

Climate indicators

The City of Calgary has a responsibility to be resilient to climate change by responding, preparing and adapting to the associated impacts. In order to prepare for climate change we need to understand what those changes will mean for our local region. This primer describes the changes we are already experiencing in Calgary, using ‘physical and impact indicators’ to measure the trend of relevant climate hazards. The improved tracking of year over year climate-related impacts to The City and the community (impact indicators) will improve the understanding of progress on reducing climate risk to the Corporation and the community.

The intent of this document is to provide context to decision and policy makers of the climate hazards impacting Calgary currently (2022) and trends over the last 30 years (1993-2022, where available). A partner document, the Climate Projections for Calgary Report (COC, 2022) details key climate projection indicators that describe how climate hazards will evolve in the 2050s and 2080s for Calgary.

There are nine main climate hazards that The City identifies as being of the greatest concern to Calgarians:

- Extreme Heat
- Drought
- Severe Storms
- River Flooding
- Wildfire
- Higher Average Temperatures
- Short Duration High Intensity Rainfall (SDHI)
- High Winds
- Heavy Snowfall

Climate indicators are used to measure the more recent trends in the climate hazards presented above and include the following types:

Physical Indicators: Represent the change in a meteorological attributed quality, physical in nature. For example, the number of hot days per year is a physical indicator for extreme heat.

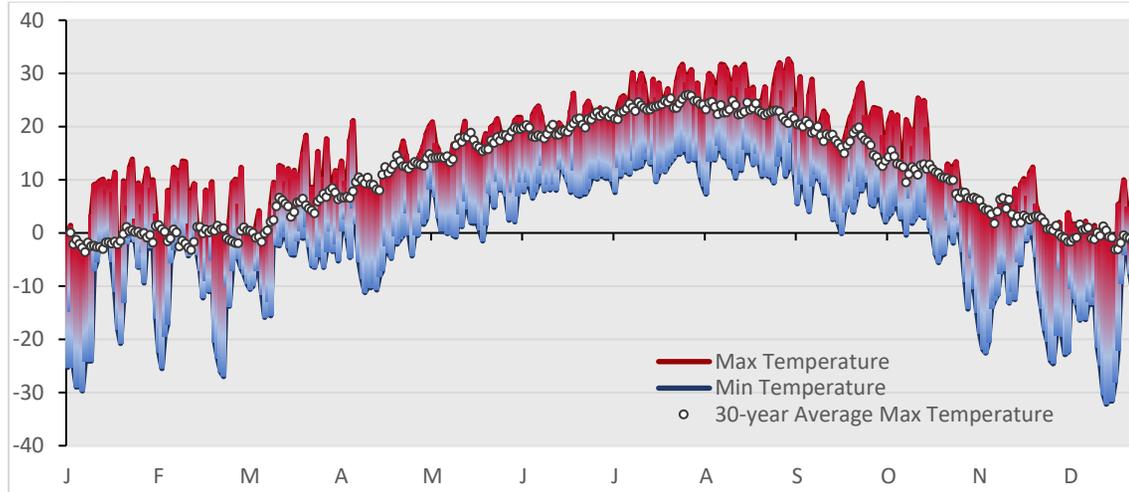
Impact Indicators: Impact indicators are measurable after the physical indicator has occurred. These are either direct or indirect impacts. For example, the number of heat related illnesses could be a direct impact of extreme heat. Impact indicators are still being developed and are less readily available than physical indicators.

