

## Extreme Heat and Cold Weather Benchmark Events Example

July 2024

### Introduction

This extreme heat and cold weather benchmark events document provides industry with information regarding the project scope, high level criteria, and visual maps used to develop benchmark events. Historical meteorological data over the past 43 years (1980-2022) has been provided for the examples listed below.

Additional work is needed to develop planning cases from weather event data. NERC is only providing the weather event data within the ERO library and will continue to work with industry to develop guidance and promote training to developing planning cases.

This example is providing industry for awareness during the Standard Development process. Information herein is accurate to the date of this posting. Additional events will be developed to complete the initial Weather Event Library.

### Project Scoping

The below table shows what is included and not included for the first iteration of the benchmark events.

	Included for First Iteration	Not Included for First Iteration
<b>Scope of Weather Events</b>	Extreme heat and cold temperature data	Other weather events (renewable lulls, hydro droughts, wildfires, hurricanes, etc.)
<b>Temporal Coverage</b>	Long historical record of weather data.	Only a few years of recent observations.
<b>Geographic Coverage</b>	Data for the entire continent, specifically the U.S. and Canada	Unique datasets for specific zones.
<b>Data Consistency and Synchronization</b>	Correlated, consistent, and time-synchronized data.	Stitched-together datasets comprising different events and/or datasets.
<b>Future Projections</b>	Historical weather data	Climate projections of future weather

### Screening for Extreme Heat and Extreme Cold Events

### ***Multi-day Weather Events***

Calculated three-day rolling average temperatures for both extreme heat and extreme cold to identify multi-day periods of extreme heat/cold.

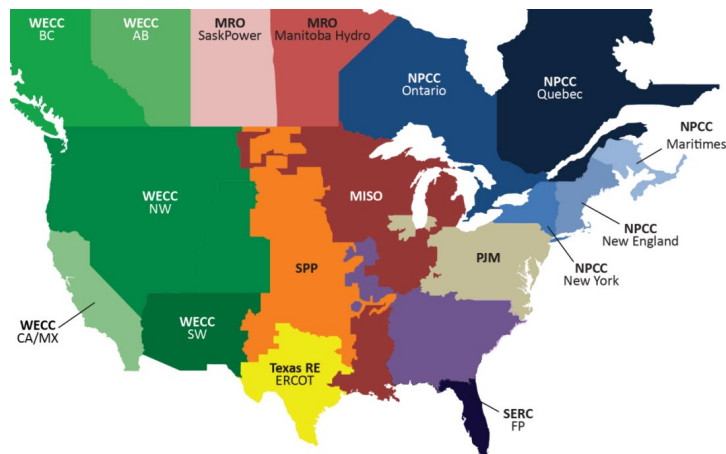
### ***Wide-area Assessment***

- Aggregated U.S. and Canada into 11 zones and evaluated average temperatures across wide-areas rather than smaller planning coordinators
- Evaluated the top 40 extreme heat and cold three-day periods for each zone and prioritized events that occurred across multiple zones during the same event
- Ensured each zone had at least its top two worst events covered

### **Wide-area Boundaries**

#### **Adapted from the NERC Assessment Areas<sup>1</sup>**

- SERC: combined NERC Assessment areas of SERC-East, SERC-Central, and SERC-Southeast into a single zone based on climate similarities.
- Florida has significantly different weather patterns, which warrant separate treatment.
- WECC-NW, WECC-SW, SERC, and SERC-FP were aggregated



<sup>1</sup> [NERC Assessment Areas.png \(1590x661\)](#)

## Extreme Cold Events

Rank of events by average three-day average min temperature, 1980-2022

Event Type	Year	Month	WECC NW	CA / MX	WECC SW	ERCOT	SPP	MISO	SERC	FRCC	PJM	NYISO	ISONE	LOWEST RANK	TOP 5 COUNT	SHORTLIST	PRIORITY EVENTS
Cold Event	1981	1							12	4	9	2	1	1	3	1	
Cold Event	1983	12	3			3	2	4	2	3	3			2	7	1	Widespread cold, worst case
Cold Event	1984	1	13			14	13	3	16		2	3		2	3	1	
Cold Event	1985	1				11	10	10	1	1	4			1	3	1	Widespread cold
Cold Event	1989	2	2	2			12			13				2	2	1	
Cold Event	1989	12				1	1	5	3	2	5			1	6	1	
Cold Event	1990	12	1	1	1		16							1	3	1	Western Cold
Cold Event	1994	1						2	7		1	1	3	1	4	1	Eastern Cold
Cold Event	1996	2	11			5	3	1	5		7	16		1	4	1	
Cold Event	2004	1	8									8	2	2	1	1	
Cold Event	2011	2			2	4	11	13						2	2	1	2011 Southwestern Event
Cold Event	2021	2				2	4	14						2	2	1	Winter Storm Uri
Cold Event	2022	12				8	9		6	11				6	0	1	Winter Storm Elliott
<b>Total Cold Events Selected</b>			<b>6</b>	<b>2</b>	<b>2</b>	<b>8</b>	<b>10</b>	<b>8</b>	<b>8</b>	<b>6</b>	<b>7</b>	<b>5</b>	<b>3</b>			<b>13</b>	

