# Water Research Centre

THE UNIVERSITY OF ADELAIDE AUSTRALIA

# Water Wednesday

*Sustaining the River Murray with less water*

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# Declining Streamflow – the Future for the Murray-Darling Basin?

Bill Young
Director, Basin Plan Modelling
Murray-Darling Basin Authority

15 July 2009, Water Research Centre, University of Adelaide

# Overview

- The current drought in the historical context
- Climate change projections
  - Rainfall and runoff
  - Water availability
  - Use under current water sharing arrangements
  - Impacts on end of system flows

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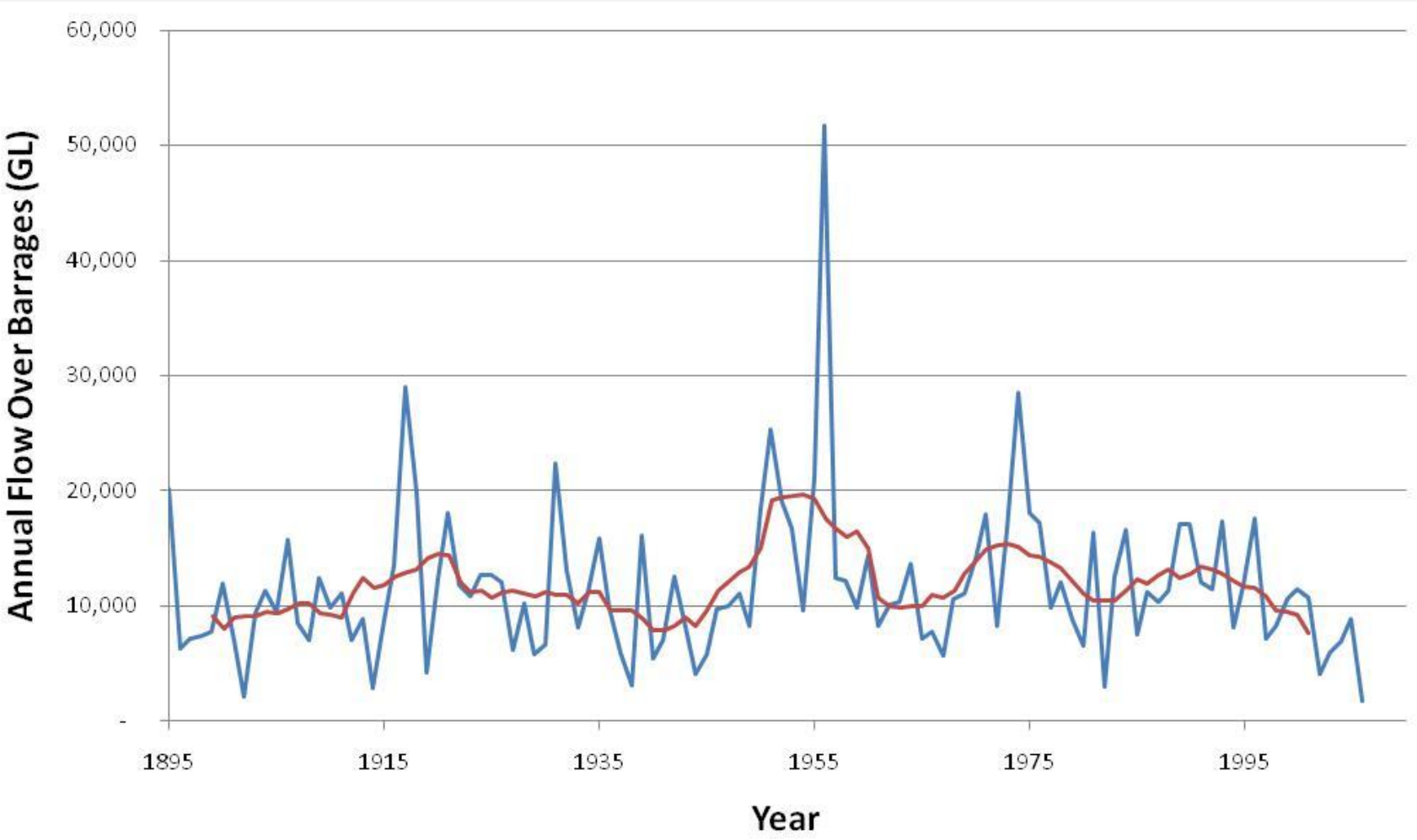
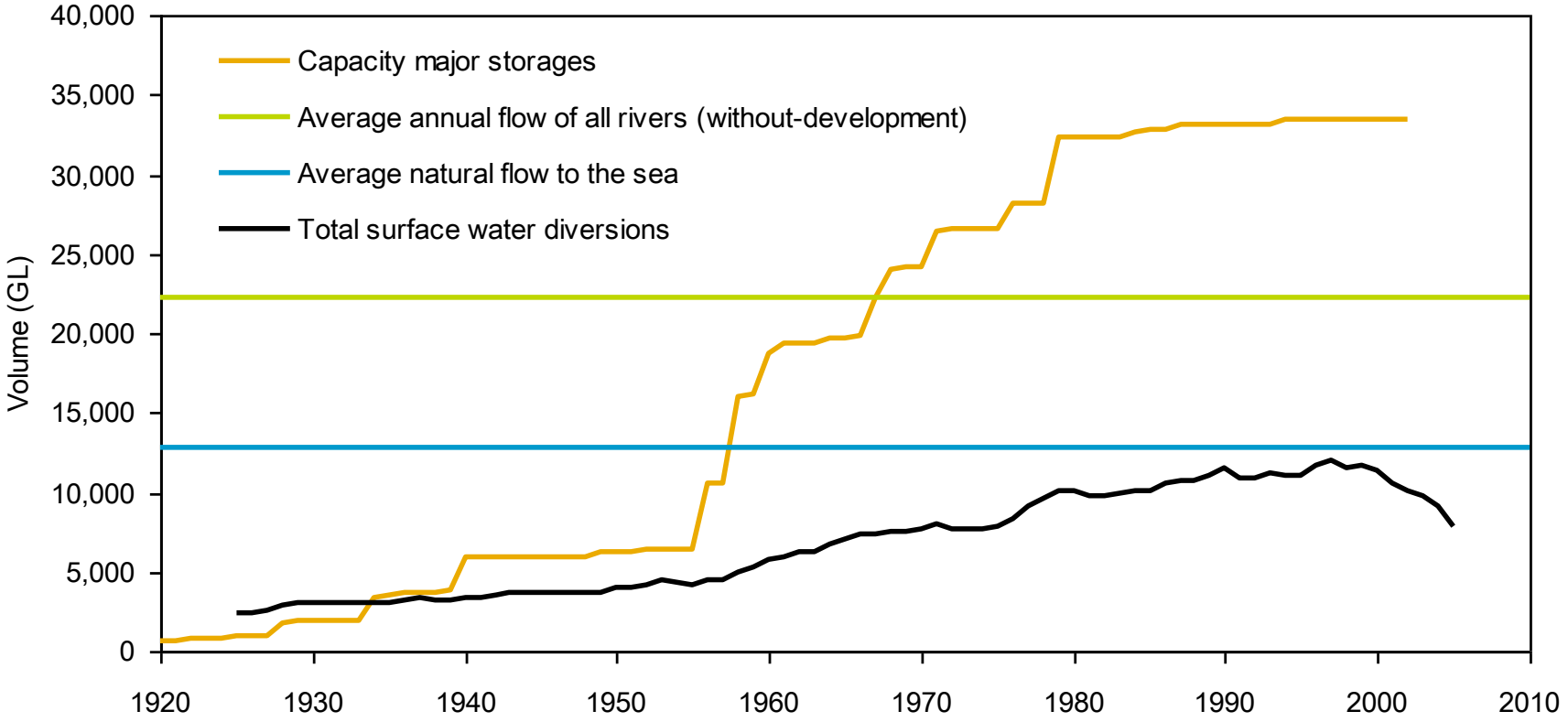
# Natural flow to the sea



# Growth in storage capacity & diversions

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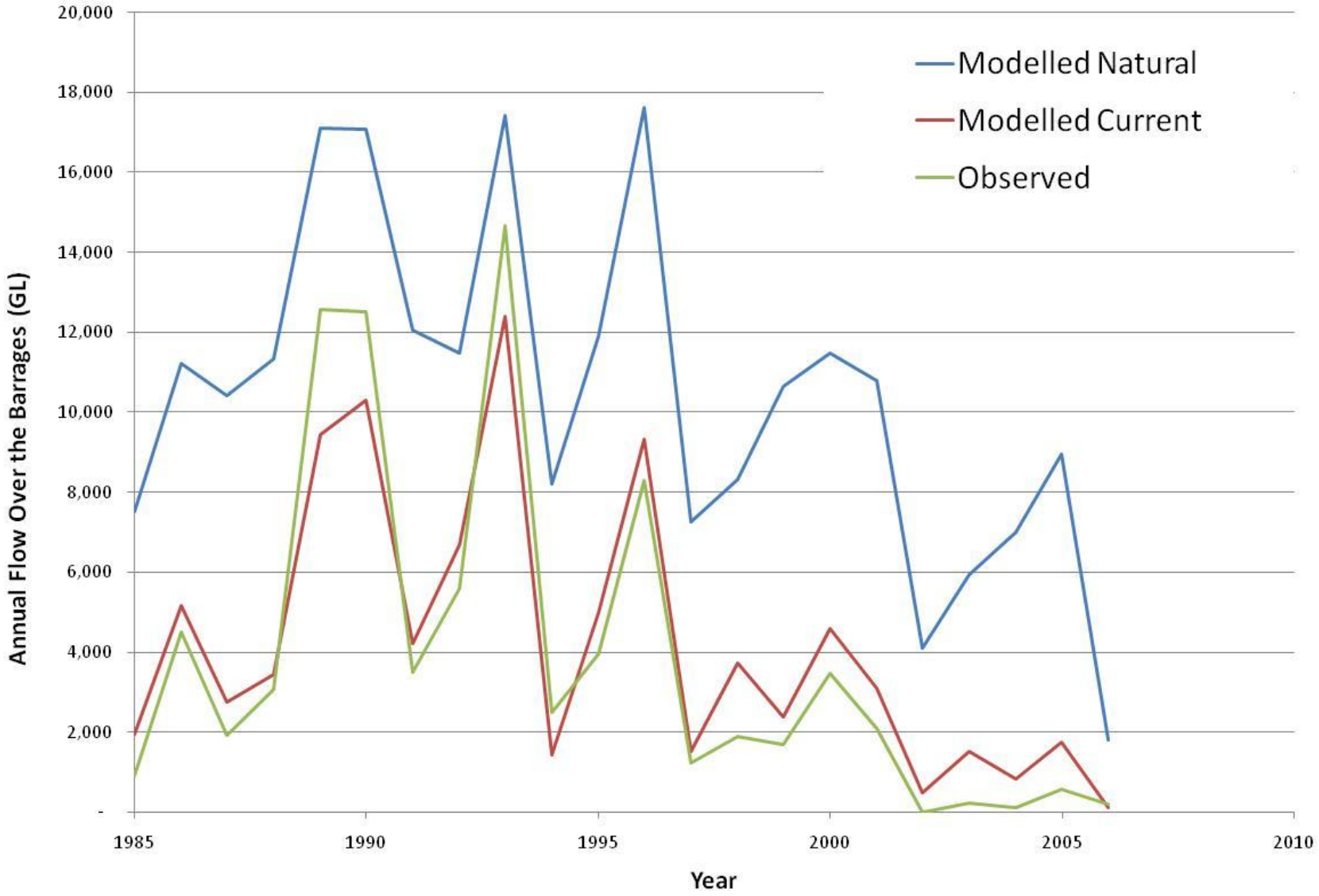
# Flows over the barrages



