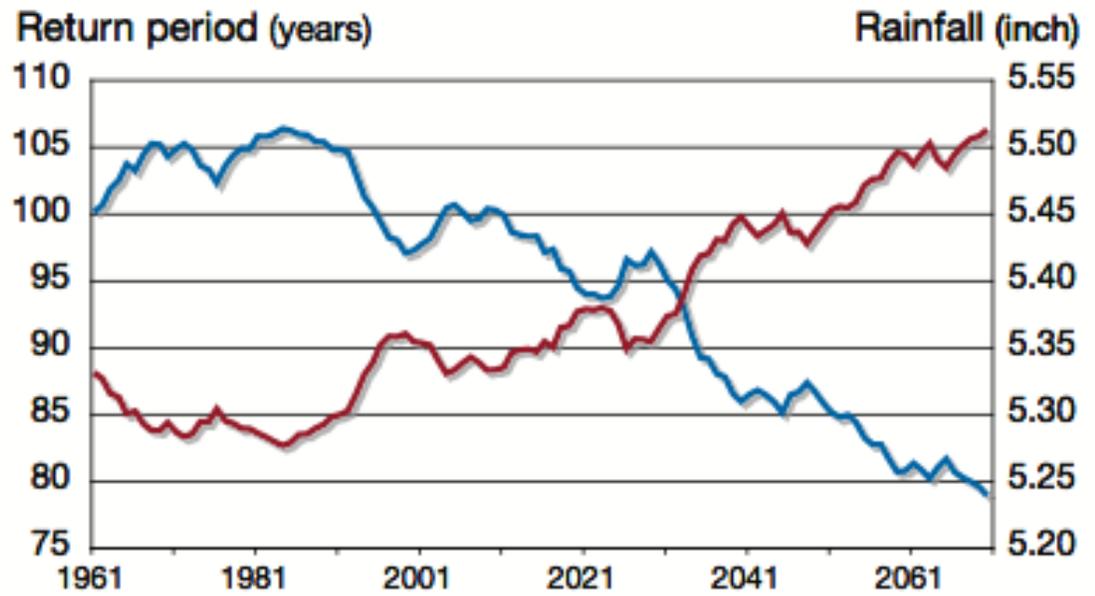


# Precipitation Projections

## Higher Emissions



# Projected Rainfall & Frequency of 100-year