Projections of Extreme Precipitation Amounts for Climate Adaptation Planning in New York State

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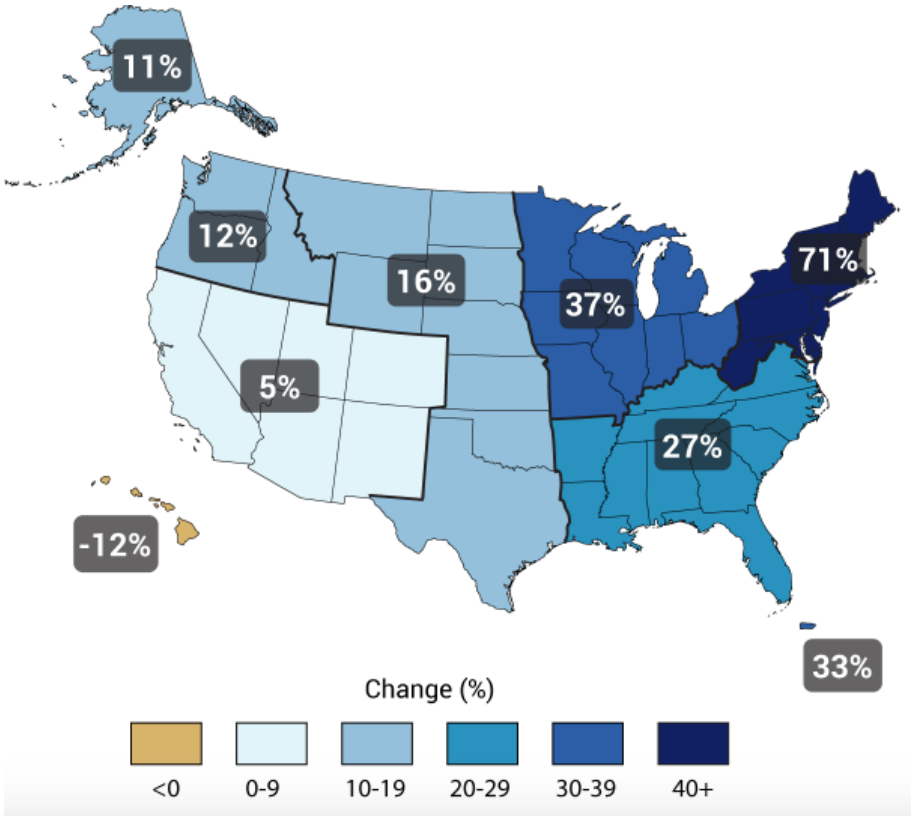
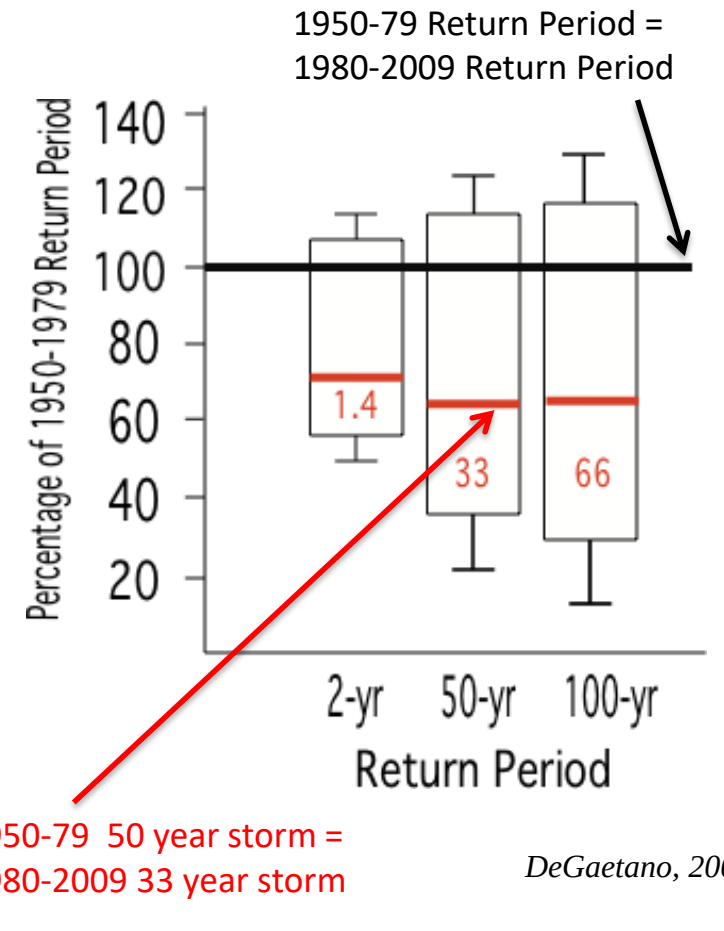
Motivation



Change in heaviest 1% of all daily events 1958-2012

from Karl et al. 2009



1950-79 50 year storm =
1980-2009 33 year storm

DeGaetano, 2009

Motivation

NY Climate Risk and Resiliency Act CCRA

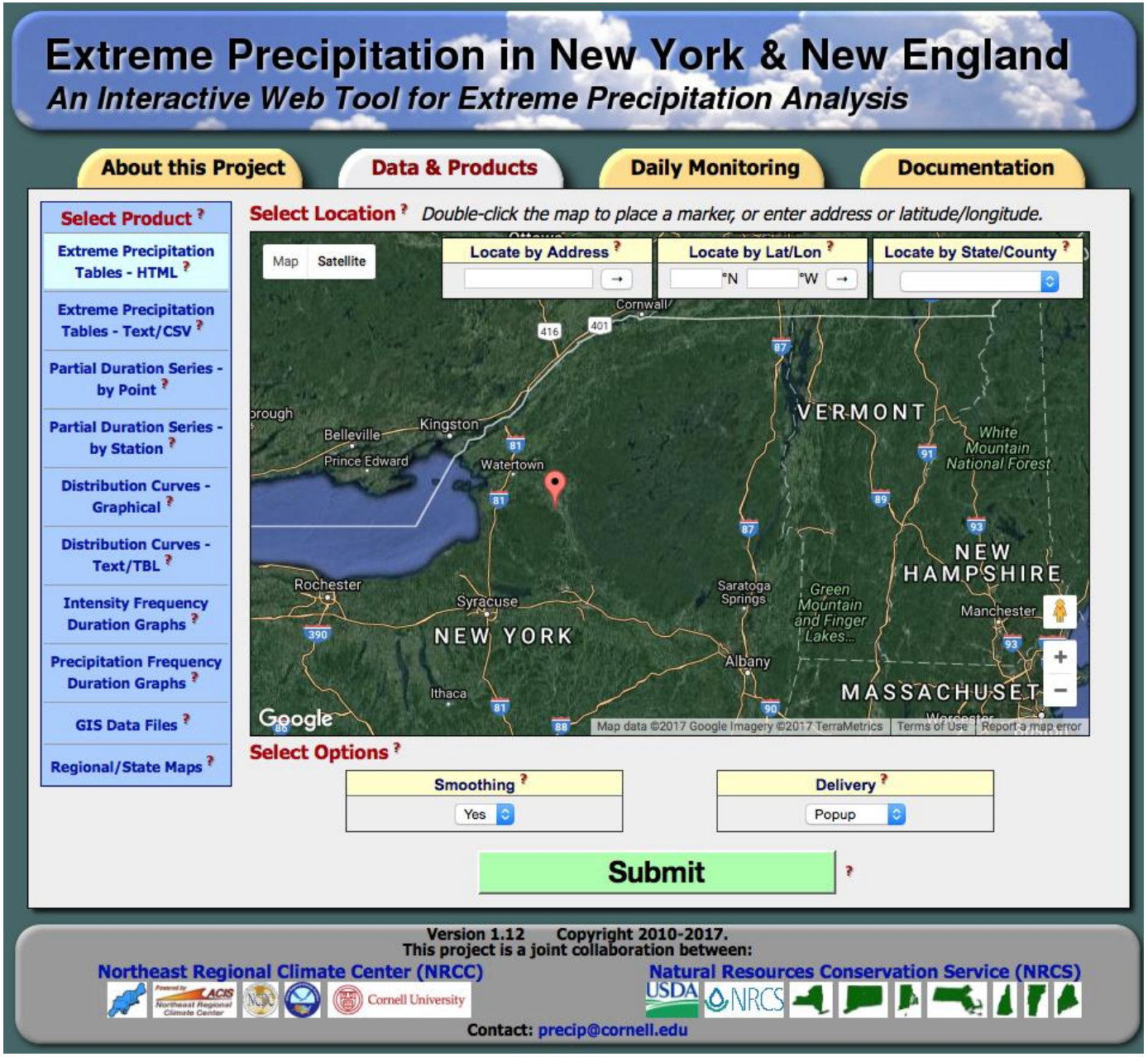
- Applies to **permitting, funding and regulatory decisions**

  For example

  - Smart growth assessments
  - Wastewater treatment plant funding
  - Hazardous waste facilities siting
  - Design and construction of petroleum and chemical storage facilities
  - Oil and gas drilling
  - State acquisition of open space

- Applicants must **demonstrate** that they have taken into account **future** physical climate risks caused by storm surges, sea-level rise or **flooding**.