# Reduction in Barrage flows

- Natural flows at barrages
  - 1895 – 2006 12,200 GL/yr
  - 1987 – 2006, 86% of long-term average 10,550 GL/yr
  - 2002 – 2006, 46% of long-term average 5,570 GL/yr

- With current development/sharing
  - 56% reduction over 1895 – 2006 (111 years) 5,090 GL/yr
  - 62% reduction over 1987 – 2006 (20 years) 4,000 GL/y
  - 96% reduction over 2002 – 2006 (5 years) 220 GL/yr

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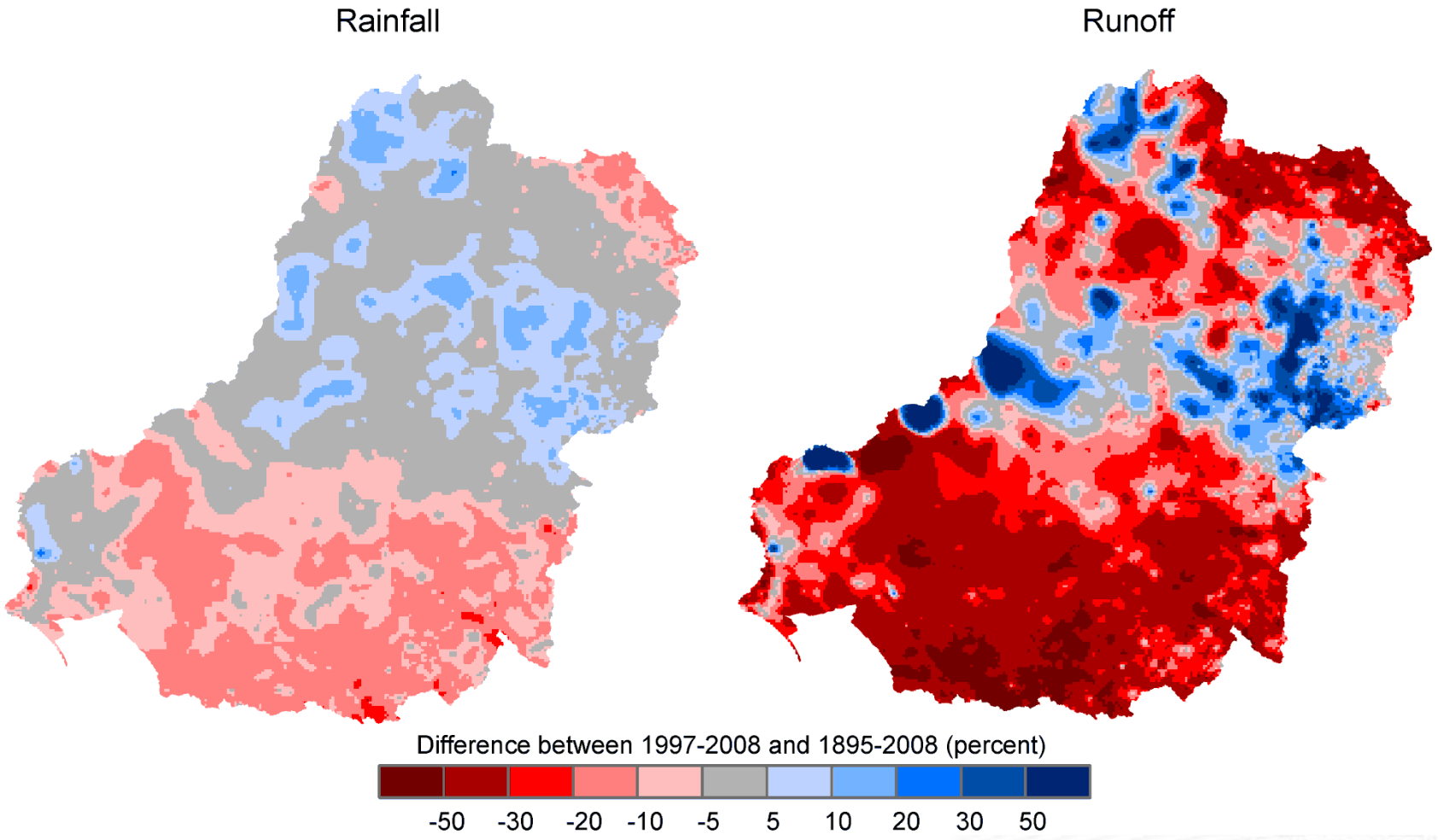
# Percent difference in rainfall and runoff

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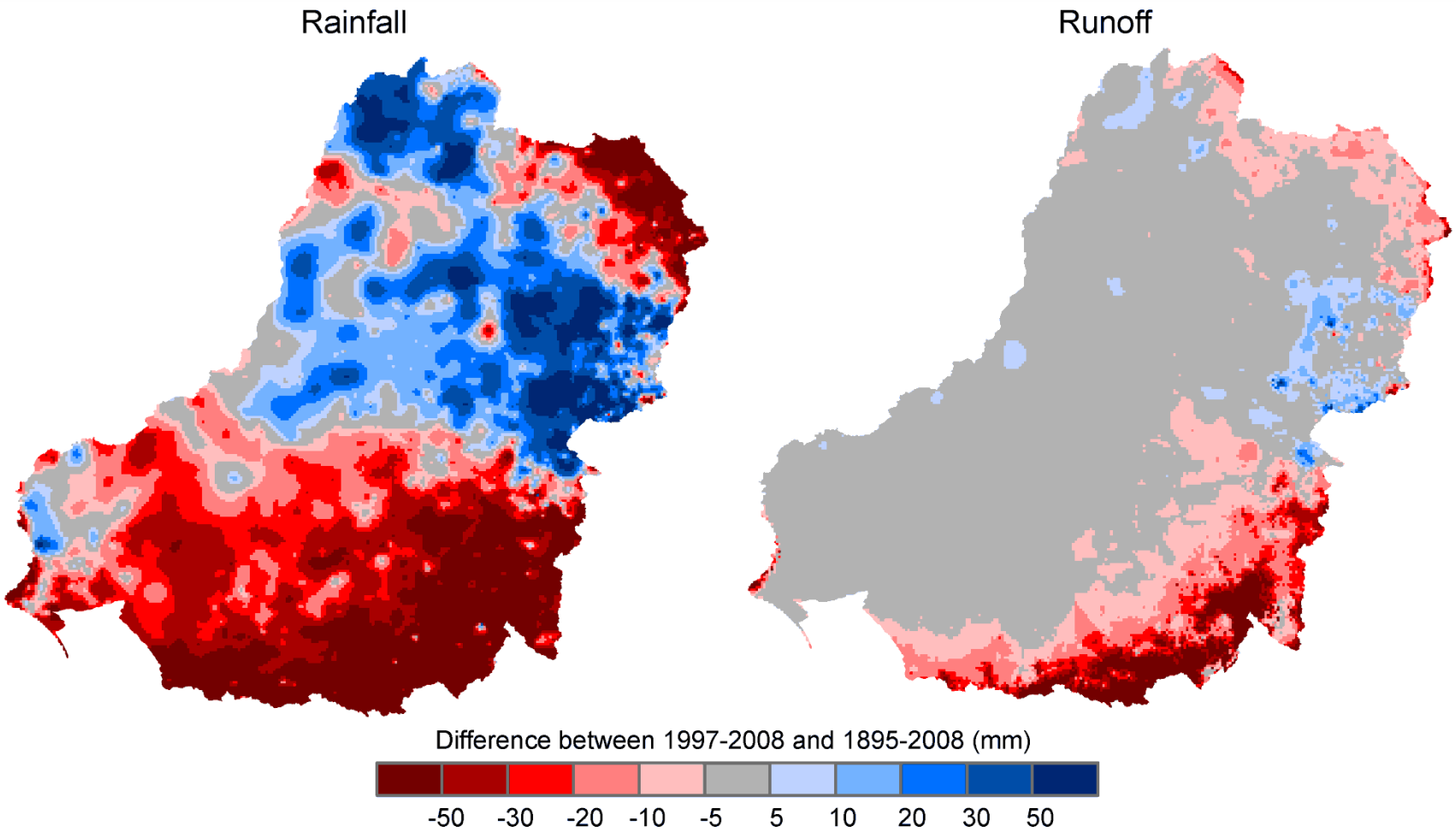
# Change (mm) in rainfall and runoff