storm

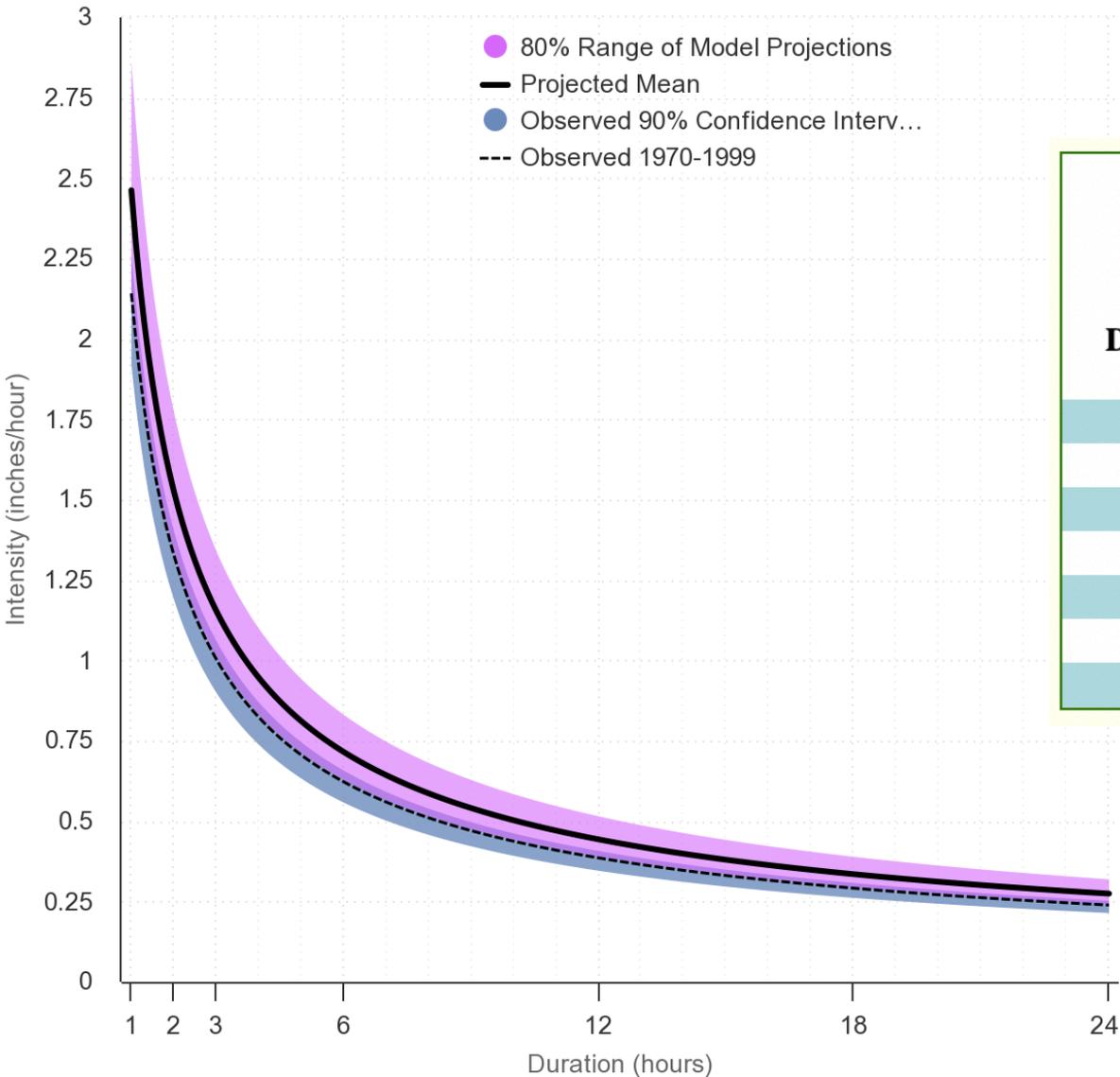


— Return period of storm equivalent to 1961–1990 100-year storm  
— Amount of 100-year storm