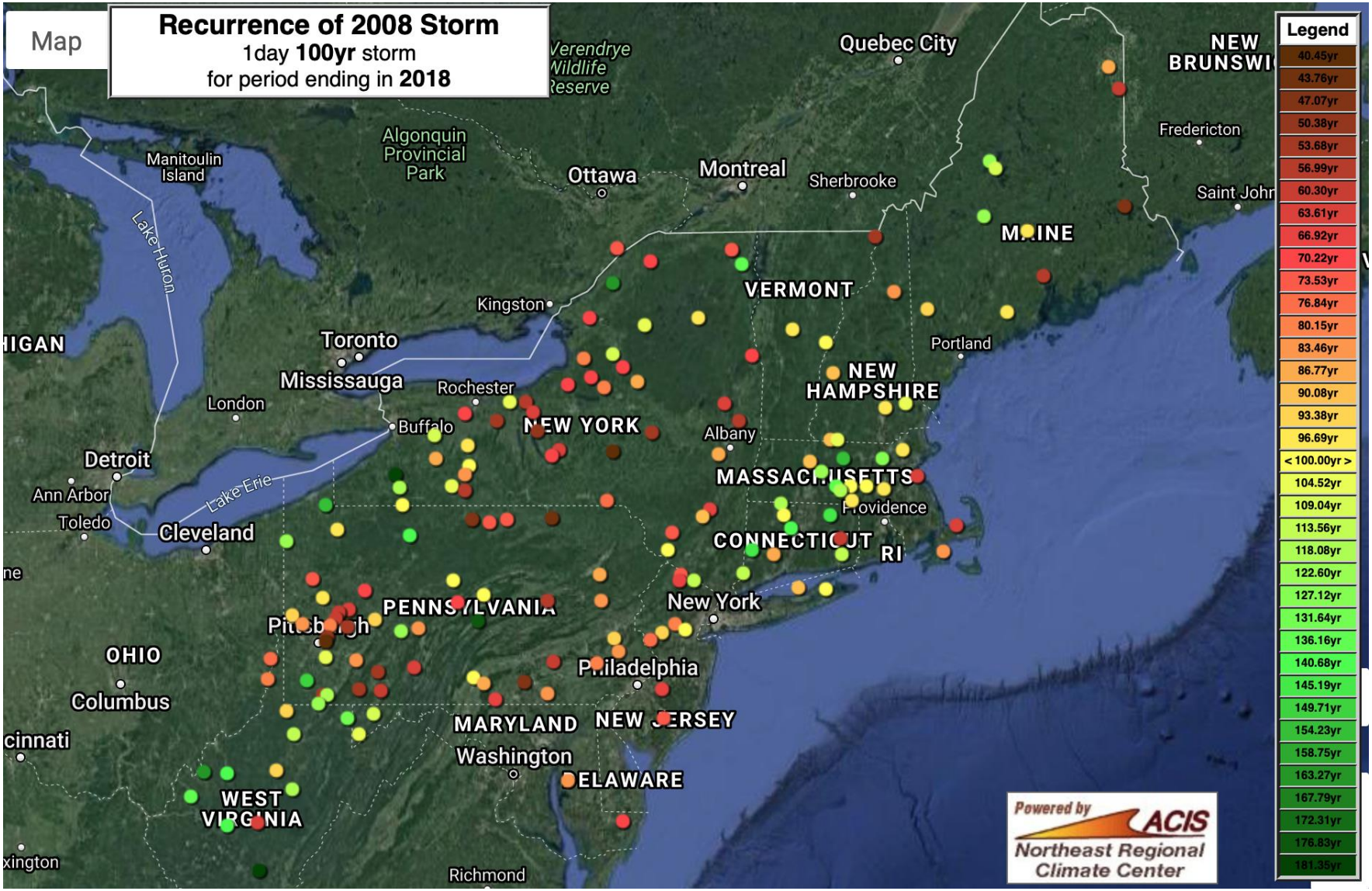
History



- NRCS funded
- Pre Atlas 14
- Tendency for
  Higher 100-yr
  Lower 2-yr
- Promoted beyond NRCS
- Early adaptation in New England States

Monitoring Extreme Precip Changes

Automated ANNUAL generation of updated extreme rainfall products.



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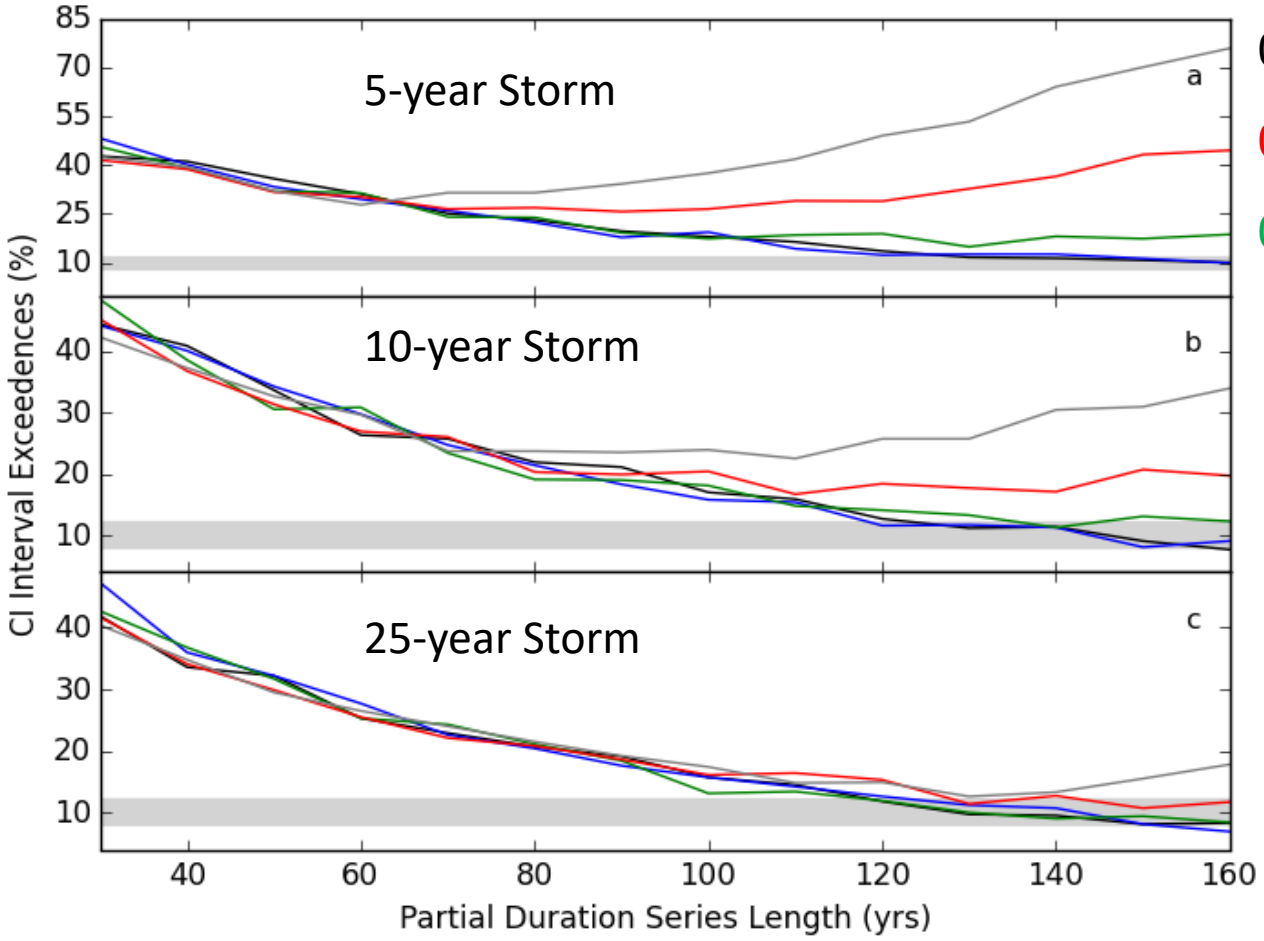
Record Length??

