

# Characterising transition towards higher degree of intermittency in Australian streams

Margarita Saft<sup>1</sup>, Murray C. Peel<sup>1</sup>, Tim J. Peterson<sup>1,2</sup>

<sup>1</sup> Department of Infrastructure Engineering, The University of Melbourne, Melbourne, Australia

<sup>2</sup> Department of Civil Engineering, Monash University, Melbourne, Australia

We are looking into a 13-year long drought to observe persistent shifts in flow regime. Study streams switched from perennial or near-perennial to intermittent or even ephemeral state. Many catchments exhibit unprecedented rate of cease-to-flow conditions for a given rainfall persisting even after the drought ends. Changes in zero flow occurrence frequency are likely to reflect transition of stream reaches to the disconnected state.

## Millennium Drought

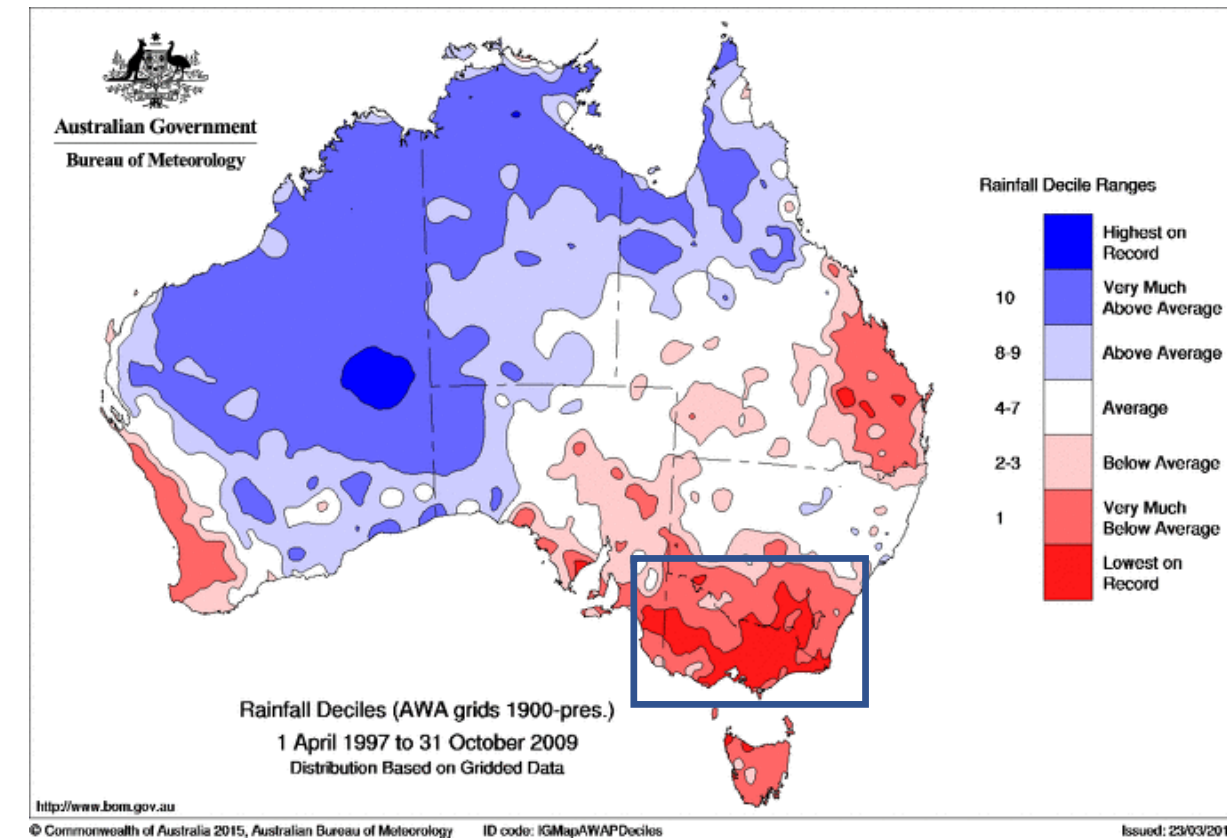
- Victoria severely affected
- Circa 1997-2009 (in some parts of Victoria 1994 - 2009)
- Finished in 2010 with record-breaking rainfall and widespread flooding