# Intensity Duration Frequency Curves: 100-yr Return Period RCP 8.5 Projection 2040-2069 vs. Observed (1970-1999)

## Precipitation Projections

### BINGHAMTON GREATER AP

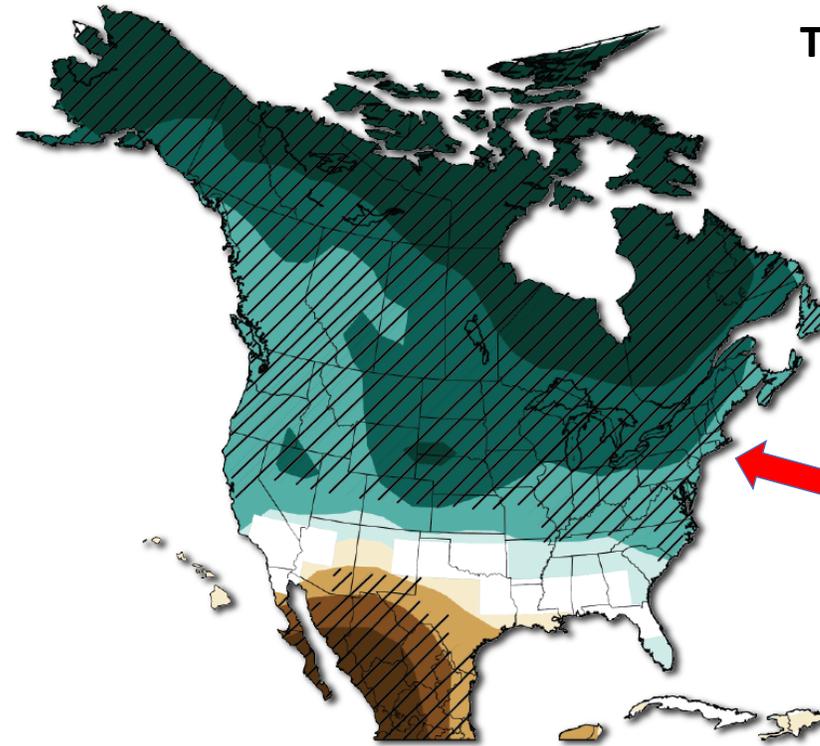


Duration (hrs)	Projected 2040-2069 Intensity			Observed 1970-1999 Intensity with Confidence Interval (CI) Bounds		
	Ensemble Member <i>i</i>			Bounds <i>i</i>		
	10 <sup>th</sup>	Mean	90 <sup>th</sup>	Low CI	Mean	High CI
1	2.17	2.46	2.86	1.92	2.14	2.26
2	1.34	1.53	1.77	1.19	1.33	1.40
3	1.01	1.15	1.34	0.90	1.00	1.06
6	0.63	0.71	0.83	0.56	0.62	0.66
12	0.39	0.44	0.51	0.35	0.39	0.41
18	0.29	0.33	0.39	0.26	0.29	0.31
24	0.24	0.27	0.32	0.21	0.24	0.25

# Continued Emissions Increases (RCP 8.5)

Projected change in seasonal precipitation for 2071-2099 (compared to 1970-1999)

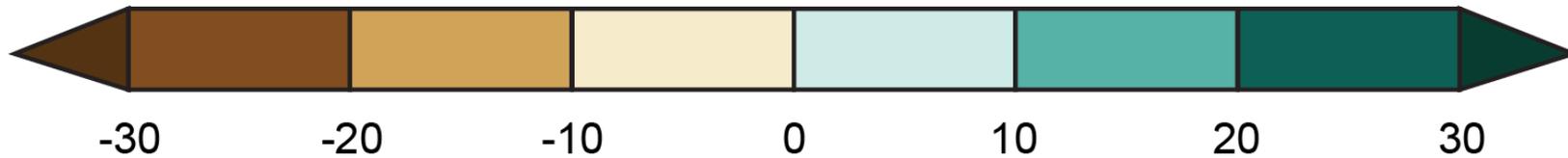
## Winter



The northern part of the U.S. is projected to see more winter precipitation.

