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A comparison of recent trends in gauged streamflows with climate change predictions in south east Australia

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Abstract: Whilst most Global Circulation Models (GCM) forecast a dryer climate over much of south eastern Australia, the magnitude of change varies substantially between models. Consequently, there is great uncertainty in predictions of climate change impacts on streamflow and the security of water supply. In order to inform adaptations of water supply systems to a drier climate, it is desirable to identify GCM's in which we have more confidence. This study examines spatial variations in recent trends in streamflow across South Eastern Australia. Site to site variations in these trends are compared with forecast changes in streamflow produced in a recent assessment of future water yields for the Murray Darling Basin, carried out by CSIRO. Predicted changes were derived by downscaling GCM predictions, and rainfall-runoff modelling. Forecast changes are available for 15 different GCM's. Of these, only some predict a consistent pattern of streamflow change to across south East Australia to that recorded in recent decades. It is argued that greater confidence should be placed in these GCM's when assessing water resource futures for south east Australia.

In the recent The Murray Darling Basin Sustainable Yields Project, CSIRO used outputs from 16 GCM predictions to forecast streamflow changes across south-eastern Australia subject to enhanced atmospheric C02 concentrations (Chiew et al. 2008). We compared forecast changes with recent historic trends. If recent trends are due to climate change, we might expect the spatial pattern in trends to be similar to changes forecast by the GCM and CSIRO rainfall-runoff modeling. To test this proposition we chose nine long-term streamflow gauging stations from sites across south-eastern Australia, all in unregulated rivers. Trends in mean flow between 1974 and 2005 were evaluated using linear regression.

Site to site variations in modeled climate change impacts are significantly correlated with site-to-site variations in observed trends for six of the GCM's. This result supports the validity of these six GCMs and the proposition that recent streamflow trends are the consequence of climate change. Coefficient for this regression is consistently greater than one indicating that actual streamflow reductions are greater than predicted from these GCM's. Ten of the 16 GCM's did not have significant results. We repeated the analysis, examining trends in the standard deviation of daily flow (calculated annually). None of the GCM's predictions where correlated with site-to-site variations in observed trends.

We show how spatial variability in recent streamflow trends can be used to assess performance of GCM predictions for use water resource assessment. We argue that more confidence should be placed in GCM's that produce the correct spatial pattern in streamflow trends.

Keywords: *climate change, global climate model, streamflow trend*

References:

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Abstract only