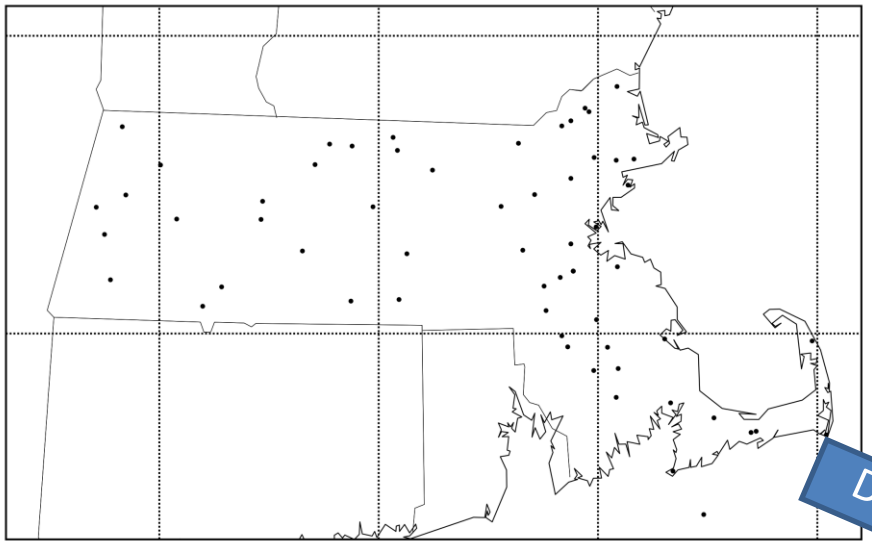


0.01% yr^{-1}

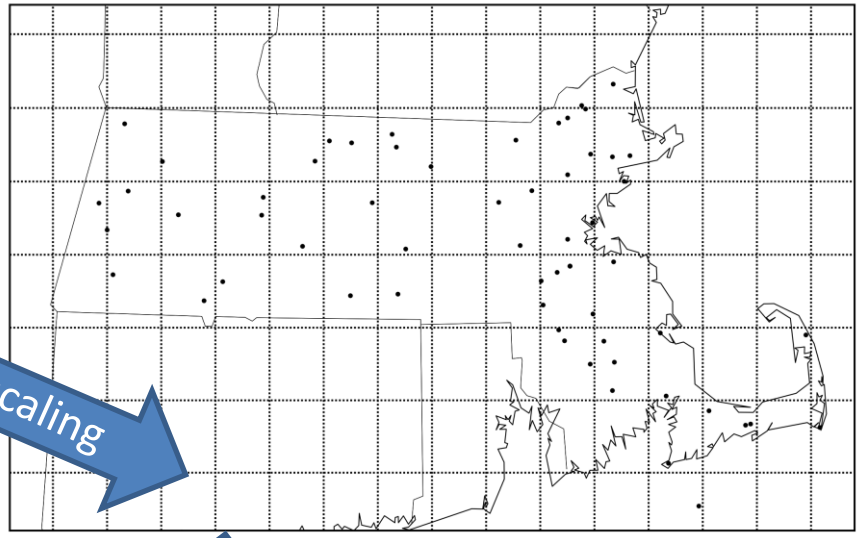
0.007% yr^{-1}

0.004% yr^{-1}

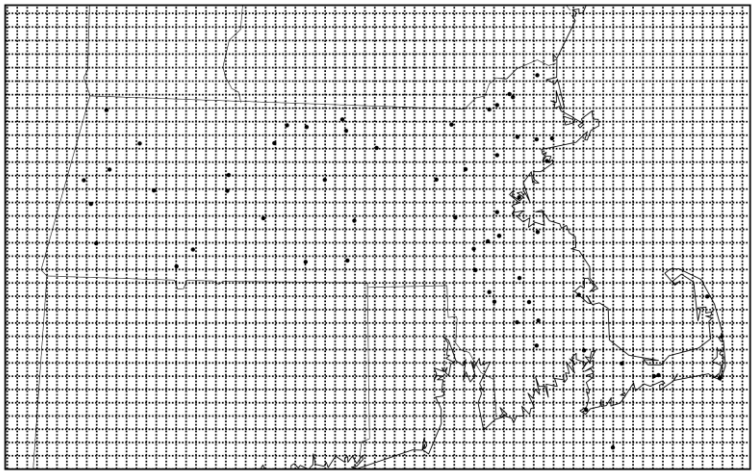
Downscaling



Downscaling



Downscaling



Downscaling Approaches

1) Dynamical Downscaling (CORDEX) (also NARCCAP)

→ Regional climate models (RCMs) run at 50-km resolution and driven by atmosphere–ocean general circulation (AOGCM) models

2) "Statistical" Downscaling – Delta Method (CMIP5)

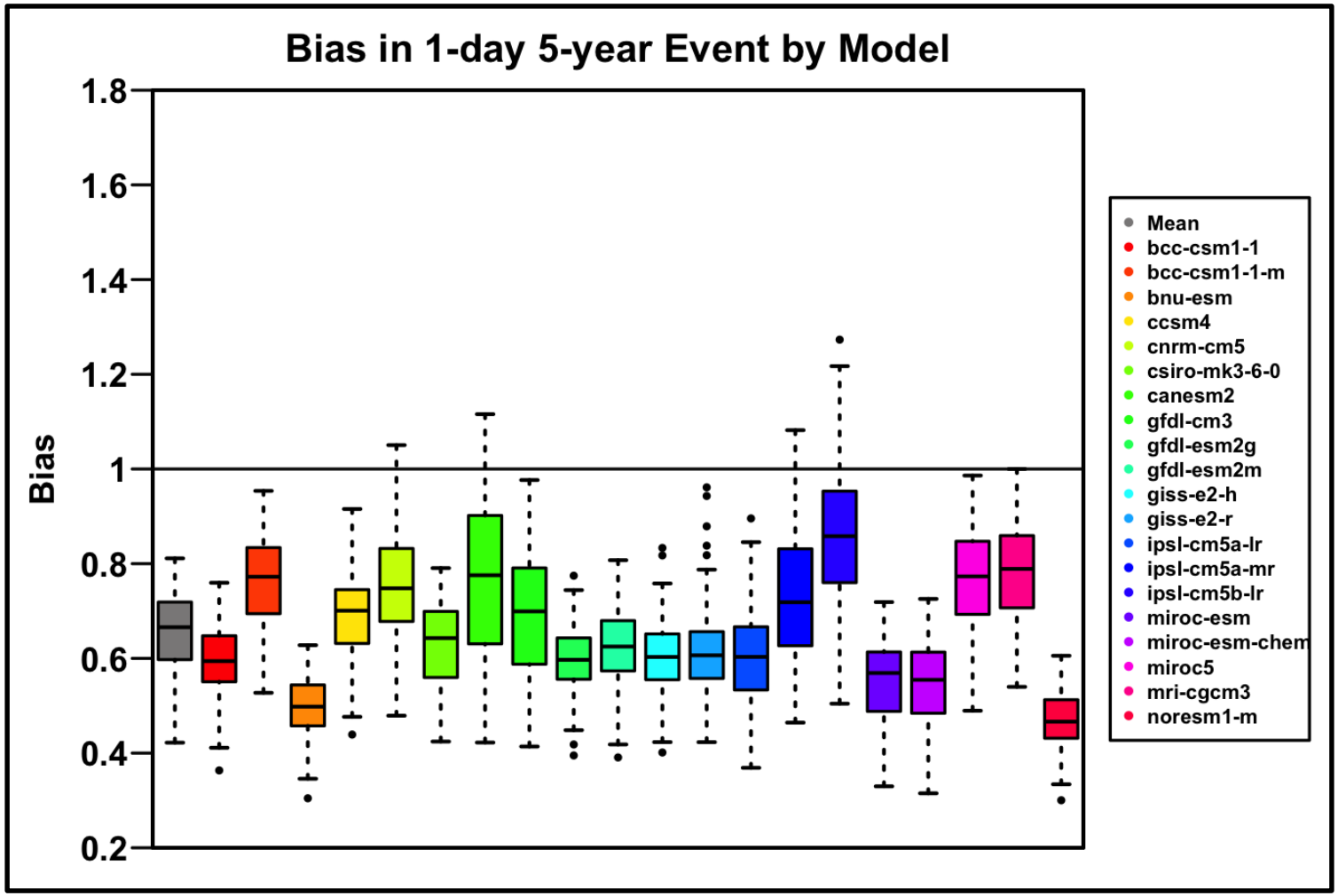
→ Compares model-simulated precipitation extremes between historical and future periods (at GCM resolution)

