



MONASH
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ARC CENTRE OF EXCELLENCE FOR
CLIMATE SYSTEM SCIENCE

Challenges and opportunities for data-model comparisons in Australia

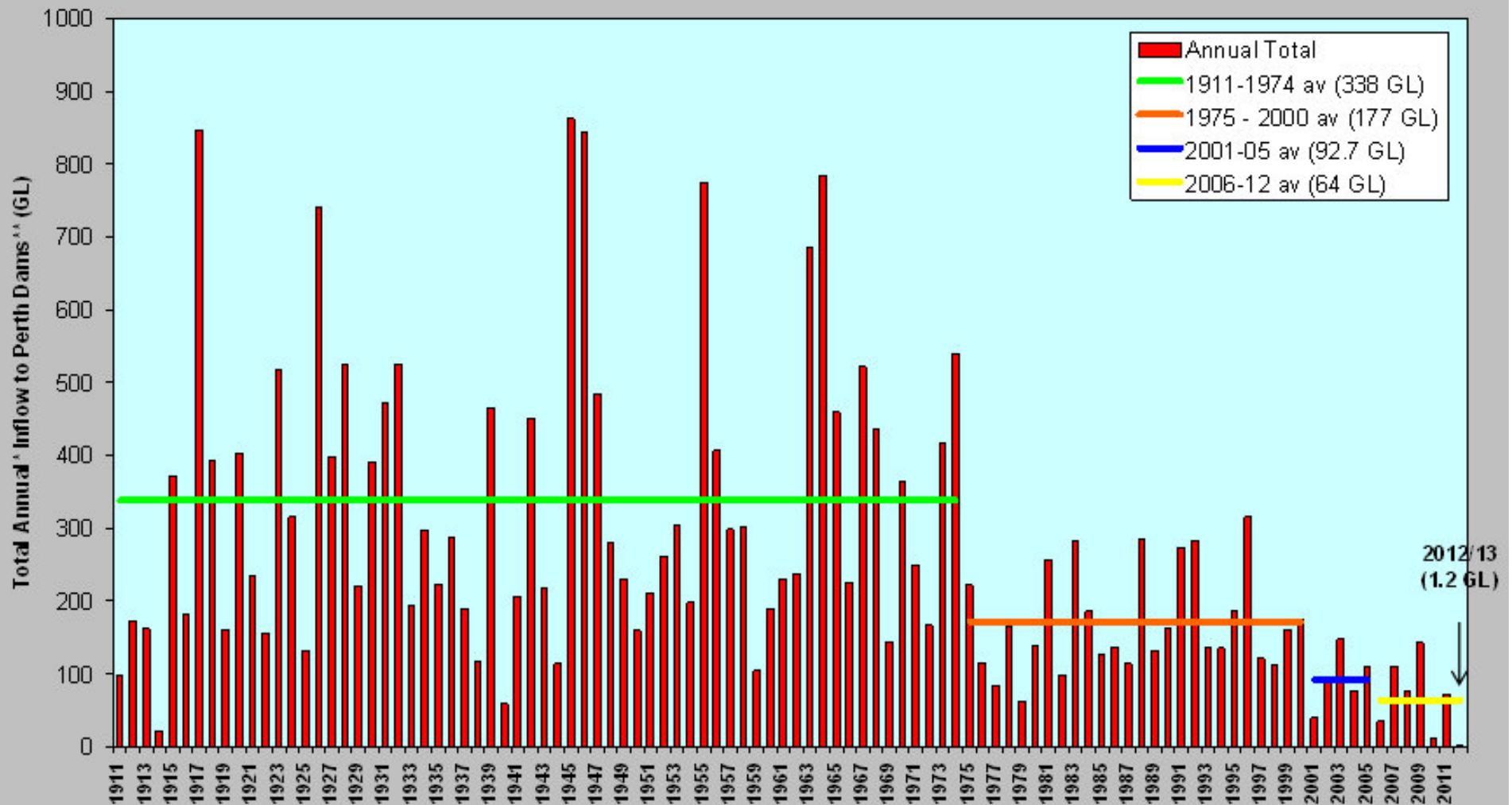
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Hydroclimatic variability and the Australian context



Notes: * year is taken as May to April and labelled year is start (winter) of year

