

# ACTUARIES CLIMATE INDEX EXECUTIVE SUMMARY



ACTUARIES CLIMATE INDEX  
INDICE ACTUARIEL CLIMATIQUE

## Actuaries Climate Index

# EXECUTIVE SUMMARY

The Actuaries Climate Index™ (ACI) is an educational tool designed to help inform actuaries, public policymakers, and the general public about climate trends and some of the potential impacts of a changing climate on the United States and Canada. The Index is an objective measure of observations of extreme weather and sea levels. It is intended to provide a useful monitoring tool of climate trends. The ACI will be updated quarterly as data for each meteorological season becomes available.

The Actuaries Climate Index is the result of a research project jointly funded by the American Academy of Actuaries, the Casualty Actuarial Society, the Canadian Institute of Actuaries, and the Society of Actuaries. Actuaries are experienced in the assessment and mitigation of financial consequences of risks and in the presentation of complex data. In keeping with this expertise, the second phase of the research project is the Actuaries Climate Risk Index™, which assesses the potential risk management implications presented by the changes measured by the ACI. The Risk Index will be based on the historical correlations of economic losses, mortality, and injuries to the Actuaries Climate Index data, and will be described separately.

Actuaries are risk professionals. They not only measure risk; they assist in mitigating and managing risk. Actuaries apply their expertise and knowledge to a wide range of problems facing people in their everyday lives and businesses in the conduct of their enterprises. Just as climate scientists build models for potential future changes in the climate, actuaries model the likelihood of the financial impact of uncertain future events. Financial security programs around the globe rely on these models. Actuarial models rely on objective data sets; one of the goals of creating these indices is to provide historical climate data sets useful to actuaries as inputs to these financial models.

# Inside the Actuaries Climate Index

The Actuaries Climate Index has six components, each of which is a monthly time series beginning in 1961. It is based on measurements from an extensive network of meteorological and coastal tide stations in the United States and Canada. All data is compared to measurements over the 30-year reference period of 1961 to 1990, which was the earliest available 30-year period with good data. The data is summarized by meteorological season (three months ending February, May, August, and November), and a 5-year moving average was selected as the key metric.

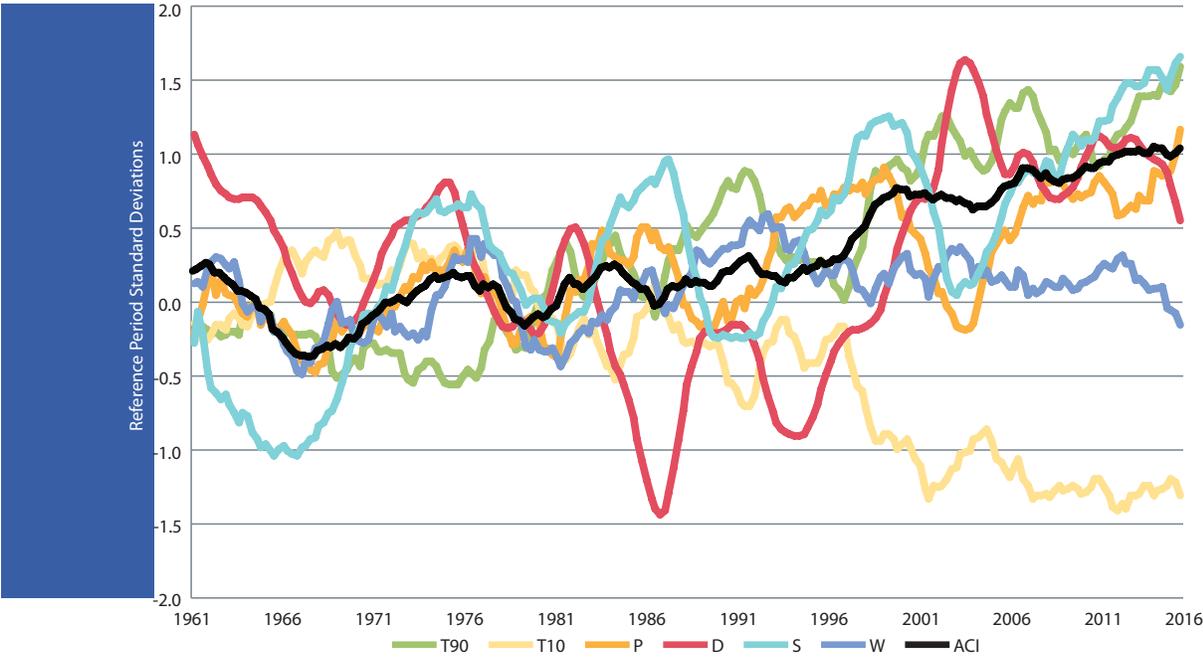
Averages tell a story, but with climate data, important trends are better revealed by looking at what is happening at the extremes.