3) Statistical Downscaling – Analog Method (CMIP5)

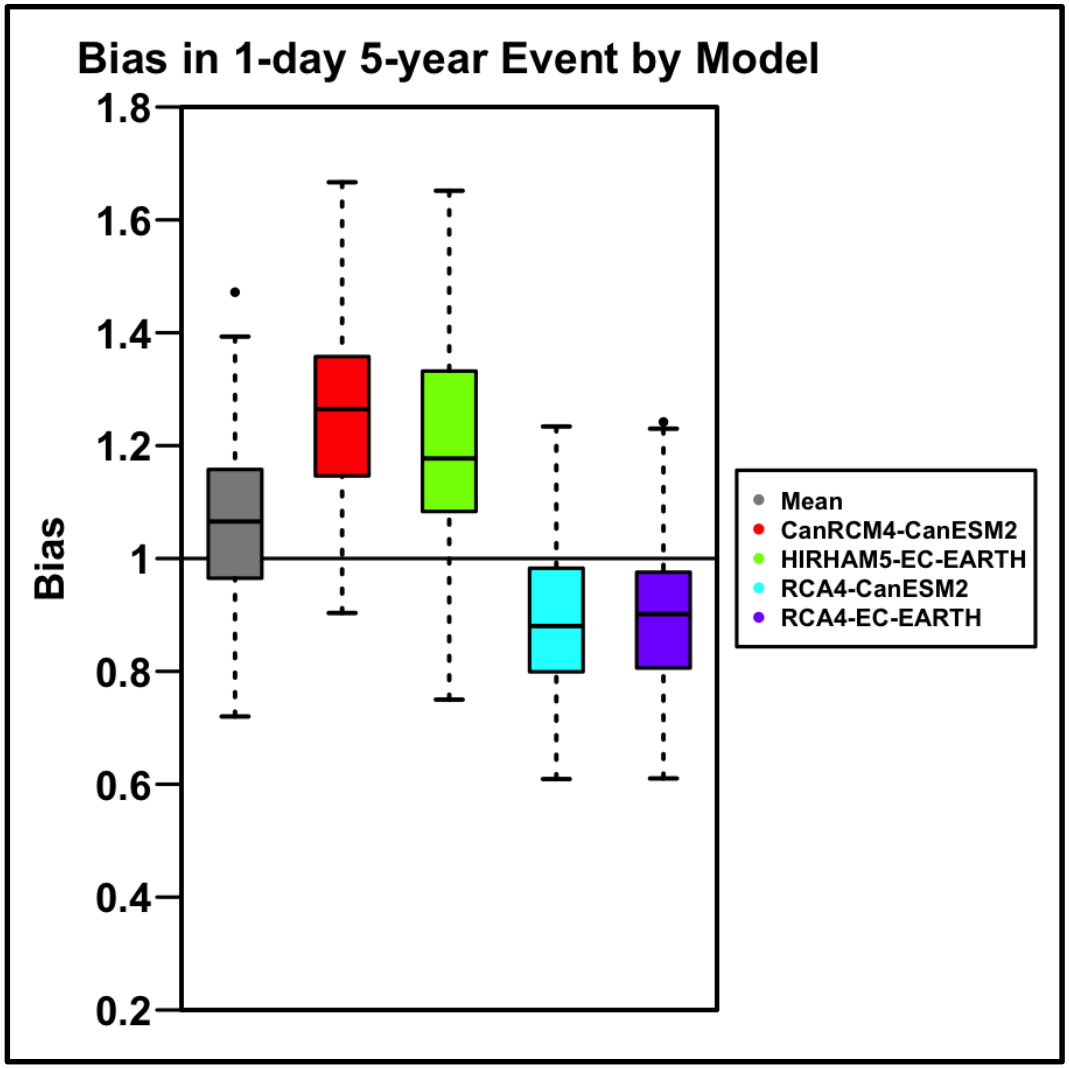
→ Uses historical weather map analogues to predict the occurrence of extreme precipitation on a given day


REALITY
CHECK
AHEAD

Raw CMIP5 No Downscaling vs Obs.



CORDEX vs. Observed



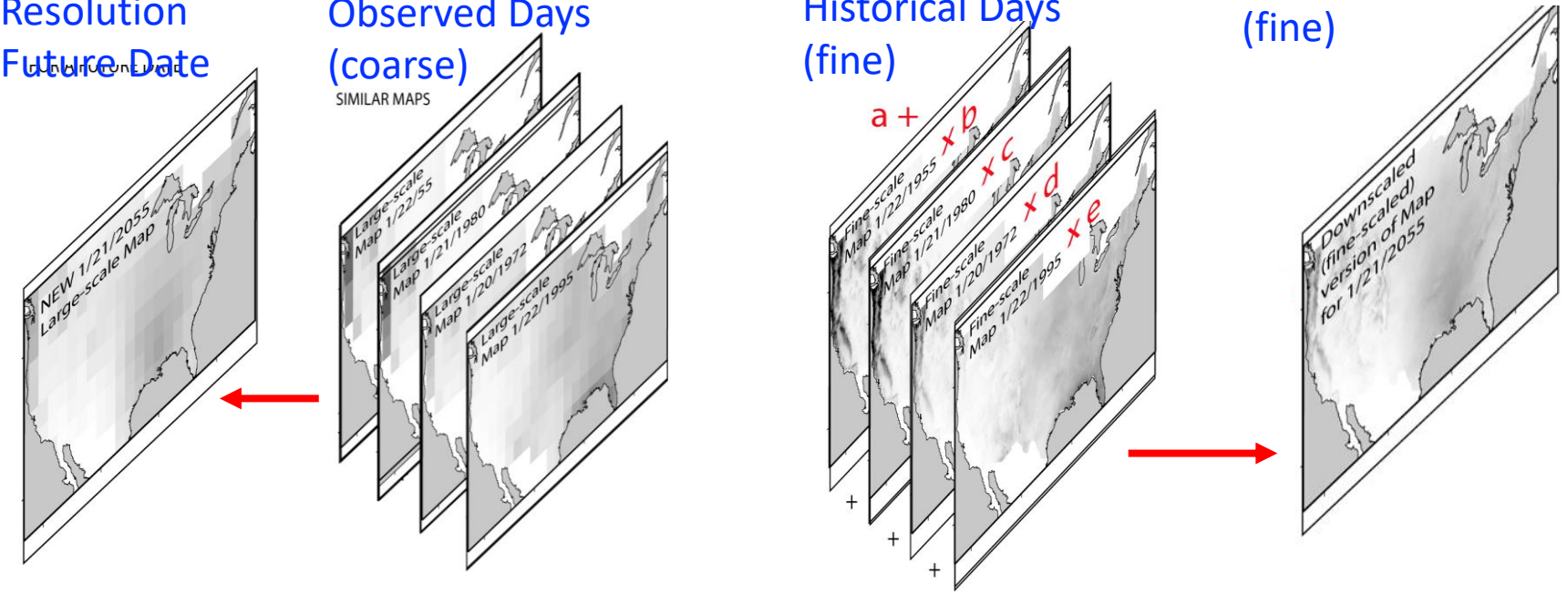
Analog Downscaling

Coarse Resolution Future Date

Similar Historical Observed Days (coarse)

Observed Historical Days (fine)

Future Day (fine)



