

*Climate implications for the future
of irrigation*

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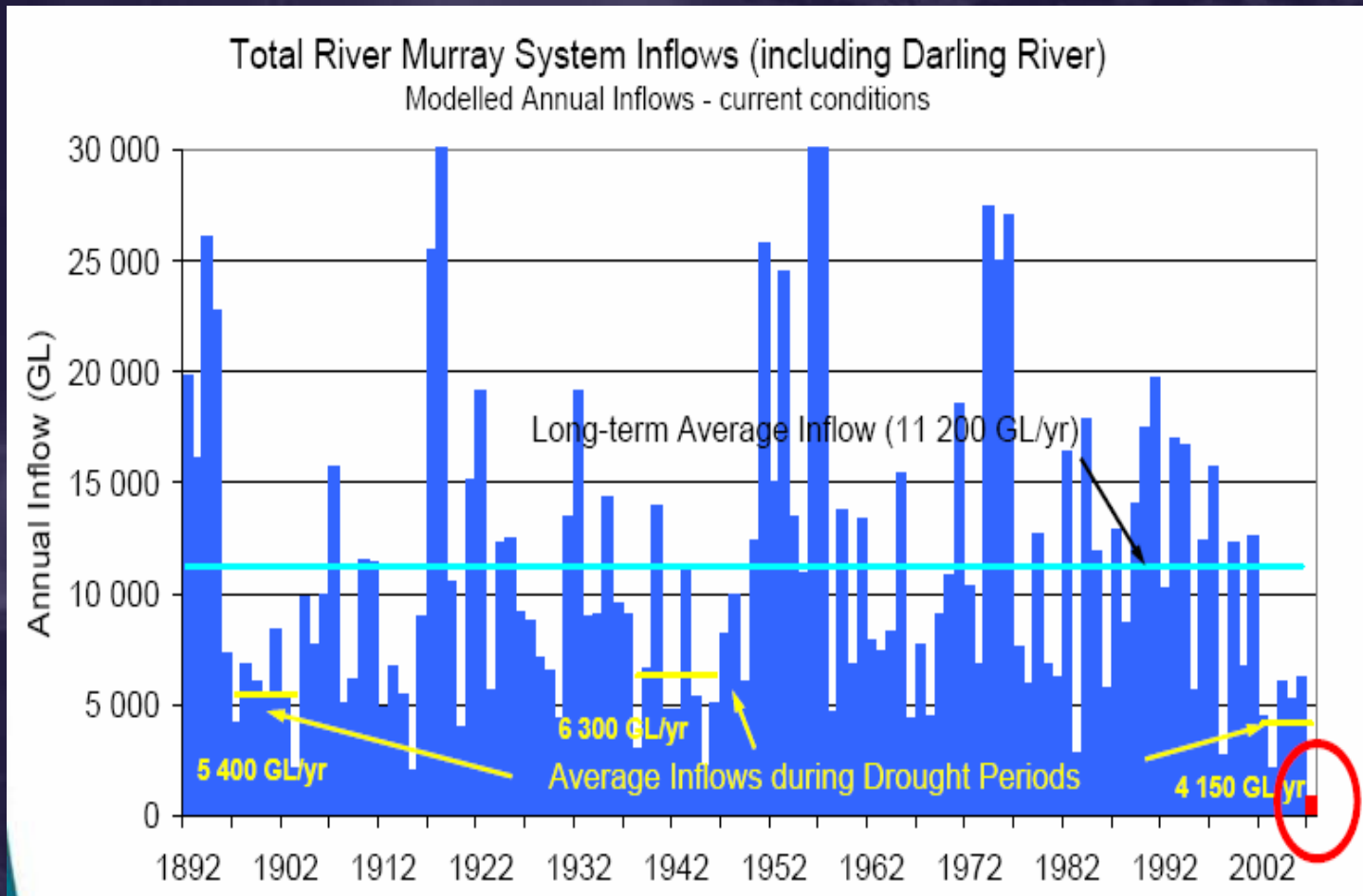
11th International Riversymposium
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Climate Variability in Australia

