How has our Rainfall Changed? - The South West

This series outlines observed changes which have occurred in various aspects of Western Australian climate in recent decades.

Indian Ocean Climate Initiative
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Informed Adaptation

Summary

Winter rainfall in the south west of Western Australia was once considered the most consistent and reliable anywhere in Australia. However, around the mid 1970s there was a shift to consistently drier winter conditions, which have continued to this day. This change occurred simultaneously with a change in the global atmospheric circulation. It is likely that both natural variability and the enhanced greenhouse effect have played a role. There have been strong impacts on surface and ground water supplies, on natural ecosystems and agriculture. Simulations of future climate with enhanced greenhouse gases show a similar pattern of drier conditions for the south west. Continuing research by IOCI is further building our understanding of what caused the rainfall changes and what we may expect in the future. Further details: 'Climate variability and change in south west Western Australia', IOCI 2002.
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Seasonal Rainfall

The annual rainfall in the south west of Western Australia has declined by about 10% since the mid 1970s. Rainfall in the south west is strongly dominated by winter rainfall. Figure 1 shows the mean monthly rainfall averaged over the region southwest of the diagonal line in Figure 4. The monthly totals for the early period (1925-1975) are shown in dark blue while the later period (1976-2003) is shown in light blue. The annual rainfall decline in the later period was due mostly to a decrease in autumn and early winter. There has been little change in rainfall totals in late winter and spring, with a slight increase in summer.

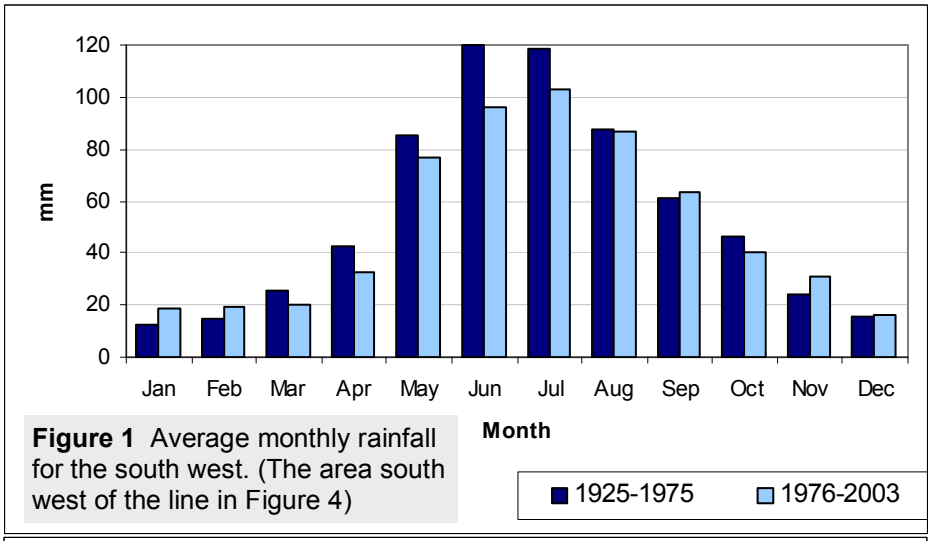

Figure 1 Average monthly rainfall for the south west. (The area south west of the line in Figure 4)

An Abrupt Change

The decline in early winter rainfall is evident when the total May to July rainfall is plotted for each year since 1925 (Figure 2). The linear rainfall trend from 1925 to 2003 was downward and statistically significant at the 99% level. However the decline was more of a sharp drop than a gradual decline, as illustrated by the dark blue lines of average rainfall in Figure 2. The mean May – July rainfall for 1925-1975 was 323 mm, while for 1976-2003 it was 276 mm - a 15% drop. In the 28 years since 1976 there has been a notable absence of wet years with only eight years when the May – July rainfall was greater than the 1925-1975 mean. This is a significant factor in the strong impact on the water sector.

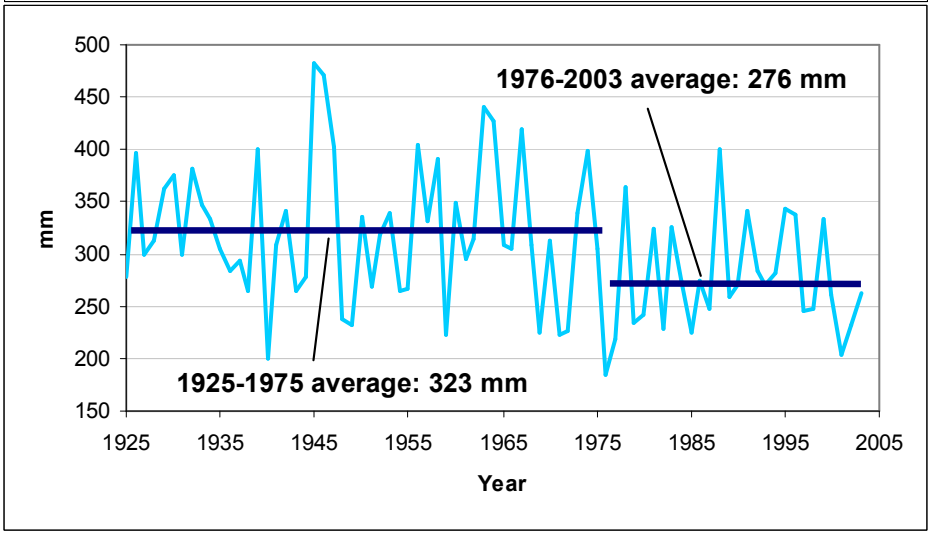

Figure 2 May - July rainfall totals averaged over the south west

Changes Across the Region

The total rainfall for May – July is shown by isohyets (lines of equal rainfall amount) in Figure 3. The south west coast receives the largest amount of rainfall, while it is drier inland and to the north. The westward shift in the isohyets in the later period is striking.