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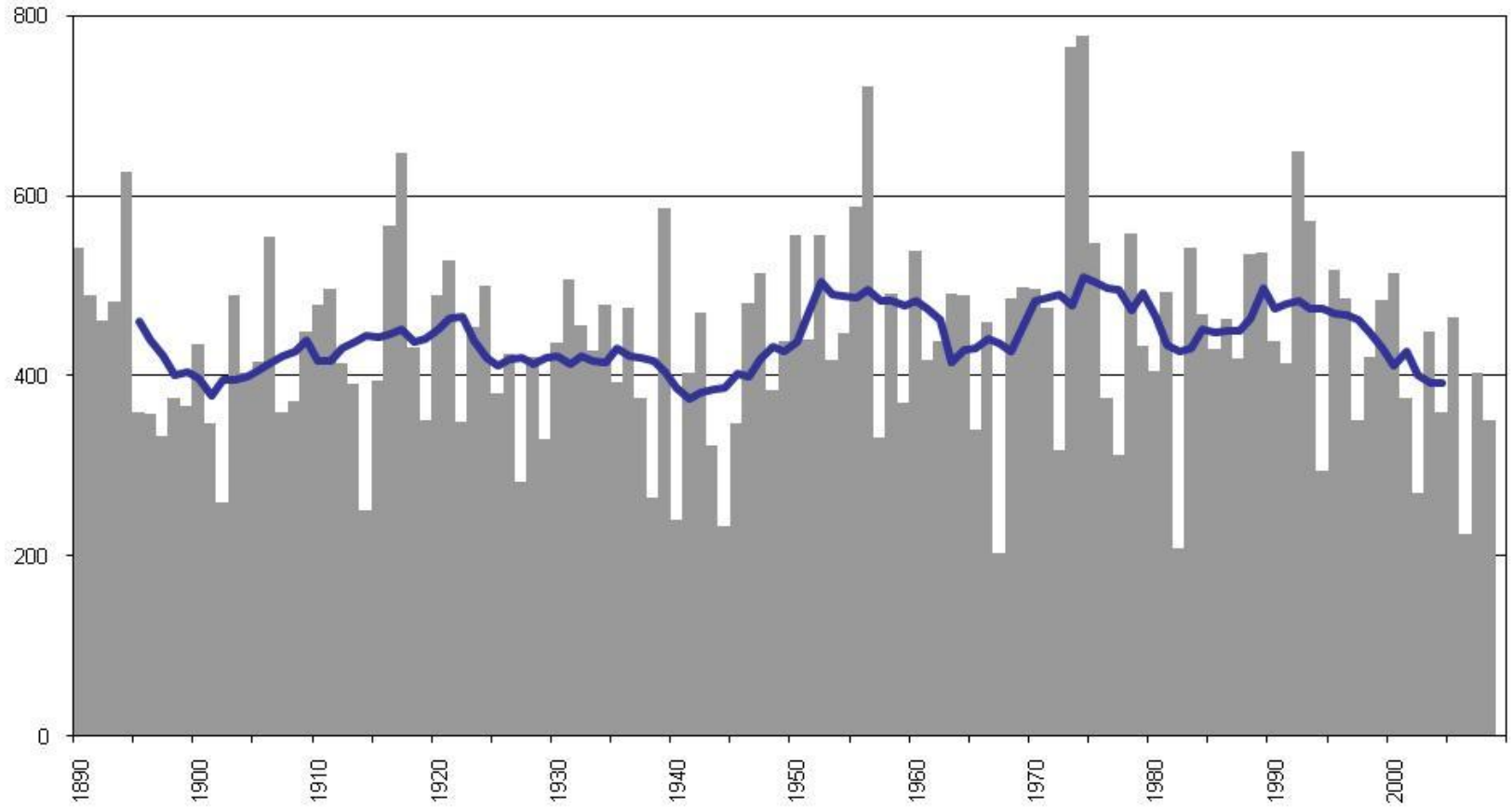
# Southern MDB Rainfall

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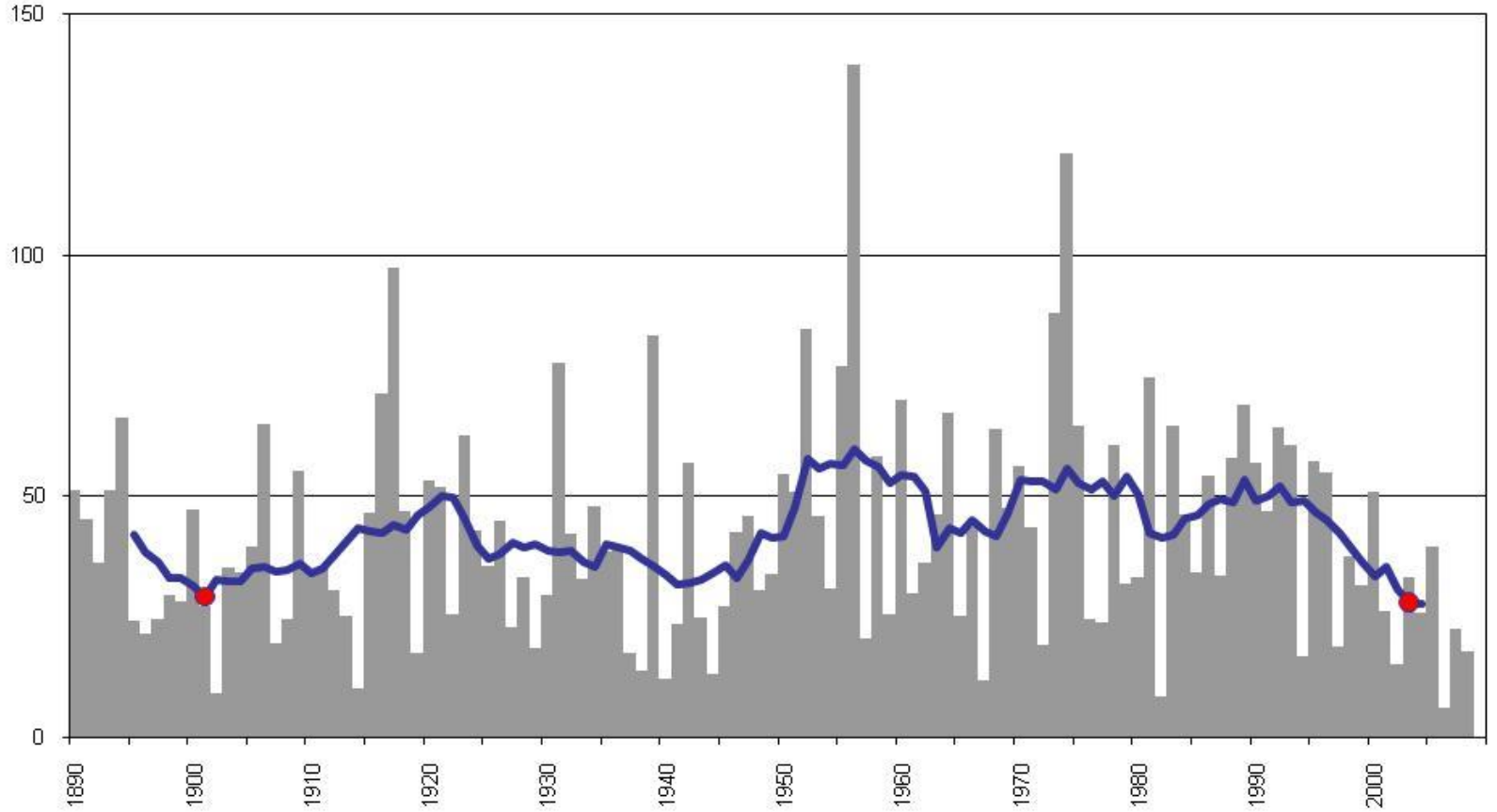
# Southern MDB Runoff

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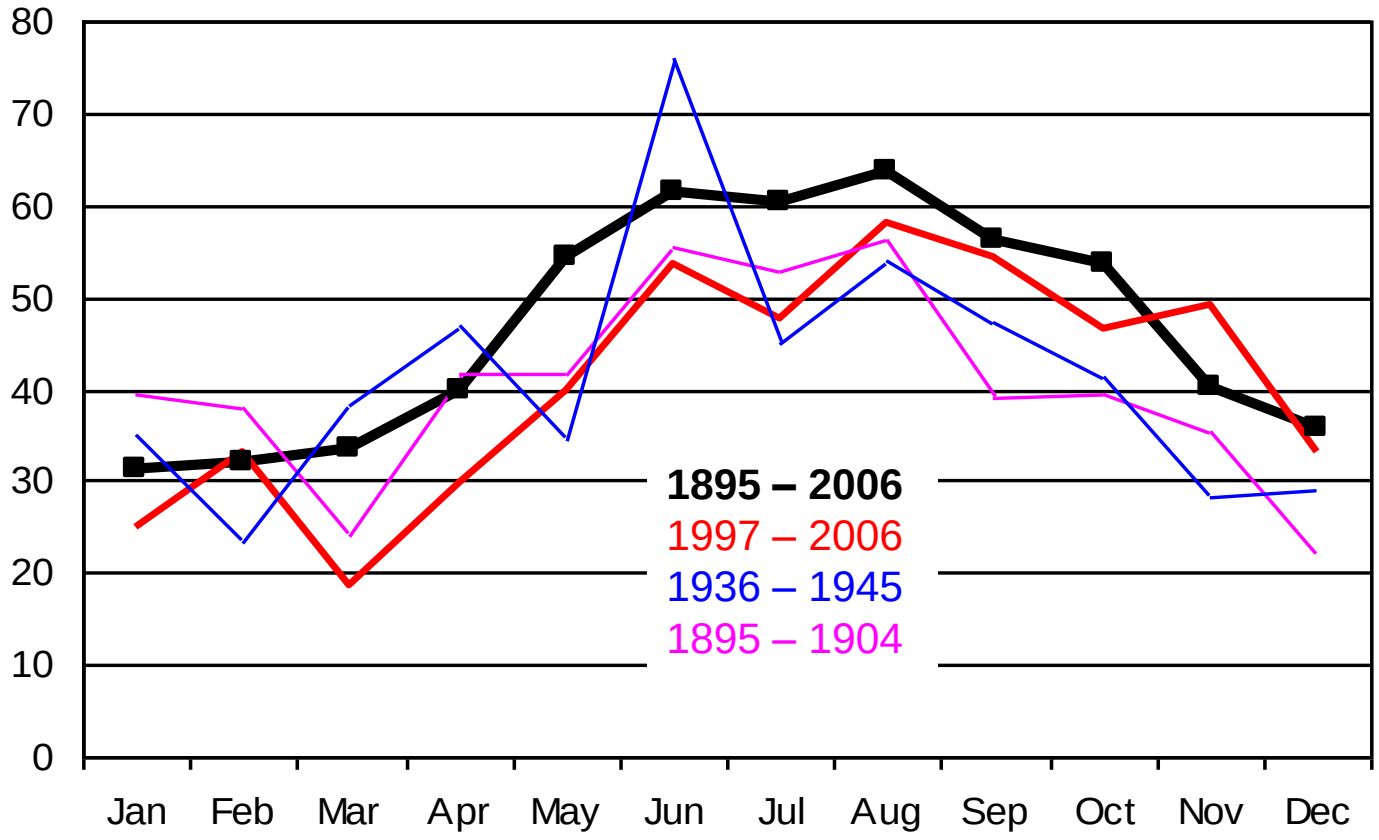
# Is this just drought or is it global warming?

