This document provides a summary of rainfall and temperature (maximum and minimum) information for the SA Murray-Darling Basin (SAMDB) Natural Resources Management (NRM) region generated using the latest group of international global climate models. Information in this document is based on a more detailed regional projections report available at www.goyderinstitute.org.

Climate projections at a glance
The future climate of the SAMDB NRM region will be drier and hotter, though the amount of global action on decreasing greenhouse gas emissions will influence the speed and severity of change.
Decreases in rainfall are projected for all seasons, with the greatest decreases in spring.
Average temperatures (maximum and minimum) are projected to increase for all seasons.

The region
The SAMDB NRM region encompasses the Murray-Darling catchment within the State, extending from the New South Wales and Victorian borders in the east to the western catchment boundary along the Mount Lofty Ranges, north to the Rangelands and south to the Murray River mouth and Murray Mallee.

The SA Climate Ready project
The Goyder Institute is a partnership between the South Australian Government through the Department of Environment, Water and Natural Resources, CSIRO, Flinders University, University of Adelaide, and the University of South Australia.

In 2011, the Goyder Institute commenced SA Climate Ready, a project to develop climate projections for South Australia. The resulting information provides a common platform on which Government, business and the community can develop solutions to climate change adaptation challenges.

The project has produced the most comprehensive set of detailed, local scale climate projections data ever available in South Australia. It covers rainfall, temperature, solar radiation, vapour pressure deficit and evapotranspiration.

For further information: Goyder Institute for Water Research
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The Goyder Institute for Water Research is a partnership between the South Australian Government through the Department of Environment, Water and Natural Resources, CSIRO, Flinders University, University of Adelaide and the University of South Australia.
How was the data generated?

The climate projection information presented here is based on selected future climate change scenarios, projected to occur under two emissions scenarios defined by the Intergovernmental Panel on Climate Change (IPCC). The climate projection information presented here is based on selected future climate change scenarios which the IPCC describe as “representative concentration pathways” (RCPs). The high emissions scenario referred to in this document is RCP8.5 and the intermediate emission scenario is RCP4.5.

The IPCC’s emissions scenarios are the product of an innovative collaboration between integrated assessment modelers, climate modelers, ecosystem modelers as well as social scientists working on emissions, economics, policy, vulnerability and impacts.

Detailed, local scale data were generated for the region using 15 Global Climate Models (GCM) and applying a technique called “downscaling” at selected weather stations.

While using 15 GCMs provides a broader range of possible future climate changes, this document uses data from a subset of the 6 “best” GCMs. These models were chosen because they were found to perform better at representing climate drivers that are particularly influential on rainfall in South Australia, such as the El Nino Southern Oscillation (ENSO) and Indian Ocean Dipole.

Further information on methods, data and outputs is available in the full regional report available at www.goyderinstitute.org.au.

Figure 1. Location and identification numbers of the 27 weather stations in the SAMDB NRM region
Climate modelling suggests that average annual rainfall could decline by up to 11.4-21.7% by the end of the 21st century in the SAMDB NRM region. Average annual rainfall is projected to decline under both intermediate emissions (RCP4.5) and high emissions (RCP8.5) scenarios (Figure 2a). By 2030 projected rainfall reductions are similar under both emissions scenarios. However, by the end of the century, projections diverge, with average rainfall declines nearly twice as much under high emissions (Figure 2a). There is considerable overlap in the range of projections across the coming century.

By 2070, projected rainfall reductions are similar within emissions scenarios, with the greatest declines in spring, with 23.6% and 34.7% declines under the intermediate and high emissions scenarios, respectively (Figure 2b).

Furthermore, by 2070, under intermediate emissions all seasons except for spring may at times experience wetter years than the baseline average (Figure 2b). Under high emissions, however, only summer may have wetter years.

Projected percent change in average annual and seasonal rainfall

Figure 2a
Projected percent change in average annual rainfall.

Figure 2b
Projected percent change in average seasonal rainfall.
Climate modelling suggests that average annual maximum temperatures could increase by up to 1.9-3.6°C by the end of the 21st century in the SAMDB NRM region.