Figure 4 shows the percentage change in May - July rainfall from the earlier to later periods across the region. Areas in red indicate a decline in rainfall since 1975, while areas in blue indicate an increase in rainfall. The percentage change is less meaningful in regions where the total rainfall is low.

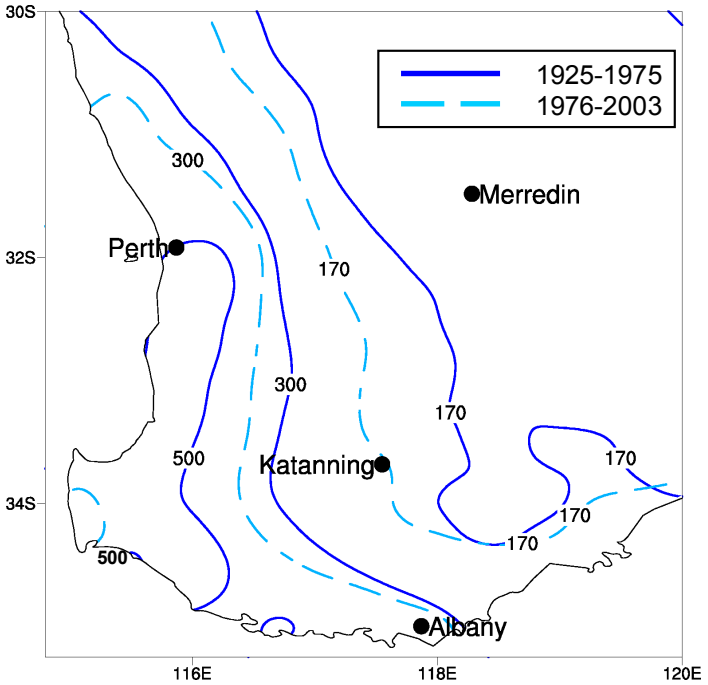

Figure 3 Isohyets of May-July rainfall totals in mm

Isohyets are lines of equal rainfall amount

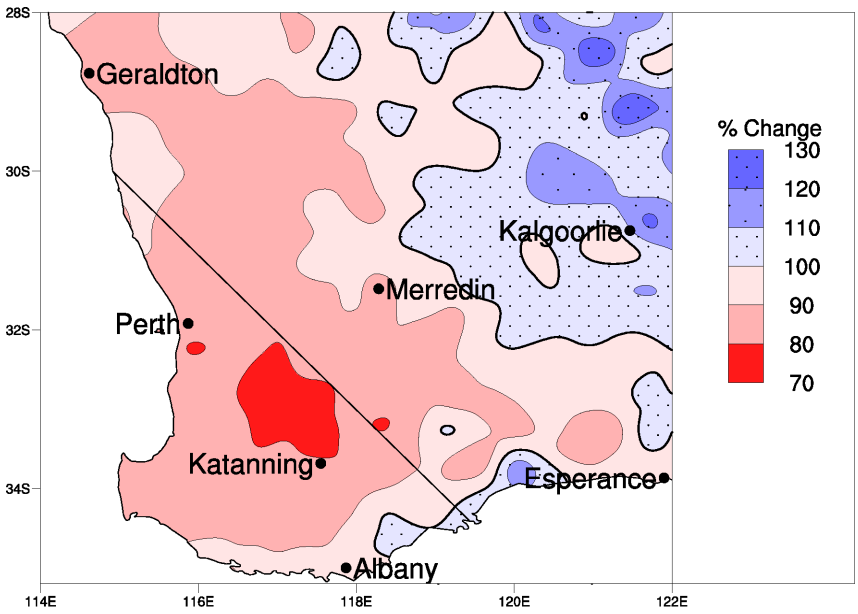

Figure 4 Average May-July rainfall for the period 1976-2003 as a percentage of the May-July rainfall for the 1925-1975 period. Red indicates a decline in rainfall in the later period, blue an increase. The area to the south west of the diagonal line is averaged to produce the values in Figures 1 and 2

What Caused the Changes?

The sharp drop in rainfall occurred at the same time as a global change in the atmospheric circulation. Both natural variability and the enhanced greenhouse effect ("global warming") are thought to have played a role in these broad scale changes.

Local factors such as land-use change may also have played a role in the rainfall decline, but this is likely to be secondary compared with the larger scale atmospheric changes.

What are the Implications?

South west Western Australia is reliant on good winter rains. The rainfall drop has led to a stream flow reduction of about 40%, a large decrease relative to the rainfall decline. This disparity is due to the lack of surplus water from very wet years. The resulting decrease in surface and ground water availability has severely reduced regional water resources and is forcing major enhancement of water systems. Some ecosystems such as wetlands and woodlands are under pressure. Agriculture has also been impacted, as it is dependent on autumn rainfall for crop and pasture establishment.

What Can We Say About the Future?

Projections for the future, with increasing greenhouse gas concentrations, suggest that a decline in rainfall may occur over the south west. The observed decline was most likely linked to both enhanced greenhouse gases and natural variability. Further research by IOCI is building our understanding of the drivers that led to the major circulation shift in the 1970s and how these drivers will change in the future.