# FAQs for the Australian Actuaries Climate Index

## What is the Australian Actuaries Climate Index?

The Australian Actuaries Climate Index (AACI) refers to a number of indices that provide objective measures of historical **extreme** weather and sea levels. It is intended to provide a useful monitoring tool of climate trends.

The AACI includes a series of component indices and a composite index.

- The component indices show changes in the frequency of extreme levels of each of temperature (high and low), rainfall, drought, wind, and sea level.
- The composite index combines the measures of high temperature, rainfall and sea level into a single index.

The index is available nationally and across 12 regions of Australia. The AACI will be updated quarterly as data for each meteorological season becomes available.

## What is the purpose of the AACI?

The AACI is designed to help inform actuaries, public policymakers, companies and the general public about climate trends in Australia. The focus is on the extremes, which are related to risks such as inland and coastal flooding, cyclones, drought, and heat waves. Hence the indices are intended to add to our understanding of how certain risks may be changing as a result of climate change.

## Why are actuaries weighing in on climate change discussions?

Actuaries are experienced in the assessment and management of the financial consequences of risks and in the summarisation and presentation of complex data. Many of the organisations that actuaries support are concerned with climate risk and with how it will affect their business – for example general insurers, banks and investment managers. The index is intended to provide a useful measure of how the extremes of weather are changing in order to support assessment of the change in risk.

## How does the index link to risk?

The index has been designed to have some correlation with risk. This has been done through the selection of climate metrics that are indicators of risk and also through the focus on the extreme tail of the metric distributions, rather than on the average of those distributions. Currently the link to risk is implicit rather than explicit. In the future, the intention is for additional indices measuring specific risk attributes to be developed by looking at the relationship between the data on extremes and historical risk data e.g.

- Risk of damage to property.
- Risk of damage to health.
- Risk of excessive energy demands.

## What are the components of the index?

The index examines changes in the frequency and duration of extreme temperatures (high and low separately), heavy precipitation, drought, strong wind, and changes in sea level. The index is available for 12 regions of Australia.

For each index the time series begins in 1981. The start dates for the wind indices are later, noting that the change in wind measurement devices (anemometers) contributed to a discontinuity in the data. The wind indices start from the date of installation of new anemometers.

The indices are based on measurements taken by the Bureau of Meteorology (BoM) from its extensive network of meteorological and coastal tide stations. All data is compared to measurements over the 30-year reference period of 1981 to 2010. The data is summarised by meteorological season (three months ending February, May, August, and November), and a 5-year moving average was selected as the key metric.

The six components are:

1. Frequency of daily maximum and minimum temperatures above the 99th percentile.
2. Frequency of daily maximum and minimum temperatures above the 1st percentile.
3. Frequency of rainfall over five consecutive days above the 99th percentile.
4. Seasonal maximum consecutive dry days.
5. Frequency of daily wind speed above the 99th percentile.
6. Seasonal maximum sea level.

## Why did you choose these six components?

The six components have the potential to impact people and the economy.

## What is the composite index?

The composite index reflects a simple average of the high temperature, rainfall and sea level indices. It is intended to bring several of the metrics into a single headline measure. The wind data was excluded as data was not available back to 1981. The low temperature measure was excluded so that temperature was not overweighted in the composite index. The drought measure was excluded as it shows a strong inverse correlation with the rainfall measure - i.e. low rainfall is naturally associated with consecutive dry days.

## What weight is given to each component in the composite index?

The high temperature, rainfall and sea level indices are given equal weight in the composite index.

## How were the regions selected?

The regions are based on CSIRO's 15 sub-clusters used for their 'Climate Change in Australia' data. There are only 12 zones in the index as we grouped some clusters where there was insufficient data for them to be assessed in isolation. These zones are intended to be climatologically consistent regions of Australia.

## What does the index score represent for each component?

A positive value in the index represents an increase in climate-related extremes relative to the reference period.

The value is expressed as a standardised anomaly. This means that for an individual metric, the standardised anomaly corresponds to how unusual that season's value is compared to the reference period mean and standard deviation for that season. Hence each component is in units of the standard deviation of that quantity (e.g. an index of 0.5 means the metric has increased by half a standard deviation). Using standardised anomalies allows us to combine underlying metrics in a consistent way relative to their natural variability.

## Who provides the data behind the index?

The data is derived from individual weather station tide gauge data and available from the Bureau of Meteorology (BoM). More specifically:

- The temperature measures are based on the 112 ACORN-SAT stations. This data has been homogenised by the BoM to ensure consistency over time.
- The rainfall data is based on all weather stations across Australia that collect rainfall data (around 2,000 stations).
- The wind data is based on 38 stations that are thought to provide the most reliable wind data, noting that wind measurement is inherently more uncertain.
- The sea level data is based on 16 tide gauges around the country and are taken from the BoM's Baseline Sea Level Monitoring Project.

## Who do you expect to use the index?

We expect the index will be useful to anyone interested in understanding how climate change is leading to changes in risk. This would include companies that are seeking to make climate related disclosures in their financial statements and who may want to be tracking measures that are linked to risk.

## How do you expect the index to be used?

At this stage, given the indices are linked to risk, but do not explicitly measure risk, we would expect them to be used as highlighting areas where the risk may be higher or lower. We would not expect the indices to be used to directly price risk (such as setting insurance premiums) since they are not based on risk measures but are correlated to them.

## What do the results show?

The index indicates increases relative to the reference period in the extremes of temperature and in the extremes of sea level. As such we expect that risks that are linked to higher temperatures and higher sea levels have increased. The wind level extremes appear broadly unchanged overall. Over the last 20 years Australia has experienced two phases of drought and this is evident in the drought and rainfall metrics which show periods of high and low.

## Why is the increase in low temperatures shown as an increase?

Both higher and lower temperatures have the potential to provide challenges. We have chosen to show the increase in the 1st percentile of temperatures as an increase in the index, and hence linked to higher risk. The higher 1st percentile temperatures are associated with, for example increased propagation of diseases, pests, and insects that were previously less likely to survive in lower temperatures.

## Can the index be used to forecast the future climate?

The AACI is based on historical data. It does not attempt to forecast future changes in the frequency of extremes. The indices are available for 12 regions. As these regions correspond to regions in the *Climate Change in Australia* projections for future climate by the BoM and CSIRO, the AACI historical data can be considered alongside relevant forward projections.

## How does the index compare to the Actuaries Climate Index (ACI) prepared by the actuarial societies in North America?

A similar index (the ACI) has been constructed by the actuarial societies in North America to show the trend in climate extremes across North America. The key differences between the AACI and the ACI are as follows:

- **Reference period:** The AACI uses 1981 to 2010, whereas the ACI uses 1961 to 1990. A more recent period means better quality data and a more contemporary view of changes in risk.
- **Definition of exceedance threshold:** The AACI uses the 99th whereas the ACI uses the 90th percentile. A more extreme threshold provides a better link to risk.
- **Wind:** The AACI is based on the maximum wind gust each day. The ACI uses the average wind speed over 24 hours.
- **Sea level:** The AACI is based on the maximum sea level for the month whereas the ACI uses the mean.
- **Composite index:** The AACI is based on only three component indices, not all six.

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