- Decline in Autumn rainfall
  - Probably linked to intensification of sub-tropical ridge
  - Decrease in frequency of La Nina events
  - Both consistent with global warming predictions
- Other changes observed in climate system which are consistent with global warming predictions
  - More extreme and earlier than expected
- However, similar changes are known to occur as a part of decadal scale climate variability

# Recent climate: reduced autumn rainfall

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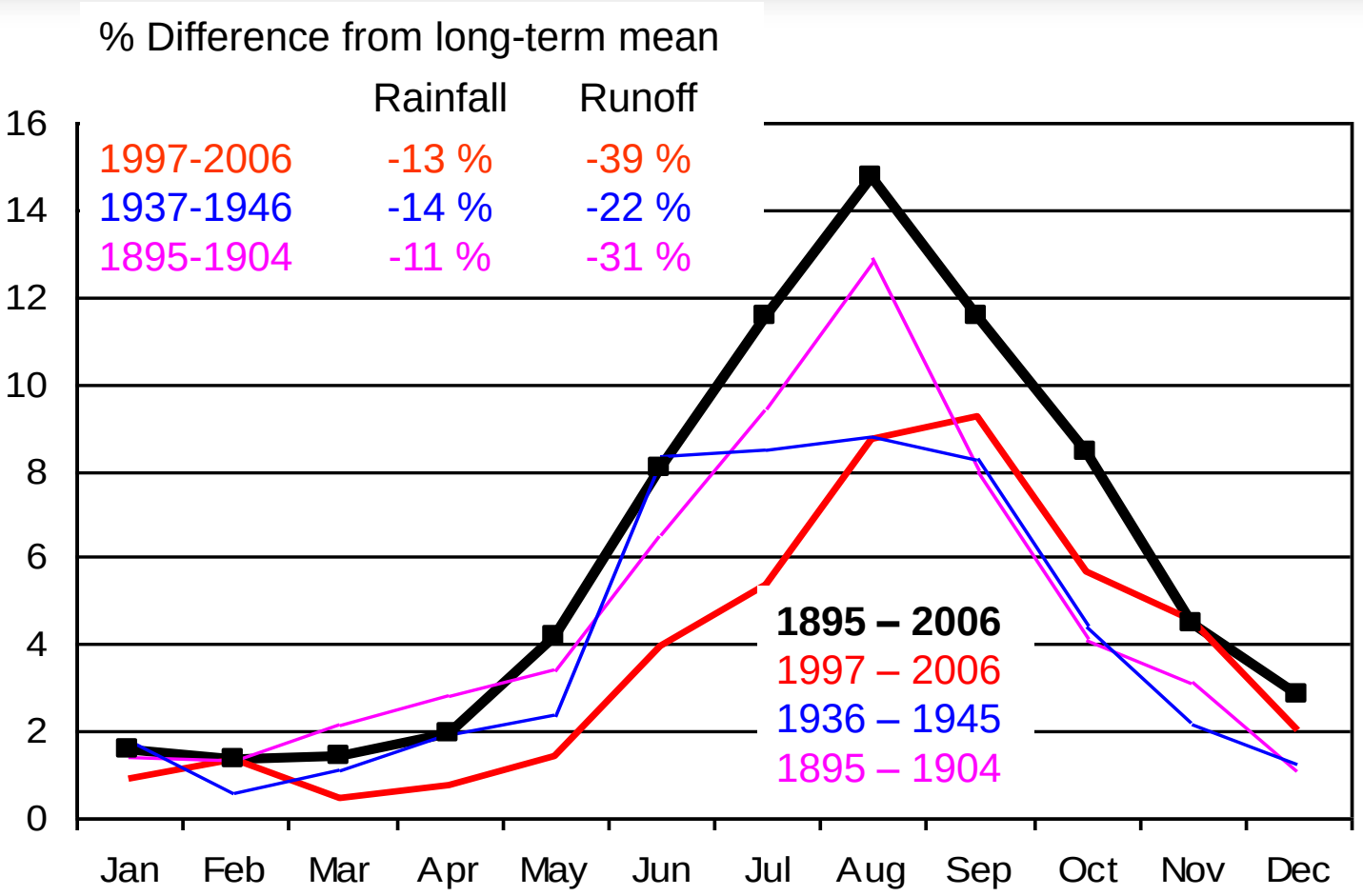
# Recent climate: reduced autumn runoff

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# Best conclusion…

*"It is likely that climate change is contributing to the current drought both through increased temperatures and a shift in rainfall drivers towards a phase associated with lower rainfall in the southern MDB"*

Accurate quantification of this contribution remains a difficult and ongoing research issue…