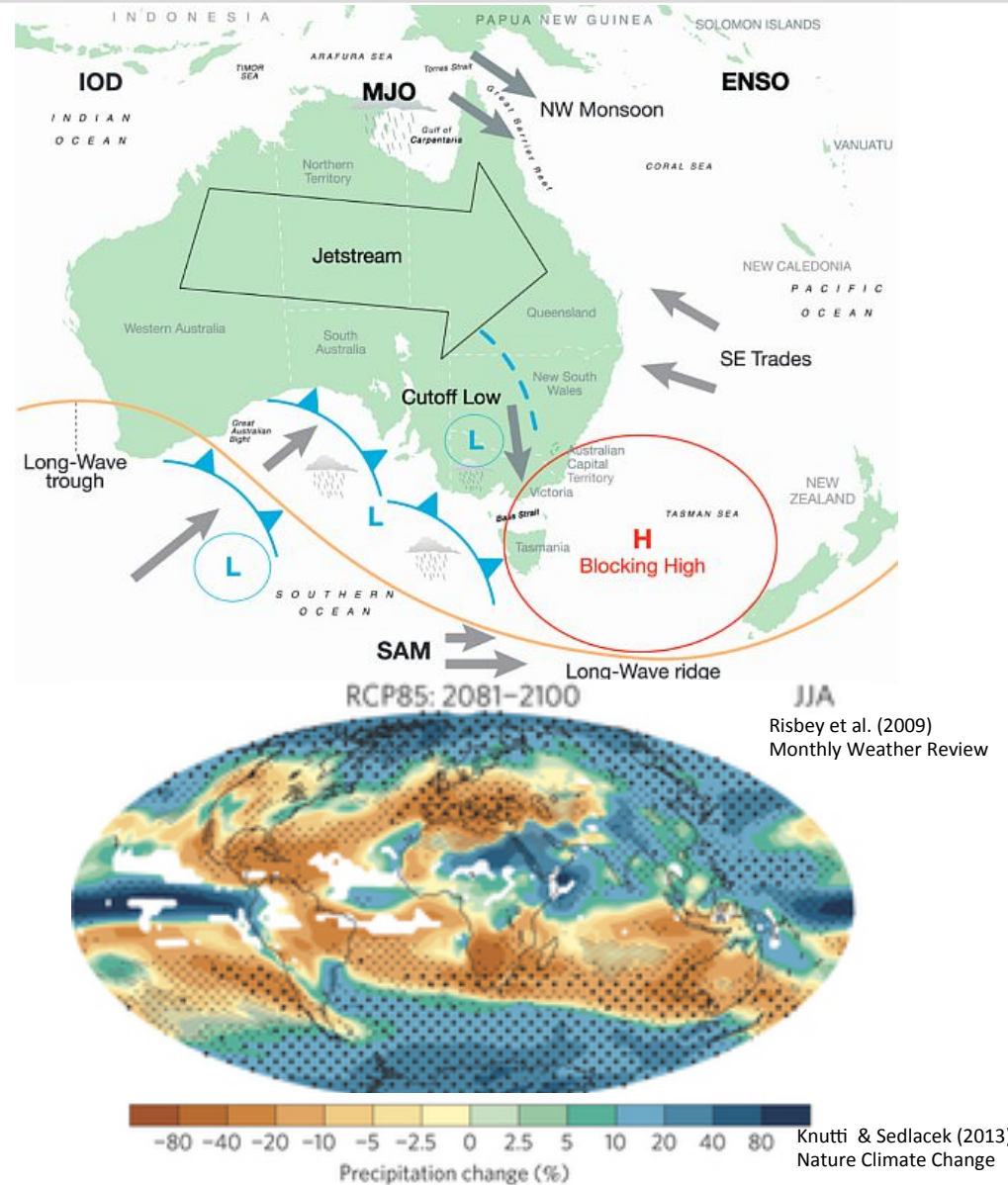
** Inflow is simulated based on Perth dams in 2001 i.e. excluding Stirling, Samson & Wokalup

What questions do we want to answer?

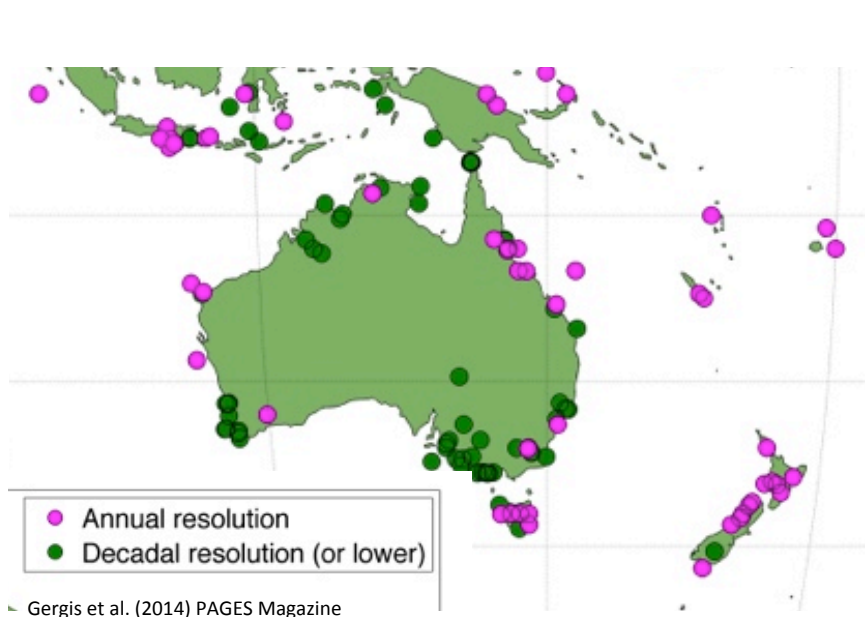
Attribution of recent events – context in palaeoclimate record

Mechanisms driving Australian hydroclimatic variability

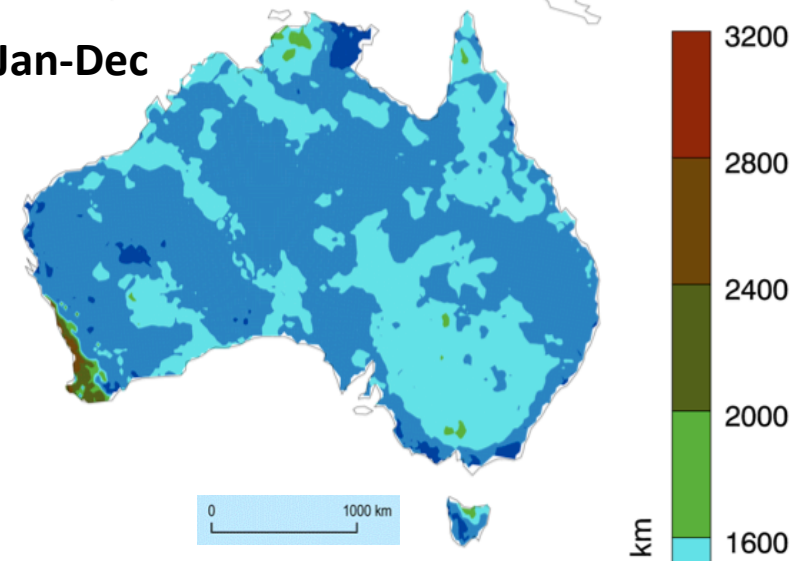
Future hydroclimatic change?



