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Exploring Dynamics of Land surface–Subsurface Coupling Under Change

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The degree of land surface–subsurface coupling is controlled by complex interactions between the atmosphere, land surface condition and subsurface hydrologic characteristics. Global climate models project increases in temperature and changes in precipitation rates and patterns which in turn alter terrestrial water and energy budgets impacting water resources. However, the degree of land surface–subsurface coupling under scenarios of land cover and climate change has not been fully explored. In this study, we used an integrated groundwater–surface water–land surface model (ParFlow.CLM) across a semi-arid catchment located in the central west New South Wales, Australia to assess variability in water and energy fluxes under historic condition and scenarios of climate and land cover change. The Baldry hydrological observatory situated in a topographically flat terrain has the area of 2 km2 and contains two distinct land cover types of pasture and a regenerated Eucalyptus forest. High resolution groundwater level measurements in the site reveal differences in groundwater connectivity in wet versus dry periods in pasture and Eucalyptus forest for the historic condition. Using downscaled climate forcing obtained from a regional climate model for eastern Australia, the degree of land surface-subsurface coupling within the catchment was examined under various scenarios of climate and changes in land cover types. It is expected that a fully integrated hydrologic model like ParFlow.CLM improve predictions in land-atmospheric feedback processes under changes in hydrologic conditions.