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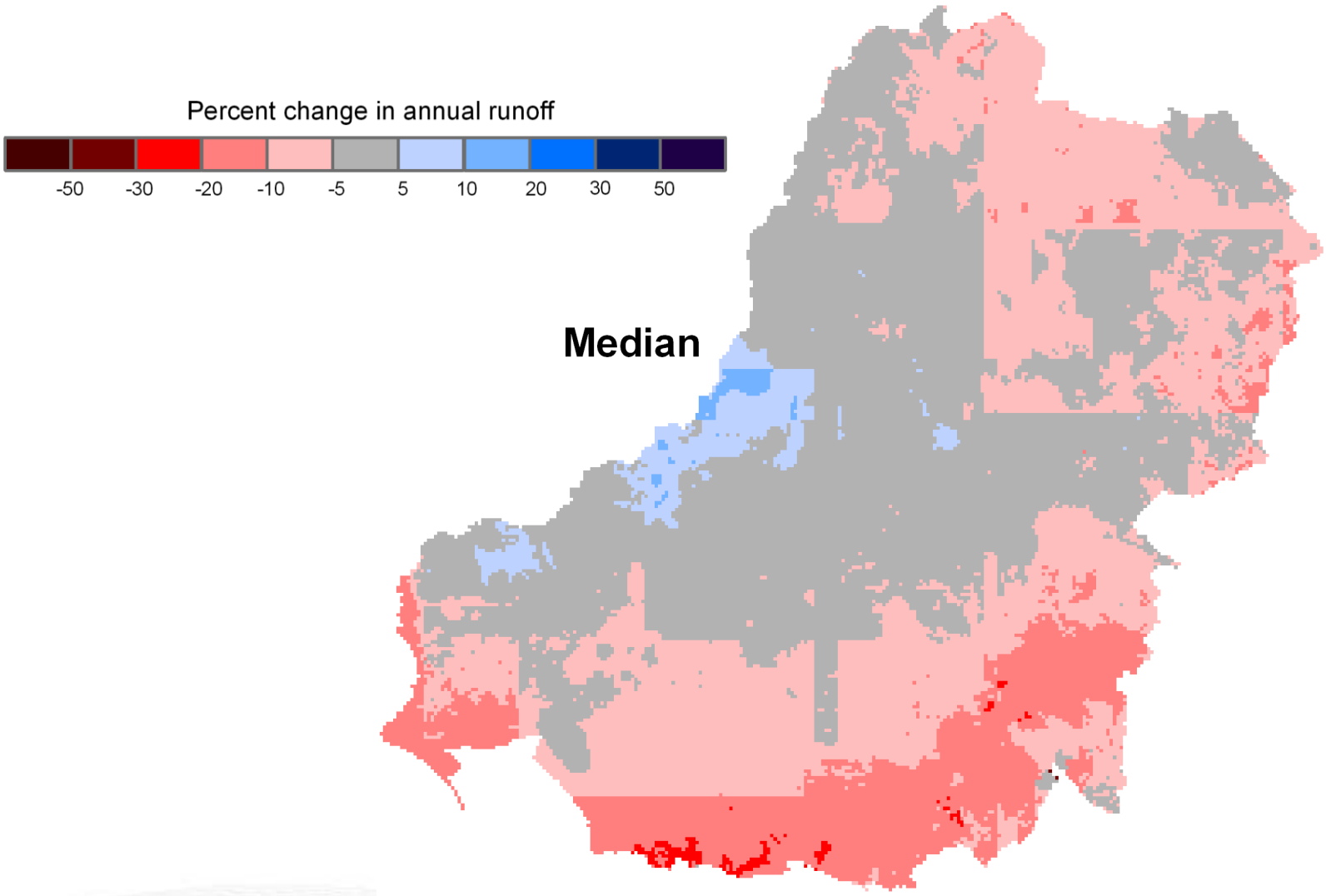
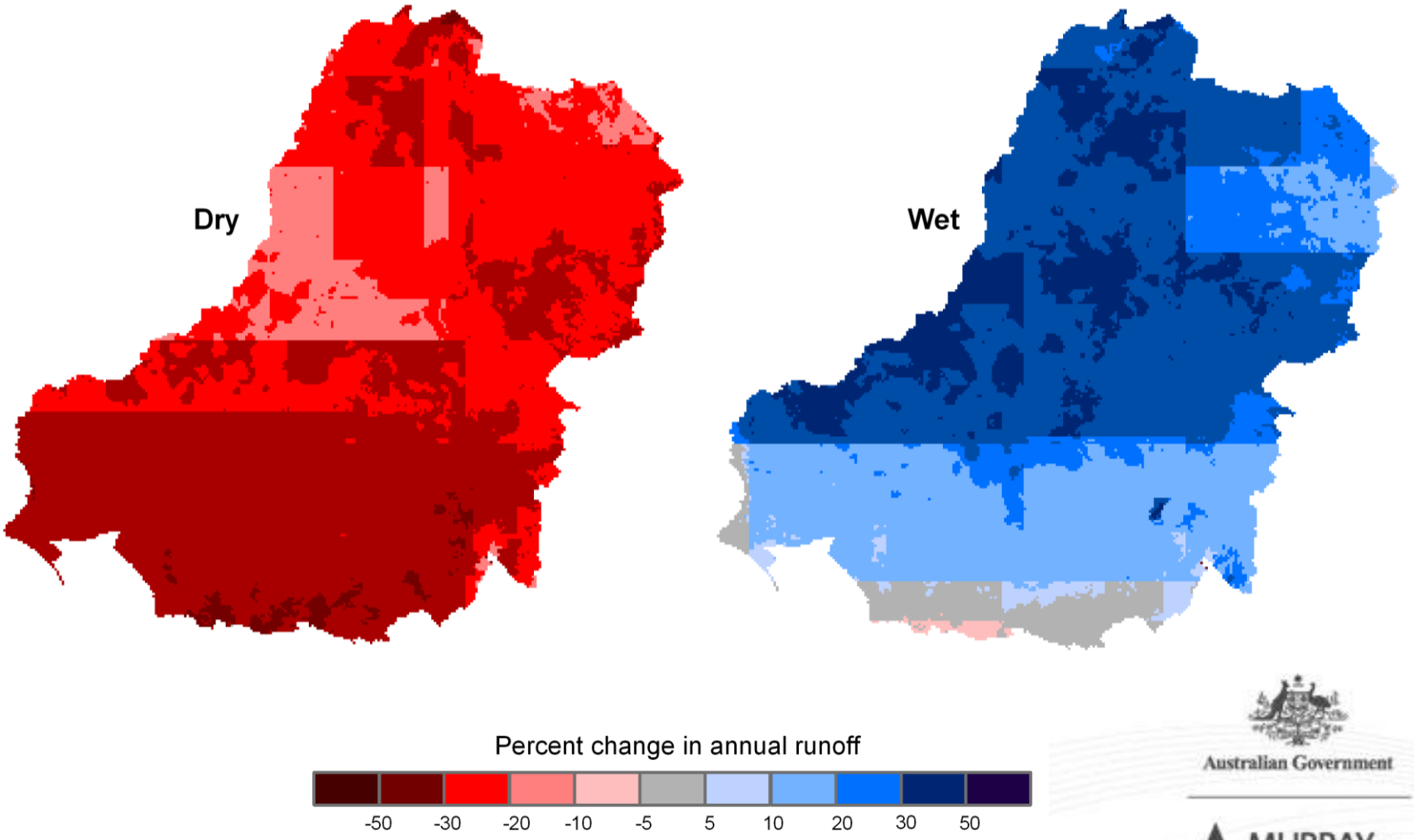
# Percent changes in runoff by 2030



# Percent changes in runoff by 2030

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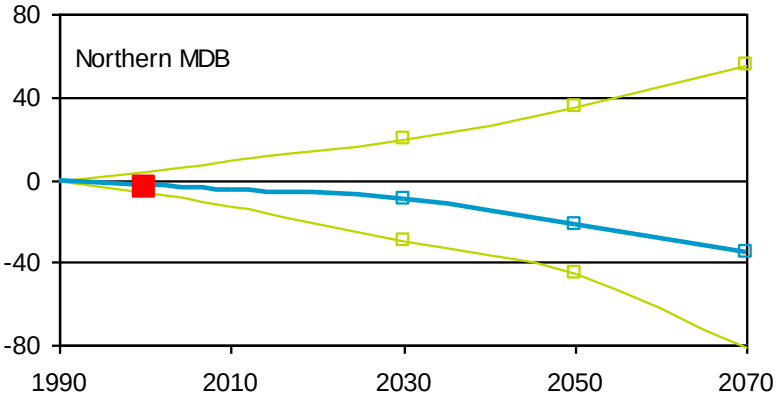
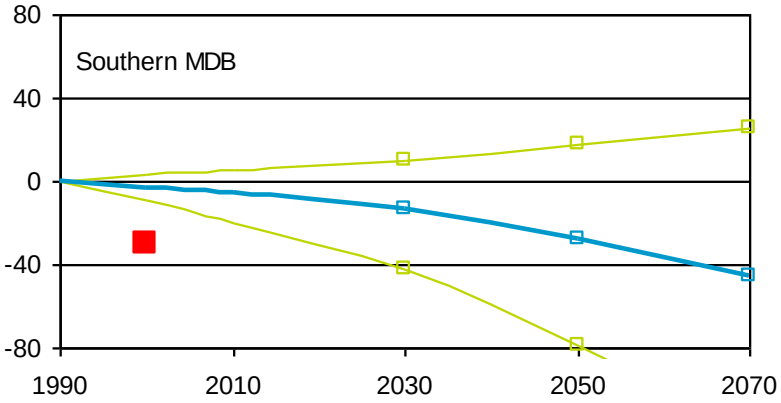
# Climate change projections for MDB

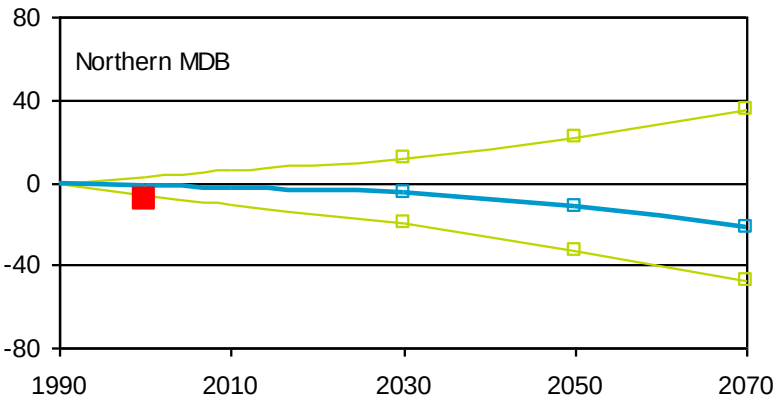
## High global warming

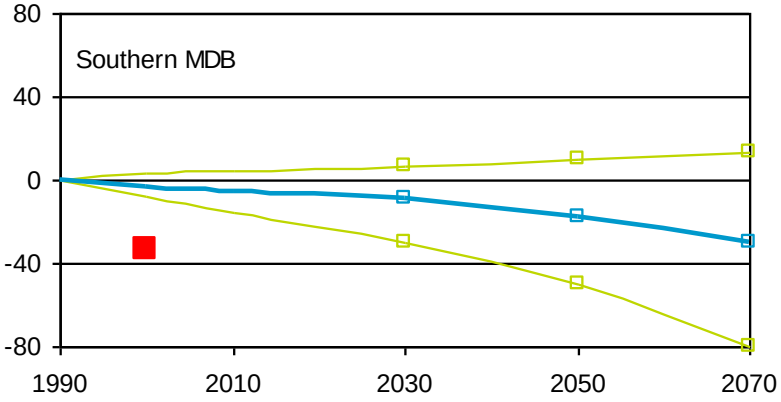



Runoff change (%)

