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**Third Five-Year Review Report for the
Hudson River PCBs Superfund Site**

**APPENDIX 10
CLIMATE CHANGE ASSESSMENT**

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**THIRD FIVE-YEAR REVIEW REPORT FOR THE
HUDSON RIVER PCBs SUPERFUND SITE**

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1 CLIMATE CHANGE ASSESSMENT

According to the Region 2 Guidance for Incorporating Climate Change Considerations in Five Year Reviews, three climate change tools were considered when assessing the Hudson River PCBs Superfund Site (Site). The three tools considered were the National Oceanic and Atmospheric Administration (NOAA) *Sea Level Rise Viewer*, United States Geological Survey (USGS) *National Landslide Inventory*, and *The Climate Explorer*. As detailed in Table A10-1, the applicable tool for the Site is *The Climate Explorer*. A discussion and screenshots of *The Climate Explorer* tool outputs are provided in this Appendix.

This Appendix and five-year review (FYR) address Operational Units (OUs) for which a remedy has been selected and where identified contamination has been left behind; therefore, OUs 1 (Remnant Deposits) and 2 (Upper Hudson River [UHR]) are addressed as part of this climate change assessment. Climate change considerations will be addressed for the remaining OUs as remedies are selected for them. For the purpose of this assessment, Fort Edward, NY and Waterford, NY were reviewed as representative geographical bounds covering OUs 1 and 2. The outputs associated with these two locations are very similar, therefore this Appendix presents only the outputs associated with Fort Edward, NY.

1.1 The Climate Explorer

The Climate Explorer provides a range of projected future climate conditions (such as temperatures, frequency of dry days, and frequency of intense rainstorms) from 2000 to the 2090s via two climate change scenarios, “Lower Emissions” and “Higher Emissions.” “Lower Emissions” (i.e., Representative Concentration Pathway [RCP]4.5) represents a scenario in which global emissions of heat-trapping gases are reduced and stabilized, and “Higher Emissions” (i.e., RCP8.5) represents a scenario in which increasing emissions continues through the end of the 21st century. The results of the analysis from *The Climate Explorer* indicate that the “Top Climate Concerns” for the Site are changes in seasonal patterns, frequency of intense rainstorms, and extreme temperatures under both scenarios (Figure A10-1).

There are many outputs of *The Climate Explorer* showing expected changes in temperature over time. In general, *The Climate Explorer* shows a slight increase in temperature over time. Two examples presented in this Appendix are the average daily maximum temperature, and the number of days with temperatures above 100°F (Table A10-2). According to this tool, the average maximum daily temperature may increase by about 6°F from 56.4°F to 62.6°F with a range of 2 to 10°F increase from the historical period (i.e., 1961 to 1990) by the 2090’s per the Lower Emissions projections (Table A10-2, Figure A10-2). Similarly, the Higher Emissions projections indicates the average maximum daily temperature may increase by about 11°F from 56.4°F to 67.5°F with a range of 6 to 17°F increase by the 2090’s (Table A10-2, Figure A10-2). According to the Lower Emissions projections, the number of days with maximum temperatures above 100°F may increase by 1.7 from 0 to 1.7 days with a range of 0 to 13.9 days per year by the 2090’s (Table A10-2, Figure A10-3). The Higher Emissions projections indicates this may increase by 14.1 from 0 to 14.1 days with range of 0 to 48.9 days per year by the 2090’s (Table A10-2, Figure A10-3).

The number of dry days (i.e., days with less than 0.01” of precipitation) per year gives a sense of the portion of the year when no moisture is being added to the environment. Number of dry days at the Site are projected to decrease by 6 days from 171 to 165 days with a range of decreasing by 33 to increasing by 28 days per year by the 2090’s according to the Lower Emissions projections (Table A10-2, Figure A10-4). Similarly,

the Higher Emissions projections indicate the number of dry days may decrease by 3 days from 171 to 168 days with a range of decreasing by 36 to increasing by 36 days per year by the 2090's (Table A10-2, Figure A10-4).

