Linking evapotranspiration seasonal cycles to the water balance of headwater catchments with contrasting land uses

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Abstract

Land use affects evapotranspiration rates and is a primary driver of the catchment water balance. The water balance of two catchments in southeastern Australia dominated by either grazed pasture or blue gum (*Eucalyptus globulus*) plantation was studied, focusing on the patterns of evapotranspiration (ET) throughout the year. Rainfall, streamflow, and groundwater levels measured between 2015-2019 were combined to estimate annual ET using a water balance equation. In the pasture, eddy covariance was used to measure ET from the catchment. Sap flow measurements were used to estimate tree transpiration in May 2017 – May 2018 and Feb 2019 – Feb 2021 in two different plots within the plantation. The tree transpiration rates were added to direct evaporation, estimated as a percentage of annual rainfall, to calculate ET from the plantation catchment. ET in the pasture showed strong seasonal cycles with very low ET rates in summer and ET rates in spring that were larger than the transpiration rates in the plantation, where trees transpired consistently throughout the year. The estimated annual ET from the water balance equation were comparable to ET estimated from other measurements. In the pasture, ET on average accounted for 88% of annual rainfall, while ET in the plantation was on average 93% of rainfall, exceeding it in the years with annual rainfall lower than 500 mm. The difference between the ET rates in the plantation and the pasture were approximately 30 to 50 mm y $^{-1}$. The larger ET rates in the plantation are reflected in a gradual decrease in the groundwater storage. The differences in ET rates were thus enough to cause a decrease in groundwater storage in the plantation, while the groundwater levels in the pasture remained stable.

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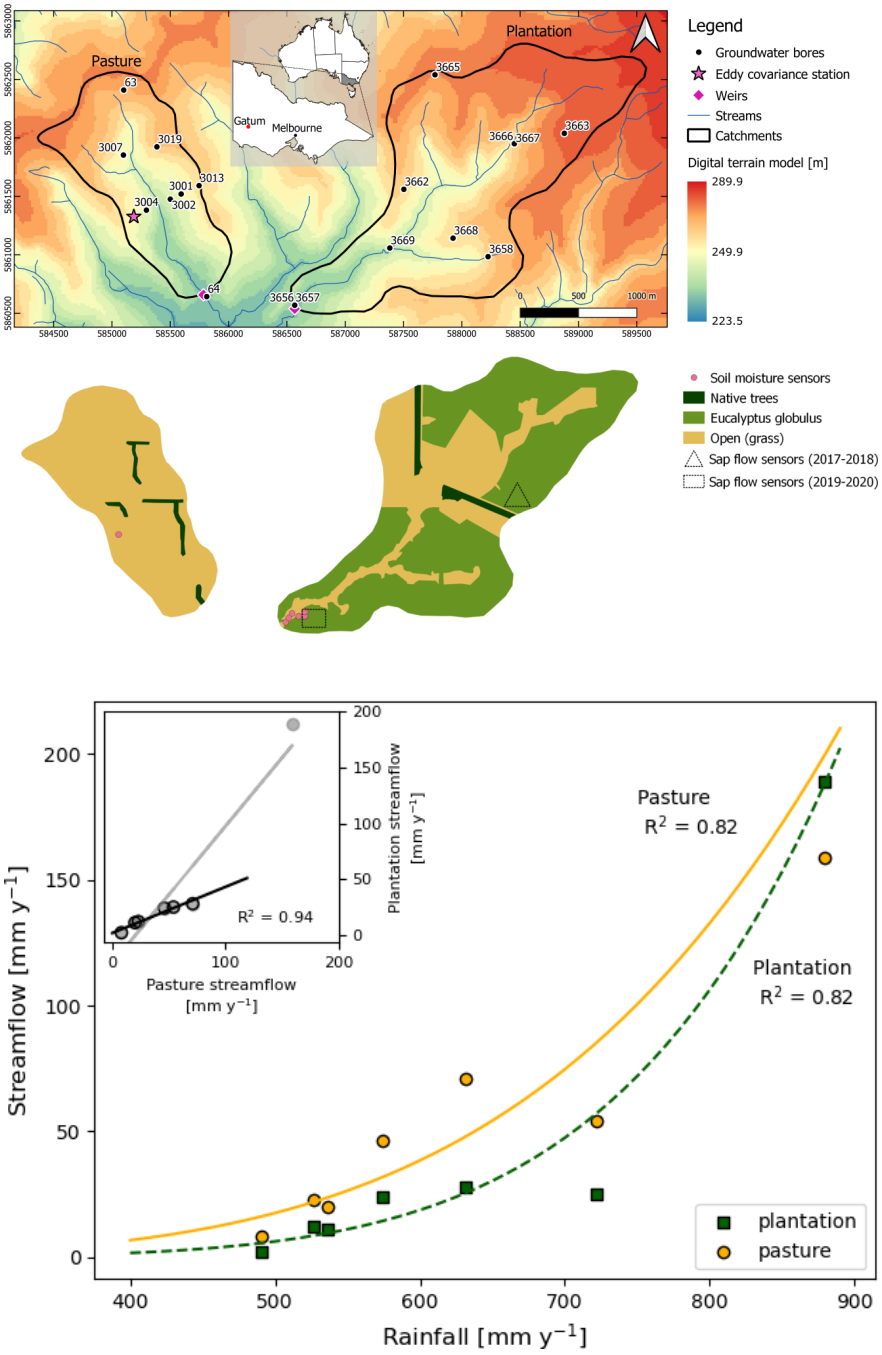