## Extreme Heat Events

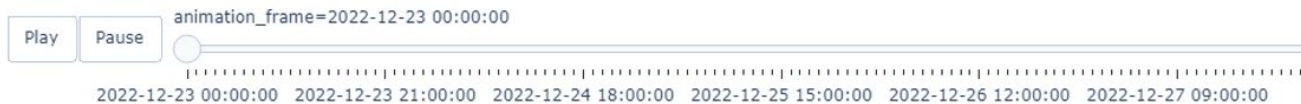
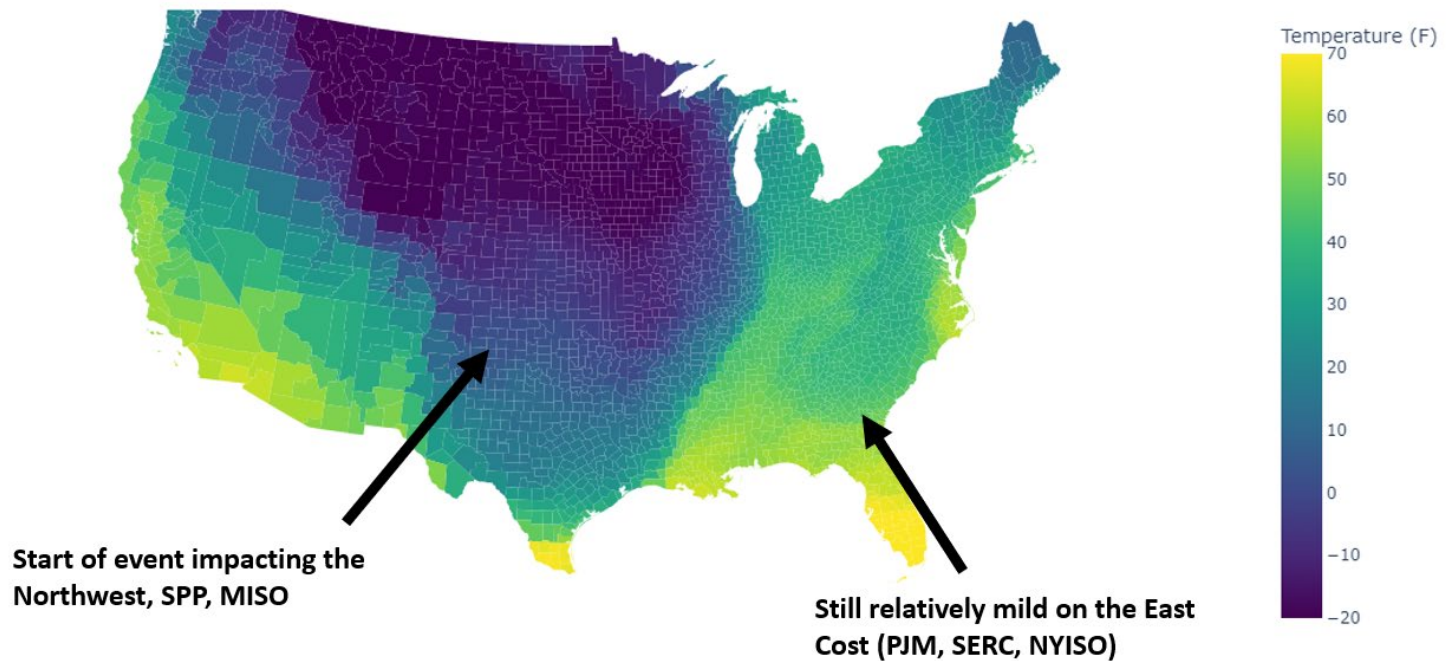
### Rank of events by average three-day average min temperature, 1980-2022

Event Type	Year	Month	WECC NW	CA / MX	WECC SW	ERCOT	SPP	MISO	SERC	FRCC	PJM	NYISO	ISONE	LOWEST RANK	TOP 5 COUNT	SHORTLIST	PRIORITY EVENTS
Heat Event	1980	6				2								2	1	1	
Heat Event	1981	6								3				3	1	1	
Heat Event	1988	8						1	15		4	7	16	1	2	1	
Heat Event	1991	7									12	9	1	1	1	1	
Heat Event	1995	7			1	8		9			3	8	13	1	2	1	Worst case Southwest
Heat Event	1998	6								1				1	1	1	
Heat Event	1999	7						4	6		2	1	6	1	3	1	
Heat Event	2000	9				1								1	1	1	
Heat Event	2002	7	7								15	13	2	2	1	1	
Heat Event	2006	7	2	3				3	7					2	3	1	
Heat Event	2006	8						12	3		5	4	4	3	4	1	Northeast Heatwave
Heat Event	2007	8							2					2	1	1	
Heat Event	2011	7						8	11	14	6	2	3	2	2	1	Eastern Interconnect Heatwave
Heat Event	2011	8				4	2		5					2	3	1	Central Plains
Heat Event	2012	7					4	2	1		1			1	4	1	Widespread heat event
Heat Event	2012	8					1	6						1	1	1	
Heat Event	2017	6			2									2	1	1	
Heat Event	2020	8	1	5	13									1	2	1	Western Heat Dome 2020
Heat Event	2022	9	10	2										2	1	1	Western Heat Dome 2022
<b>Total Heat Events Selected</b>			<b>4</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>6</b>	<b>2</b>	<b>8</b>	<b>7</b>	<b>7</b>			<b>19</b>	