The frequency of intense rainstorms (i.e., storms involving precipitation of more than 2" per day) was identified by *The Climate Explorer* as a top climate concern. Projections from *The Climate Explorer* indicate intense storms may increase from the observed historical average of 0.2 days per year to 0.4 days per year per the Lower Emissions projections on average, with a range of 0 to 2.3 days per year (Table A10-2, Figure A10-5). According to the Higher Emissions projections, the annual count of days with more than 2" of rain may increase to 0.5 days per year by the 2090's on average, with a range of 0 to 2.8 days per year (Table A10-2, Figure A10-5). Annual counts of intense rainstorms for the Site are projected to increase between 0 and 3% per year. Historically, the Site averaged between 0 and 2 intense rainstorms annually (Figure A10-1).

1.2 NOAA Sea Level Rise Viewer and USGS Landslide Inventory

Two additional tools, the NOAA *Sea Level Rise Viewer* and USGS *Landslide Inventory*, were reviewed but were not applicable to the Site due to their geographical range.¹ The Site is freshwater and non-tidal and, thus, there is no mechanism for direct impact by sea level rise. This is reflected in the geographical limits of information provided by the NOAA *Sea Level Rise Viewer* tool, which extends up the Lower Hudson River from the Battery in New York City to the Federal Dam in Troy, NY (the latter preventing further upstream reach of the tide). Similarly, per the USGS *Landslide Inventory*, there have been no historical landslides recorded within the Site. However, it should be noted that due to the nature of OU1, which has localized topography of steep slopes along most boundaries of the Remnant Deposits, there is a potential for landslides. Slope failure has been observed previously near the Remnant Deposits but has not impacted to cover system at the site. OU1 will continue to be monitored and maintained.

2 DISCUSSION

The Climate Explorer indicated that top climate concerns for the Site include changed seasonal patterns, greater frequency of extreme temperatures, and greater frequency of intense rainstorms. These potential impacts from climate change have the potential to have effects at the Site. For OU1, impacts associated with these climate concerns primarily relate to potential impacts to the cover system from rain events. The cover system will continue to be inspected on a routine basis with additional inspections associated with significant rainfalls and repairs made as necessary. For OU2, some examples of mechanisms of interest at the Site include supply of sediment from watershed, sediment stability and redistribution within the Site, physicochemical processes (desorption, diffusion, solubilization, volatilization), microbiological activity, bioturbation, food-web structure, ecology and bioavailability. At this time, there is insufficient information to assess how climate change may affect these mechanisms and any potential impact positive or negative to the remedy. Long term monitoring at the Site will continue and establish the effectiveness of the remedy. Using the monitoring data, changes in the mechanisms of interest resulting from climate concerns may be

¹ *Risk Factor*, created by the nonprofit First Street Foundation, is another tool sometimes used in FYR climate change assessments. In contrast to the other tools reviewed, *Risk Factor* does cover the geographical area of the Site; however, it only assesses flooding, heat, fire, and wind risk for regional infrastructure and community resources in areas adjacent to OU1 and OU2, thus it was not used in this assessment.

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indirectly inferred and special studies developed to further the understanding of any Site impacts resulting from these mechanisms if necessary.

3 ABBREVIATIONS AND ACRONYMS

FYR	Five-Year Review
NOAA	National Oceanic and Atmospheric Administration
OM&M	Operation, Maintenance & Monitoring
OU	Operable Unit
PCB	Polychlorinated Biphenyls
RCP	Representative Concentration Pathway
UHR	Upper Hudson River
USGS	United State Geological Survey

4 REFERENCES

National Oceanic and Atmospheric Administration (NOAA). 2014. “The Climate Explorer” <https://climate-explorer.nemac.org/>. Accessed June 2023.

_____.2023. “Sea Level Rise Viewer” <https://coast.noaa.gov/digitalcoast/tools/slr.html>. Accessed June 2023.

United State Geological Survey. 2019. “U.S. Landslide Inventory” <https://www.usgs.gov/tools/us-landslide-inventory>. Accessed June 2023.

First Street Foundation. “Risk Factor” <https://riskfactor.com>. Accessed June 2023.

