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Inter-annual Attribution for Runoff Change Using a SWAT Model with Integrated Land Use Dynamics

Qinli Yang (1,2,3), Shasha Luo (1), Hongcai Wu (1), Guoqing Wang (3), Junming Shao (4,2)

(1) School of Resources and Environment, University of Electronic Science and Technology of China, No. 2006, Xiyuan Avenue, Chengdu 611731, China, (2) Big Data Research Center, University of Electronic Science and Technology of China, No. 2006, Xiyuan Avenue, Chengdu 611731, China, (3) State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering, Nanjing Hydraulic Research Institute, Nanjing 210029, China, (4) School of Computer Science and Engineering, University of Electronic Science and Technology of China, No. 2006, Xiyuan Avenue, Chengdu 611731, China

The contributions of different driving factors to runoff change have been extensively quantified in previous studies. However, how the contributions change over time is commonly unknown. In this study, the authors propose a framework for inter-annual attribution analysis of runoff change by using a Soil and Water Assessment Tool (SWAT) model with integrated continuous land use. Following the framework, contributions of driving factors (i.e. climate variability, land use change and other human activity factors) to runoff variation in each year during 1989-2012 were quantified for the Qingliu River catchment, China. The results indicate that runoff increased ($p>0.05$) during 1960-2012 with an abrupt change occurring in 1984. Land use changes year by year with two largest transitions occurring from 1995-1996 and from 2001 to 2002. The contributions of different driving factors change over time. Climate variability dominates runoff change in most years over 1989-2012 except for 2005 and 2007, during which human activity is the main contributor. Land use change causes runoff increase and exhibits relatively small contribution to runoff change. The other human activity factors show stronger impact on runoff after 2004. The results highlight the importance of analysing attribution of runoff changes in a dynamic manner. The findings should benefit decision-makers on taking and adjusting adaptive practices and strategies for water resources management in a changing environment.