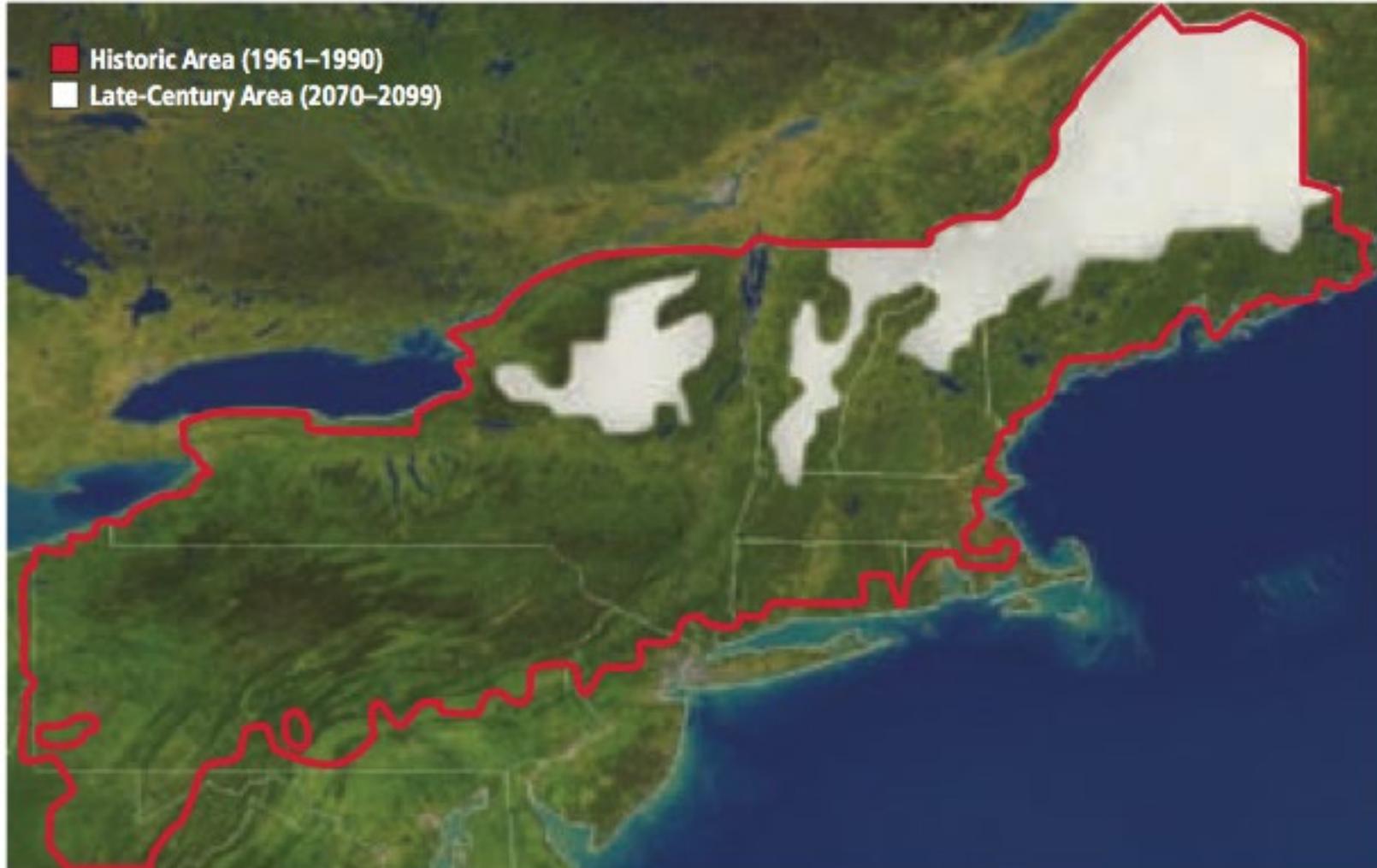
20-30% increase for NY

Precipitation Change (%)