APPENDIX 10

Tables and Figures

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Tables

Table A10-1
Summary of Climate Change Assessment Tool Use for the Third FYR

Tool	Climate Assessment Metric	Climate Assessment Metric Output Included in Appendix 10	Rationale
The Climate Explorer	Average Daily Maximum Temperature	✓	Provides projected climate change impact on seasonality, temperature, and intense rainstorms, which may impact PCB fate and transport at the Site.
	Days with Maximum Temperature > 100°F	✓	
	Days with >2" Precipitation	✓	
	Top Climate Concerns	✓	
Risk Factor	Flood Factor	X	-Estimates future risk of flood, fire, heat, and wind exposure to road, residential, commercial, and critical infrastructure, and social facilities.
	Fire Factor	X	
	Heat Factor	X	-May provide context for regional conditions, but does not provide information to characterize risk to the remedy.
	Wind Factor	X	
NOAA Sea Level Rise Viewer	Sea Level Rise	X	-The Site is freshwater and non-tidal, thus is not expected to be impacted by sea level rise.
	Marsh Migration	X	
	Vulnerability	X	-The Site is located outside the range of this tool, which extends from the Battery in New York City to Albany, NY.
	High Tide Flooding	X	
USGS Landslide Inventory	Landslide History	X	Historical landslides are not located within the Site.

Notes:

1. Green "✓" indicates inclusion of tool outputs (i.e., screenshots) in Appendix 10. Black "x" indicates tools were reviewed, but tool outputs are not included in Appendix 10.

Table A10-2
Summary of Climate Change Assessment Results

Climate Assessment Metric	Location	Historical Observed Range (1961 -1990)	Lower Emission (RCP 4.5) 2090s Projections^{1,2}	Higher Emission (RCP 8.5) 2090s Projections^{1,2}
Average Daily Maximum Temperature (°F)	Fort Edward	56.4	62.6 [58.6 - 66.0]	67.5 [62.0 - 72.9]
Annual Count of Days with Maximum Temperature above 100°F	Fort Edward	0	1.70 [0 - 13.9]	14.1 [0 - 48.9]
Annual Count of Days with less than 0.01" of Precipitation	Fort Edward	171	165 [138 - 199]	168 [135 - 207]
Annual Count of Days with greater than 2" of Precipitation	Fort Edward	0.20	0.40 [0 - 2.3]	0.50 [0 - 2.8]

Note:

1. Lower Emissions (i.e., Representative Concentration Pathway [RCP]4.5) and Higher Emissions (i.e., RCP8.5) represent the two climate change scenarios presented by *The Climate Explorer*.
2. The weighted mean of projections for Lower Emissions and Higher Emissions are presented. The minimum and maximum values modeled at each time step are presented in the brackets.

Figures

The Climate Explorer

Fort Edward, NY

Explore planning tools available from our partners

Top climate concerns

Top regional hazards for Fort Edward, NY, according to the 2018 National Climate Assessment. These statements compare projections for the middle third of this century (2035-2064) with average conditions observed from 1961-1990.

Show full range of projections

[Methodology](#)

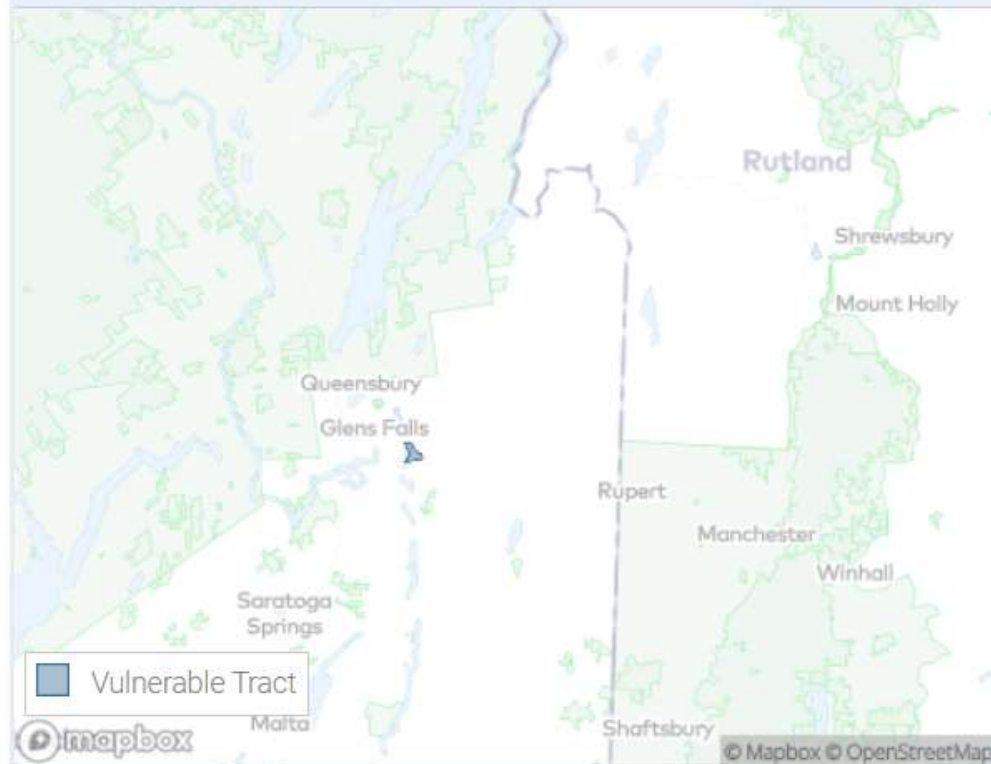
Changed seasonal patterns may affect rural ecosystems, environments, and economies.