## Dataset

- 87 non-perennial streams in Victoria
- Non-perennial defined as cease-to-flow conditions encountered prior to the Millennium Drought
- Long and near-complete records
- Unimpaired flows (regulation, irrigation, major storages excluded)

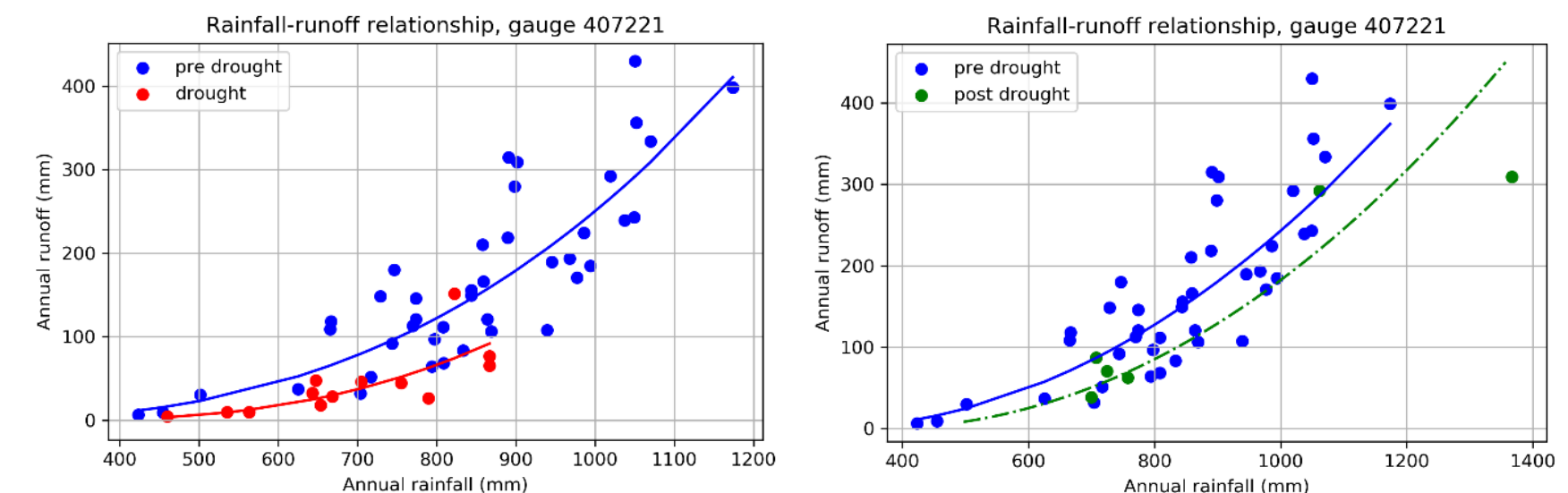
## Hydrological shift background

- Annual runoff for a given rainfall declined during the Millennium drought
- Some catchments appeared to be more vulnerable to hydrologic shift
- Recovery was partial and varied widely between catchments
- Cease to flow conditions have not been explored alongside rainfall before