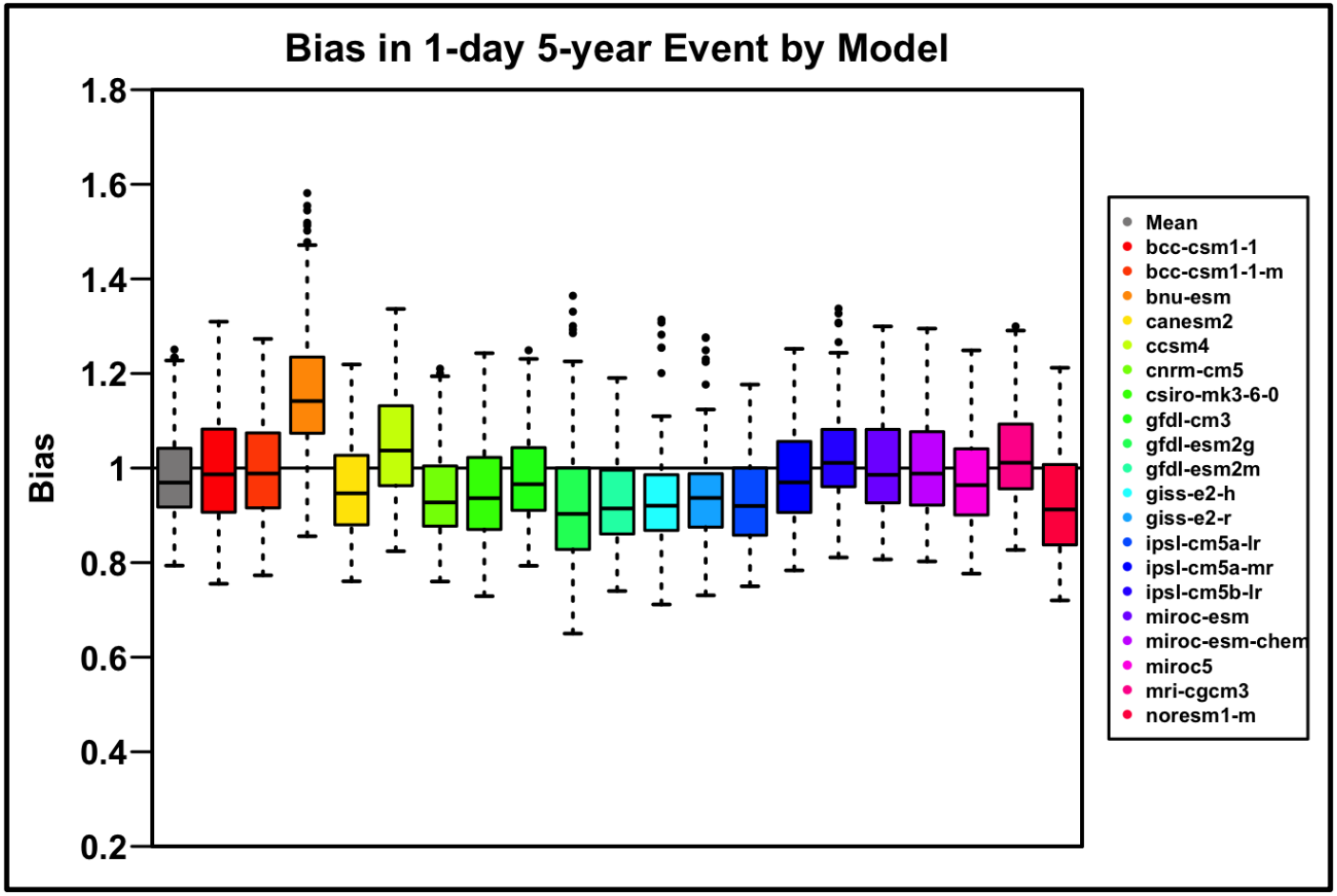
$F_{Low} = b(H1_{Low}) + c(H2_{Low}) + d(H3_{Low}) + d(H4_{Low}) + a$

Develop statistical relationship between analog cases

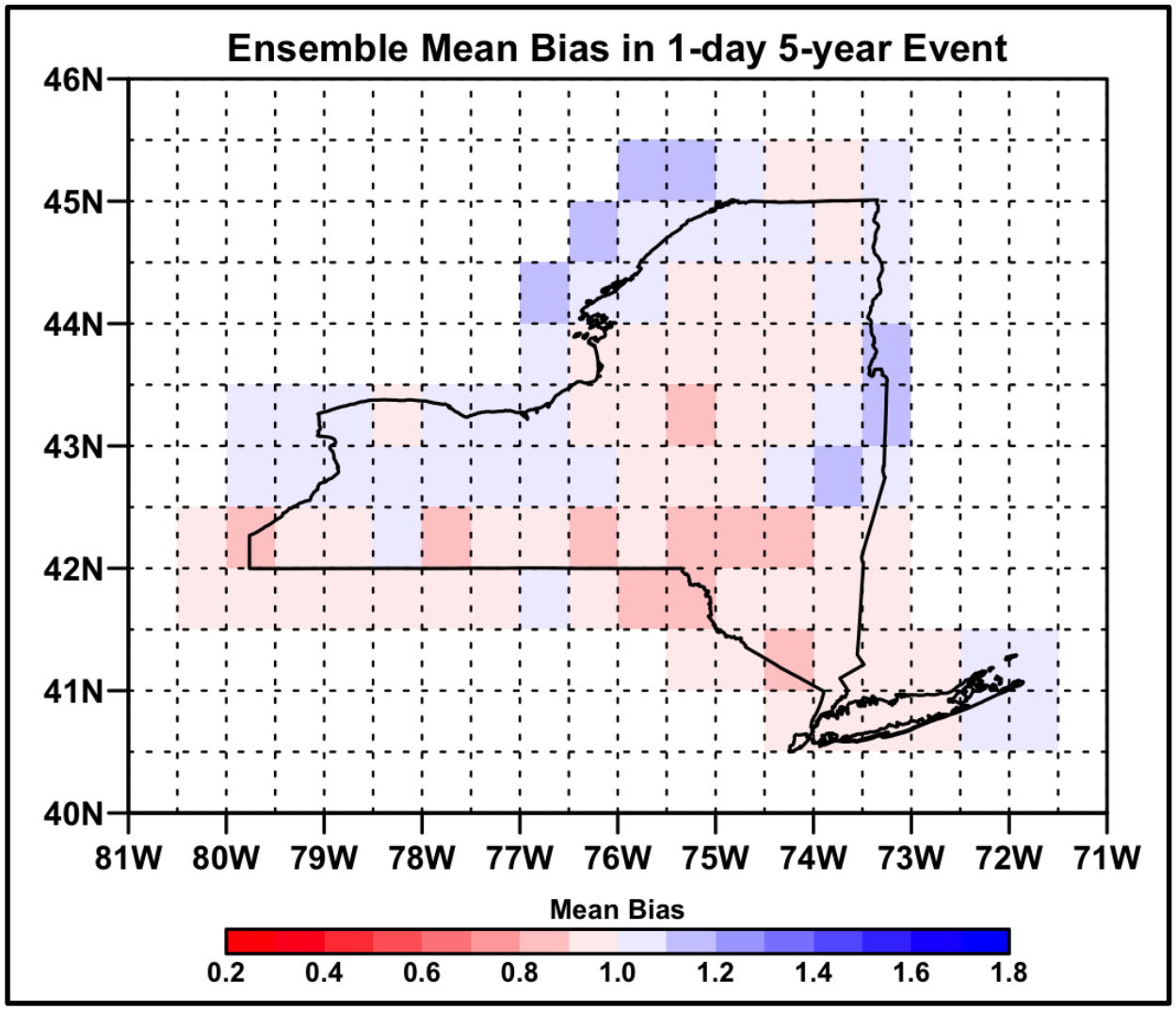
$b(H1_{High}) + c(H2_{High}) + c(H3_{High}) + c(H4_{High}) + a = F_{High}$

