

# Climate Resiliency Data

## Introduction

AT&T engaged Argonne National Laboratory to generate detailed climate risk data. Argonne simulated historical flooding, hurricanes, and windstorms to project what these extreme weather factors will look like in the future. This dataset contains projections for inland flooding, coastal flooding, and wind speeds across Florida, Georgia, North Carolina and South Carolina. Values are provided for 10-year and 50-year return periods. We've also provided Generalized Extreme Value distribution parameters to allow the calculation of an arbitrary return period.

## Generalized Extreme Value Distribution (GEV)

The Generalized Extreme Value distribution is a family of continuous probability distributions described by location, scale, and shape parameters. For more information, reference the [Wikipedia page](#). This dataset contains the location, scale, and shape parameters at each location point. The Python code snippet below shows an example of how to generate projections for any n-year return period.

```
1 from scipy.stats import genextreme
2
3 def returnMedian(year, loc, scale, shape):
4     median = genextreme.ppf(1-1/year, -shape, loc, scale)
5     return median
```

## Low, Median, and High Returns Values

An uncertainty characterization approach was utilized to quantify the uncertainty range for the climate values at each return period. This is done to account for the variation between the 3 climate models used to produce the climate projections. The method creates an ensemble of 500 values where each value is taken by random sampling one max value from the 3 climate models each year. This provides 500 GEV distributions. The low, median, and high return values are the 5<sup>th</sup>, 50<sup>th</sup>, and 95<sup>th</sup> percentiles from the 500 distributions, respectively. A high return value means that 95% of the values that were modeled at that location point have the high value or lower.

## Historic and Mid-century GEV values

The wind, wildfire, and drought datasets have GEV values from both the historic timeframe (1995-2004) and the mid-century timeframe (2045-2054). Having values from both periods allows for interpretation of the change over time in severity for the given climate variable.

### Definitions:

**CFWI:** Canadian Fire Weather Index. The CFWI is calculated with air temperature, relative humidity, wind speed at 18 UTC, and 24-hour rainfall. The index provides a daily numerical value that indicates the potential for fire intensity at each grid point.

**VPD:** Vapor Pressure Deficit is calculated using the temperature and relative humidity to determine the amount of water, in the form of water vapor, the air can hold. This metric is a key indicator of drought, especially as moisture moves from the surface into the atmosphere under warming conditions.

**kPa:** The kilopascal is a unit of pressure and the standard for measuring VPD.

**GEV:** Generalized Extreme Value provides the statistical framework to make inferences about the probability of extreme or rare events.

## Metadata

### Inland Flooding

File: inland.csv, 823,703 rows

Coverage: Florida, Georgia, South Carolina, and North Carolina

Field Name	Unit	Description	Example
Longitude	Decimal Degrees	Longitude of a given point	-87.89831
Latitude	Decimal Degrees	Latitude of a given point	30.41289
Low_10yr	Feet	5th percentile water depth in feet for 10yr event. 5% of flood events have a lower projected water depth for this point.	0.2703535
Median_10yr	Feet	50th percentile water depth in feet for 10yr event. 50% of flood events have a lower projected water depth for this point.	0.40786448
High_10yr	Feet	95th percentile water depth in feet for 10yr event. 95% of flood events have a lower projected water depth for this point.	0.54231745

Low_50yr	Feet	5th percentile water depth in feet for 50yr event. 5% of flood events have a lower projected water depth for this point.	0.53220093
Median_50yr	Feet	50th percentile water depth in feet for 50yr event. 50% of flood events have a lower projected water depth for this point.	0.929791
High_50yr	Feet	95th percentile water depth in feet for 50yr event. 95% of flood events have a lower projected water depth for this point.	1.3355047
Location	N/A	Location parameter for GEV distribution	0.07579144
Scale	N/A	Scale parameter for GEV distribution	0.09119649
Shape	N/A	Shape parameter for GEV distribution	0.39816913

## Coastal Flooding

File: coastal.csv, 1,072,032 rows

Coverage: Florida, Georgia, South Carolina, and North Carolina

Field Name	Unit	Description	Example
Longitude	Decimal Degrees	Longitude of a given point	35.2592532
Latitude	Decimal Degrees	Latitude of a given point	-77.907492
MidCentMaxWL	Feet	Projected maximum water level in feet above local mean sea level computed for the 10 (2045-2054) warm-seasons (July 1 -October 31)	2.351459

## Coastal Flooding with GEV parameters

File: coastal\_w\_GEVparam.csv, 486,422 rows

Coverage: Florida, Georgia, South Carolina, and North Carolina

Field Name	Unit	Description	Example
Longitude	Decimal Degrees	Longitude of a given point	-76.926
Latitude	Decimal Degrees	Latitude of a given point	36.405
Median_10yr	Feet	50th percentile water depth in feet for 10yr event. 50% of coastal flood events have a lower projected water depth for this point.	1.69570882
Median_50yr	Feet	50th percentile water depth in feet for 50yr event. 50% of coastal flood events have a lower projected water depth for this point.	2.1840581
Location	N/A	Location parameter for GEV distribution	0.97794036
Scale	N/A	Scale parameter for GEV distribution	0.33306567
Shape	N/A	Shape parameter for GEV distribution	-0.0387519

May, 1 2022

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## Wind Speeds

File: Wind\_Extremes\_Historic\_and\_Midcentury.csv, 51,574 rows

Coverage: 48 Contiguous U.S.