Under intermediate emissions (RCP4.5) average maximum temperatures could increase by 0.9°C by 2030 and 1.9°C by 2090 (Figure 3a). Changes are even greater under high emissions (RCP8.5), which projects an increase of 1.1°C by 2030 and 3.6°C by the end of the century.

While the difference between emissions scenarios is small early in the century, by the end of the century maximum temperature under high emissions is nearly double that under intermediate emissions.

Seasonally, increases in average maximum temperatures are more variable, though the pattern of change is similar between scenarios. Across all seasons, temperatures are greater under high emissions, by 0.9 -1.2°C (Figure 3b).

Under both emissions scenarios, warming in the spring is projected to be greater than any other season (0.2 -0.5°C under intermediate emissions; 0.5 -0.7°C under high emissions) (Figure 3b). The projected ranges about the averages show little overlap between emissions scenarios and indicate greater variation under high emissions than intermediate emissions (Figure 3b).
Climate modelling suggests that average annual minimum temperatures could increase by up to 1.5-3.1°C by the end of the 21st century in the SAMDB NRM region.

Under the intermediate emissions scenario (RCP4.5), average minimum temperatures will rise by 0.7°C by 2030 and up to 1.5°C by 2090. Under the high emissions scenario (RCP8.5) a rise of 0.9°C is projected by 2030 and 3.1°C by the end of the century (Figure 4a).

Minimum temperatures are consistently greater under high emissions. By the end of the century, the projected changes under high emissions are more than double those under intermediate emissions.

The higher spring warming seen in the maximum temperature projections are not repeated in the minimum temperature projections, with autumn generally experiencing slightly more warming than the other seasons.

By 2070, for example, autumn minimum temperature increases are projected to be 0.2-0.7°C greater than other seasons under high emissions, and under intermediate emissions, are the same as summer but greater than spring and winter (Figure 4b). Changes in minimum temperatures are projected to be lowest in winter under both emissions scenarios (Figure 4b).

Like the maximum temperature change projections, the value ranges show low overlap between emissions scenarios, with the difference increasing over the years (Figure 4a).

Unlike the maximum temperature projections, the degree of variation above and below the average was generally more similar within each emissions scenario, and higher variation occurred in summer and autumn than winter or spring (Figure 4b).
How to access the detailed data?

Detailed data sets are available for weather stations in each of the NRM regions in South Australia through the Enviro Data SA website https://data.environment.sa.gov.au. Users of the site can download data through a search tool that allows for filtering of data by NRM region, GCM and RCP. Anyone interested in using the detailed data sets should first read the User Guide, which is located on the Enviro Data SA website.

Further information links

The Goyder Institute website includes further information about project outputs, including:

- regional summary documents for all NRM regions in South Australia
- case studies on how the climate projections data can been used to inform decision making
- a detailed report on climate projections for South Australian NRM regions (Charles and Fu 2014).

Acknowledgments

This document is a synopsis of data drawn from the following report:


This report should be consulted for further information regarding methods and data on other climate variables.

Glossary

Climate change: A change in the state of the climate, identified by changes in the mean and/or variability of its properties, that persists for long periods (typically decades or longer); driven by natural and anthropogenic processes.

Climate change projections: The simulated response of the climate system to one of the emission scenarios (RCPs) and generally derived using climate models.

Downscaling: Downscaling is a method that derives local to regional scale information from larger-scale (e.g. national or global) models or data analyses.

GCM (Global Climate Model): Comprehensive numerical models of the climate system based on the physical, chemical and biological properties of its components, their interactions and feedback processes, and accounting for some of its known properties. Used to study and simulate climate.

IPCC (Intergovernmental Panel on Climate Change): Scientific body providing an internationally accepted authority on climate change.

RCPs (Representative Concentration Pathways referred to here as emissions scenarios): Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases and aerosols and chemically active gases, as well as land use/land cover.

* Definitions are based on the glossary from the Intergovernmental Panel on Climate Change Fifth Assessment Report, Working Group 1 Report.