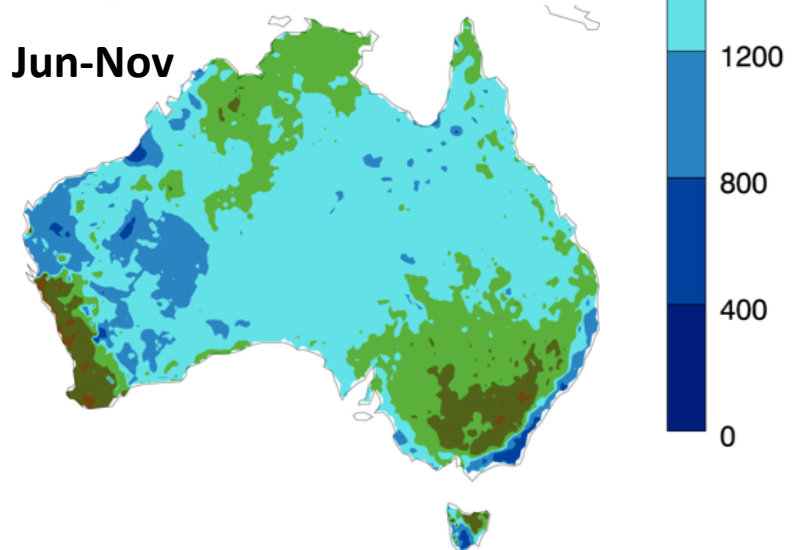
Data challenges – proxy availability (or not)



Jan-Dec



Jun-Nov

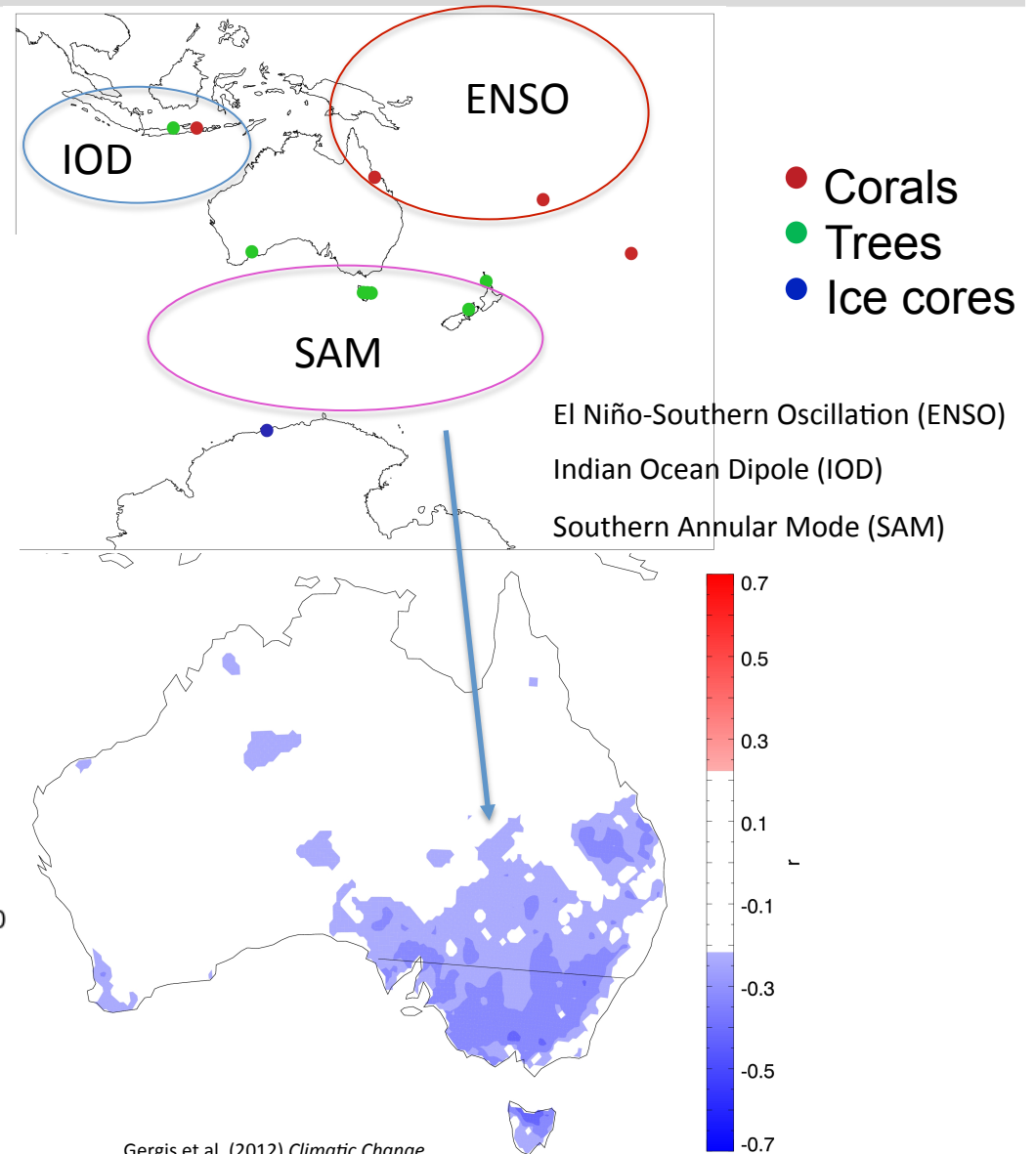
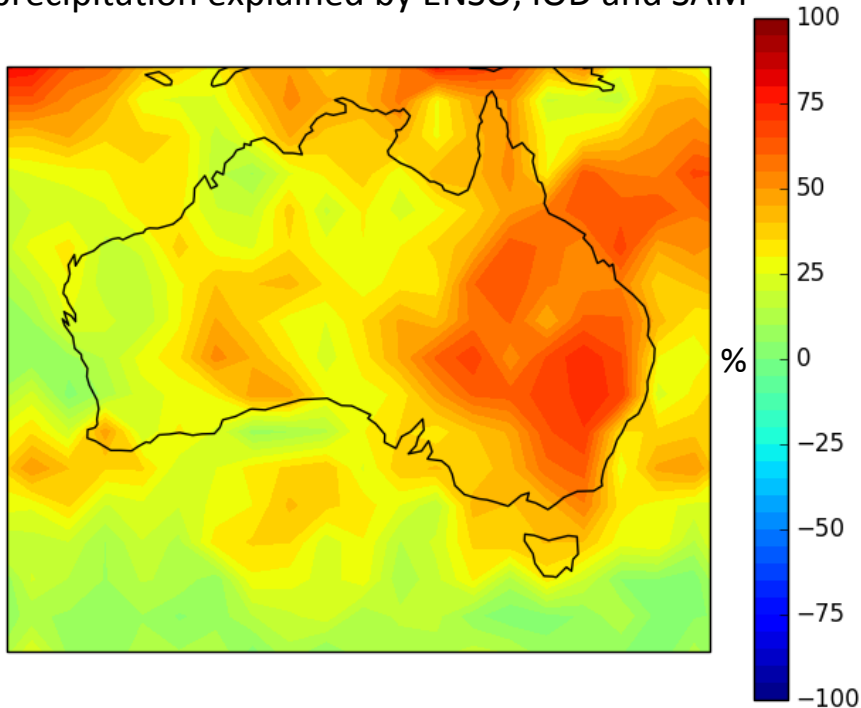


