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Response of hydrological processes to climate and land use changes in Hiso River watershed, Fukushima, Japan

Shilei Peng[1], Chunying Wang[2], Sadao Eguchi[3], Kanta Kuramochi[1], Masato Igura[3], Kazunori Kohyama[3], Satoru Ohkoshi[4], and Ryusuke Hatano[1]

[1]Hokkaido University , Research Faculty of Agriculture, Japan (pengshilei@chem.agr.hokudai.ac.jp)
[2]North China University of Water Resources and Electric Power, Zhengzhou 450045, China (wangchunying1987@yahoo.com)
[3]Institute for Agro-Environmental Sciences, National Agriculture and Food Research Organization (NARO), Tsukuba 3058604, Japan (sadao@affrc.go.jp)
[4]Fukushima Agricultural Technology Center, Koriyama 9608670, Japan (ohkoshi_satoru_01@pref.fukushima.lg.jp)

Hydrological processes at basin scale are driven by climate and land-use changes. Hiso River watershed (HRW) is within a radiocesium contaminated area caused by the disaster in Fukushima Daiichi nuclear power plant (FDNPP). It's urgently needed to make evaluations on how changes of climate and land-use bring impacts on hydrological processes, which control pollutants transport in watershed. This study applied a combination method of Statistical DownScaling Model (SDSM) and Soil and Water Assessment Tool (SWAT) to generate future climatic and hydrologic variables. Future climate data was obtained from three Representative Concentration Pathway (RCP2.6, 4.5 and 8.5) scenarios of a single General Circulation Models (GCMs) in three future periods of 2030s, 2060s and 2090s (2010-2039, 2040-2069, 2070-2099), with a baseline period (1980-2009). Furthermore, according to land-use change in HRW during 2013-2017, three land-use change scenarios under the three future climate scenarios were established. Results suggested that SDSM showed good capabilities in capturing daily maximum/minimum temperature and precipitation. The SWAT model presented good performances in simulating monthly and yearly streamflow. Results also suggested projected higher temperatures and lower rainfall led to decreased annual water yield and evapotranspiration (ET). The annual water yield and ET decreased in most seasons while had a slight increase in spring. RCP8.5 scenario always generated larger magnitudes for climatic variables and water balance components compared with other climate scenarios. Land-use changes had strong impact on surface runoff and groundwater flow. These findings could provide reference for decontamination and revitalization policy-making under complicated land use and climate change conditions.