



## SECTION 2.

# CLIMATE TRENDS & PROJECTIONS

## 2 HOW WILL THE CLIMATE CHANGE? (CLIMATE TRENDS AND PROJECTIONS)

At some stage in the development of your organisation's adaptation approach and identification of options, there will be a desire to obtain information to better understand what causes climate change and how the climate is likely to change at a global, regional and local scale. This in turn provides the information needed to help understand climate risk and vulnerability (Section 3) and the selection of adaptation options (Section 4).

There is a tendency for adaptation practitioners and decision makers to think that more climate data is better, but in reality this is not true. Instead, this can cause confusion and become a focus of adaptation rather than progressing onto the important task of identifying and implementing options.

**Key rule:** Too much climate data can be a distraction and create confusion. Consider how much climate data is required based on the type of risk assessment and options appraisal process you will deliver.

The basic principles underpinning the drivers of climate change are outlined in many guides and reports, with the Climate Change in Australia website being a useful national level source of information<sup>4</sup>. More detailed explanation is contained in the reports prepared by the Intergovernmental Panel on Climate Change, the world's leading international body for the assessment of climate change.

While there is significant complexity in the science underpinning our understanding of future climate there are some key concepts that are relevant for all levels of planning. Importantly, it is not possible to "predict" or "forecast" the future climate. Instead, *climate models* have been constructed that present a range of "projections" or "scenarios" that can be used to explore what future climate conditions may occur.

Projections contain inherent variability, which is important to understand when determining how best to use climate data for identifying adaptation options. Two of the main sources of variability come from the choice of global *climate model* and representative concentration pathway (RCP).

Global *climate models* are numerical models that are used to generate projections for climate variables like temperature and rainfall. Over 40 have been developed around the world, some of which perform better than others for Australian conditions.

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<sup>4</sup> <http://www.climatechangeinaustralia.gov.au>

Representative concentration pathways (RCPs) consider time series of emissions together with concentrations of the full suite of greenhouse gases, aerosols and chemically active gases, as well as varying land-use and land cover to produce alternative future climate conditions (7). The four main RCPs used as the basis for *climate projections* (8) are:

- **Peak and decline scenario (RCP2.5)** – an emissions pathway leading to very low greenhouse gas concentration levels; a so-called "peak" scenario;
- **Intermediate, stabilisation scenario (RCP4.5)** – an emissions pathway where the impact of climate change on the atmosphere is stabilised before 2100 by using a range of technologies and strategies for reducing greenhouse gas emissions;
- **“Intermediate, stabilisation scenario” (RCP6.0)** – an emissions pathway where the impact of climate change on the atmosphere is stabilised after 2100 by using a range of technologies and strategies for reducing greenhouse gas emissions; and
- **High emissions scenario (RCP8.5)**– an emissions pathway characterized by increasing greenhouse gas emissions over time leading to high greenhouse gas concentration levels.

Another reason for the difference between *climate projections* is the timeframe being considered. For example, temperature and rainfall projections will be different in 2030 compared with 2070 because of the underlying assumptions about different levels of greenhouse gases in the atmosphere through time, which then feeds into the *climate models*.

For South Australia, there are two main sources of data on *climate projections*. This data can be used for a range of purposes, including planning and design of infrastructure e.g. determining the capacity of stormwater infrastructure or evaporation ponds. The primary data sources are:

- **SA Climate-ready (SACR)<sup>5</sup>**: released in February 2015, this is the Goyder Institute’s “Agreed downscaled *climate projections* for South Australia” project. The project provides regional-scale projected climate trends for the State for four future timeframes (2030, 2050, 2070 and 2090), under two emissions scenarios (intermediate and high), and for five climate variables: areal evapotranspiration; temperature; rainfall; vapour pressure deficit; and solar radiation; and
- **Climate Change in Australia (CCIA)<sup>6</sup>**: released in February 2015, this is a nationally-focused CSIRO and Bureau of Meteorology project that provides “application ready” climate data. Information is available for: fire weather days; sea surface temperature; mean and extreme sea-level rise; sea surface

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<sup>5</sup> Further information and regional scale summaries generated from SACR can be found at: [www.goyderinstitute.org](http://www.goyderinstitute.org) or <https://data.environment.sa.gov.au> for access to the detailed datasets.

<sup>6</sup> Additional information on the project and access to projection data can be found at: [www.climatechangeinaustralia.gov.au](http://www.climatechangeinaustralia.gov.au).

salinity; ocean acidification; solar radiation; point potential evapotranspiration; temperature; rainfall; wet areal evapotranspiration; relative humidity; and, wind speed.

**Has your organisation already assembled *climate projection* information?** Be sure to check the climate change adaptation plan and integrated vulnerability assessment for your region, industry adaptation plans and see if your organisation already has its own adaptation plan.

See *Step 2 of the LGA SA's Climate Adaptation Planning Guidelines for further general information on Future Climate Projections.*

## 2.1 Scan

At the *Scan* level, the primary aim is to engage key stakeholders in a discussion about why responding to climate change is important for your organisation or your region, what the impacts are likely to be, and response options.

Because climate change has its foundations in complex science, there is a tendency at the *Scan* level to spend time and resources trying to understand exactly how the climate will change in your region, and at a fine local scale. However, this is not required. Instead, describing regional trends is more important and can be encapsulated in statements like:

- *Our region will become warmer and drier in the future;*
- *Our coast line will experience rising sea levels; and*
- *There will be an increased risk of fire as conditions become warmer and drier.*

Developing a basic level of understanding about why there are different projections and what these projections mean can be useful. For example, how will temperatures and sea levels increase under an intermediate versus high emissions scenario?

*Scan* level detail can be obtained from the Climate Change in Australia website under its Regional Climate Change Explorer, Climate Futures Exploration Tool or by using the Climate Analogues tool.

The SA Climate Ready data also provides regional summaries which can be found on the Goyder Institute's website.

When identifying regional trends, both data sources are suitable.

## 2.2 Plan

Building on the summaries prepared for the *Scan* level of assessment, the *Plan* level will require trajectories, which describe through the use of graphs and tables how elements of climate may differ through time based on different emissions scenarios and choice of *climate models*.

While recognising that there are a broad range of *climate projections*, the *Plan* level will often see practitioners and stakeholders making a choice about which *climate scenario* to use to assist with identifying and choosing which actions to implement. The decision on whether this is necessary will depend on the purpose for which the data is being collated. For example, detailed risk assessments generally require selection of a single or small number of projections. In contrast, adaptation pathways approaches can accommodate a broad range of projections.

Data for the *Plan* level of analysis will most likely come from the Climate Change in Australia website, which provides a range of intermediate level analysis tools.

## 2.3 Delve Deeper

A *Delve Deeper* level analysis may require detailed understanding of climate futures. This is because analysis being undertaken at the risk assessment and options appraisal stages will be using models that can accommodate a broad range of *climate scenarios*.

Compiling detailed projections information at this stage and knowing how to use the data requires specialist expertise and knowledge.

When seeking this data from Climate Change in Australia, it will require the use of advanced tools, which typically require face to face training to understand how they operate. This can be arranged via CSIRO.

SA Climate Ready also provides detailed projections data sets. This data can be accessed online from Enviro Data SA, which provides a gateway to data and information relating to the science and monitoring of South Australia's environment and natural resources.

An explanation of the respective application of the Climate Change in Australia and SA Climate Ready data is provided in the SA Climate Ready Data User Guide, which is available from the Goyder Institute website.