Reasonable spatial coherence in some seasons

But, near-coastal areas generally show less coherence

Data challenges – using remote proxies

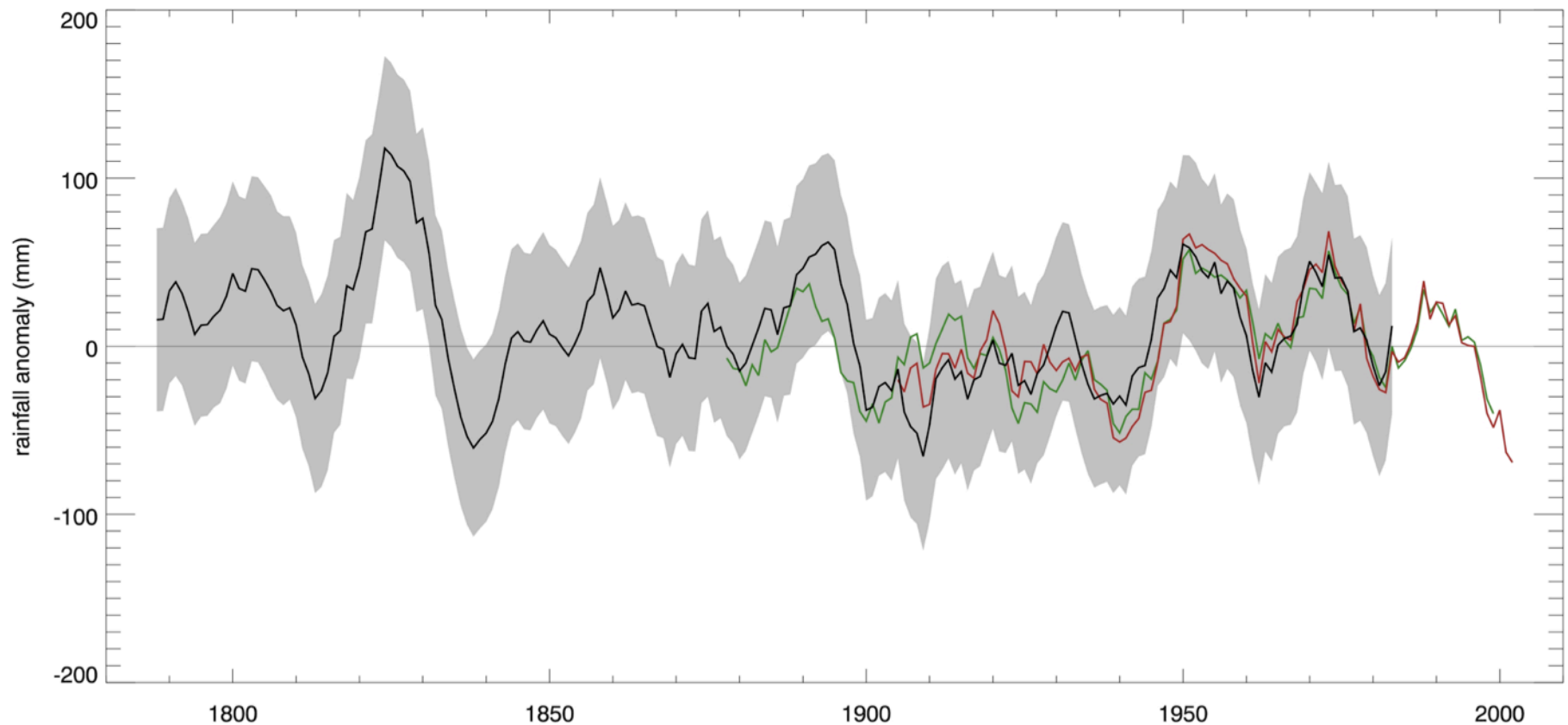
Percentage of variance in interannual precipitation explained by ENSO, IOD and SAM