# Area with Snow Cover for at least 30 days

Under high emissions scenario



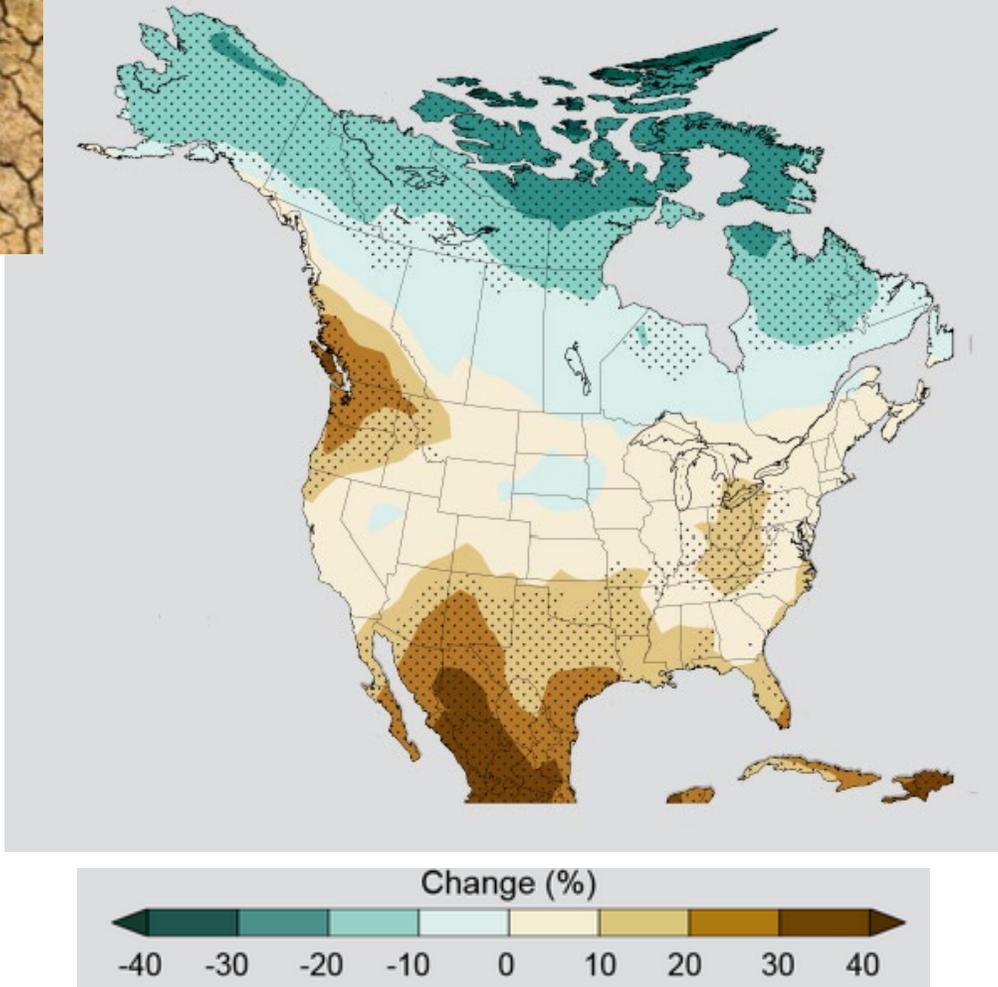
## Summer Drought

Summer drought is projected to increase, affecting water supply, agriculture, ecosystems, and energy production.

Variable soil water availability due to changes in seasonal precipitation.

## Changes in Consecutive Dry Days

### Continued Emissions Increases (RCP 8.5)



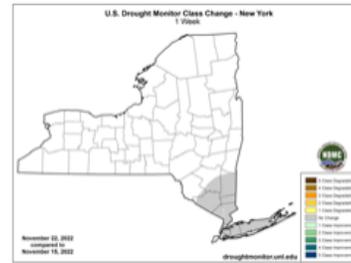


Click a state to zoom maps below  
Return to Northeast

Drought Status Update

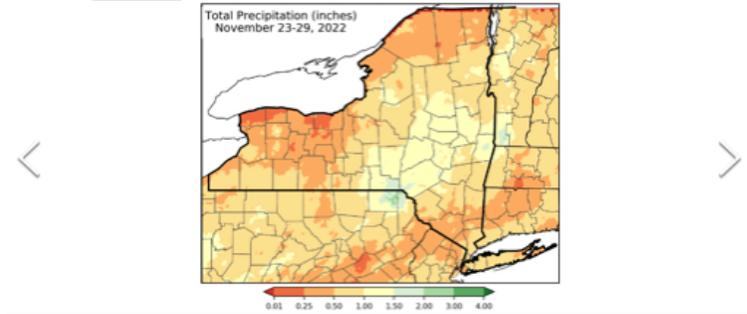
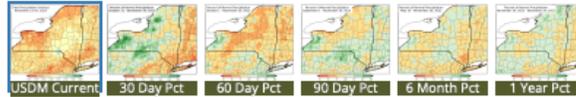
November 23, 2022 - There were only minor changes in conditions this week, with severe and moderate drought contracting slightly in northeastern Massachusetts and abnormal dryness easing in southeastern Massachusetts. The U.S. Drought Monitor released on November 23 showed less than 1% of New York and New England in severe drought, 3% in moderate drought, and 12% as abnormally dry, the same as last week. [Drought Early Warning Update](#)