## The six Actuaries Climate Index components are:

1. Frequency of temperatures above the 90<sup>th</sup> percentile (*T90*);
2. Frequency of temperatures below the 10<sup>th</sup> percentile (*T10*);
3. Maximum rainfall per month in five consecutive days (*P*);
4. Annual maximum consecutive dry days (*D*);
5. Frequency of wind speed above the 90<sup>th</sup> percentile (*W*); and
6. Sea level changes (*S*).

Figure 1 shows the ACI and each of the components. The composite ACI represents the average of the six components (with the sign of the change in cool/cold temperatures reversed). As temperatures have warmed over the United States and Canada in recent decades, the frequency of cool/cold temperatures is declining and its change relative to the reference period is generally a negative number. By subtracting this component in the Index calculation, the ACI is increased by the reduction in cold extremes, consistent with the increased melting of permafrost and increased propagation of diseases, pests, and insects that were previously less likely to survive in lower temperatures. A positive value in the ACI represents an increase in climate-related extremes relative to the reference period.

**Figure 1. Seasonal five-year moving averages of components, Canada and the United States.**



# Region Definitions

Figure 2 shows the 12 regions used for the Actuaries Climate Index; these regions are defined along state and provincial borders.

Figure 2. Regions used in the ACI.

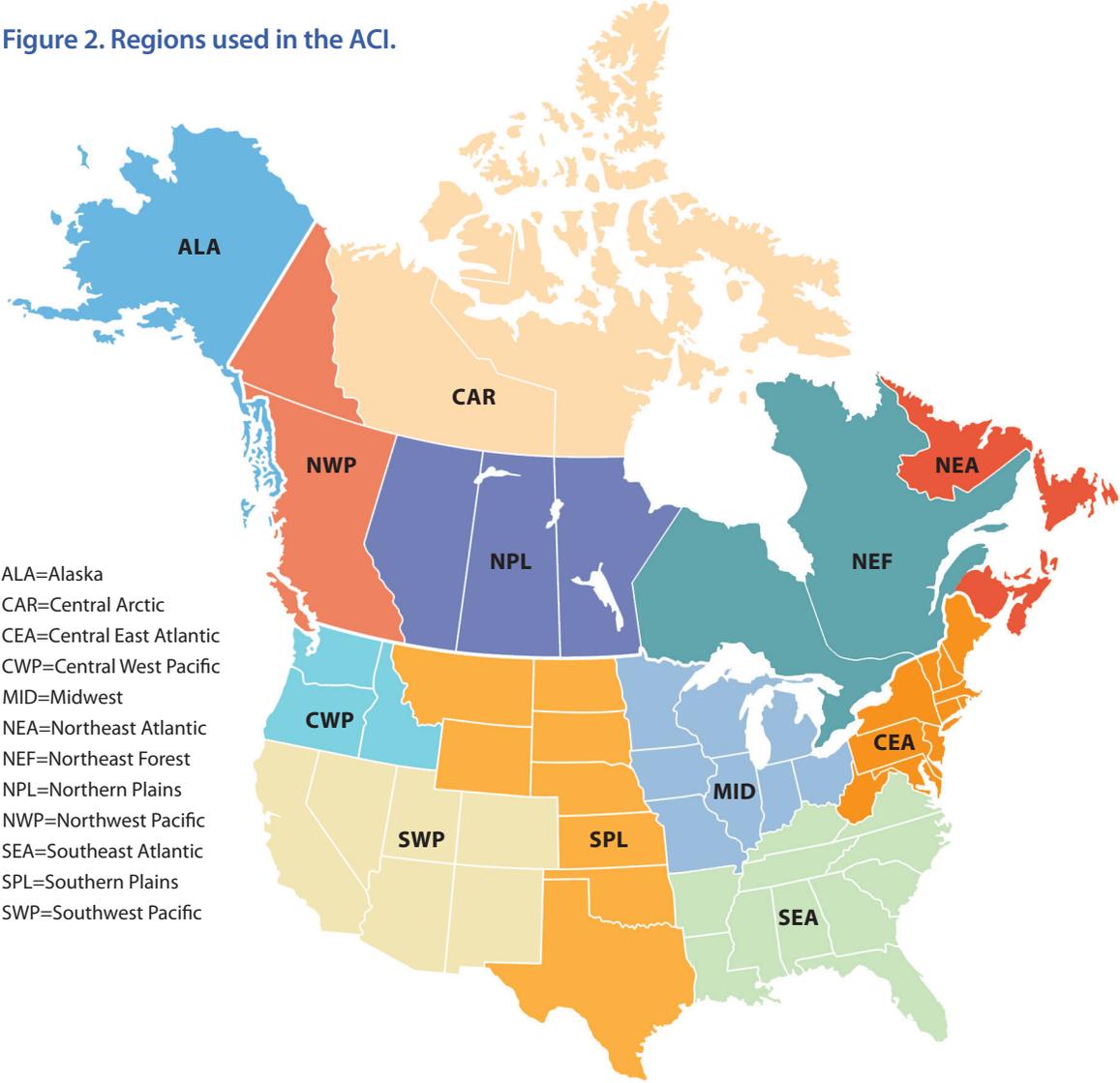


Figure 3. The Actuaries Climate Index for Canada and the United States.

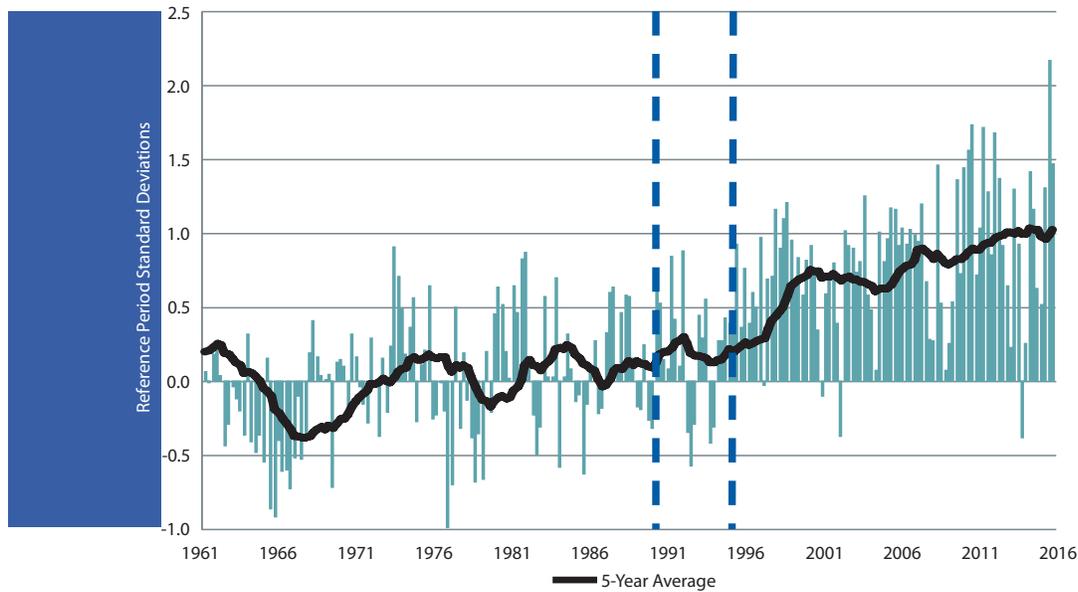


Figure 3 above shows results for the ACI by season for Canada and the United States. The most recent 5-year moving average is at about one standard deviation above the mean. By definition, the Index averages zero over the 1961-1990 reference period. Figure 3 shows that the average Index continued to be near zero until about 1995, after which all but four seasons were positive, i.e., greater than the average during the reference period. The dotted lines indicate the end of the reference period and beginning of the period of more frequent climate extremes.

The Index in the past 20 years has been driven upward primarily by more warm/hot temperatures, fewer cool/cold temperatures, higher sea levels, more heavy precipitation, and more drought.

Further details on the ACI methodology can be found in the document, *Actuaries Climate Index Development & Design*.



ACTUARIES CLIMATE INDEX  
INDICE ACTUARIEL CLIMATIQUE

**ACTUARIESCLIMATEINDEX.ORG**