Gergis et al. (2012) *Climatic Change*

Data challenges – using remote proxies

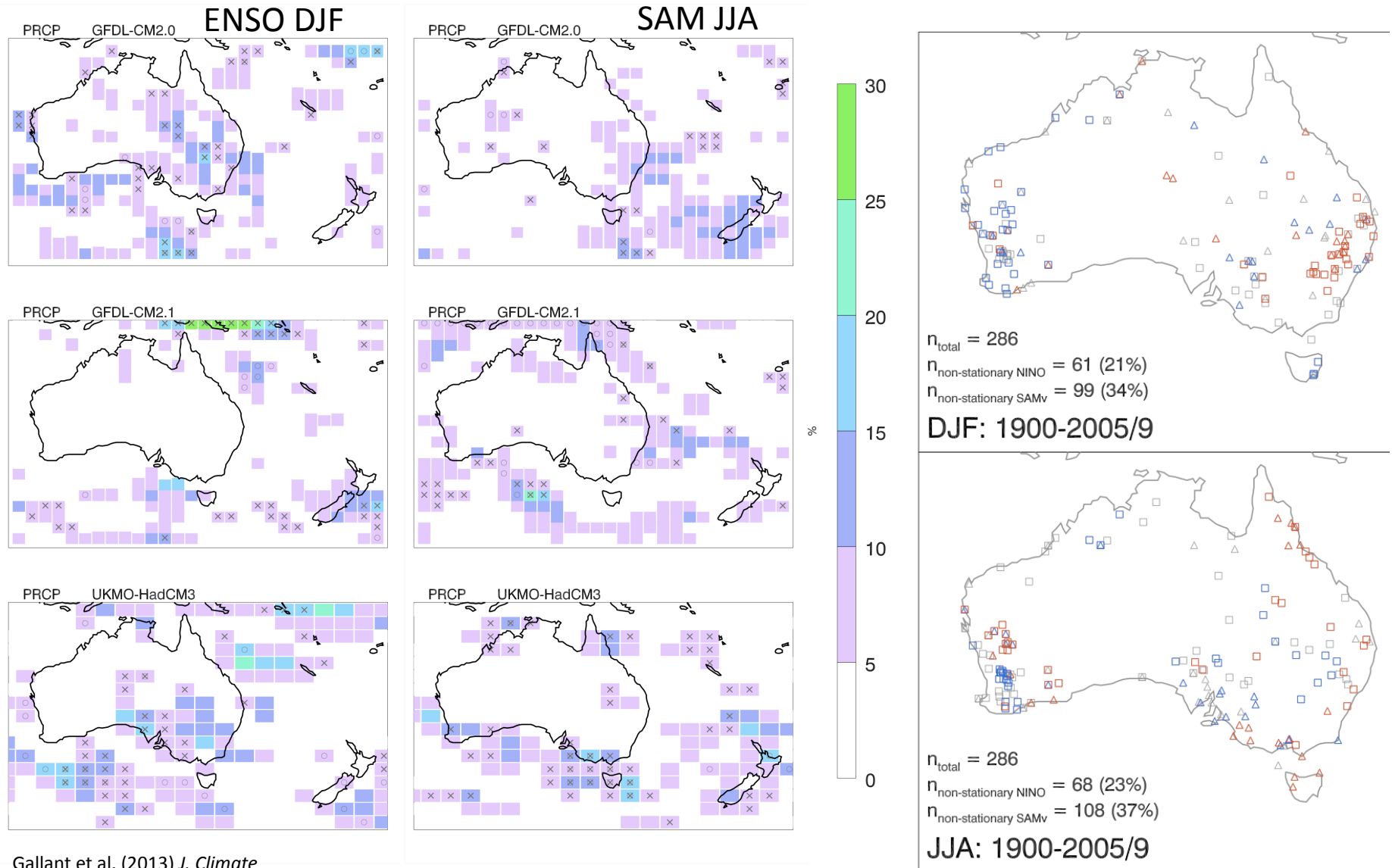
Southeast Australian rainfall reconstruction: 1783–1989



Gergis et al. (2012) *Climatic Change*

- Median of rainfall reconstruction ensemble
- Observed area-averaged rainfall from spatially complete grids (1900–2009)
- Observed area-averaged rainfall from extended stations (1873–2006)

Data challenges – using remote proxies



Data challenges in Australia - summary



Lack of data a problem, particularly inland (often where information most highly valued!)