US Drought Monitor (updated weekly)



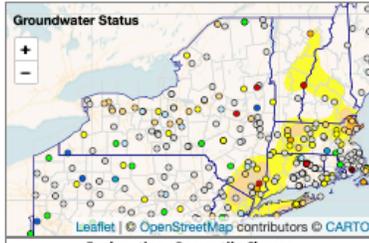
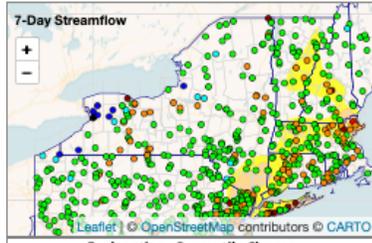
Last USDM Week (ending 2022-11-22) ACIS Precipitation Maps

Current ACIS Precipitation Maps



USGS Streamflow and Groundwater

Show USDM



Leaflet | OpenStreetMap contributors | CARTO

Leaflet | OpenStreetMap contributors | CARTO

Explanation - Percentile Classes

Explanation - Percentile Classes

<http://nedews.nrcc.cornell.edu>



- Drought Monitor
- Precipitation
- Streamflow & Groundwater
- Drought indices
- Outlooks

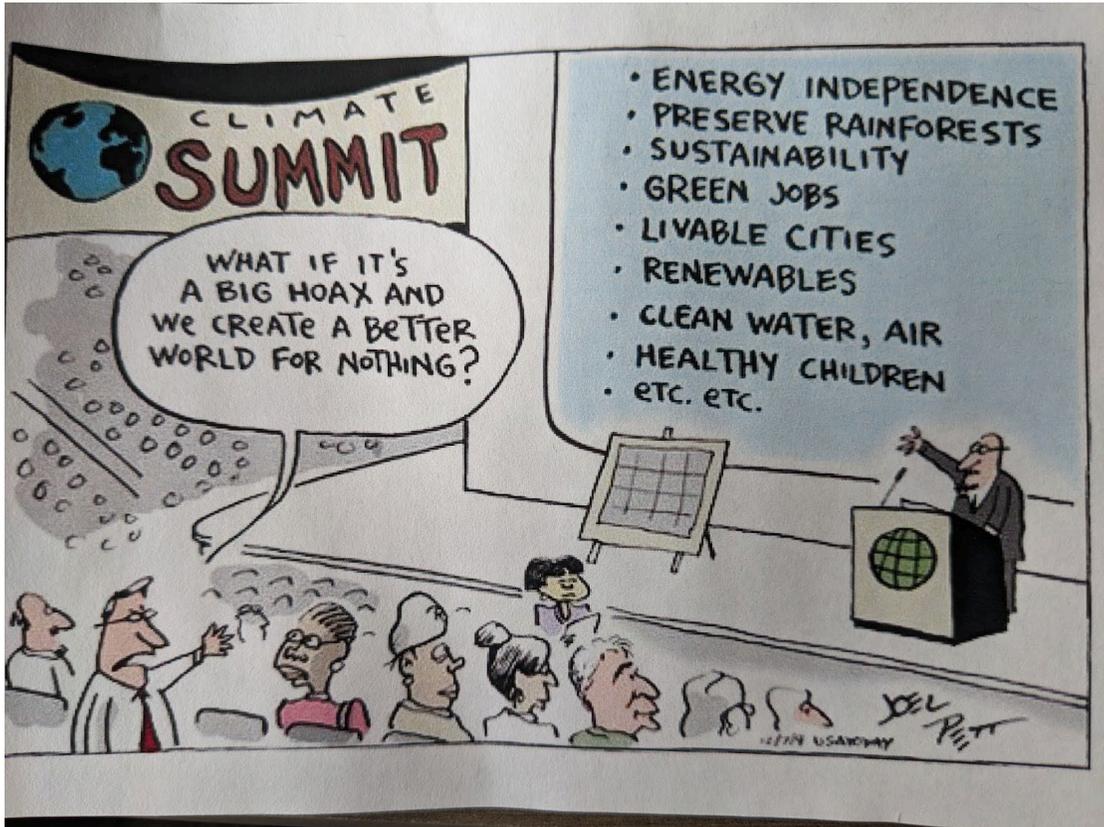
- ▼ NRCC SPI Maps
- ▼ Current ACIS Maps - SPI
- ▼ Current ACIS Maps - SPEI
- ▼ NRCC Gridded KBDI
- ▼ Experimental NWM Streamflow Maps
- ▼ Experimental NWM Soil Moisture Maps
- ▼ SPoRT Volumetric Soil Moisture Maps
- ▼ Evaporative Demand Drought Index Maps
- ▲ NOAA NCEP Outlooks