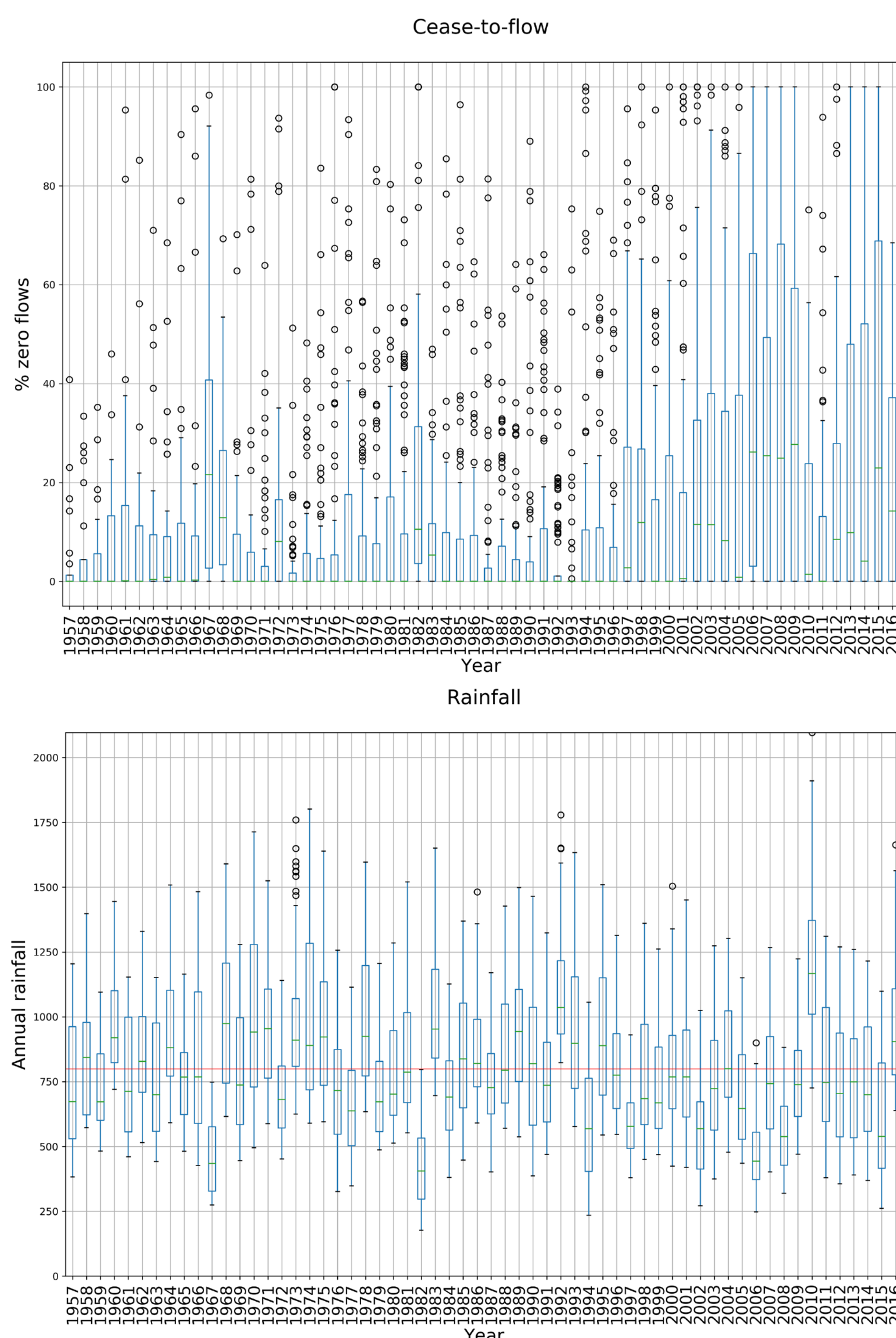


Left: Millennium drought rainfall decile ranges (sourced from www.bom.com.au)