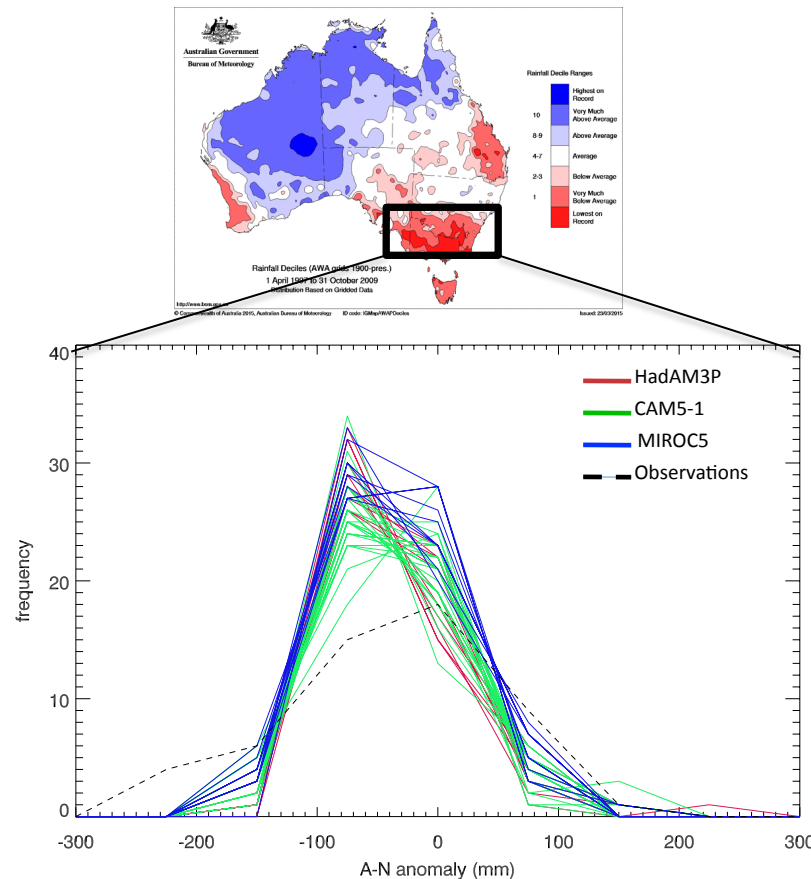
Spatial coherency of rainfall in Australia = good

Seasonal variation in coherency = less good if proxies pick up highly seasonal signal in season with less coherence

Reliance on teleconnected data for reconstructions potentially problematic

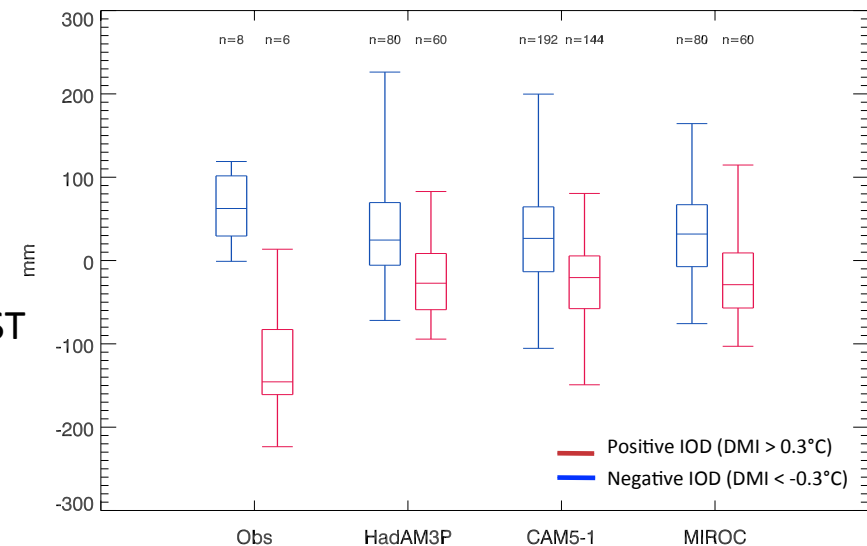
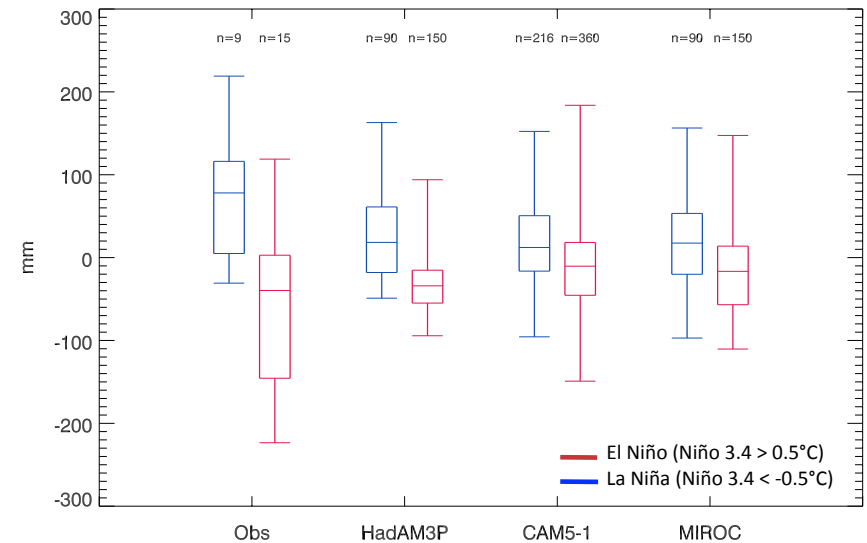
- Potential problems associated with non-stationarity (not the only issue)
- Danger of periods where proxies are unreliable

Modelling challenges in Australia – variability underestimated



Variability in precipitation underestimated in forced SST runs.

