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Investigating Ecohydrological Feedbacks between Vegetation and Climate on Mean Annual Runoff from catchments in South-west Western Australia

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The effects of land use change on annual water yield can be described by variants of the Budkyo hydrological model. A recent modification using a simple process-based ecohydrological model provides insight into the partitioning of rainfall between runoff and evapotranspiration. The single free parameter in the model depends on the ratio between the 'effective' rooting depth multiplied by the fractional plant available water holding capacity divided by the mean rainfall depth per storm event. In previous work we have shown that effective rooting depth can be related to land use and climate and demonstrated the utility of the uncalibrated model to predict mean annual runoff from 2000-2011 across 11 catchments in South-west Western Australia. In this paper we extend the analysis to investigate changes in mean rainfall depth over time. We show that in general, the past four decades have been quite stable, but some rainfall stations exhibited step-change declines in mean rainfall depth in the mid-1970s. There is also some evidence of greater mean rainfall depths early in the last century. We use this information to re-analyse long term runoff trends and provide comment on the importance of understanding ecohydrological feedbacks between vegetation and climate in projecting scenarios of water yield response to climate change.