## Medium global warming

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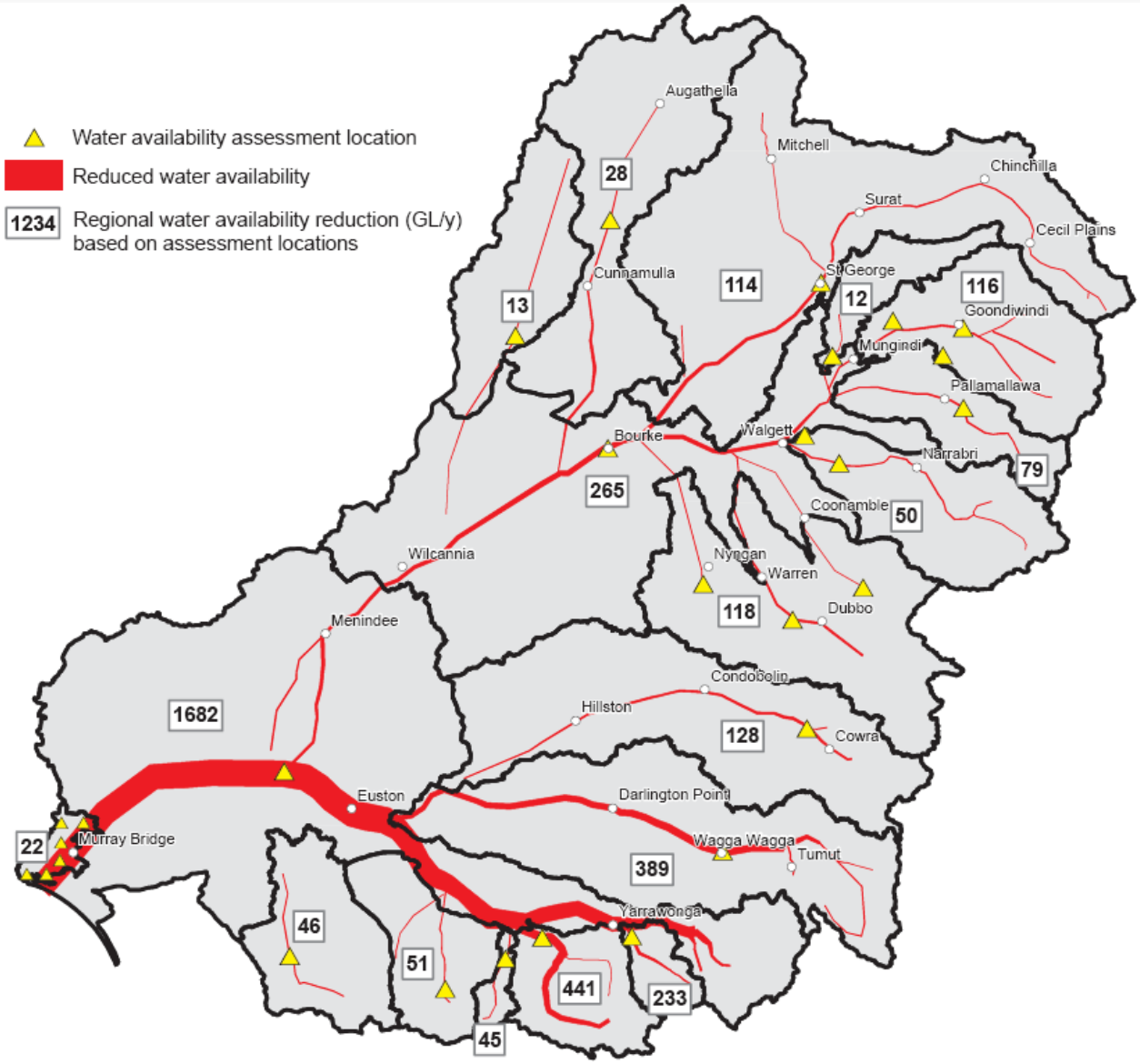
# Median 2030 streamflow reductions

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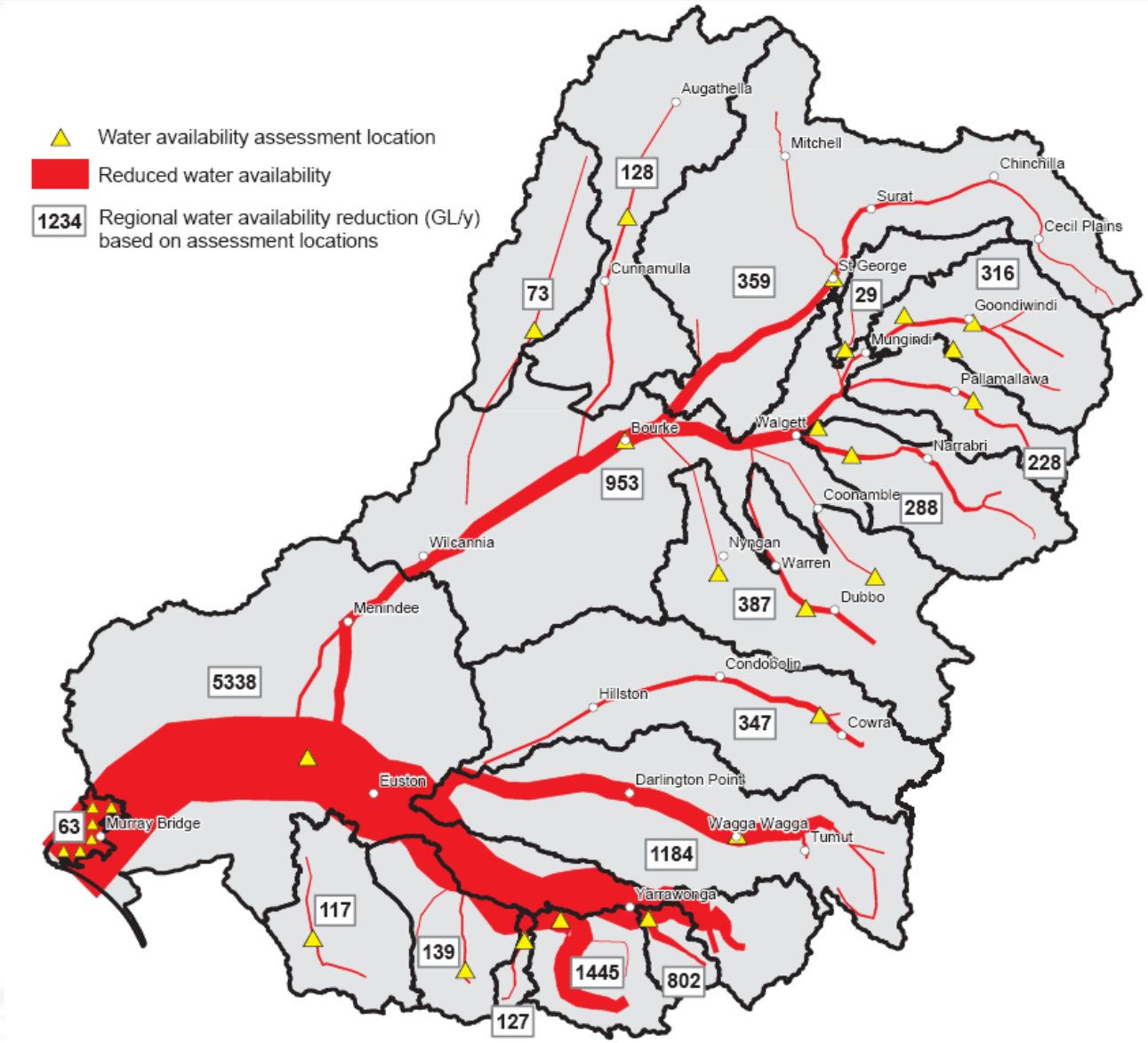
# Dry extreme 2030 streamflow reductions

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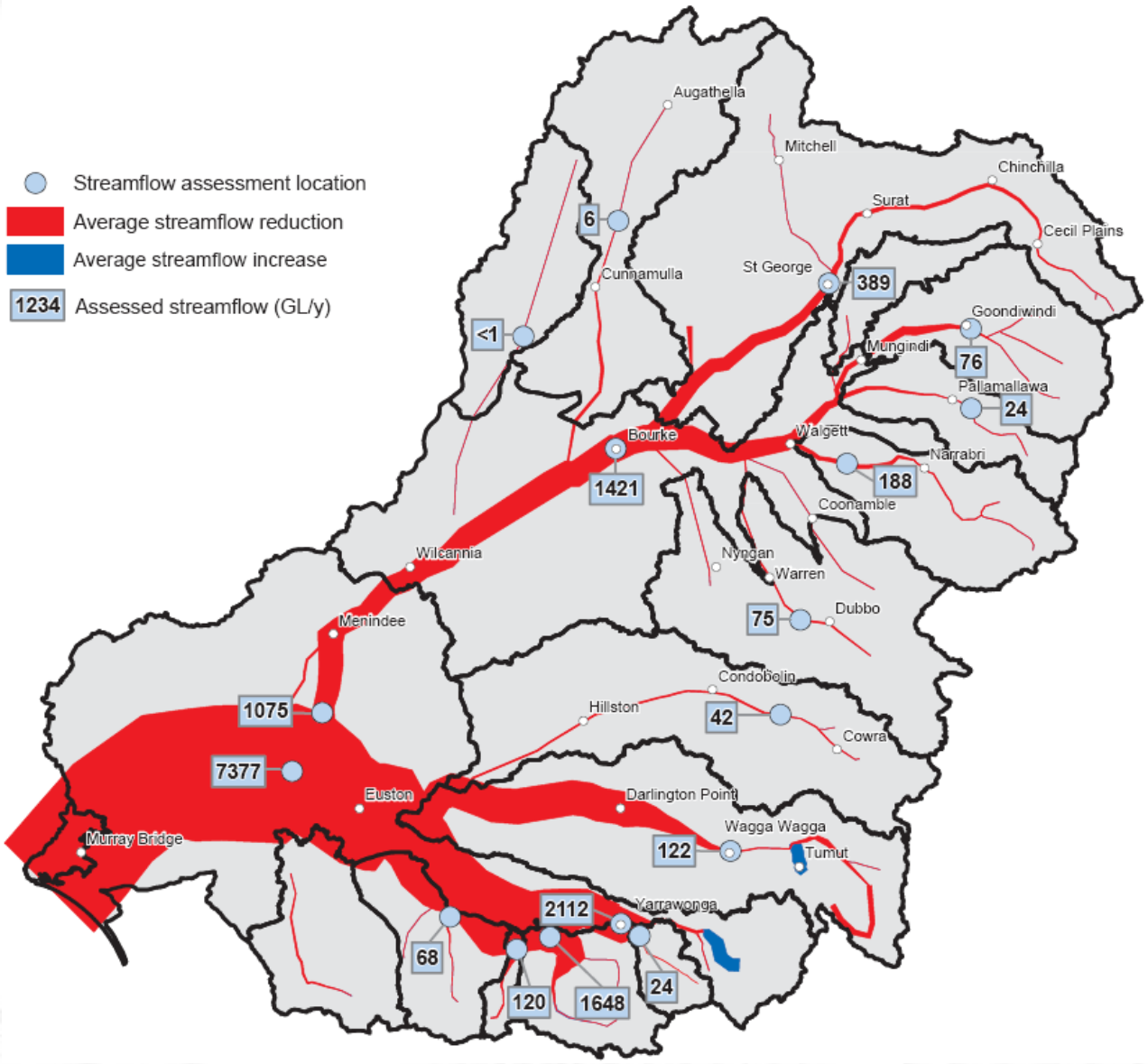
# Streamflow reduction due to diversions