Annual counts of **intense rainstorms** – those that drop two or more inches in one day – are projected to increase between 0 - 3%. Historically, Fort Edward averaged 0 (0 - 2) intense rainstorms per year.

Extreme temperatures on the hottest days of the year are projected to increase between 2 - 26°F. Historically, extreme temperatures in Fort Edward averaged 89°F (85 - 100°F).

At Risk Neighborhoods

Washington County has 3 census tracts where vulnerabilities to climate change exceed the county median.



The Climate Explorer

About the data Share Settings

Fort Edward, NY

Stations

Washington County - Average Daily Maximum Temp (°F)

Average Daily Maximum Temp (°F)

Graph

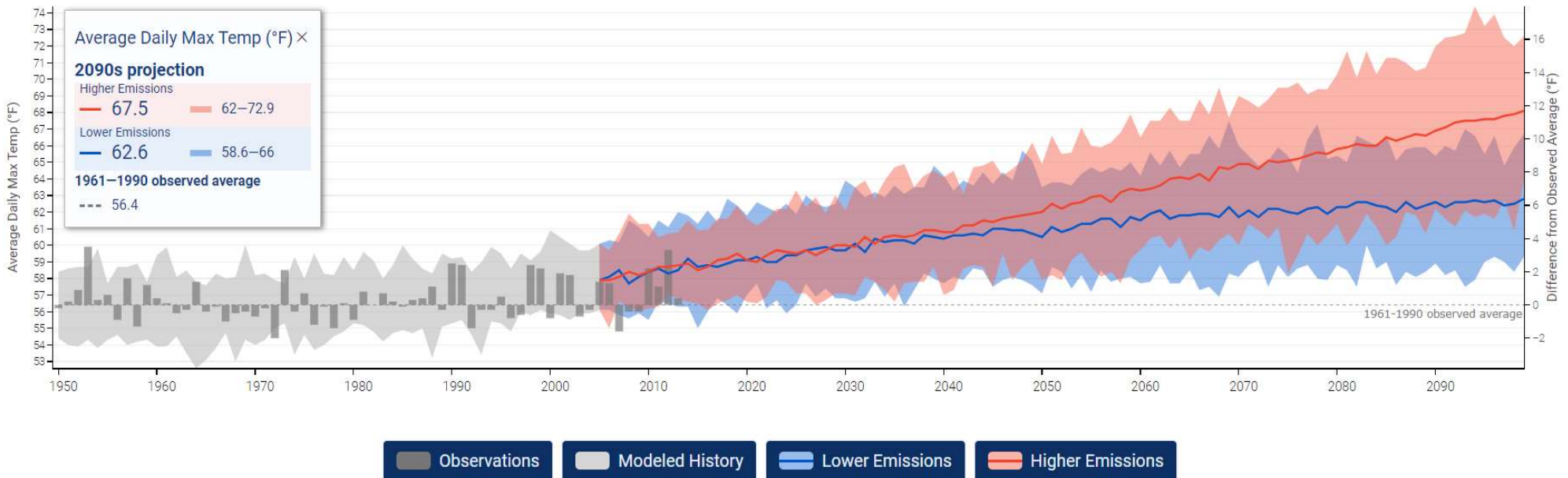
Map

Annual

Monthly

Downloads

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- Historical Weather Data
- Historical Thresholds
- High-Tide Flooding
- Take Action

The Climate Explorer: Predicted Average Daily Maximum Temperature for Fort Edward, NY from 1950 to 2100

