Do IPCC AR4 models produce the rainfall increase over Northwest Australia?

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Many parts of Australia have experienced a long-term rainfall reduction, but over Northwest Australia summer rainfall has been increasing (by as much as 50% since 1950). If this increasing rainfall trend continues, it could be an important future water resource for Australia. However, most climate models, used for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR4), project a future rainfall reduction over the region. This means that a substantial reduction has to commence to reverse the current trend. Is such a result believable? Do models even produce the observed trend and correct teleconnection patterns with known climate drivers?

We show that forced with all anthropogenic forcings, including aerosols, most models do not simulate the observed rainfall trend over the region, suggesting a need to investigate the possibility of natural variability as a driver. Analysis of a multi-century long unforced coupled model experiment shows that multidecadal variability indeed has the potential to generate trends comparable to the observed.

Further analysis using IPCC AR4 models suggests that the projected future rainfall reduction is at least in part associated with an unrealistic rainfall teleconnection arising from a common model cold tongue bias [*Cai et al.* 2009]. As a consequence of the bias, the warm pool, the mean convection centre, and the associated ascending branch of the Walker Circulation are situated too far west, such that its longitudinal fluctuations with the model El Niño-Southern Oscillation cycle generates a rainfall teleconnection greatest over Northwest Australia rather Northeast Australia. Under climate change, the Walker Circulation weakens and moves eastwards, contributing to the projected future reduction.

References:

Cai W., A. Sullivan, and T. Cowan (2009), Rainfall Teleconnections with Indo-Pacific Variability in the WCRP CMIP3 Models, *Journal of Climate*, **22**, 5046–5071