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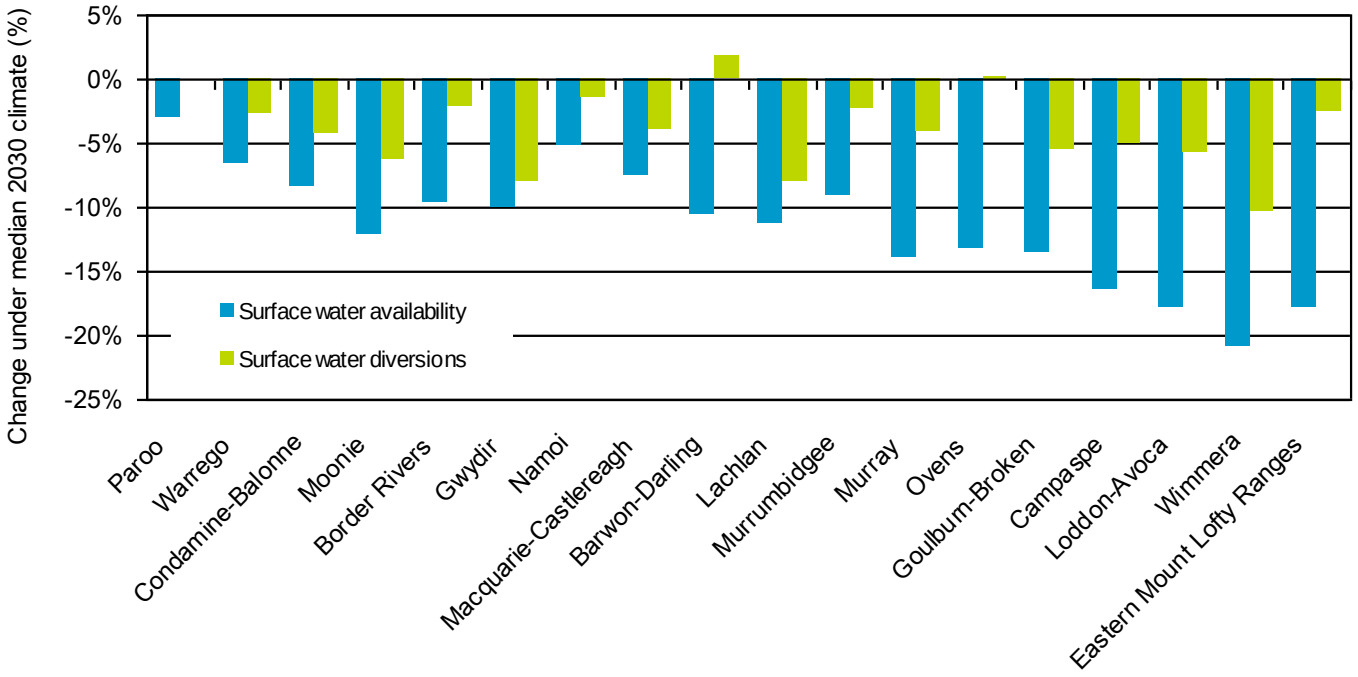
# Impact of climate by region

- MDB: median impact is an 11% reduction in available water
  - ranges from 2% to 21% reduction across regions
  - ~2500 GL/year across MDB on average
- Consequence under current water sharing arrangements is a 4% reduction in surface water diversions
  - ranges from 1% increase to 11 percent decrease across regions
  - ~450 GL/yr across MDB on average

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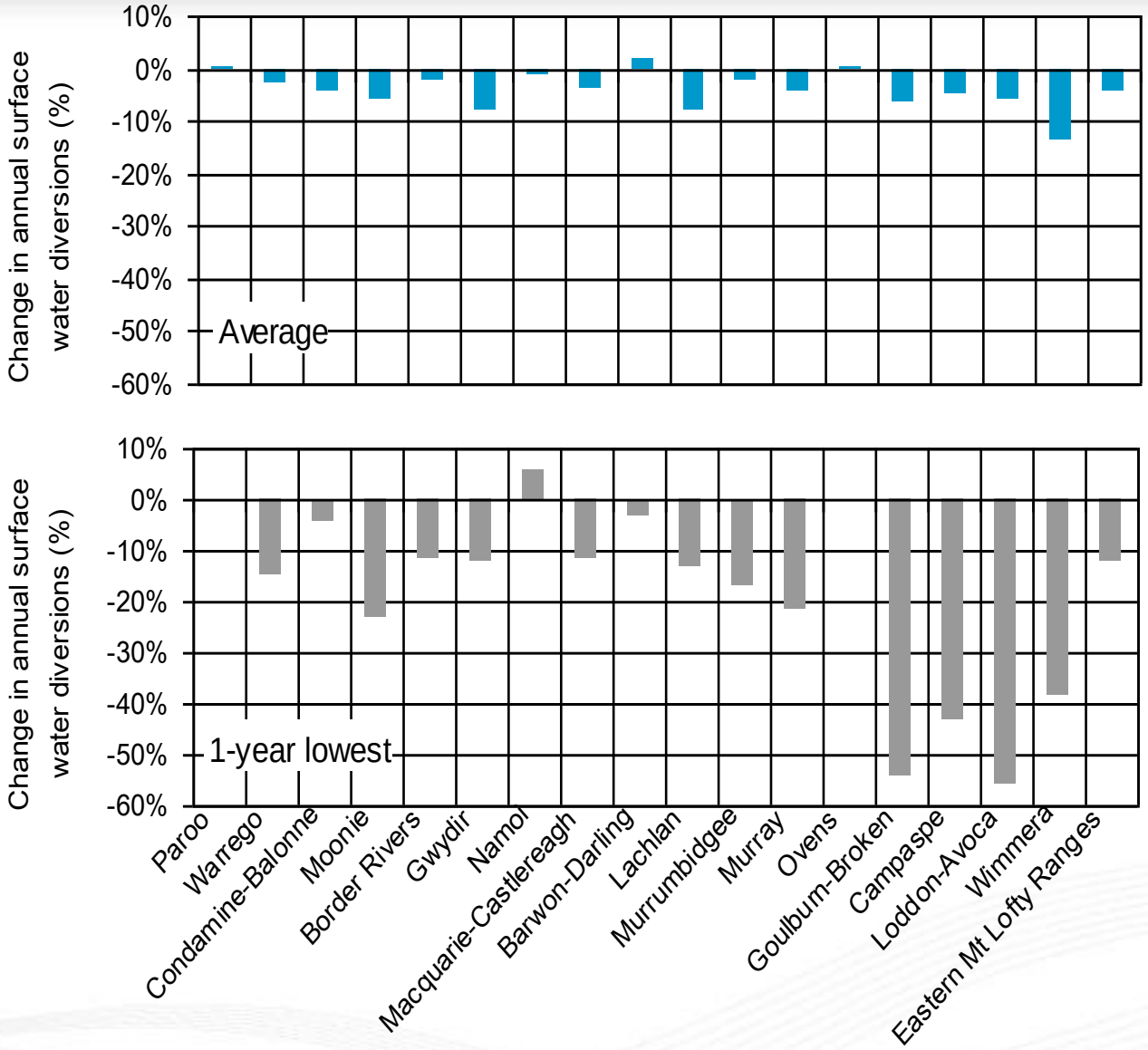
# Change in diversions in dry years

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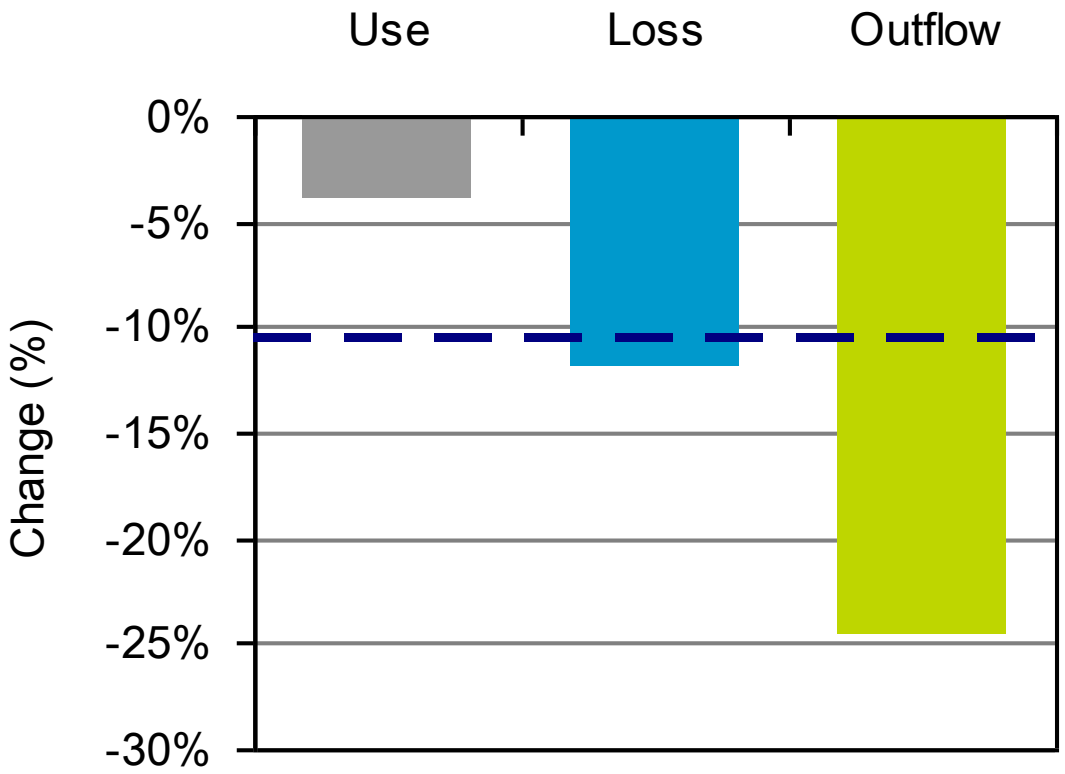
# Impact sharing – median 2030 climate

