Geophysical Research Abstracts
Vol. 18, EGU2016-13483, 2016
EGU General Assembly 2016

Lessons learned from integrated hydrological modeling of ephemeral catchments with different land uses

Matteo Camporese (1), Joshua Dean (2), and Edoardo Daly (3)

(1) Department of Civil, Environmental and Architectural Engineering, University of Padua, Padua, Italy (matteo.camporese@unipd.it), (2) Earth and Climate Cluster, Faculty of Earth and Life Sciences, Vrije Universiteit, Amsterdam, The Netherlands (j.f.dean@vu.nl), (3) Department of Civil Engineering, Monash University, Clayton, Australia (edoardo.daly@monash.edu)

Land use, in particular tree cover, has a strong influence on evapotranspiration (ET) and thus a large effect on the water budget of ephemeral catchments in arid and semi-arid climates. Unfortunately, the dearth of medium to long-term experimental observations in such areas limits the understanding of the interplay between catchment geology, land use, and climate in driving catchment water balance. Here we use four years (2011-2014) of rainfall, streamflow, and groundwater level measurements to estimate the water balance components in two small, adjacent, ephemeral catchments in a semi-arid region of south-eastern Australia; one catchment was predominantly covered with a eucalypt plantation established in July 2008 and the other was dedicated to grazing pasture.

The integrated hydrological model CATHY (CATchment HYdrology) was calibrated against the data in the two catchments using streamflow and groundwater level observations in 2011; the data in the following years (2012-2014) were used for the model validation.

The model was able to adequately reproduce the periods of flow in both catchments in all years, although streamflow and groundwater levels were better reproduced in the pasture than in the plantation. This can partly be attributed to the root growth of the trees, which is difficult to estimate; the declining water storage in the eucalypt catchment could only be obtained when including a simple model of root growth dynamics. Other sources of uncertainty could be due to an imperfect description of the surface topography and bedrock geology, which prevent us from accurately reproducing the effects of the tree furrows and subsurface wetness connectivity.

The water balances estimated from both data and model showed a significant increase in ET in the eucalypt plantation catchment at the expense of groundwater storage: ET accounted for 95-104% of rainfall in the pasture catchment and 104-119% in the eucalypt catchment across the four years studied. However, the observed streamflow decline in the plantation was significantly less than predicted by the model, with streamflow discharge ranging from 1 to 4% of rainfall in both catchments for the entire study period.

Overall, the observed data and model simulations suggest the response of ephemeral catchments to land use change is driven by complex interactions between climate, geology and vegetation; long-term, data-rich, highly parameterized hyper-resolution modeling studies are required to further separate these factors.