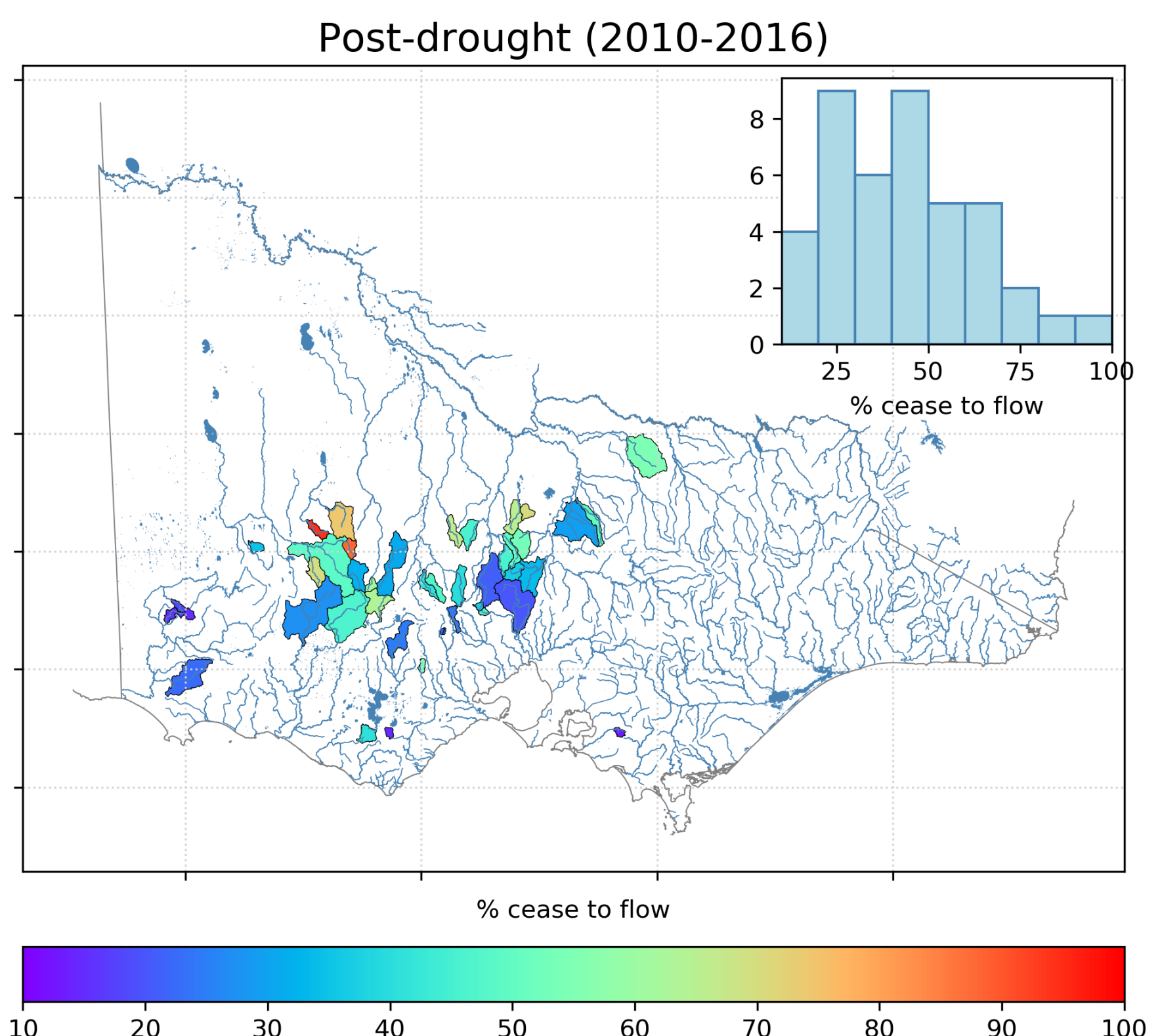
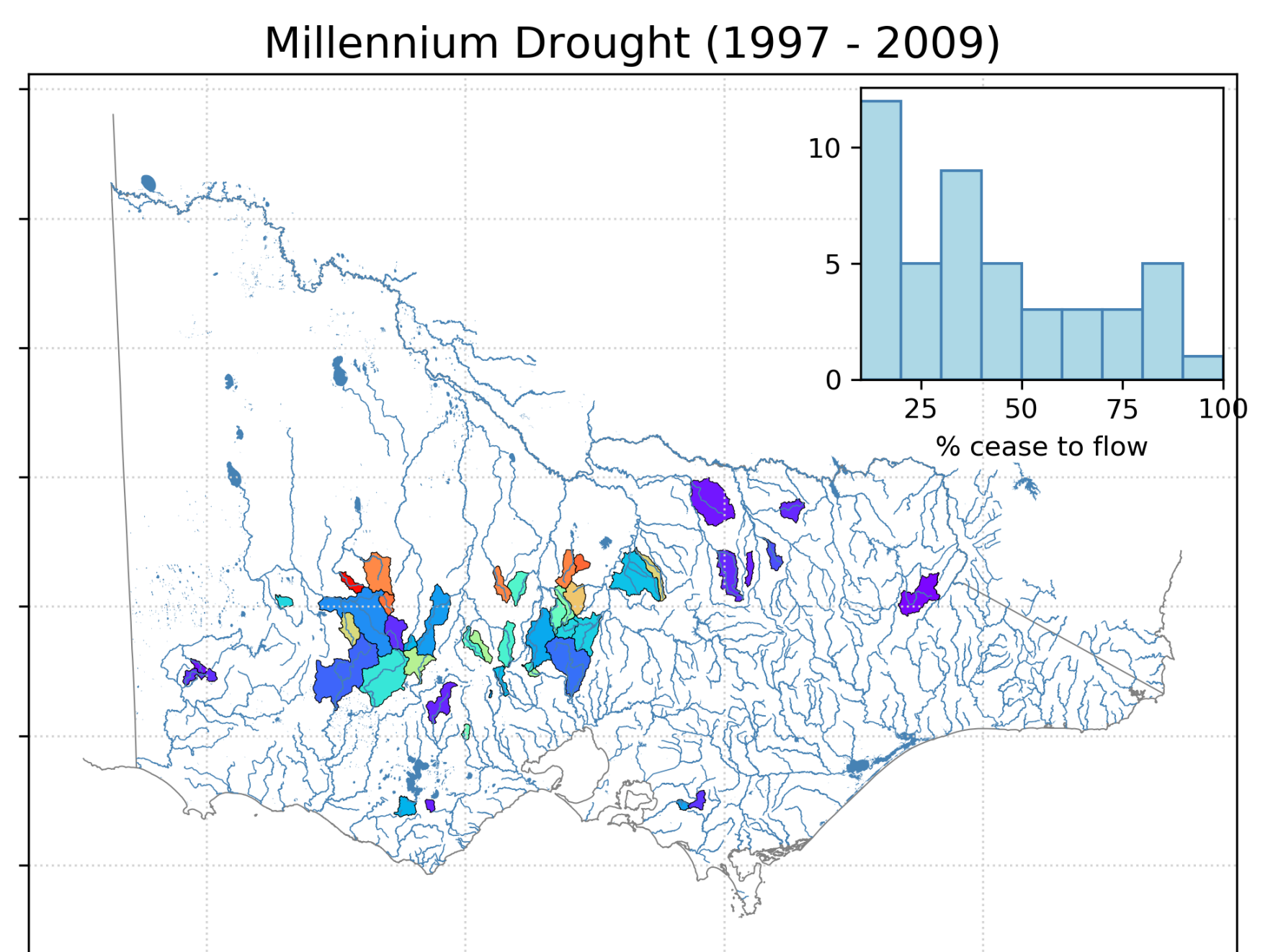