<b>Day 1 QPF</b> Valid: 12Z 11/29/22 - 12Z 11/30/22	<b>Day 2 QPF</b> Valid: 12Z 11/30/22 - 12Z 12/01/22	<b>Day 3 QPF</b> Valid: 12Z 12/01/22 - 12Z 12/02/22	<b>7 Day QPF</b> Valid: 12Z 11/29/22 - 12Z 12/06/22
Explanation - Forecast precipitation (inches)			
0.01 0.10 0.25 0.50 0.75 1.00	0.010.100.250.500.751.001.251.50	0.01 0.10 0.25	0.00.10.20.30.40.50.75.1.001.502.00
Data provided by <a href="#">DOC/NOAA/NWS/NCEP/WPC</a>			
<b>6-10 Day Precipitation Outlook</b> 2022-12-04 to 2022-12-08	<b>6-10 Day Temperature Outlook</b> 2022-12-04 to 2022-12-08	<b>8-14 Day Precipitation Outlook</b> 2022-12-06 to 2022-12-12	<b>8-14 Day Temperature Outlook</b> 2022-12-06 to 2022-12-12
Explanation - Probabilities (percent)			
50 40 33 33 40 50 Prob Below Normal Prob Above Normal	60 50 40 33 33 40 50 60 Prob Below Normal Prob Above Normal	40 33 33 40 Prob Below Normal Prob Above Normal	50 40 33 33 40 50 Prob Below Normal Prob Above Normal
Data provided by <a href="#">DOC/NOAA/NWS/NCEP/CPC</a>			
<b>Monthly Precipitation Outlook</b> Dec 2022	<b>Monthly Temperature Outlook</b> Dec 2022	<b>3-Month Precipitation Outlook</b> DJF 2022-2023	<b>3-Month Temperature Outlook</b> DJF 2022-2023
Explanation - Probabilities (percent)			
33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 Prob Below Normal Prob Above Equi	33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 Prob Below Normal Prob Above Equi	33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 Prob Below Normal Prob Above Equi	33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 33 Prob Below Normal Prob Above Equi
Data provided by <a href="#">DOC/NOAA/NWS/NCEP/CPC</a> <a href="#">Help</a>			
<b>Weeks 3-4 Precipitation Outlook</b> Weeks 3-4, QPF	<b>Weeks 3-4 Temperature Outlook</b> Weeks 3-4, QPF	<b>U.S. Monthly Drought Outlook</b> Monthly Drought Index by State Week	<b>U.S. Seasonal Drought Outlook</b> Seasonal Drought Index by State Week

<http://nedews.nrcc.cornell.edu>



# Questions?



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