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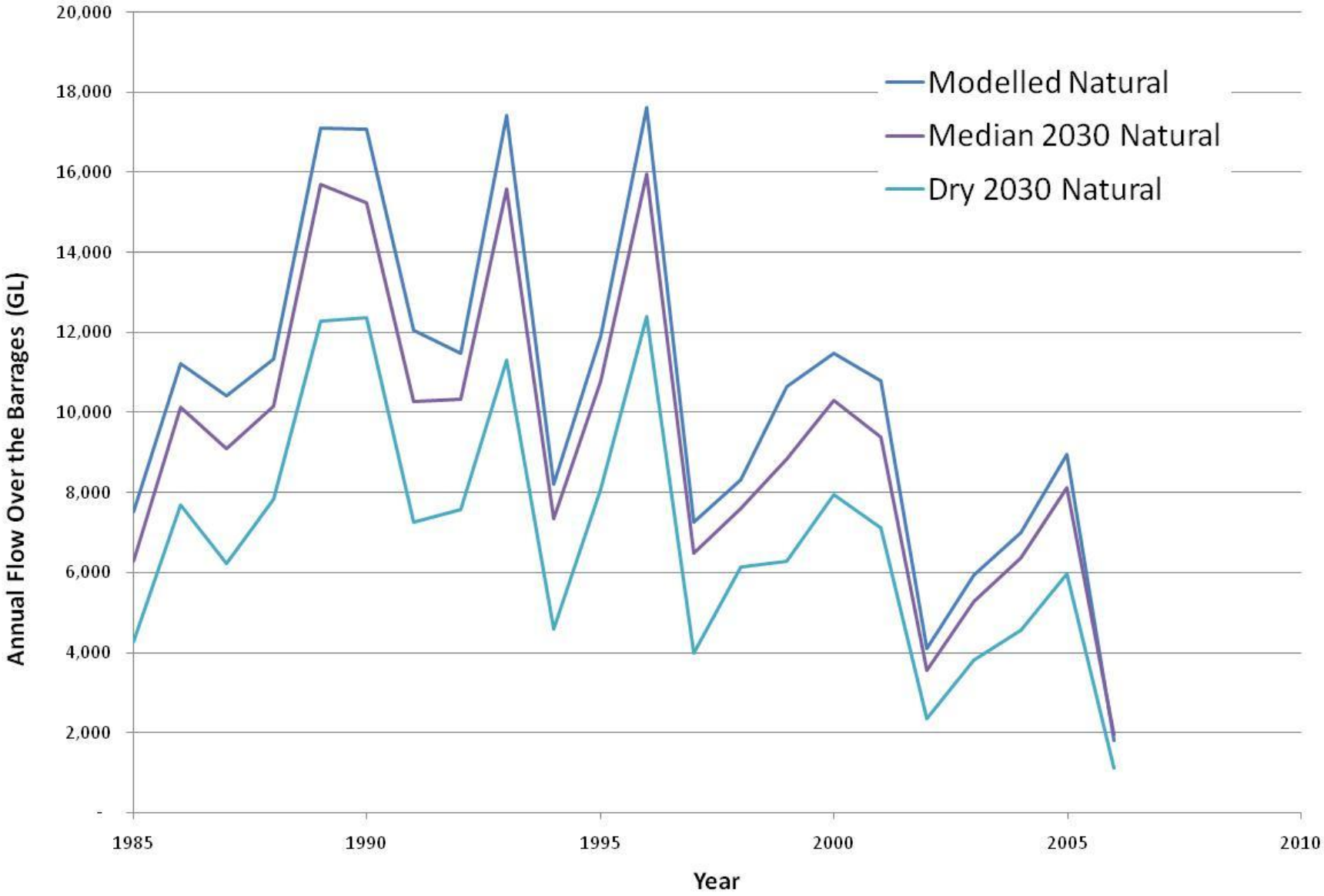
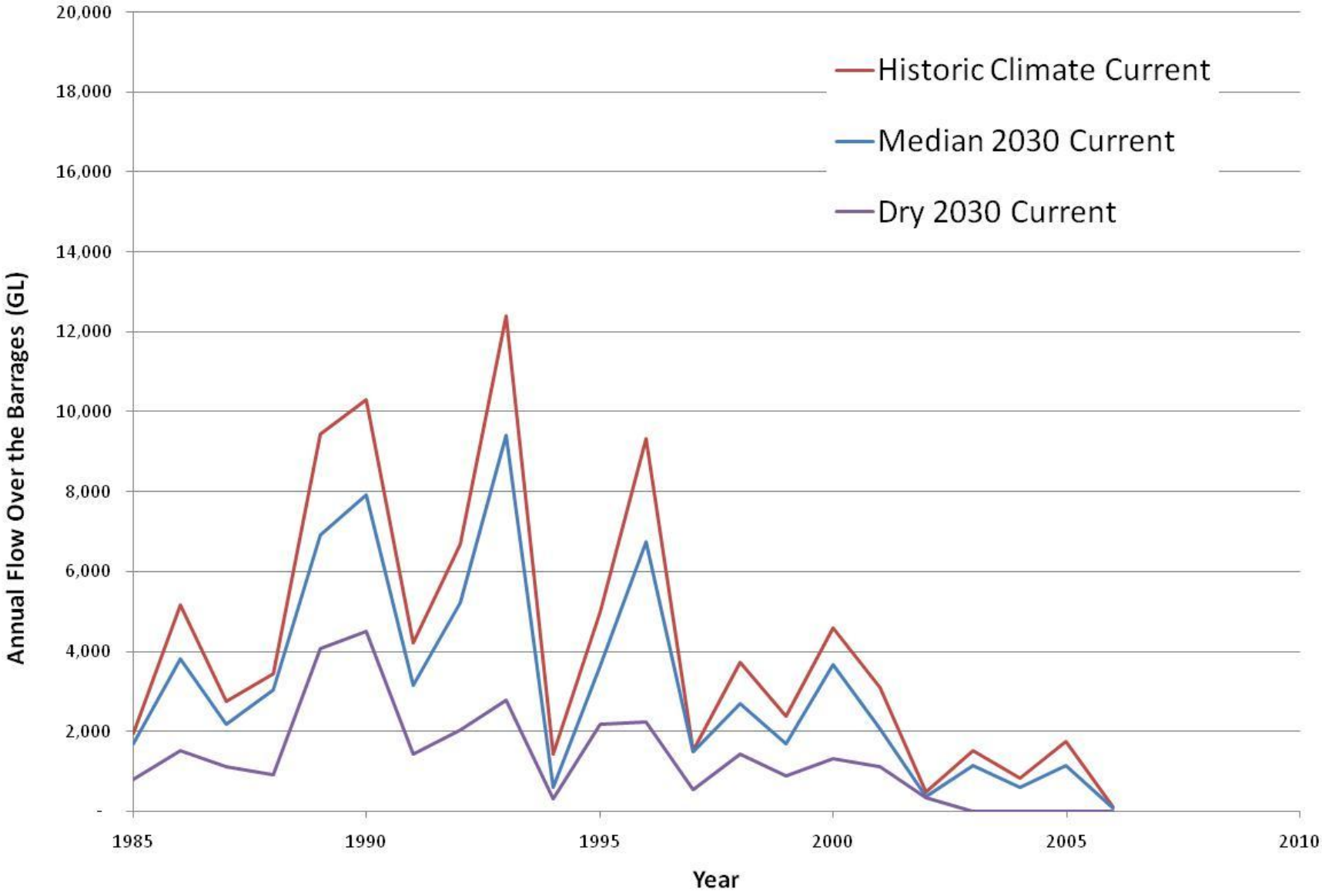
# Flow over the barrages – no diversions



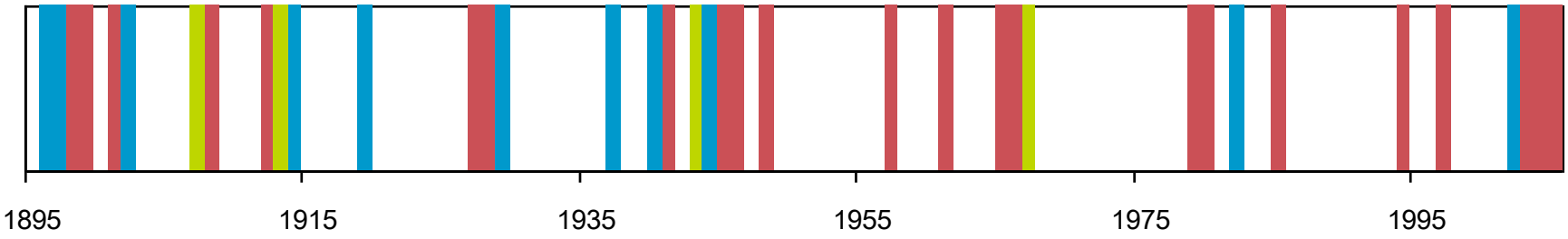
# Flow over the barrages – current sharing



# End of Basin flows

- Total flow at the Murray mouth reduced by 61 percent
- Flow ceases 40 percent of the time compared to 1 percent of the time in the absence of consumptive use

- Severe drought inflows to Lower Lakes (<1500 GL/year)
  - Never under without-development conditions
  - 9 percent of years at current development with historical climate
  - 13 percent of years under median 2030 climate
  - 33 percent of years under dry extreme 2030 climate



# Conclusions

- We are in a severe drought which can be partly attributed to climate change
- The recent period very low flows over the barrages is a result both of drought and surface water diversions
- Current water sharing arrangements would transfer a disproportionate fraction of the impact of anticipated climate change to the environment
- The new Basin Plan will set sustainable diversion limits on all water resources considering the range of possible future climate conditions

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# Acknowledgements


- CSIRO MDB Sustainable Yields Project
- National Water Commission
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