Abandoned causeway and pumping equipment in the bed of a dried-out lagoon on a station property near the River Murray at Big Bend, SA, September 2007. Greg Rinder, CSIRO

Living today with a future climate

Figures released by the Bureau of Meteorology in mid-October indicate the present drought is breaking new records. A new research collaboration is benchmarking today's drying conditions against long-term modelling under climate change.

Over the past three years in south-eastern Australia, and particularly in Victoria and Tasmania, rainfalls in many places were at the lowest level ever recorded. This includes many areas critical for inflows into the southern part of the Murray–Darling system.

'While similar periods of drought occurred in the middle of last century, this has also been the hottest drought on record, adding to the impact,' the Bureau's Dr David Jones said in a special climate statement released by his organisation.

In 2008, we can now ask: is south-eastern Australia previewing the likely climate of 2055 if greenhouse gas emissions to the atmosphere continue to increase at the present rate?

Dr Wendy Craik, Chief Executive of the Murray–Darling Basin Commission, told a recent climate change conference in Melbourne that the current drought seems to have fast-forwarded the southern Murray–Darling Basin to 2055 – and the most extreme climatic state envisaged by the world's most advanced simulations of the global climate system.

'The question is: is it going to get worse or is this as bad as it gets?' she asked.

Dr Craik was speaking at the second annual review of the South East Australian Climate Initiative (SEACI), a three-year, AU$7 million program to explore how climate change is likely to affect the basin, which grows a third of Australia's high value food and accounts for 45 per cent of the value of all irrigated crop and pasture production.

Funded jointly by the Murray–Darling Basin Commission, Victoria's Department of Sustainability and Environment, Land and Water Australia and the Commonwealth Department of Climate Change, SEACI is a collaborative project involving meteorologists, climatologists, climate modellers and hydrologists from the Bureau of Meteorology and CSIRO.

The research includes identifying the key mechanisms shaping the climate of the Murray–Darling Basin – including, potentially, the enhanced greenhouse effect. The aim is to understand how such mechanisms interact to give rise to climate variability.

According to Centre for Australian Weather and Climate Research scientist Dr Ian Smith, there has been a significant shift in seasonal rainfall over the southern basin. As with the 1937–45 drought, autumns have been much drier, and winter rainfall is also down on the long-term average.

'Autumns were dry in the mid-century drought, but the reduction in autumn rainfall in the current drought is staggering,' Dr Smith said.

For Victoria, several good autumns punctuated the 1937–45 drought but Dr Smith said there had been no really wet autumns since 1989. The average autumn rainfall over the 18-year period 1991 to 2008 was about 28 per cent below the average for the previous 30 years.

The impact of reduced autumn rainfall is that it delays the saturation of soils in the high country catchments, in turn delaying and drastically reducing runoff from subsequent winter and spring precipitation.

Rainfall over much of the southern Murray–Darling Basin has declined by around 15 per cent in the past 30 years, and runoff is down by about 48 per cent. In an arc from the Grampians in south-western Victoria to south-east Queensland, most major dams have been at record or near-record low levels during the past decade.

The identified causes show imprints of climate change influences, in part through a reduction in the number of La Niña events, and in part through changing weather systems originating from the subtropical Indian Ocean that are conducive to late autumn rainfall across Victoria.

In the search for an explanation, SEACI researchers looked for correlations between autumn rainfall and the climate mechanisms whose interactions are known to influence climate across Australia.

They identified a persistent zone of high pressure – the Sub-Tropical Ridge (STR). The dry, descending air of the Subtropical Ridge impedes the penetration of rain-bearing systems, leading to a drier southern half of the Murray–Darling Basin.

The ridge's influence was evident during this year's La Niña event, which brought massive storms and flooding to Queensland and New South Wales as far south as Sydney, but had little impact on the parched Murray Valley or the headwater catchments of the Murray, Murrumbidgee and Goulburn rivers.

The relationship between runoff and rainfall has serious implications for future inflows into the system if the southern basin's climate continues warming at the present rate.

● **Graeme O'Neill and Craig Macaulay**

More information:
SEACI, www.mdbc.gov.au/subs/seaci