- > Australia has one of the most variable climates in the world
- > Periods of intense drought and bushfire are often punctuated by sudden flooding
- > The severity of Australia's climate fluctuations causes difficulties for clients across many sectors
- > Difficulty compounded by uncertainty about the future (especially regarding impacts of human-induced global warming)



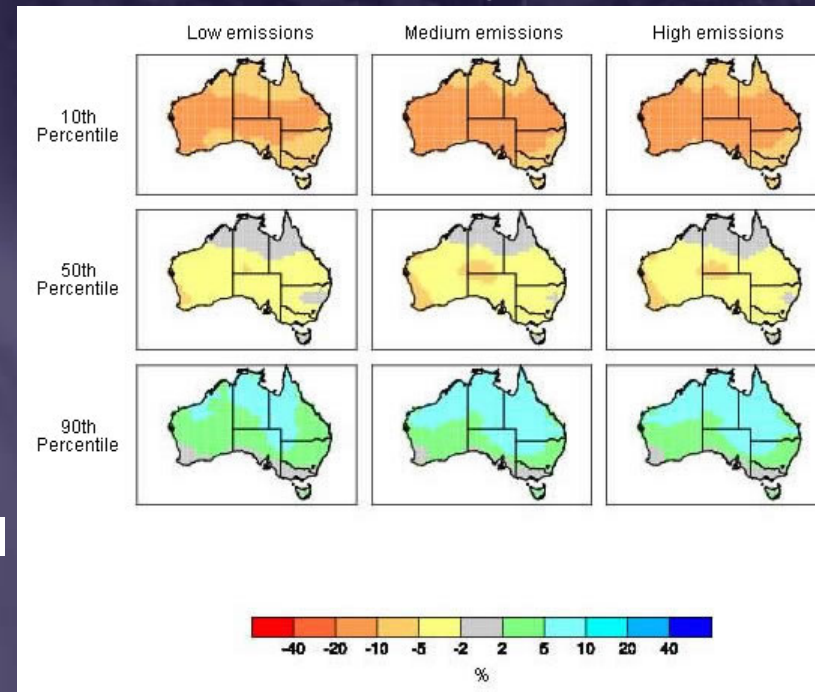
Murray River inflows



Human-induced global warming

- > Reports such as IPCC and CSIRO have identified a range of potential impacts of global warming including changes in:
 - o rainfall and temperature
 - o catchment flows/yields
 - o extreme weather events
 - o flooding due to sea level rise
 - o bushfire risk
 - o coastal erosion
- > This is all very concerning - major social and economic consequences!!
- > There are large uncertainties in climate change projections

Projected percent change in rainfall by 2030



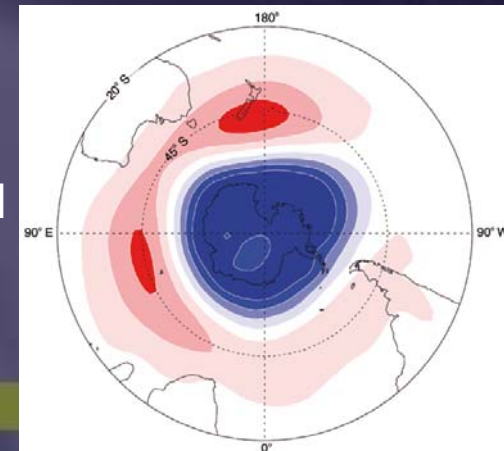
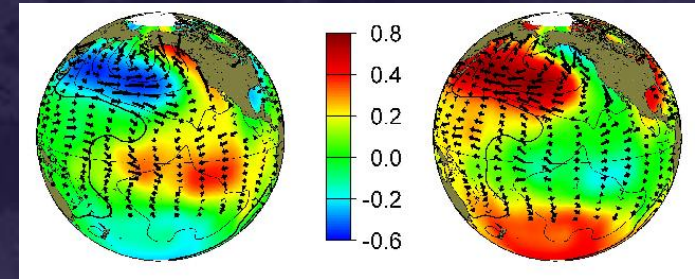
www.climatechangeinaustralia.gov.au