Apply statistical relationship high resolution historical analogs

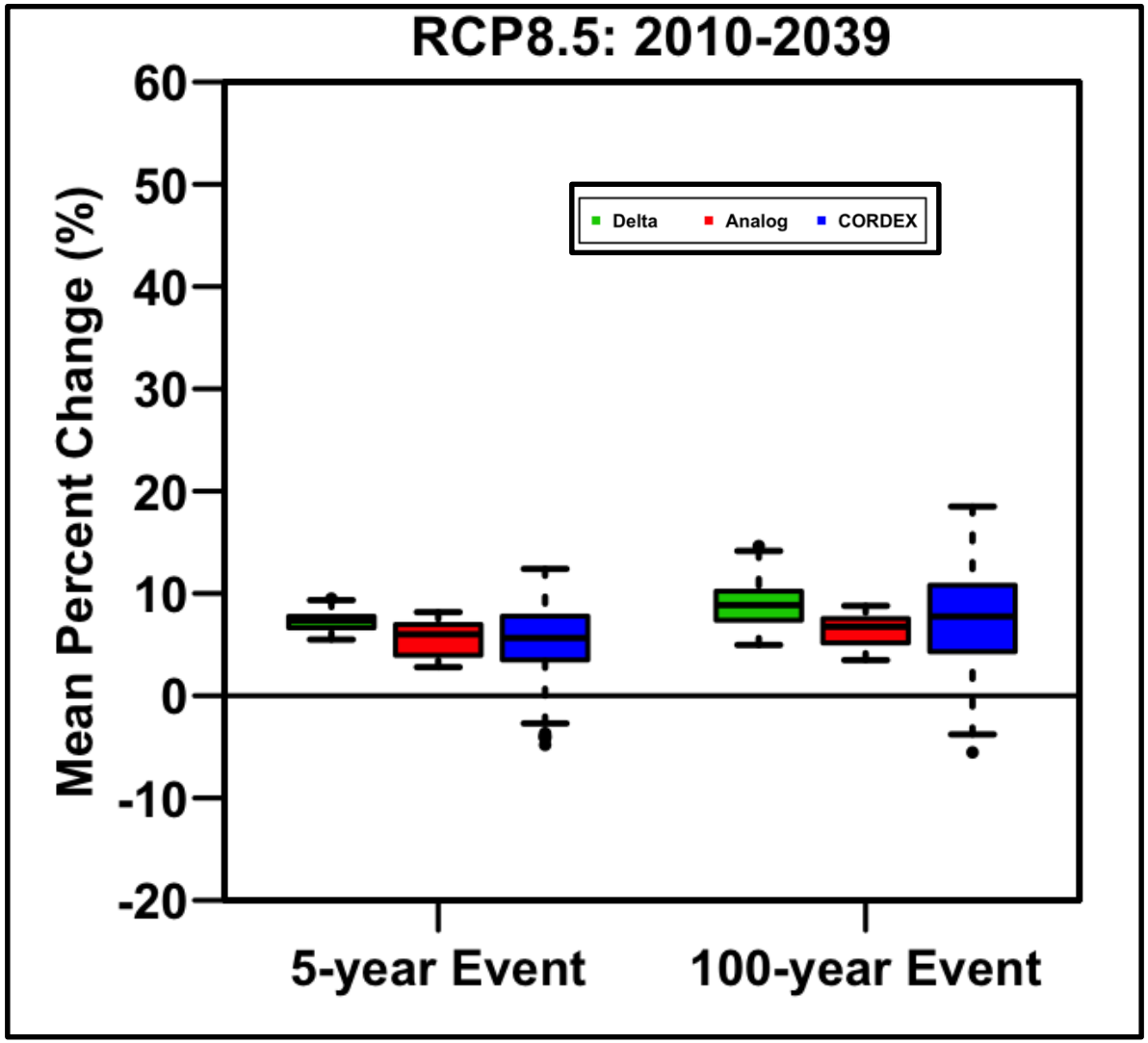
Analog Method vs. Observed



Analog vs Observed Ensemble Mean Bias



Projected Changes in 1-day 5- and 100-Year Rainfall Amounts Relative to 1970–1999



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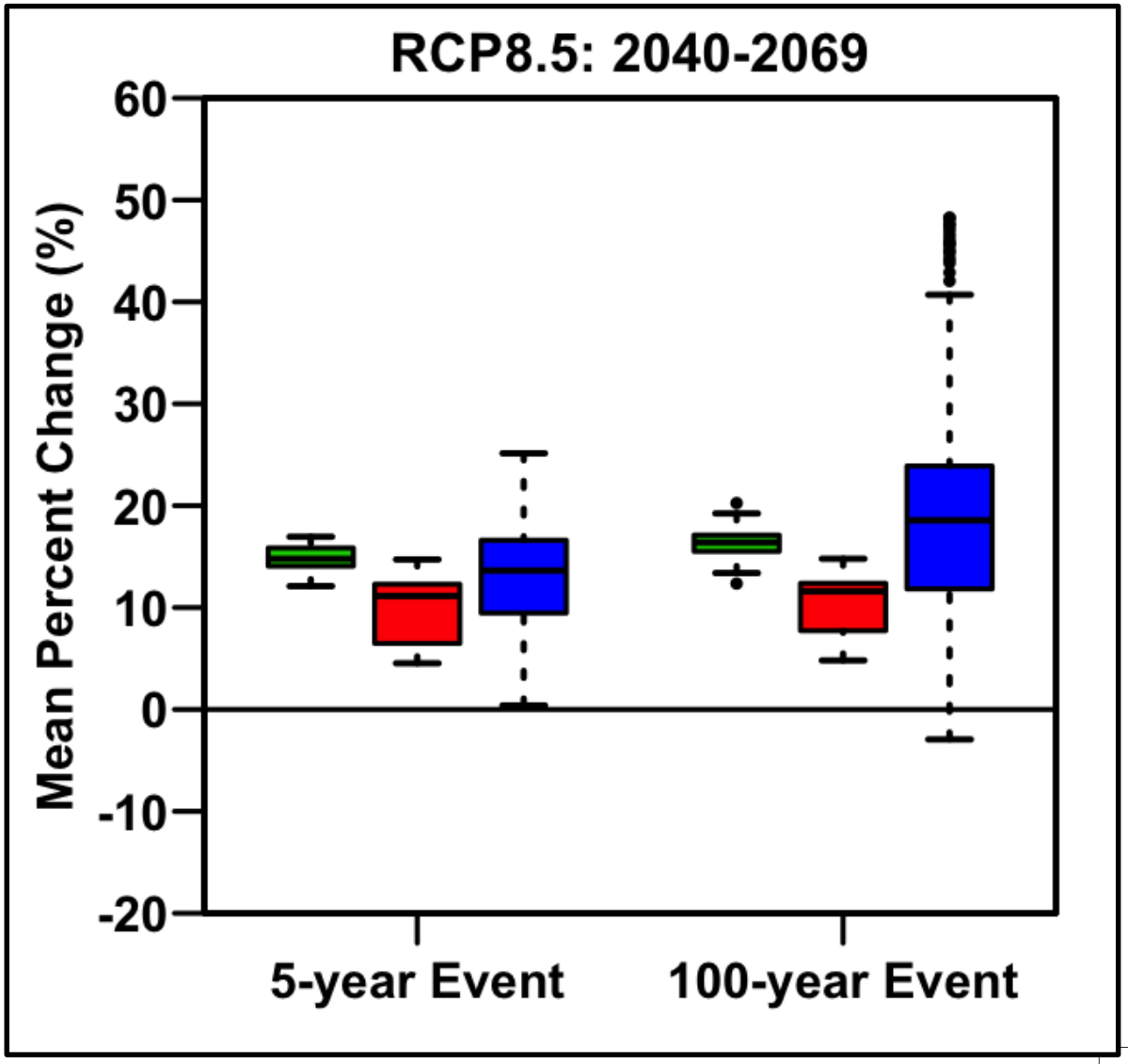