Figure A10-2

July 2024



The Climate Explorer

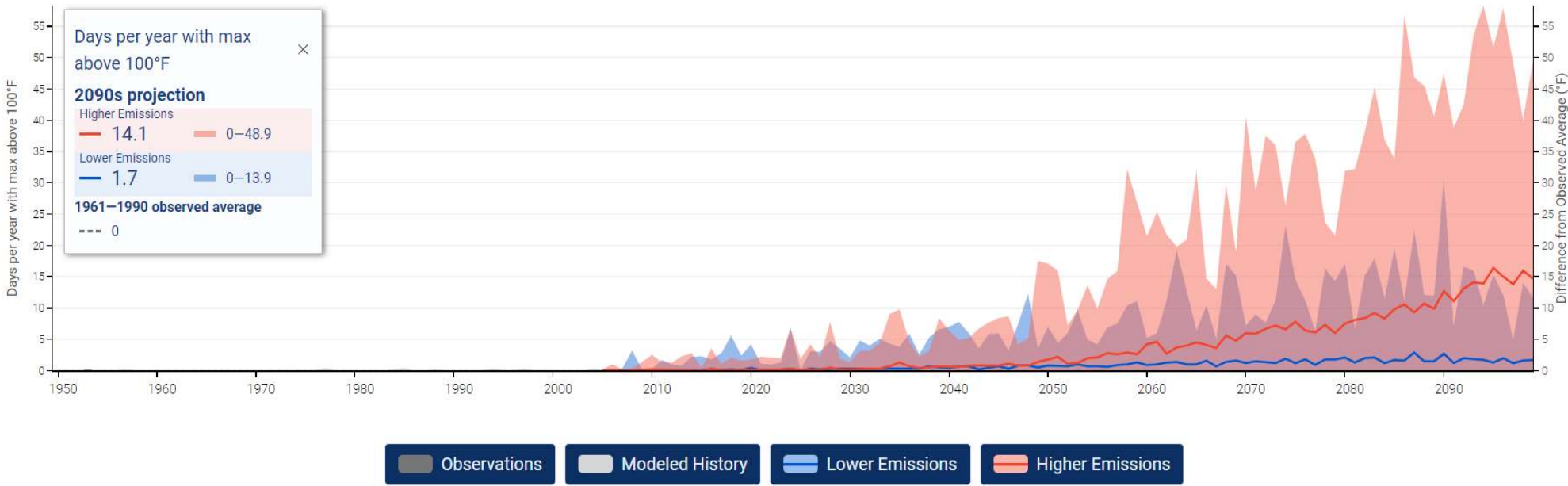
About the data Share Settings

Fort Edward, NY

Stations

Washington County - Days w/ maximum temp > 100°F

Days w/ maximum temp > 100°F Graph Map Annual Monthly Downloads About



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The Climate Explorer: Predicted Annual Count of Days with Maximum Temperature above 100°F for Fort Edward, NY from 1950 to 2100