Human-induced global warming

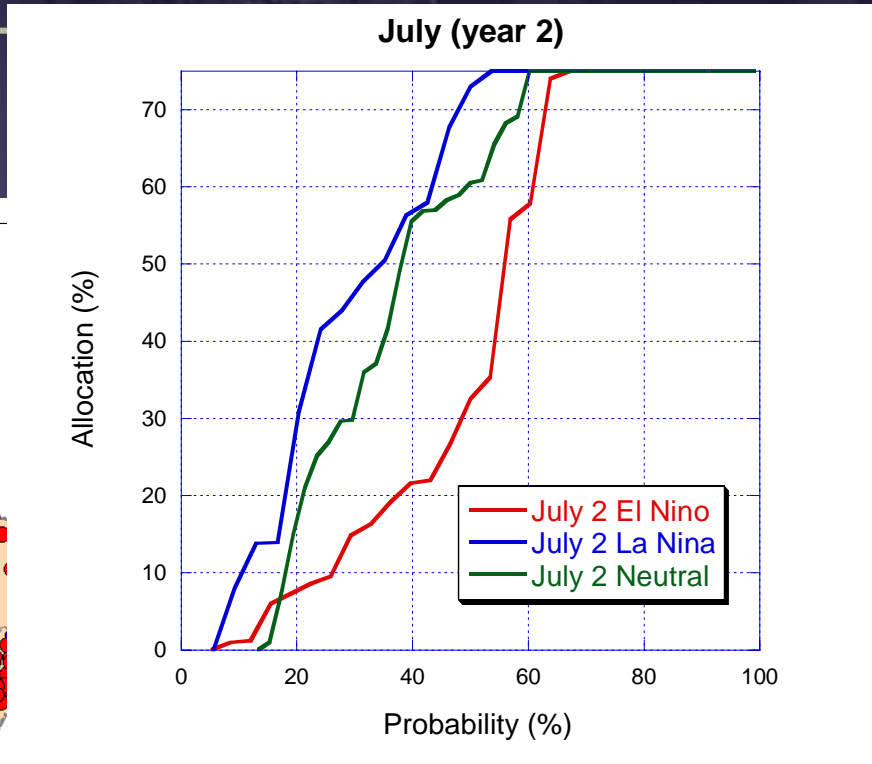
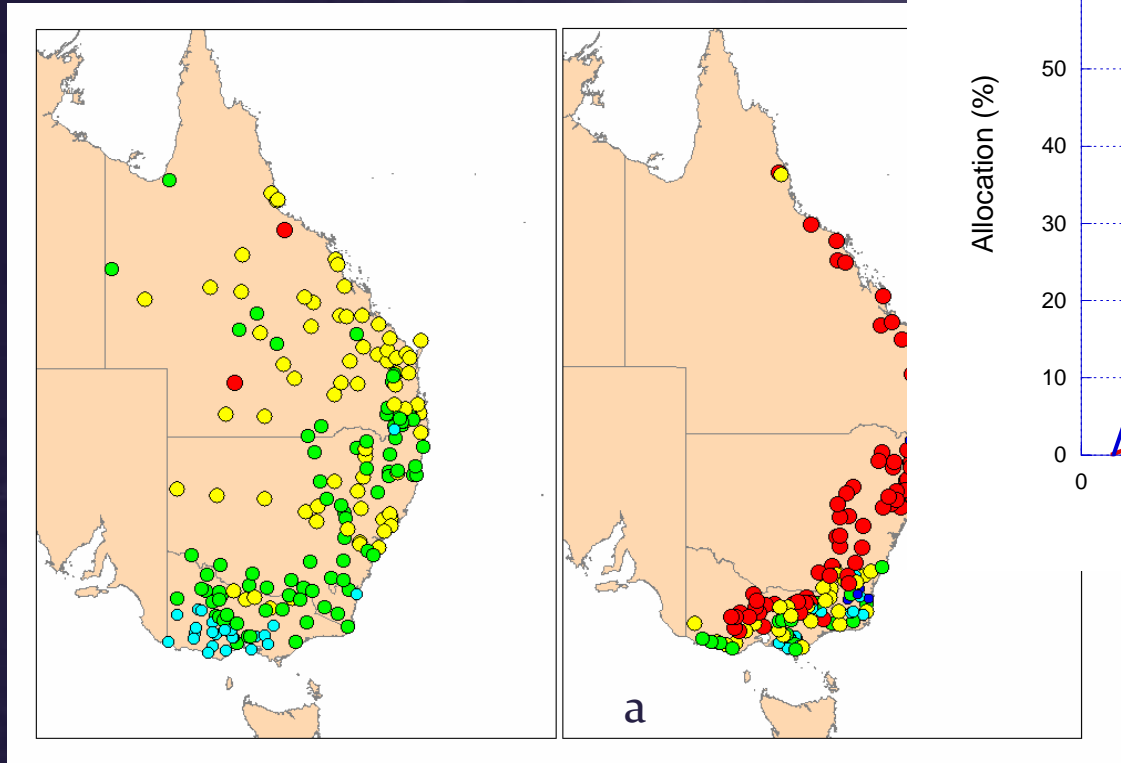
- > Impacts of human induced change are highly uncertain
 - Rainfall and evap not simulated well at all (especially sub-annual)
 - Climate models based on incomplete understanding of highly complex global climate system
 - Climate models do not realistically reproduce natural climate cycles
 - Uncertainty around emission scenarios used to drive the GCMs
 - No info on what will happen between now and 2030 or 2070
 - Climate model grids too big to capture regional scale climate info (~250km²!!!)
 - Climate models will improve but a lot of work still to be done
- > BUT we need to do something **now** !!
- > Insights into natural climate variability provide useful info into what **has occurred** & what is **possible** in the future