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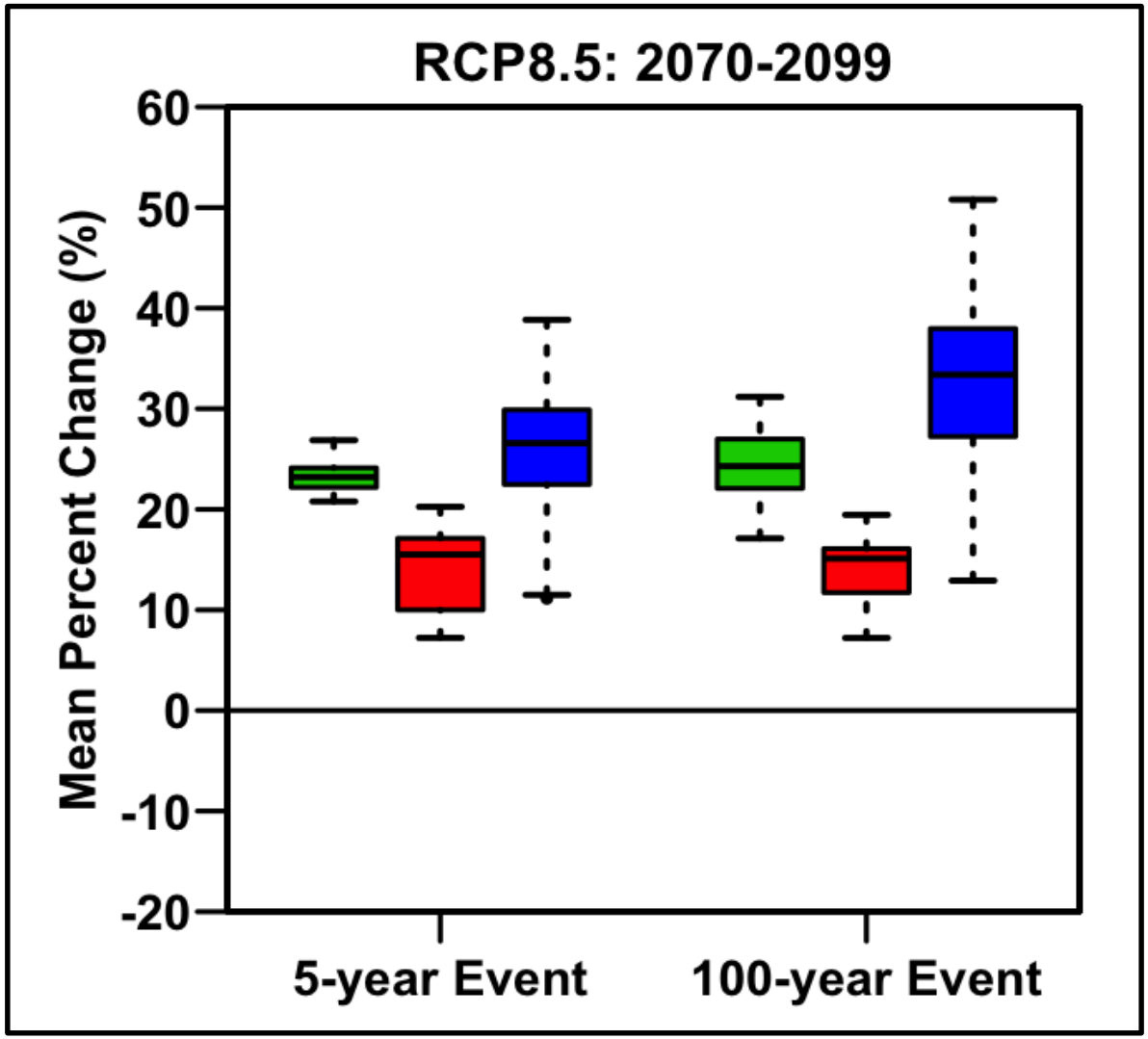
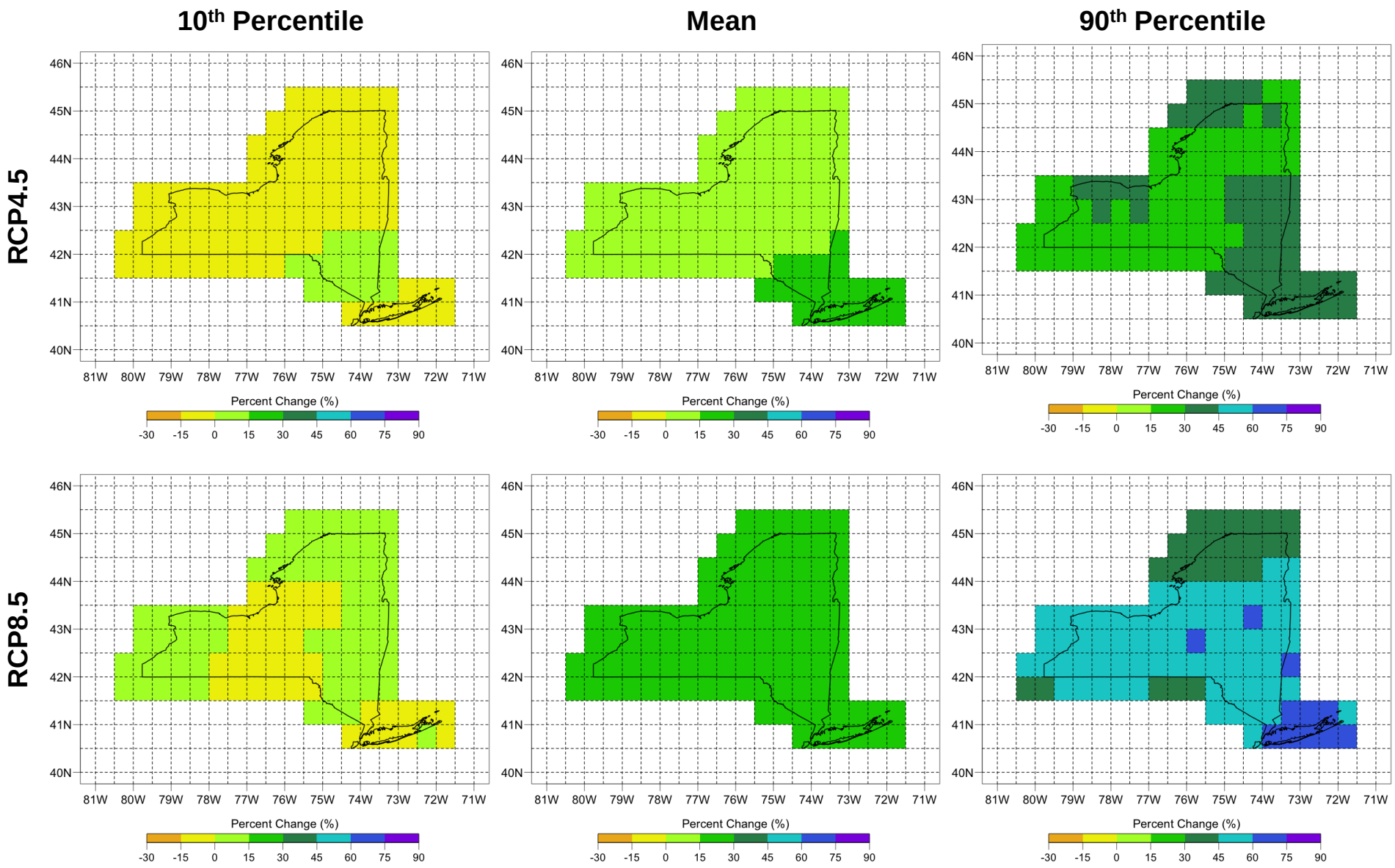
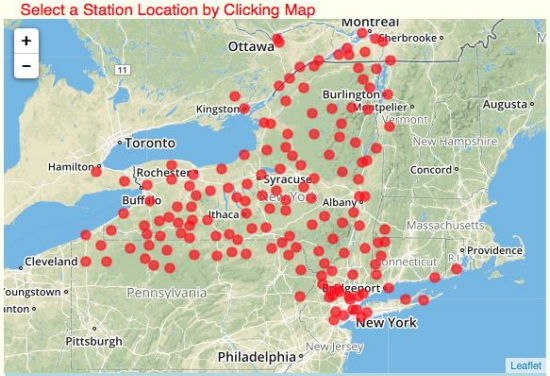


Projected Changes in 1-day 100-year Rainfall Amounts 2070–2099 vs. 1970–1999



Station-specific IDF Graphs | Statewide Maps of Projected Changes

Select a Station Location by Clicking Map



Select a RETURN PERIOD

2-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr

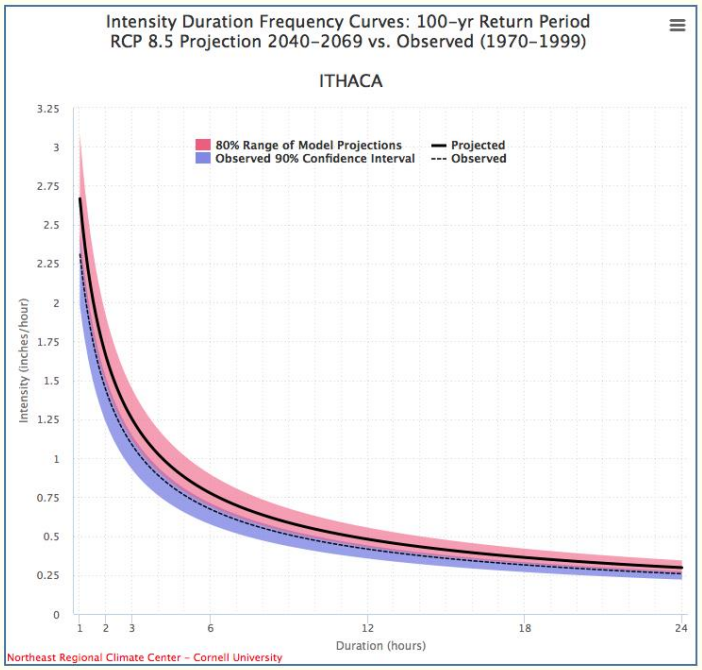
Select an EMISSION SCENARIO

- High RCP 8.5
- Low RCP 4.5

Select a TIME PERIOD

- 2010-2039
- 2040-2069
- 2070-2099

About this Project Numerous studies have documented significant increases in both the frequency and magnitude of extreme precipitation in the northeastern U.S. since the mid-to-late 20th century. The most recent assessment from the Intergovernmental Panel on Climate Change (IPCC) suggests that the frequency and magnitude of extreme precipitation in this region will likely continue to increase throughout the 21st century. Such changes could greatly exacerbate the societal impacts of extreme precipitation in the future. In consideration of these impacts, the Northeast Regional Climate Center (NRCC) has partnered with the New York State Energy Research and Development Authority (NYSERDA) to downscale global climate model output and create extreme precipitation projections that will ultimately be incorporated into climate change adaptation planning for New York State. Read more...



