Climate Change

Projections for Australia

CSIRO

Introduction

Greenhouse gas levels in the atmosphere have increased over the past 200 years due to human activities. During the 20th century, the Earth warmed by about 0.6°C and sea-level rose by about 15 cm. Most of the warming observed over the last 50 years is due to human influences.

Australia warmed by 0.7°C from 1910–1999, with most of this increase occurring after 1950. Minima generally increased more than maxima. Australia's rainfall is highly variable in space and time, and although there have been regional trends, little change in the continental-average has been observed since 1910.

Scientists expect that continued increases in greenhouse gas levels will lead to further global warming and regional climate change.

Global warming and sea-level rise

Allowing for uncertainty in future emissions of greenhouse gases and the response of the climate system, scientists have calculated that the Earth's average surface temperature is likely to rise by 1.4 to 5.8°C by the year 2100 relative to 1990. This is a warming rate of 0.1 to 0.5°C per decade. Associated with this warming is a rise in sea-level of 9 to 88 cm by 2100, or 0.8 to 8.0 cm per decade.

Australian climate change

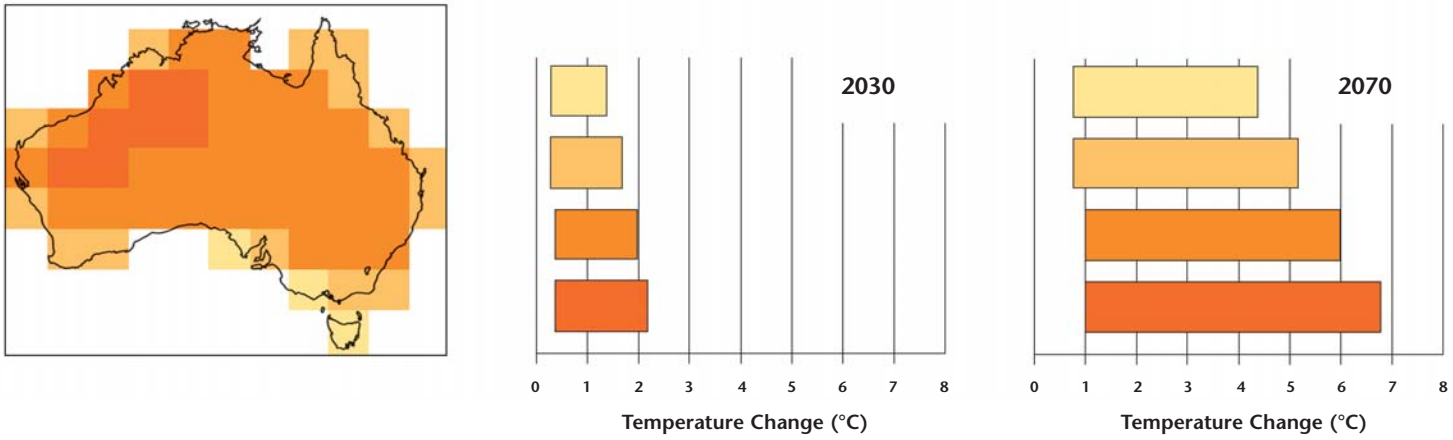
Using climate model simulations, CSIRO has estimated future changes in Australian temperature, rainfall and evaporation. The estimates take into account uncertainties associated with the range of future global warming and the range of regional climate model responses.

Temperature

Figure 1 shows the annual average warming for around 2030 and 2070, relative to 1990. By 2030, the warming is 0.4 to 2°C over most of Australia, with slightly less warming in some coastal areas and Tasmania, and slightly more warming in the north-west. By 2070, annual average temperatures increase by 1 to 6°C over most of Australia with spatial variations similar to those for 2030. Greatest warming occurs in spring and least in winter. In the north-west, most warming occurs in summer.

Increases in average temperature can lead to large changes in the occurrence of extremely hot or cold days. For example, the average number of days over 35°C each summer in Melbourne would increase from 8 at present to 9–12 by 2030 and 10–20 by 2070. In Perth, such hot days would rise from 15 at present to 16–22 by 2030 and 18–39 by 2070.

Figure 1: Ranges of average annual warming (°C) for around 2030 and 2070 relative to 1990. Coloured bars show changes for areas with corresponding colours in the map.



Conversely, the average number of winter days below 0°C in Canberra would drop from 44 at present to 31–42 by 2030 and 6–38 by 2070. Tatura, in Victoria's Goulburn Valley, would see a decline in such cold days from 15 at present to 6–13 by 2030 and 0–9 by 2070.

Rainfall

Figure 2 shows changes in annual average rainfall for around 2030 and 2070, relative to 1990. Changes tend toward decrease in the south-west (–20% to +5% by 2030 and –60% to +10% by 2070), and in parts of the south-east and Queensland (–10% to +5% by 2030 and –35% to +10% by 2070). Most other locations show changes which vary from –10% to +10% by 2030 and –35% to +35% by 2070. Decreases are most pronounced in winter and spring. Some inland and eastern coastal areas may become wetter in summer, and some inland areas may become wetter in autumn. Where average rainfall increases, there would be more extremely wet years, and where average rainfall decreases there would be more dry spells.

Most models simulate an increase in extreme daily rainfall leading to more frequent heavy rainfall events and flooding. This occurs where average rainfall increases and can occur where average rainfall decreases slightly. Reductions in extreme daily rainfall occur where average rainfall declines significantly.

Evaporation and moisture balance

Warmer conditions will lead to increased evaporation. When this is combined with the simulated changes in rainfall, there is a decrease in available moisture. This means greater moisture stress for Australia.

Tropical cyclones

Tropical cyclone wind-speeds may increase by 5–20% by the end of the century. Regions of cyclone origin are likely to remain unchanged. The number of severe oceanic storm surges in the north may rise as the intensity of tropical cyclones increases. Projected rises in sea-level would exacerbate this effect.

El Niño and La Niña

El Niño and La Niña events have a strong influence on climate variability in many parts of Australia, and this will continue. Climate models do not give a consistent indication of future changes, but the drying associated with El Niños may be enhanced by global warming.

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Figure 2: Ranges of annual average rainfall change (%) for around 2030 and 2070 relative to 1990. Coloured bars show changes for areas with corresponding colours in the map.