What are the natural influences on Australia's climate?

- > El Niño/Southern Oscillation (ENSO):
 - o El Niño – warm, dry conditions in eastern Australia
 - o La Niña – wetter conditions in eastern Australia
- > Interdecadal Pacific Oscillation (IPO):
 - o Positive phase – more frequent El Niño and less frequent & less intense La Niña
 - o Negative phase – reverse of +ve phase
- > Southern Annular Mode (SAM):
 - o Antarctic oscillation influences position and strength of westerlies/rain producing systems in southern ocean
- > Indian Ocean Dipole (IOD):
 - o ENSO-like phenomenon in the Indian Ocean
- > IPCC, Stern etc concentrate on impacts of people induced (anthropogenic) change
 - o no climate variability which is crucial for Australia



Example of climate impacts in eastern Australia

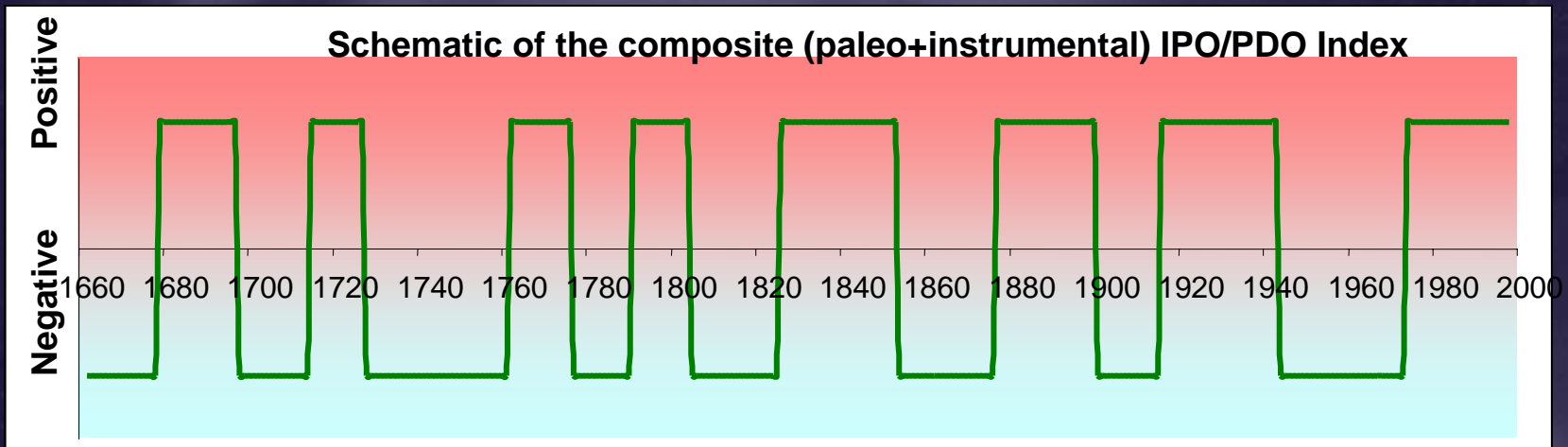
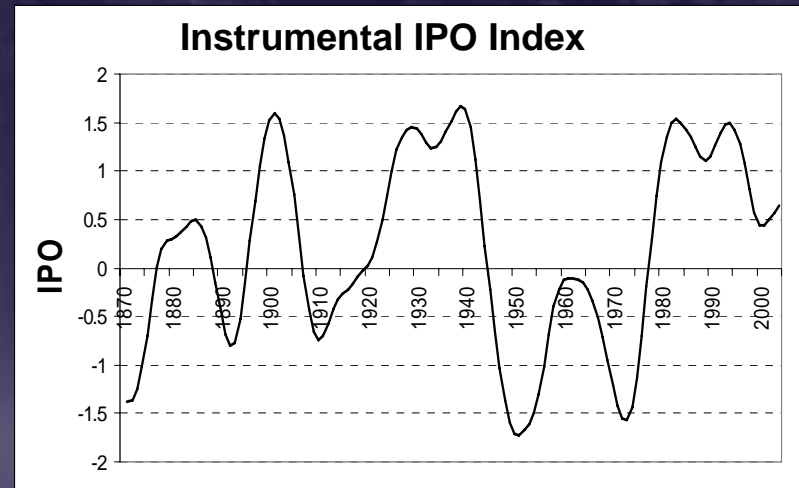


Verdon 2007

Ratio of mean La Niña to mean El Niño (a) rainfall & (b) streamflow (Verdon et al. 2004)