Field Name	Unit	Description	Example
Longitude	Decimal Degrees	Longitude of a given point	-97.527954
Latitude	Decimal Degrees	Latitude of a given point	25.93115
hist_median_10yr	Miles per hour	50th percentile Wind speed (mph) at the 10yr return period from the historic timeframe (1995-2004)	30.5872997
hist_median_50yr	Miles per hour	50th percentile Wind speed (mph) at the 50yr return period from the historic timeframe (1995-2004)	35.85373156
hist_location	N/A	Location parameter for GEV distribution at the historic timeframe (1995-2004)	11.25429462
hist_shape	N/A	Shape parameter for GEV distribution at the historic timeframe (1995-2004)	0.208787882
hist_scale	N/A	Scale parameter for GEV distribution at the historic timeframe (1995-2004)	0.836666441
midcent_median_10yr	Miles per hour	50th percentile Wind speed (mph) at the 10yr return period from the mid-century timeframe (2045-2054)	31.29517644
midcent_median_50yr	Miles per hour	50th percentile Wind speed (mph) at the 50yr return period from the mid-century timeframe (2045-2054)	40.55010473
midcent_location	N/A	Location parameter for GEV distribution at the mid-century timeframe (2045-2054)	11.16899317
midcent_shape	N/A	Scale parameter for GEV distribution at the mid-century timeframe (2045-2054)	0.354432368
midcent_scale	N/A	Shape parameter for GEV distribution at the mid-century timeframe (2045-2054)	0.820234873
10yr_percent_change	Percent	Percent change from historical 10yr return period to the mid-century 10yr return period	2.314283215
50yr_percent_change	Percent	Percent change from historical 50yr return period to the mid-century 50yr return period	13.09870122

### Wildfire

File: Wildfire\_Extremes\_Historic\_and\_Midcentury.csv, 51,574 rows

Coverage: 48 Contiguous U.S.

Field Name	Unit	Description	Example
Longitude	Decimal Degrees	Longitude of a given point	-97.527954
Latitude	Decimal Degrees	Latitude of a given point	25.93115
hist_median_10yr	CFWI Scale	50th percentile Canadian Fire Weather Index at the 10yr return period from the historic timeframe (1995-2004)	77.27146895
hist_median_50yr	CFWI Scale	50th percentile Canadian Fire Weather Index at the 50yr return period from the historic timeframe (1995-2004)	89.95226483
hist_location	N/A	Location parameter for GEV distribution at the historic timeframe (1995-2004)	51.89556572
hist_shape	N/A	Shape parameter for GEV distribution at the historic timeframe (1995-2004)	- 0.181910988
hist_scale	N/A	Scale parameter for GEV distribution at the historic timeframe (1995-2004)	14.17025364
midcent_median_10yr	CFWI Scale	50th percentile Canadian Fire Weather Index at the 10yr return period from the mid-century timeframe (2045-2054)	83.25678705
midcent_median_50yr	CFWI Scale	50th percentile Canadian Fire Weather Index at the 50yr return period from the mid-century timeframe (2045-2054)	92.05089959
midcent_location	N/A	Location parameter for GEV distribution at the mid-century timeframe (2045-2054)	58.55686192
midcent_shape	N/A	Shape parameter for GEV distribution at the mid-century timeframe (2045-2054)	- 0.348102193
midcent_scale	N/A	Scale parameter for GEV distribution at the mid-century timeframe (2045-2054)	15.70102218
10yr_percent_change	Percent	Percent change from historical 10yr return period to the mid-century 10yr return period	7.745831911
50yr_percent_change	Percent	Percent change from historical 50yr return period to the mid-century 50yr return period	2.33305383

## Drought

File: Drought\_Extremes\_Historic\_and\_Midcentury.csv, 51,574 rows

Coverage: 48 Contiguous U.S.

Field Name	Unit	Description	Example
Longitude	Decimal Degrees	Longitude of a given point	-97.527954
Latitude	Decimal Degrees	Latitude of a given point	25.93115
hist_median_10yr	kilopascals (kPa)	50th percentile VPD (kPa) at the 10yr return period from the historic timeframe (1995-2004)	4.821693898
hist_median_50yr	kilopascals (kPa)	50th percentile VPD (kPa) at the 50yr return period from the historic timeframe (1995-2004)	5.448632369
hist_location	N/A	Location parameter for GEV distribution at the historic timeframe (1995-2004)	3.646524068
hist_shape	N/A	Scale parameter for GEV distribution at the historic timeframe (1995-2004)	-0.137188274
hist_scale	N/A	Shape parameter for GEV distribution at the historic timeframe (1995-2004)	0.595987792
midcent_median_10yr	kilopascals (kPa)	50th percentile VPD (kPa) at the 10yr return period from the mid-century timeframe (2045-2054)	6.081844831
midcent_median_50yr	kilopascals (kPa)	50th percentile VPD (kPa) at the 50yr return period from the mid-century timeframe (2045-2054)	9.177020673
midcent_location	N/A	Location parameter for GEV distribution at the mid-century timeframe (2045-2054)	3.853783779
midcent_shape	N/A	Scale parameter for GEV distribution at the mid-century timeframe (2045-2054)	0.342475346
midcent_scale	N/A	Shape parameter for GEV distribution at the mid-century timeframe (2045-2054)	0.649576896
10yr_percent_change	Percent	Percent change from historical 10yr return period to the mid-century 10yr return period	26.13502556
50yr_percent_change	Percent	Percent change from historical 50yr return period to the mid-century 50yr return period	68.427966



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