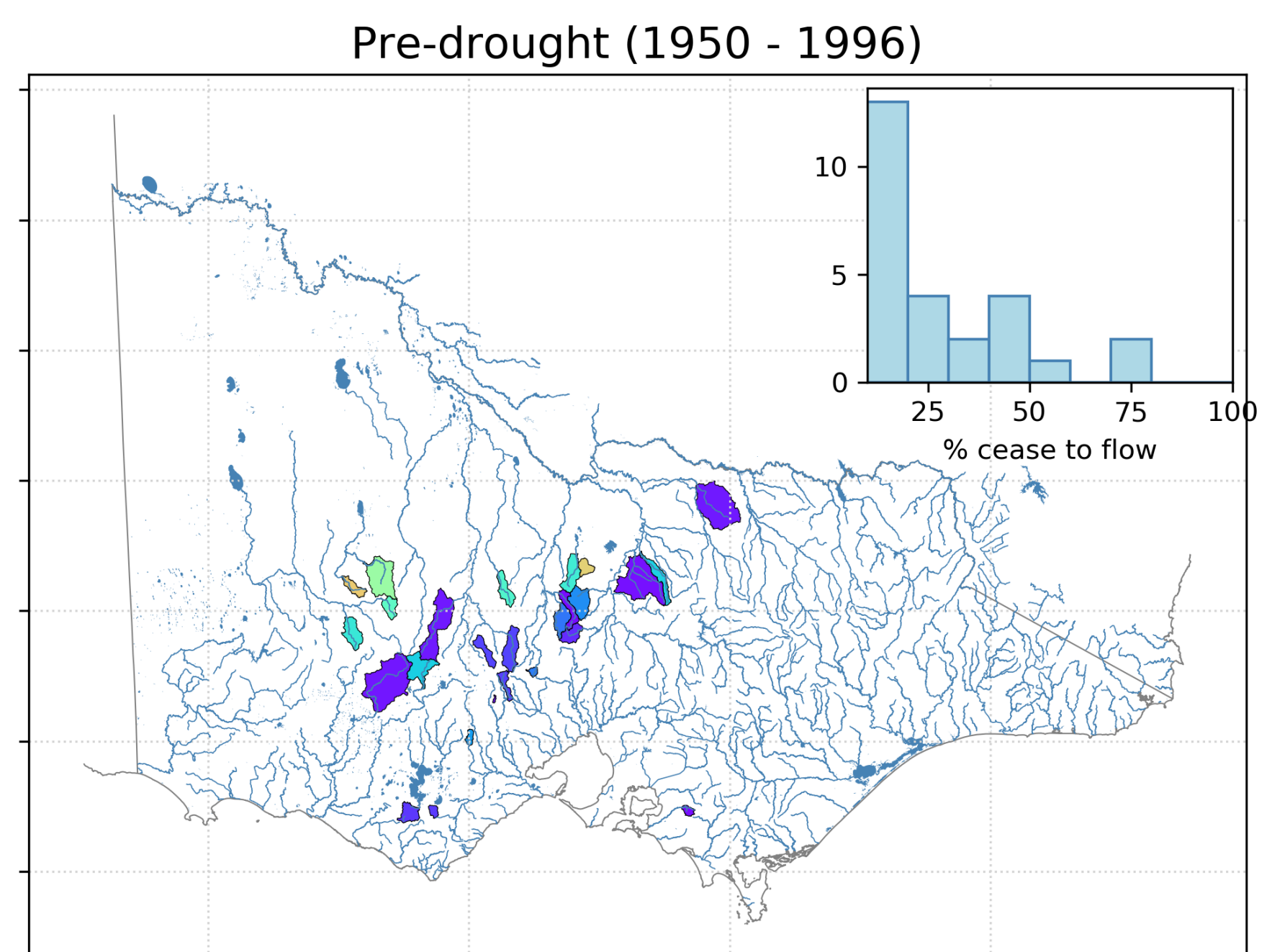
Bottom: Shift in annual rainfall-runoff relationship in an example catchment  
Left: during Millennium drought  
Right: after Millennium drought