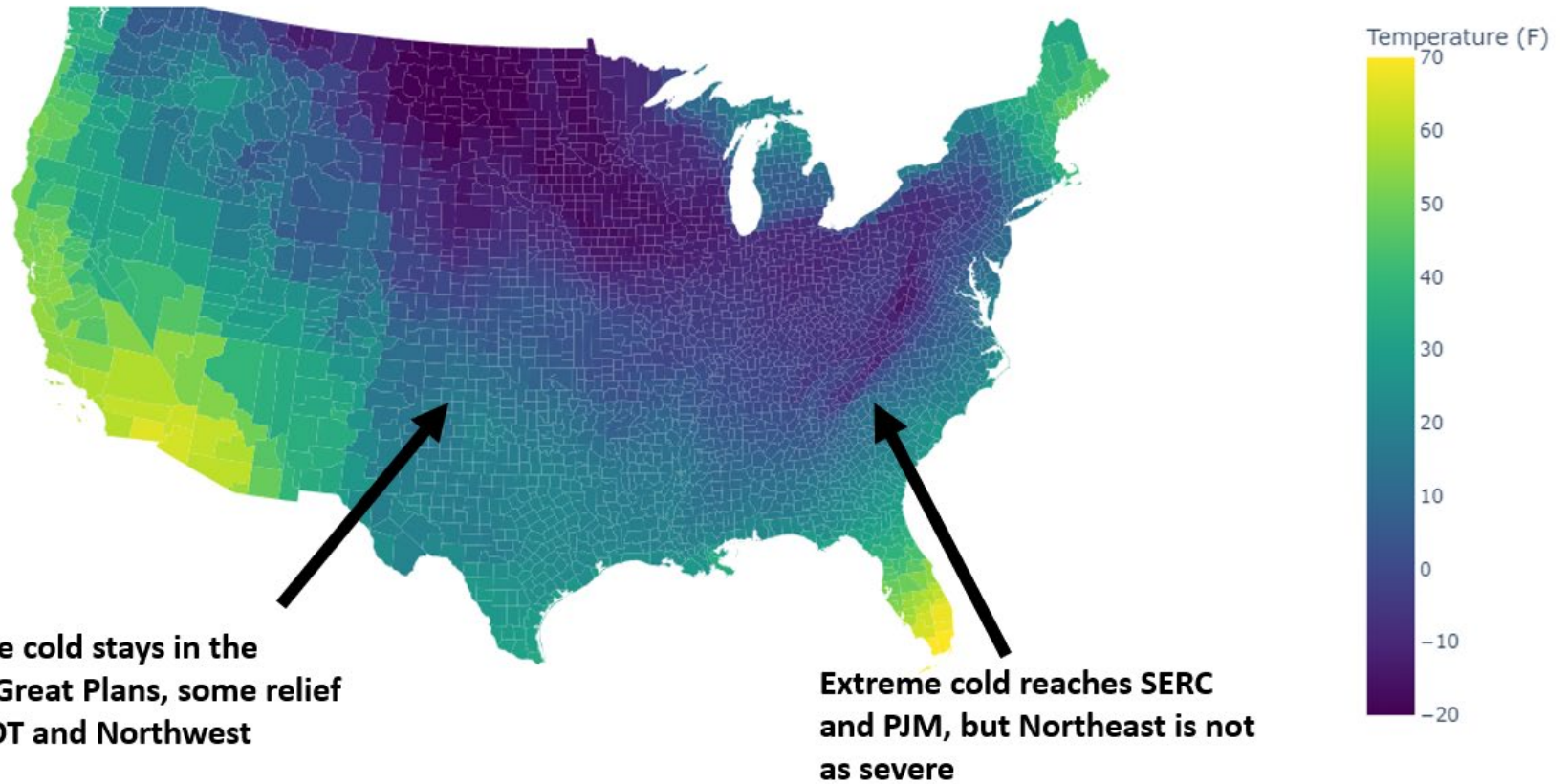
## Winter Storm Elliott Examples

Winter storm Elliott provides entities with an extreme event example showing hour by hour data. This will allow entities the ability to locate when their zone was most vulnerable and to gather data needed when building out its benchmark planning cases. The following figures represent various instances of winter storm Elliott's temperature.

Winter Storm Elliott



### Winter Storm Elliott





### Winter Storm Elliott

