

Projected future runoff of the Breede River under climate change

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Abstract

The Breede River is the largest river in the Western Cape Province of South Africa, and as such, is a key resource for a variety of activities within the region. It is this significance of the river that prompted a study into the impact of climate change on future runoff in the river and hence, the potential impacts a projected change in catchment runoff may have on the future use of the river. Due to the complexities of the catchment only specialised hydrological models can capture the system dynamics of the river adequately. This limitation prompted the use of an alternative approach (self-organising maps (SOMs)) to hydrological modelling and, at the same time, performed an assessment of the appropriateness of this alternative approach for use in such applications.

SOMs are a powerful tool in synoptic climatology as they can be used to objectively classify a large number of daily synoptic states into a predetermined number of groups. Each archetypal synoptic pattern is linked to an observed associated runoff in the catchment. With an assessment of the change in frequency of each atmospheric state from control to future comes an assessment of the change in frequency of the associated runoff from control to future. The end result of this is a quantified assessment of the projected change in both high-frequency runoff events and in the projected change in mean annual runoff (MAR) in the catchment from the present to the future under 3 climate models.

Not only does this information assist in the process of long-term policy decisions made in relation to water-transfer schemes, but it also allows for an assessment of the future ecological sustainability of the catchment. This is achieved by assessing the projected future level of flow at each runoff gauging station against the current benchmark for ecological sustainability.

Keywords: Breede River, runoff, climate change, ecological sustainability