	Projected 2040-2069 Intensity Ensemble Member			Observed 1970-1999 Intensity with Confidence Interval (CI) Bounds		
Duration (hrs)	10th	Mean	90th	Low CI	Mean	High CI
1	2.38	2.67	3.08	1.98	2.31	2.45
2	1.47	1.65	1.91	1.23	1.43	1.52
3	1.11	1.25	1.44	0.93	1.08	1.15
6	0.69	0.77	0.89	0.57	0.67	0.71
12	0.43	0.48	0.55	0.36	0.42	0.44
18	0.32	0.36	0.42	0.27	0.31	0.33
24	0.27	0.30	0.34	0.22	0.26	0.27

http://ny-idf-projections.nrcc.cornell.edu

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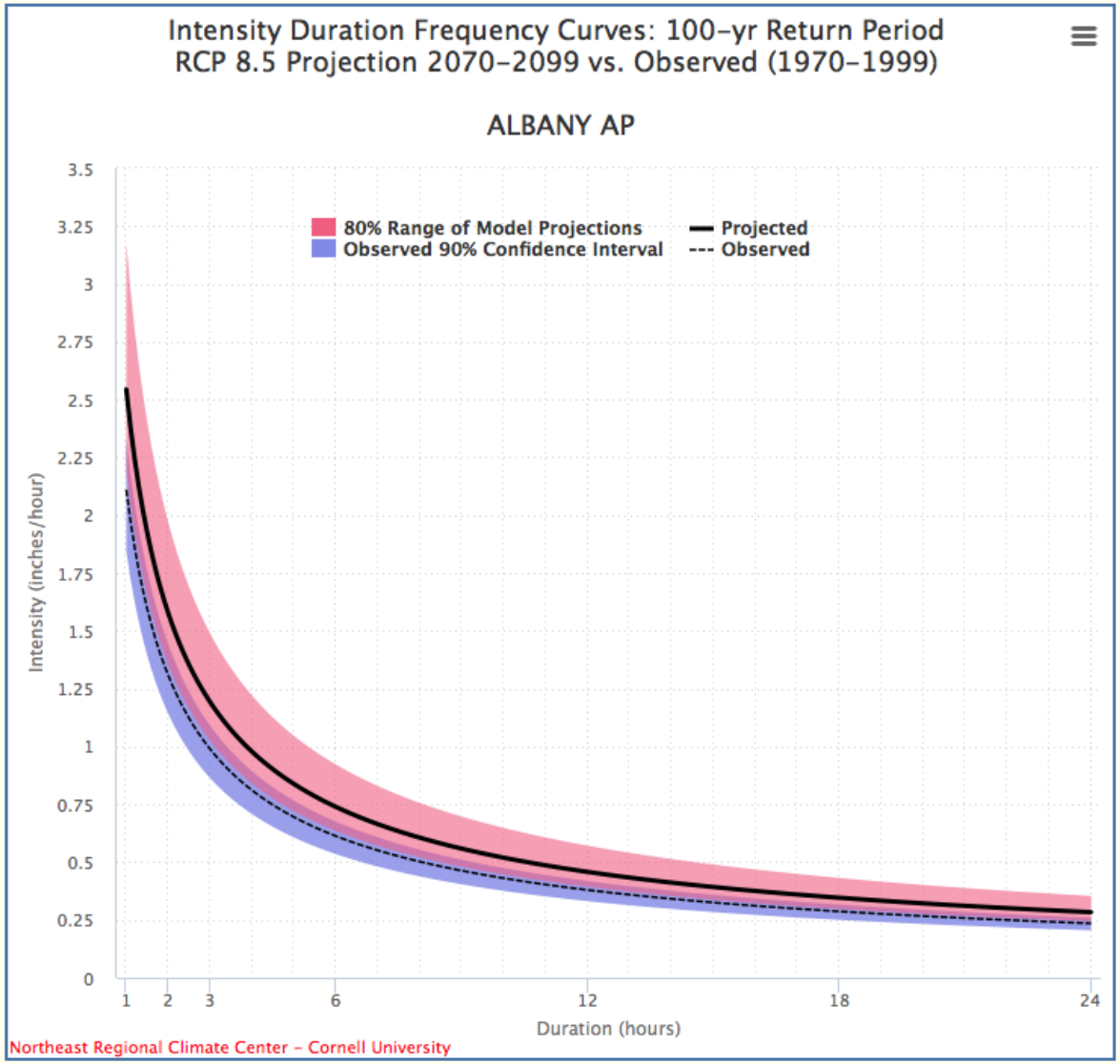
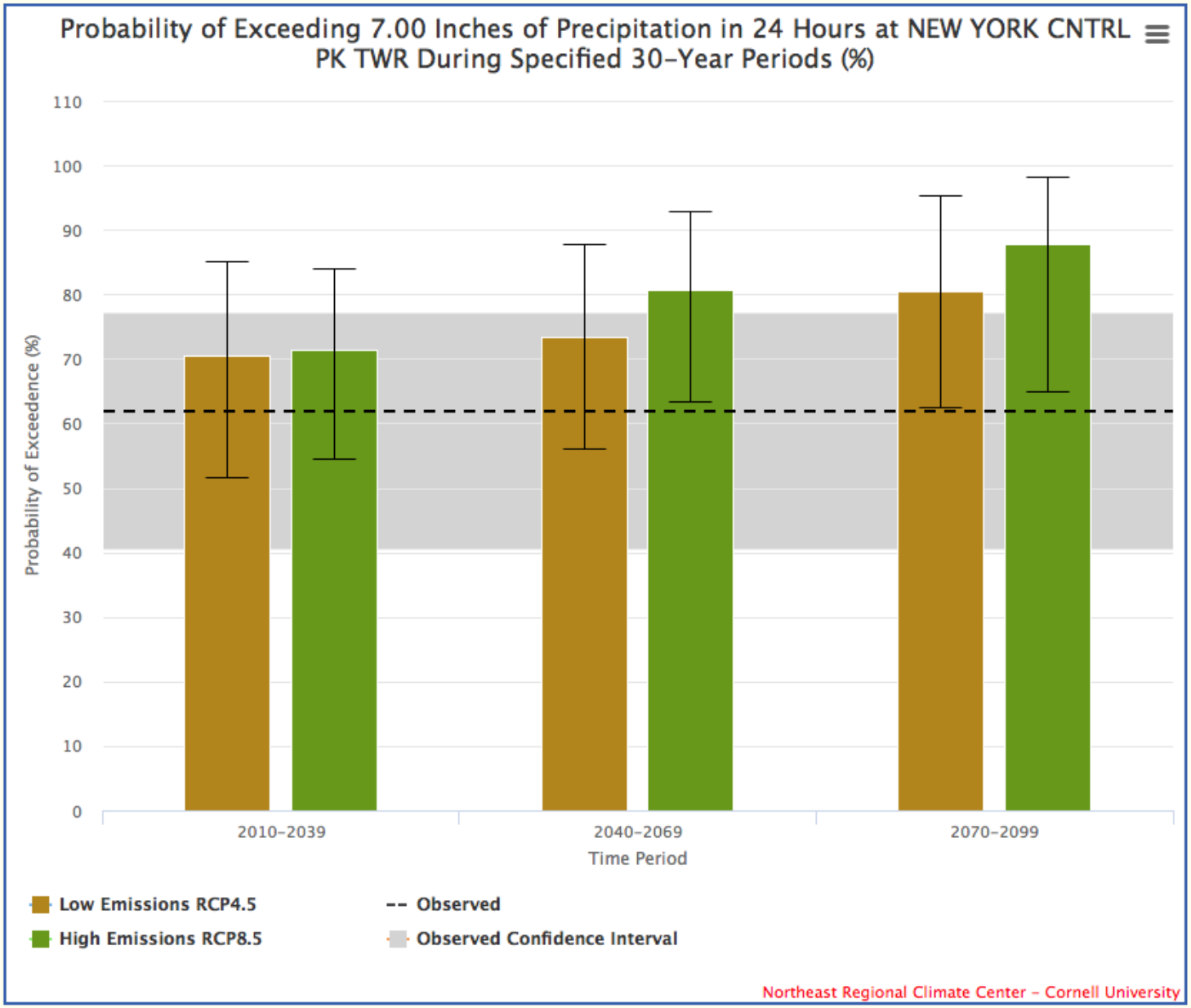


	Projected 2070-2099 Intensity Ensemble Member			Observed 1970-1999 Intensity with Confidence Interval (CI) Bounds		
Duration (hrs)	10th	Mean	90th	Low CI	Mean	High CI
1	2.19	2.54	3.18	1.84	2.11	2.32
2	1.35	1.58	1.97	1.14	1.31	1.44
3	1.02	1.19	1.49	0.86	0.99	1.09
6	0.63	0.74	0.92	0.53	0.61	0.67
12	0.39	0.46	0.57	0.33	0.38	0.42
18	0.30	0.35	0.43	0.25	0.29	0.32
24	0.24	0.28	0.35	0.21	0.24	0.26



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THANK YOU!