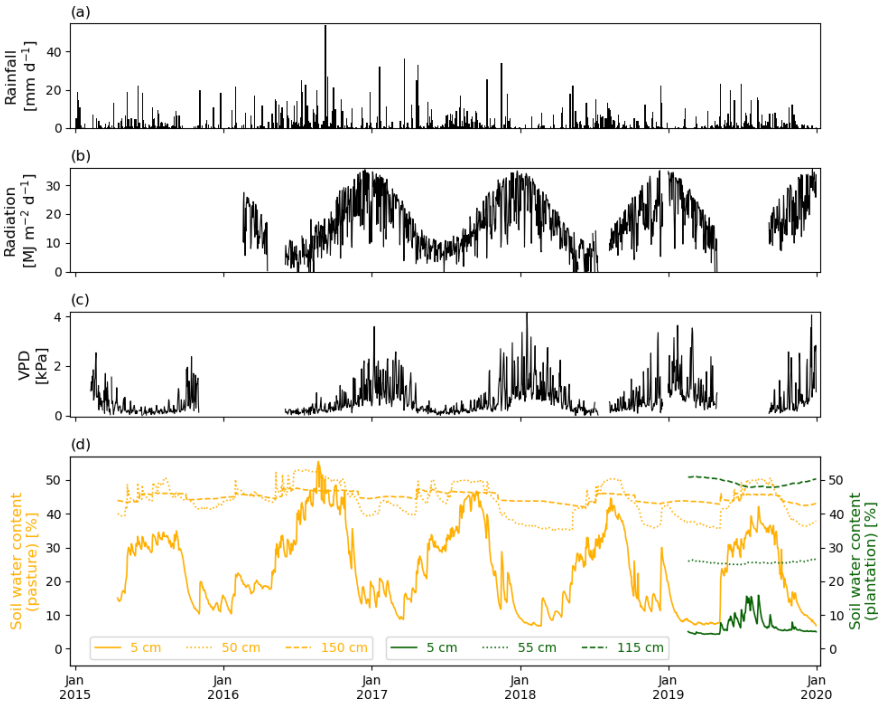

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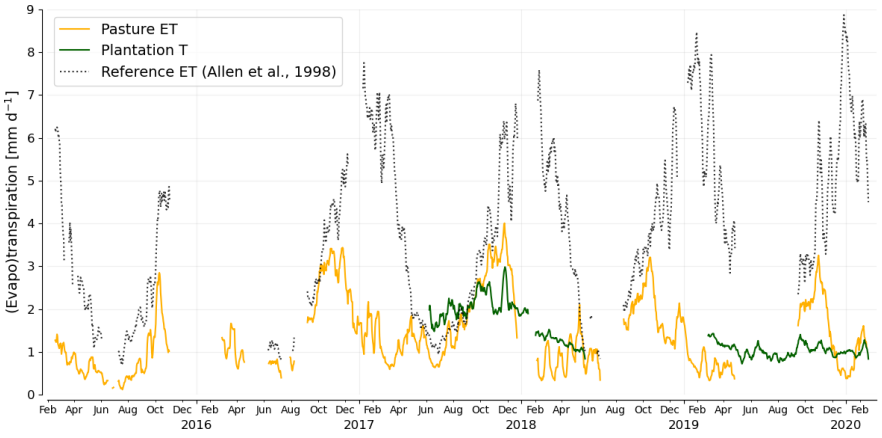