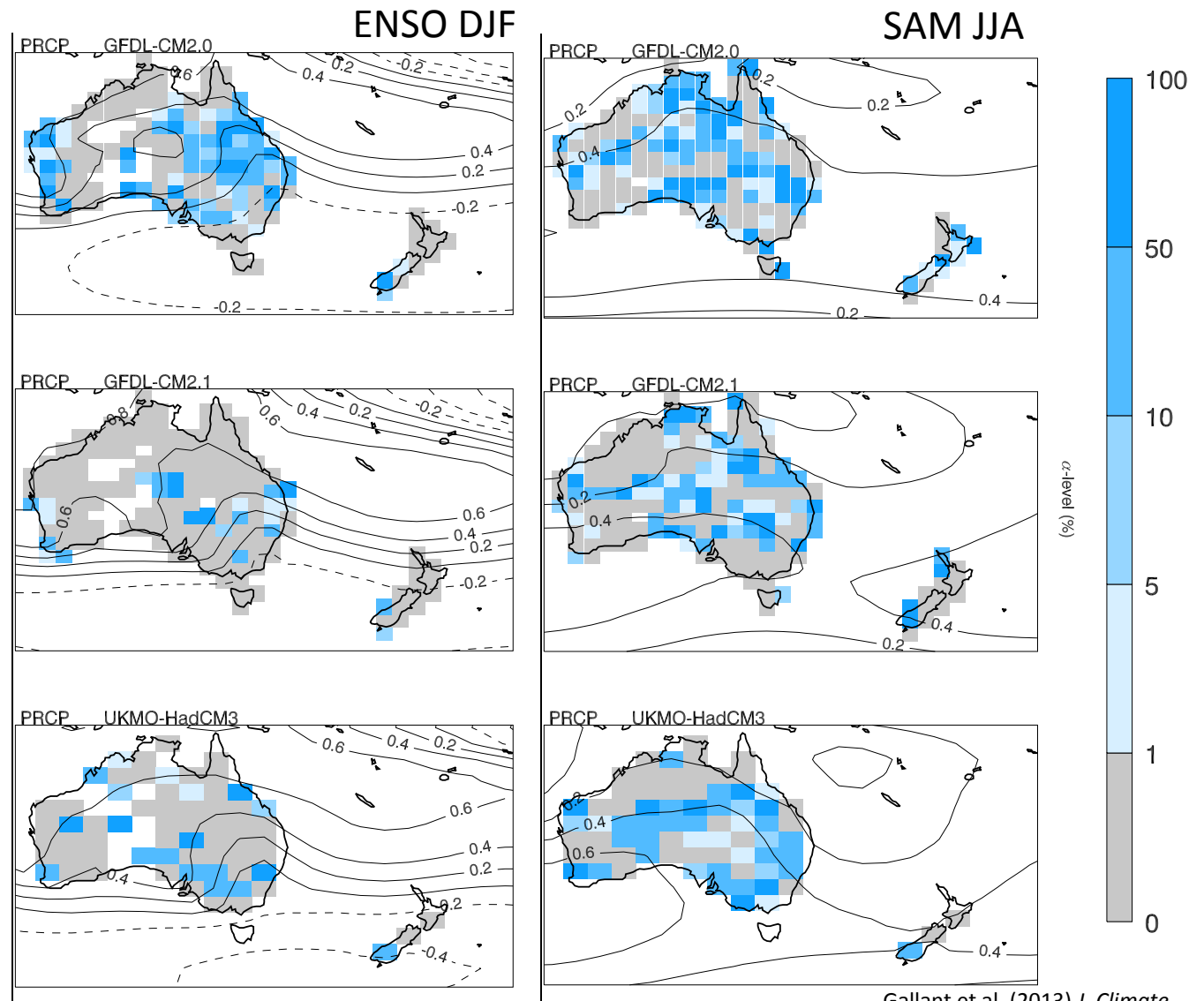
Relationships with El Niño–Southern Oscillation and Indian Ocean Dipole of correct sign, strength underestimated.



