

## Monthly Attribution Overview - October 2024

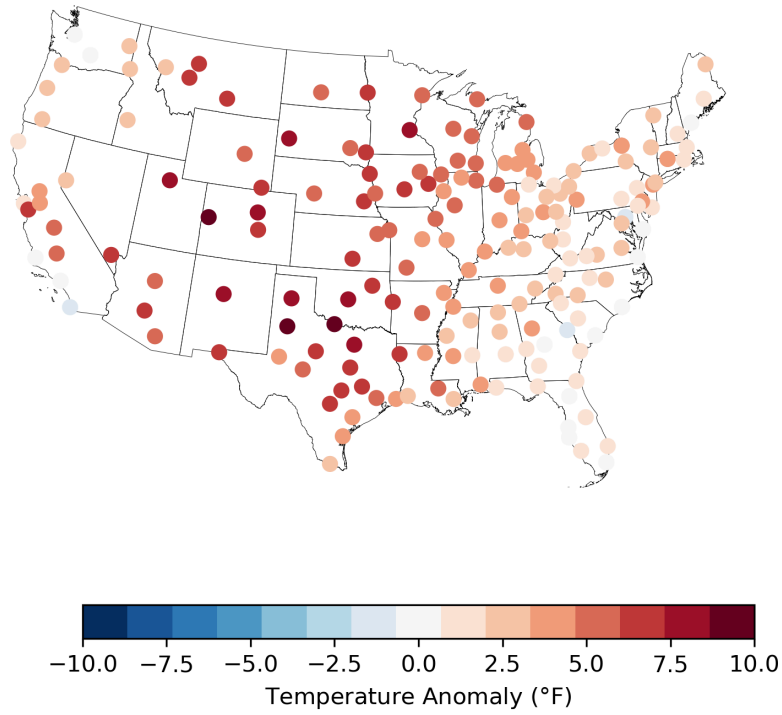
### An analysis of how climate change boosted United States temperatures in October 2024

*Using Climate Central's Climate Shift Index (CSI) tool to measure the impact of climate change on daily temperatures across the United States, as well as NOAA's Applied Climate Information System (ACIS) to find daily temperature information, we have compiled a high-level overview of how climate change has affected temperature trends in October in cities across the United States.*

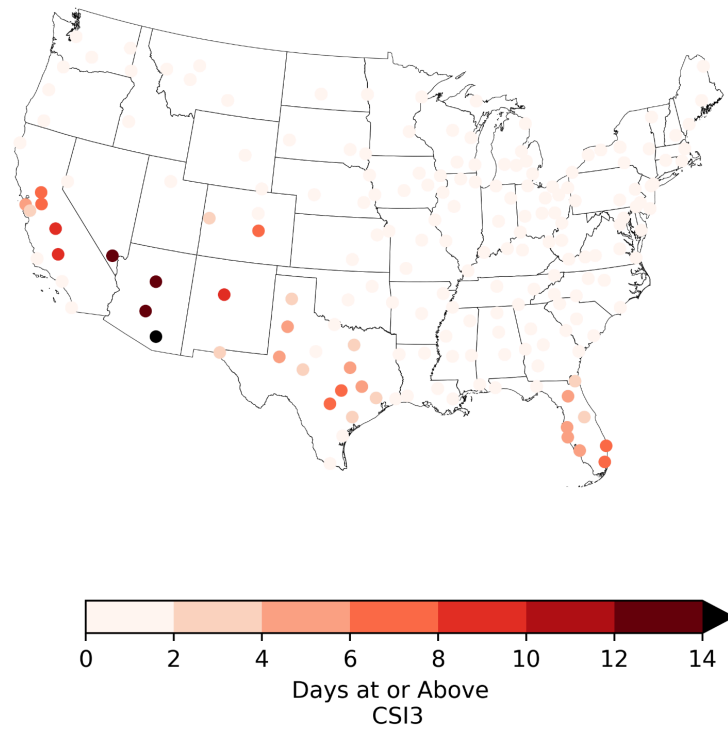
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#### 1. High Level Findings

- October temperature anomalies in the U.S. were elevated across much of the country: 185 out of 191 analyzed cities were warmer than normal. The highest anomalies stretched from the Rocky Mountains to the Mississippi (Figure 1).
- This was the hottest October on record in 19 cities – including 9 cities in Texas– and was in the top 5 hottest Octobers for an additional 19 cities.
- The Southwest showed particularly elevated October temperatures. Average temperatures across 8 cities in New Mexico, Colorado, Arizona, and Utah were 7.1°F higher than normal.
- Climate Shift Index (CSI) values meanwhile followed a different trend: California, Arizona, New Mexico, Texas, and Florida stood out as the states with cities experiencing the highest number of days with climate change-influenced temperatures at or above CSI 3 (temperatures made at least 3x more likely because of climate change) (Figure 2).
- On average, cities analyzed in the Southwest experienced at least 7 days with temperatures resulting in CSI values greater than or equal to 3.