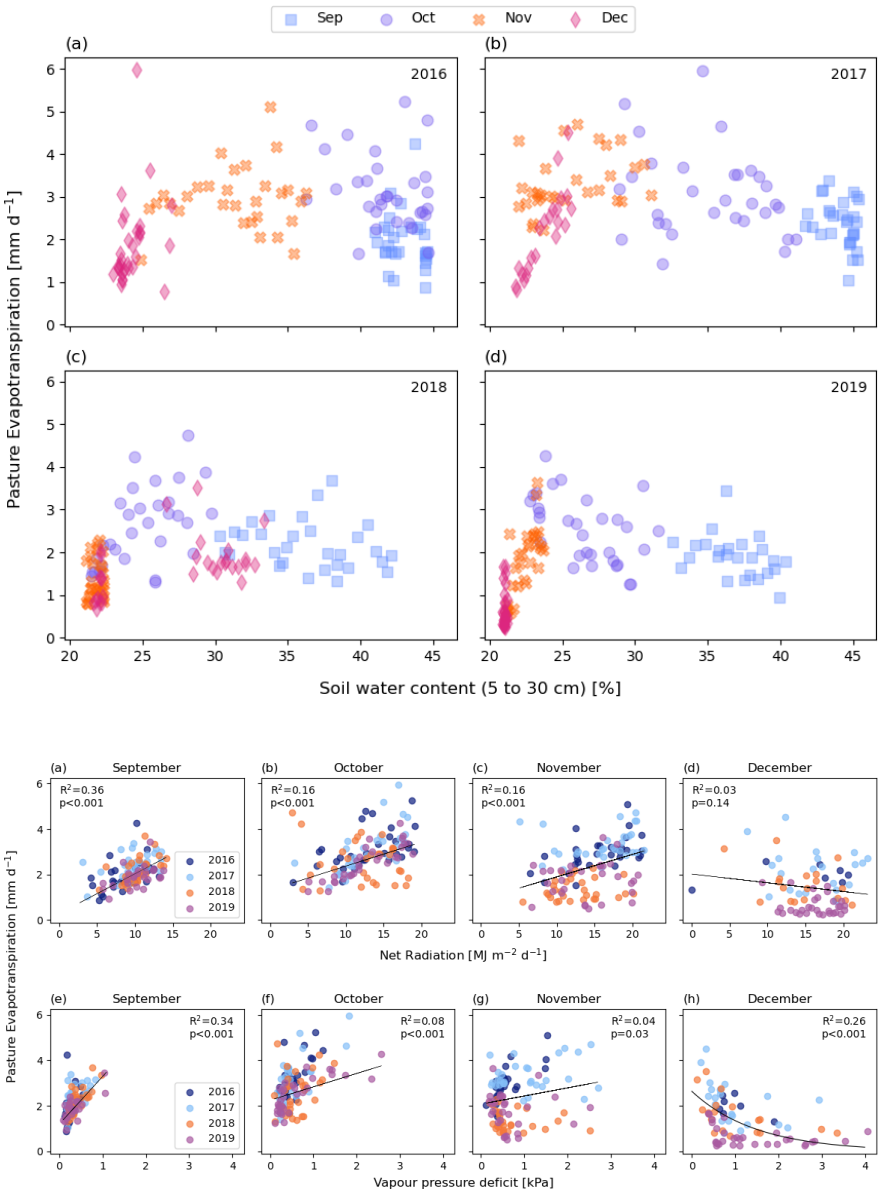

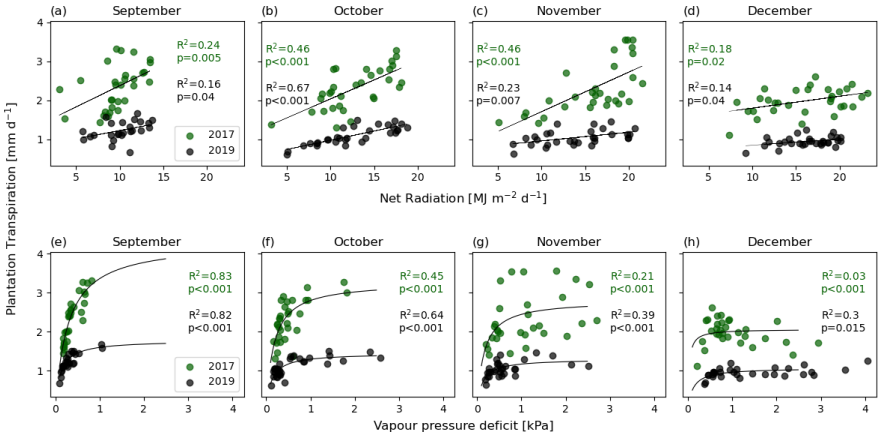

