Geophysical Research Abstracts
Vol. 17, EGU2015-8954-4, 2015
EGU General Assembly 2015

Hydrological modelling in small, semi-arid catchments of south-eastern Australia: reforestation affects groundwater but not streamflow

Joshua Dean (1), Matteo Camporese (2), Samantha Grover (3), John Webb (3), Evan Dresel (4), and Edoardo Daly (5)

(1) Biological and Environmental Sciences, University of Stirling, Stirling, United Kingdom (joshua.dean@stir.ac.uk), (2) Department of Civil, Environmental and Architectural Engineering, University of Padua, Padua, Italy (matteo.camporese@unipd.it), (3) Department of Agricultural Sciences, La Trobe University, Bundoora, Vic, Australia (S.Grover@latrobe.edu.au, John.Webb@latrobe.edu.au), (4) Department of Environment and Primary Industries, Bendigo, Vic, Australia (evan.dresel@depi.vic.gov.au), (5) Department of Civil Engineering, Monash University, Clayton, Vic, Australia (edoardo.daly@monash.edu)

Land use has a strong influence on evapotranspiration (ET) and thus a large effect on catchment hydrology. The dearth of data from arid and semi-arid catchments limits the understanding of the possible effects of land-use and land-use change on water resources in these environments. Here we use three years of rainfall, streamflow, and groundwater level measurements to estimate the water balance components in two small, adjacent ephemeral Australian catchments, one predominantly covered with a young eucalypt plantation and the other primarily dedicated to grazing pasture.

The average annual rainfall for the study area is ∼670 mm, with ET greatly exceeding rainfall for most of the year, excepting the winter months of May through September. The paired catchments are similar in size and are situated on the same Devonian granitic geology. Land-use is the most striking difference between the catchments; this allows for a strong hydrological comparison of the eucalypt catchment (planted in 2008) with the pasture catchment. The majority of data is available from 2009 until present, although historical bi-monthly groundwater level data exists back to 1986. We focus on 2010-2012, and we have maximum data for 2012, including eddy covariance and sap flow measurements. The integrated hydrological model CATHY was calibrated and validated against the data in the two catchments for 2011 and 2012.

The water balances estimated from both data and model show a significant increase in ET in the eucalypt plantation catchment at the expense of groundwater storage: ET accounted for 95-97% of rainfall in the pasture catchment and 104-110% in the eucalypt catchment across the three years studied. Direct measurements of ET in 2012 confirm the water balance values. However, streamflow was more or less constant at 3-4% of rainfall in both catchments for the study period. The model results suggest that this is because streamflow is generated primarily from surface runoff, showing that land use controls on hydrological regimes in semi-arid regions can be highly complex and region-specific.