Limitations of the instrumental record

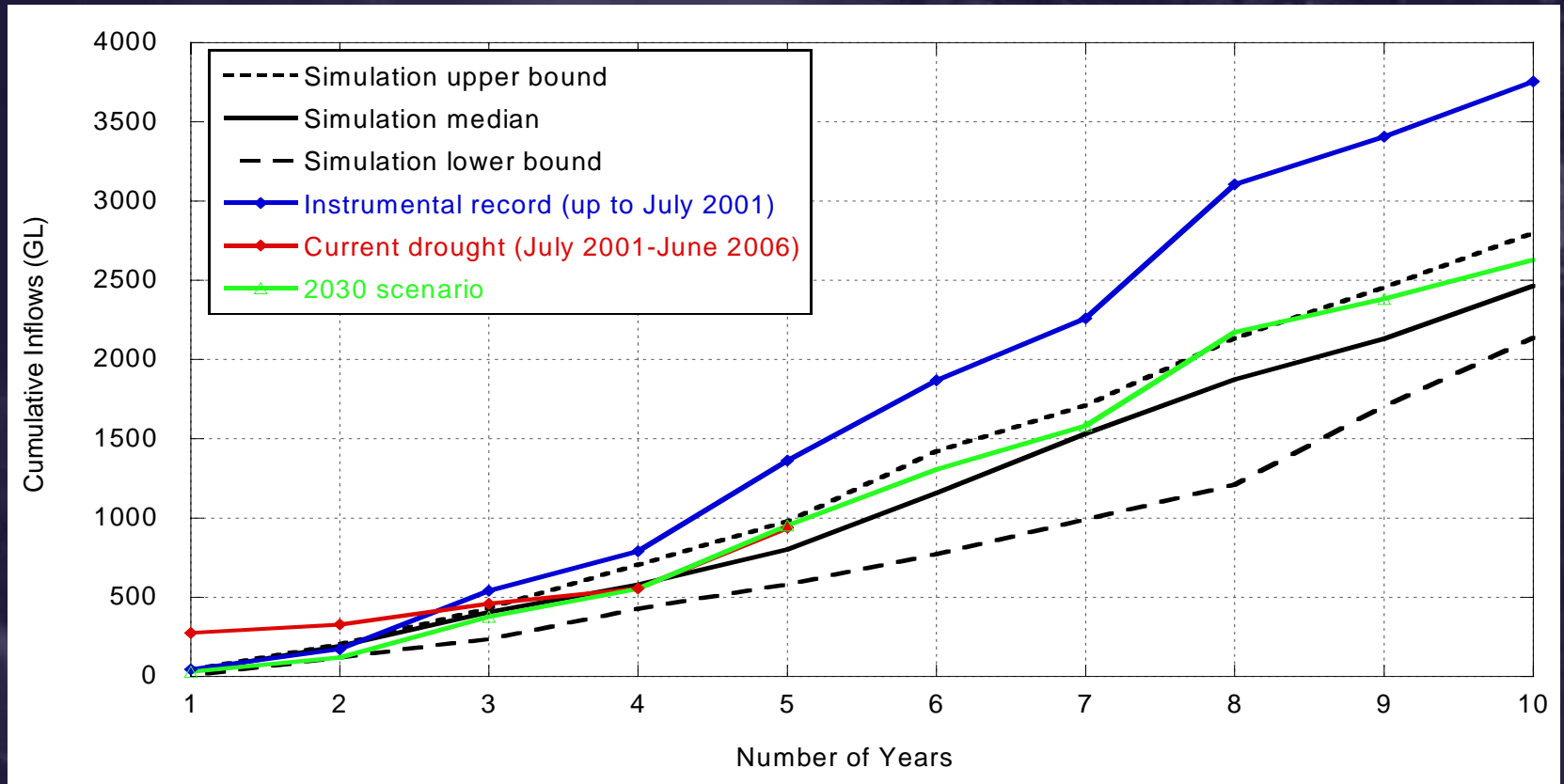
- Instrumental record typically ~100 years
- Uncertainty around flood/drought cycles (only 3 samples)
- How do we develop management strategies?



How do we use this information in water resource management?

- > A more appropriate approach for water resource management...
 - o Understand natural/physical mechanisms driving our climate
 - o Characterise impacts of these natural mechanisms on Australian hydroclimatology
 - o Stochastically generate future climate scenarios that incorporate natural variability AND possible impacts of human induced warming
 - o Develop appropriate adaptation/mitigation strategies to make most of favourable conditions
 - o Can also use this information for seasonal forecasting

An example of how to use climate insight in water resource planning



Concluding Remarks

- > Natural climate variability has always occurred and always will regardless of what we do to reduce greenhouse gas
- > We need to understand what drives our climate so we can improve seasonal forecasting and long-term planning
- > Need to consider natural variability on multi-time scales (e.g. 2-5 years cycles (inter-decadal), multi-decadal, and the palaeo scale)
- > We can use GCM based climate change projections as scenarios to develop adaptation measures but it does not necessarily mean we have all bases covered!
- > **Is what we are seeing climate change or natural cycles?**
 - **Currently we don't fully understand, and therefore aren't prepared, for either!!!**