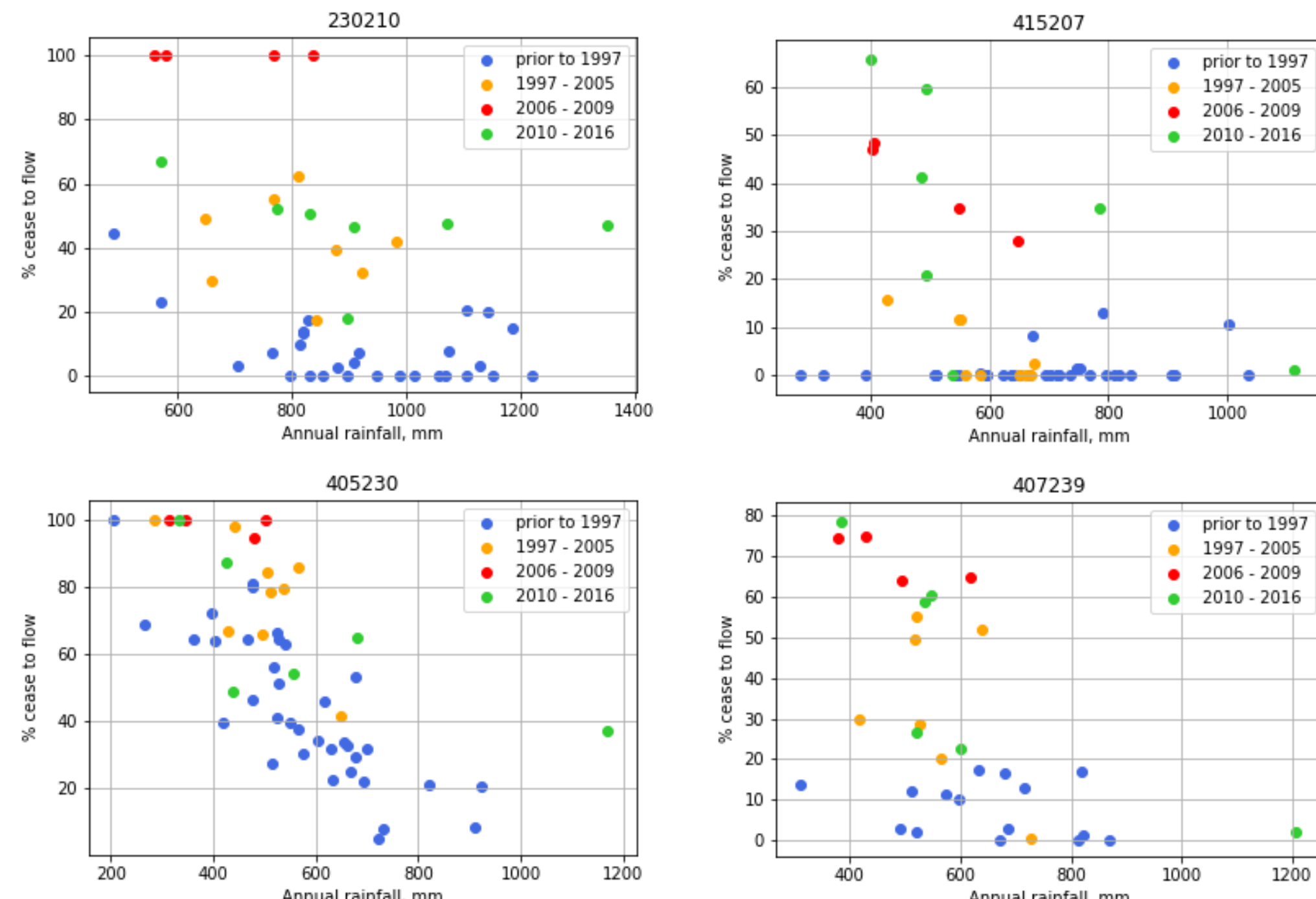
## Change in cease-to-flow frequency



## Catchments with cease-to-flow conditions persisting at least 10% of time



## Cease-to-flow conditions vs Rainfall in example catchments



- Millennium drought resulted in catchments switching from perennial or near-perennial to intermittent or even ephemeral flow regime
- Changes in flow regime are not fully explained by changing rainfall
- Tipping point was passed ca. 2006
- Evidence of recovery since the drought, but not back to pre-drought conditions