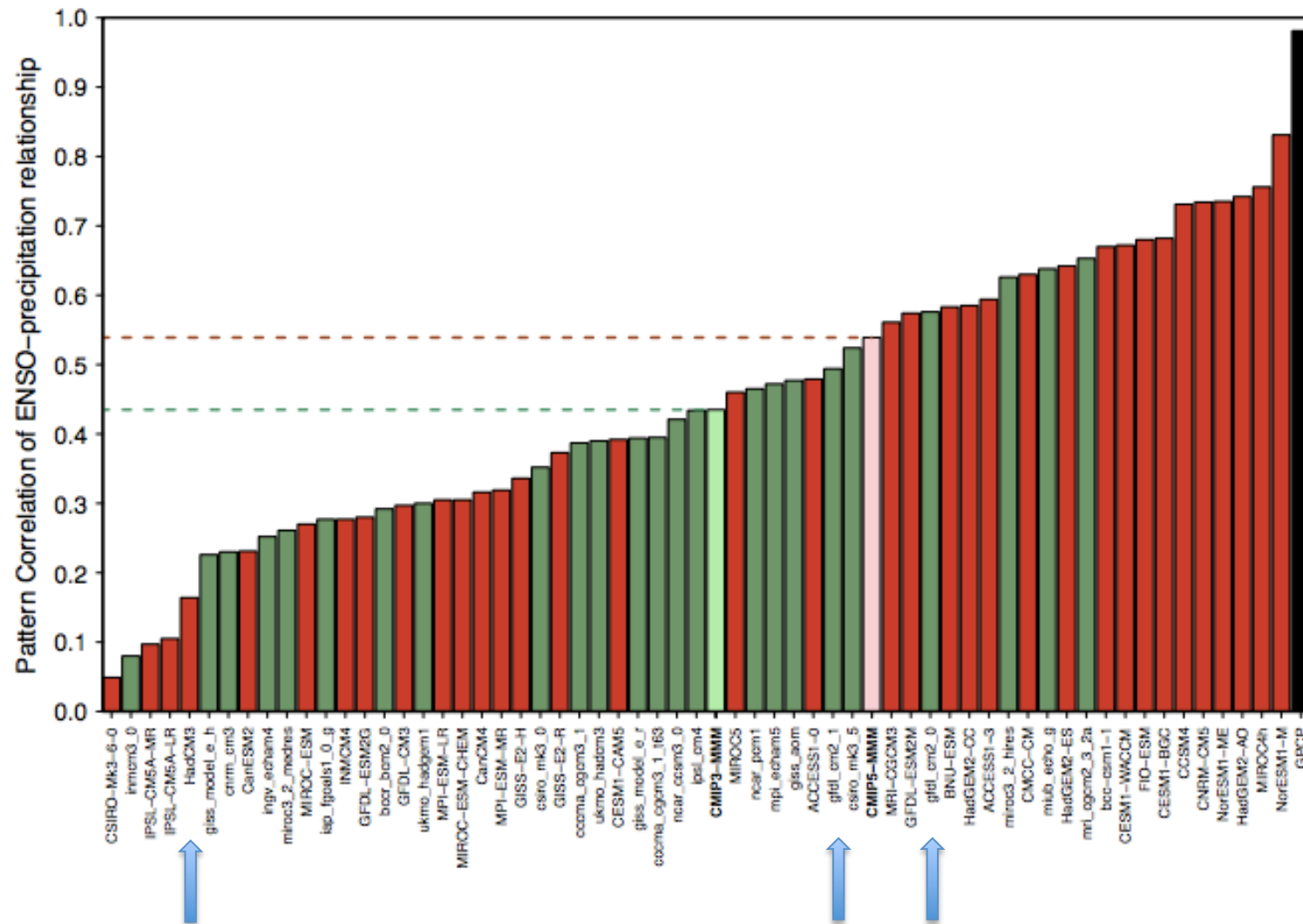
Modelling challenges in Australia – teleconnection patterns

Coupled models do not simulate teleconnections well

Errors independent between models (i.e. not systematic)



Modelling challenges in Australia – teleconnection patterns

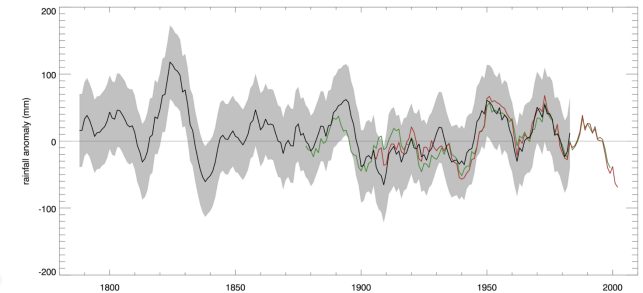
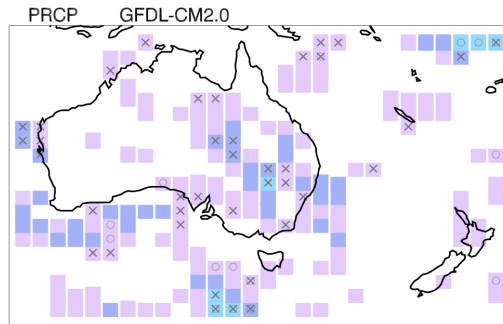


Model challenges - summary

Underestimation of variability in precipitation, particularly in lower tails (showed southeast Australia only)

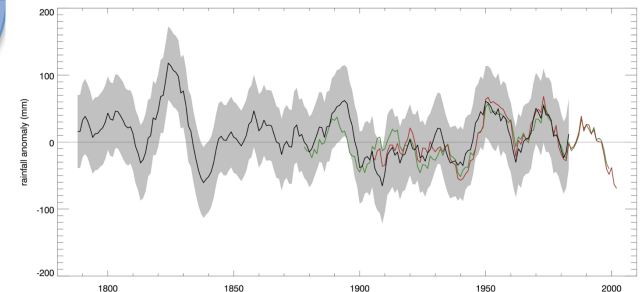
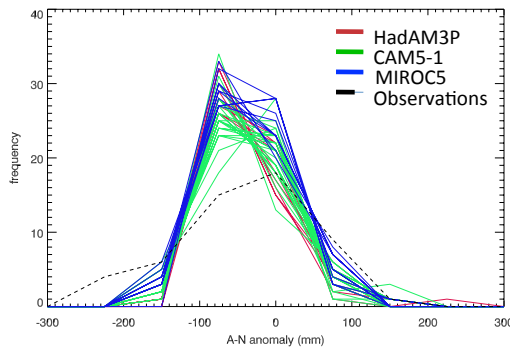
One large source of underestimation stems from weaker teleconnections in the models

An iterative approach to data-model comparison



Models

Proxies



An iterative exchange for building knowledge