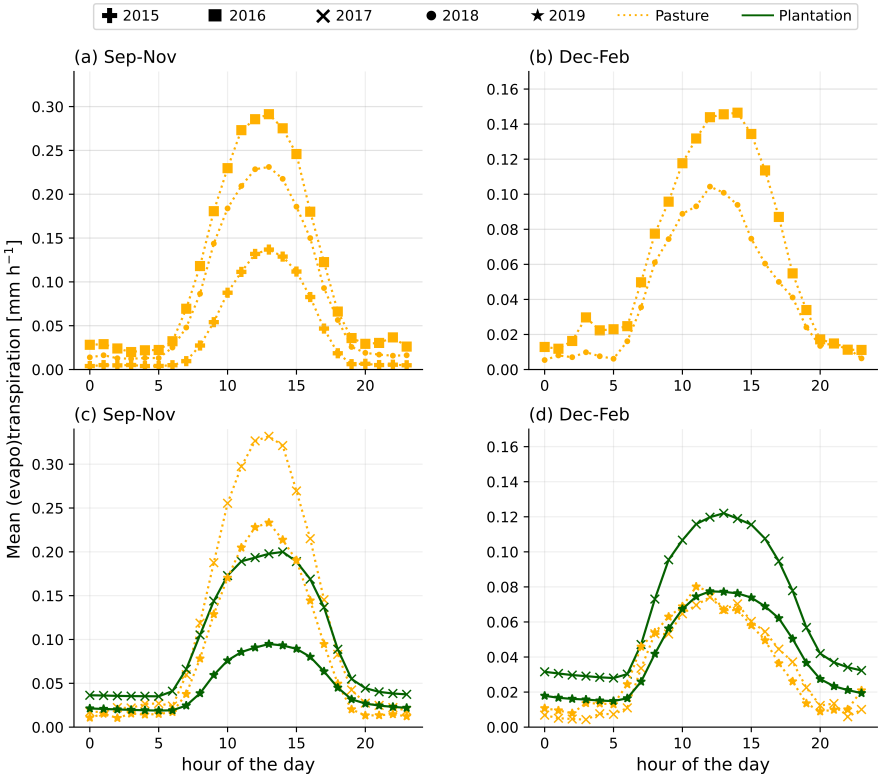

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