Most Significant Climate Trends: 1993 - 2022

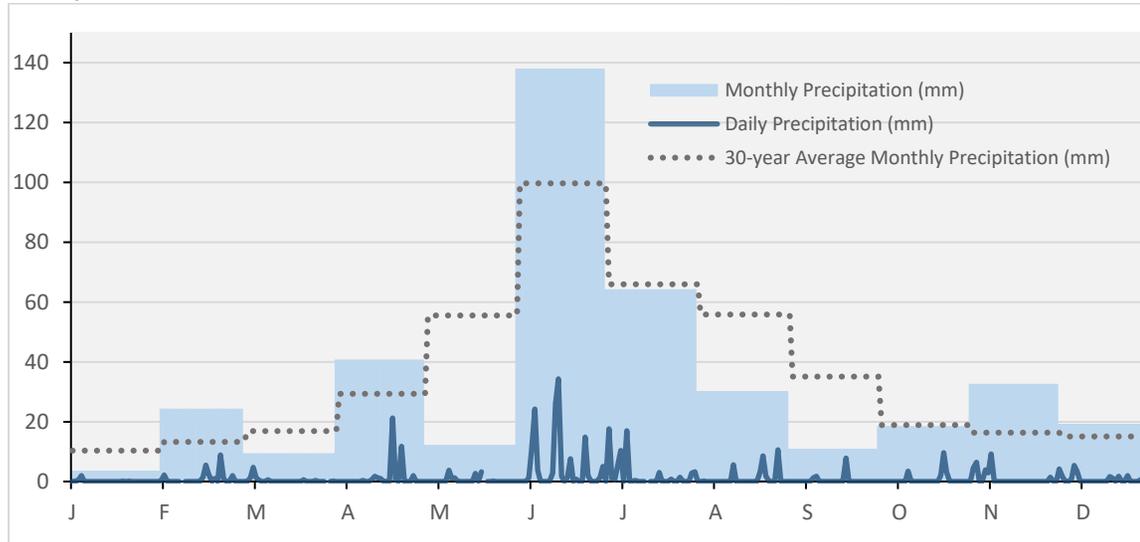
			
<p>Extreme heat – number of warm nights per year ↑</p> <p>As temperatures have increased, extreme heat events have also increased.</p> <p>While the number of hot days per year have been increasing, the number of warm nights (minimum temperature ≥ 14°C) have also been increasing in this 30-year period. This is especially concerning as warm nights are correlated with the number of heat-related hospital visits; humans rely on a reprieve from hot temperatures during the night.</p>	<p>Short duration high intensity rainfall – maximum hourly rainfall ↑</p> <p>As temperatures have increased, the moisture in the atmosphere has increased, leading to more intense rainfall events.</p> <p>The annual maximum rainfall received over an hour and daily duration has been increasing in the northeast and south communities of Calgary, respectively. Short duration high-intensity (SDHI) rainfall can overwhelm stormwater capacity causing localized flooding, potentially damaging underground utilities.</p>	<p>Heavy snowfall – winter total ↑</p> <p>Even as temperatures have increased and seasons have started to shift, winter temperatures have remained cold enough for snowfall events to occur. This trend has been exhibited over the last 30 years as snowfall amounts have increased considerably in the winter months. Heavy snowfall events can break branches and damage trees.</p>	<p>Wildfire – smoke hours ↑</p> <p>As temperatures have increased, wildfire and smoky conditions have also increased.</p> <p>The smoke hours observed at the Calgary Airport have increased exponentially over the last 30 years, from an average of 11 hours per year (1961-1990), to an average of 71 per (1993-2022), with 2021 reported the highest number of smoke hours in Calgary’s recorded history with 512 smoke hours. High smoke events can exacerbate respiratory problems, posing an issue for public health.</p>

2022 Year in Review

Temperature - 2022 Daily Temperature at the Calgary Airport (°C)



Precipitation - 2022 Monthly and Daily Precipitation at the Calgary Airport (mm)



Notable physical indicators in 2022:

- ❖ **20 hot days** ($T_{\max} \geq 29^{\circ}\text{C}$), above the 30-year average of 10 per year. There were 3 heat waves ($T_{\max} \geq 29^{\circ}\text{C}$, $T_{\min} \geq 14^{\circ}\text{C}$ for two consecutive days), the most on record in Calgary.
- ❖ **123 smoke hours** observed at the Calgary Airport, well above the 30-year average of 71 per year. Smoke hours have been increasing exponentially over the last 60 years.
- ❖ **62 cm** of snow fell in the winter months— higher than the 30-year average of 55 cm. Winter snowfall totals have been increasing consistently over the last 30 years.
- ❖ The maximum reported hourly rainfall was **25.8 mm** in Huntington Hills on July 7, 2022 (supercell thunderstorm). The 30-year average maximum rainfall is 37 mm.
- ❖ **15 thunderstorms** affected the City in 2022, higher than the 15-year average of 13.
- ❖ The date of first snowfall accumulation ($\geq 2\text{cm}$) was **October 22, 2022**, about 3 weeks later than normal.
- ❖ **117 freeze thaw cycles** occurred, below the 30-year average of 128.
- ❖ The highest daily flow rate for the bow river was **359 m³/s**, on June 15, 2022.
- ❖ There were **54 chinook days**, higher than the average of 46 chinook days per year.

Notable impact indicator data in 2022:

- ❖ The water peak day demand was **688 ML**, less than the 22 year average of 696 ML.
- ❖ *The number of heat-related hospital visits and hospitalizations for 2021 were 12.96 and 1.25 per 100,000 people, respectively, higher than the 24-year and 28-year averages of 0.28 and 5. These increases can be attributed to the 2021 heat dome. 2022 data has yet to be released and will be provided in the 2023 year in review.*