**Figure 1.** Threaded ACIS temperature anomalies for October 2024 relative to the 1991-2020 standard normal period. Analysis based on ACIS data.



**Figure 2.** Days with a CSI of 3 or higher for October 2024 for ACIS threaded stations. Analysis based on ERA5 data (October 1-29) and GFS data (October 30-31).

## 2. Local Temperature Anomaly Analysis

- The most unusually hot city in October was Grand Junction, Colorado, where it was 8.9°F hotter than normal.
- 56 cities had October temperature anomalies greater than 5°F. These included 11 in Texas and 5 in Iowa.
- The average temperature anomaly across all cities was 3.6°F.
- 185 out of 191 ACIS stations analyzed had positive temperature trends for October, indicating that these cities have been warming on average since 1970.
- Reno, NV had an unusually warm October (with an average daily temperature anomaly of 3°F), and is the fastest-warming ACIS station for October on average, warming 7.4 °F on average since 1970.

City	State	Temperature Anomaly (°F)	Average Temperature (°F)	Warming Since 1970 (°F)
Grand Junction	CO	8.85	62.05	-0.5
Lubbock	TX	8.76	70.56	2.3
Wichita Falls	TX	8.67	73.27	2.1
Denver	CO	8.00	59.15	1.2
Dallas	TX	7.98	75.73	3.1
Minneapolis	MN	7.94	57.44	3.1
Rapid City	SD	7.93	54.97	-0.6
Salt Lake City	UT	7.80	62.35	3.4
Amarillo	TX	7.51	66.71	2.9
Oklahoma City	OK	7.50	68.61	1.2

**Table 1.** Top 10 ACIS stations with the highest October 2024 temperature anomaly.

City	State	Warming Since 1970 (°F)	Temperature Anomaly (°F)	Average Temperature (°F)
Reno	NV	7.4	3.02	58.06
El Paso	TX	7.0	7.15	73.85
Las Vegas	NV	6.1	6.12	76.52
Tucson	AZ	6.1	5.94	78.60
Burlington	VT	5.9	2.95	53.29

Phoenix	AZ	5.5	7.09	84.48
Fairbanks	AK	5.4	0.40	26.66
New Orleans	LA	5.4	2.02	74.47
Anchorage	AK	5.3	0.54	36.89
Chattanooga	TN	5.2	3.04	65.79

**Table 2.** Top 10 ACIS stations with the fastest warming October since 1970.

### 3. Local Climate Shift Index Analysis

- 12 out of 191 ACIS stations analyzed had at least one week with daily CSI values greater than or equal to 3, indicating that temperatures on those days were made at least three times as likely due to climate change in those cities.
- San Juan, Puerto Rico had 16 days at CSI 5, indicating that temperatures on these days were made at least 5 times more likely to occur because of climate change.
- All 3 cities in Arizona were in the top 10 cities with the strongest climate signal. Additionally, each of these cities had at least 9 days of temperatures with CSI values of 5.
- On average, cities analyzed in the Southwest experienced at least 7.6 days with temperatures resulting in CSI values greater than or equal to 3.

City	State	Days at CSI = 3 or higher	Days at CSI = 5	Average Temperature (°F)	Temperature Anomaly (°F)
San Juan	PR	16	16	85.60	2.95
Tucson	AZ	15	11	78.60	5.94
Flagstaff	AZ	14	13	53.08	5.53
Phoenix	AZ	13	9	84.48	7.09
Las Vegas	NV	13	8	76.52	6.12
Bakersfield	CA	9	6	72.45	4.75
Fresno	CA	9	7	72.39	5.74
Albuquerque	NM	8	2	65.76	7.41
San Antonio	TX	7	1	78.47	7.16
Sacramento	CA	7	3	68.39	3.84
Miami	FL	7	4	80.23	0.18

**Table 3.** Top 10 ACIS stations with the highest number of days at or above a CSI of 3 during October 2024.

## METHODS

### Calculating the Climate Shift Index

All Climate Shift Index (CSI) levels reported in this brief are based on daily average temperatures and [ERA5 data](#) from October 1 to October 26, 2024, and GFS data from October 27 to October 30, 2024. See the [frequently asked questions](#) for details on computing the Climate Shift Index, including a summary of the multi-model approach described in [Gilford et al. \(2022\)](#).

### City Analysis

We analyzed 191 Applied Climate Information System (ACIS) stations associated with U.S. cities. For each city, we found the CSI time series from the nearest 0.25° grid cell. We calculated the number of days at CSI levels 2, 3, 4, and 5. We used ACIS data to find the average monthly temperatures, temperature anomalies, and precipitation information, and to derive average monthly warming trends for each city.