Figure A10-3

July 2024



The Climate Explorer

About the data Share Settings

Fort Edward, NY

Stations

Washington County - Dry Days

Dry Days

Graph

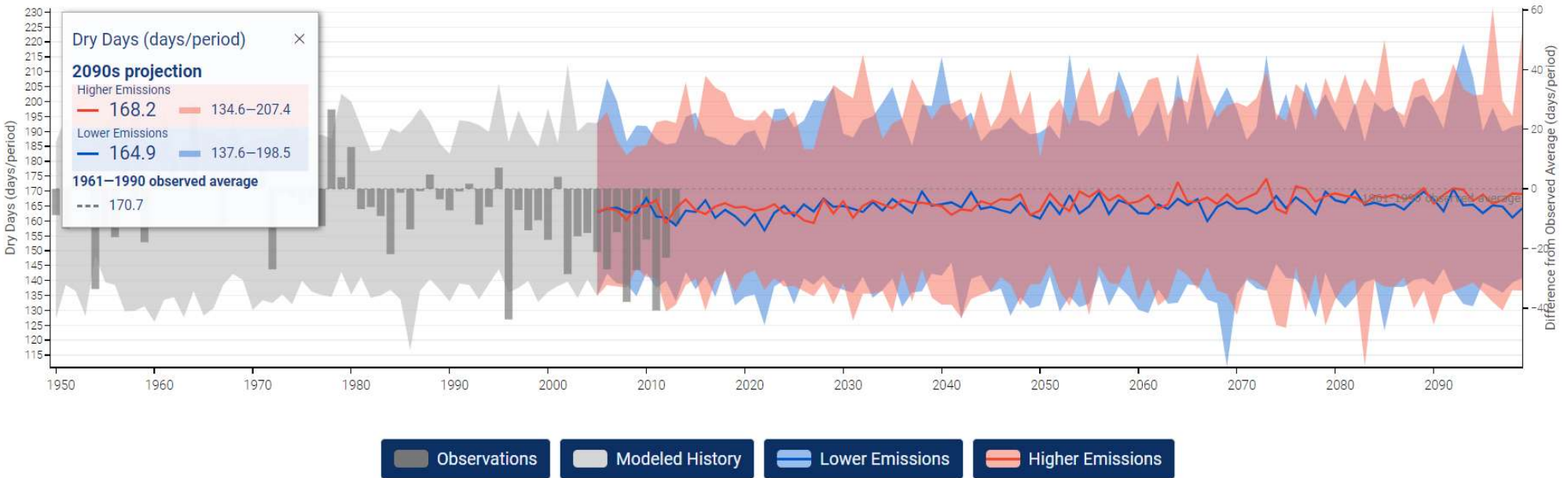
Map

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The Climate Explorer: Predicted Annual Count of Days with <0.01” of Precipitation for Fort Edward, NY from 1950 to 2100

Figure A10-4

July 2024

Fort Edward, NY

Stations

Washington County - Days w/ > 2" Precipitation

Days w/ > 2" Precipitation

Graph

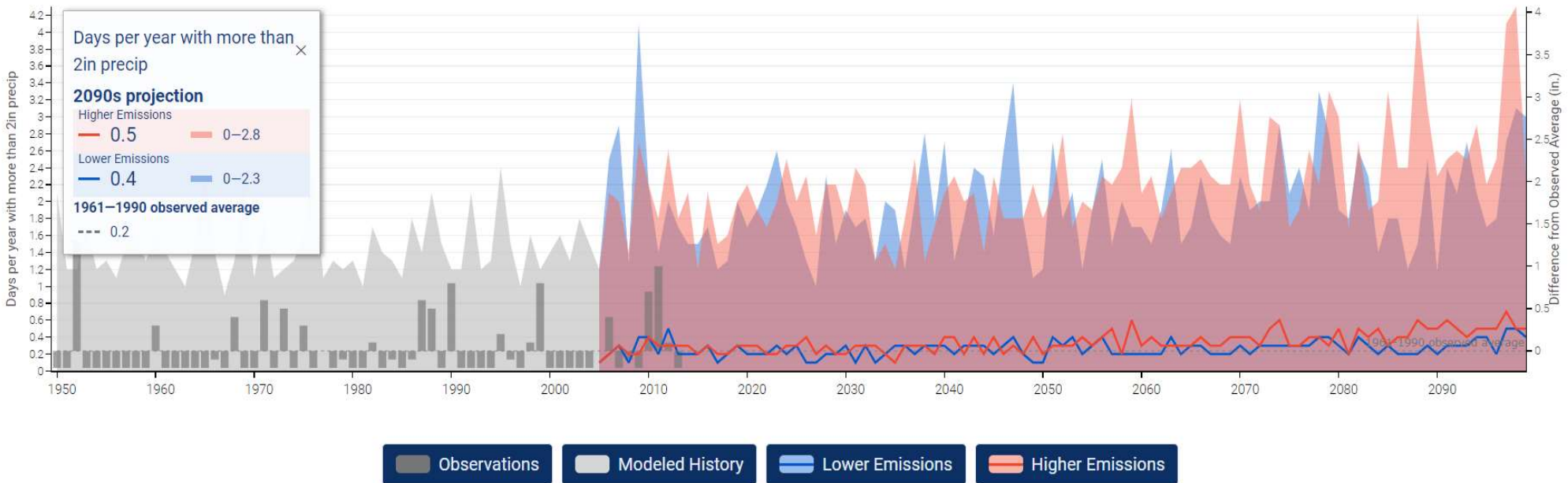
Map

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The Climate Explorer: Predicted Annual Count of Days with >2" of Precipitation for Fort Edward, NY from 1950 to 2100

Figure A10-5
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