Geophysical Research Abstracts
Vol. 20, EGU2018-9346, 2018
EGU General Assembly 2018

Impacts of the climatic change on the hydrology of the Eden catchment in Scotland, UK using DiCaSM model approach

Muhammad Afzal (1), Ragab Ragb (1), James Blake (1), Andrew Black (2), and Lindsey McEwen (3)

(1) Centre for Ecology and Hydrology, Water Resources, Wallingford, United Kingdom (muhafzal@ceh.ac.uk), (2) Department of Geography, University of Dundee, Dundee, UK, (3) Department of Geography and Environmental Management, University of the West of England, Bristol, UK

The impact of climate change on water resources availability especially during the drought events has been investigated on a study catchment in the east of Scotland, UK. In this study, we applied physically based hydrological modelling approach using the distributed catchment-scale (DiCaSM) model on Eden Catchment. The studied catchment is located in the Fife region of Scotland with the catchment area of 309 km2. The catchment has been subjected to drought in the 1970s and in the 1990s. This catchment is a significant source of water supplies for the agriculture more particularly during the summer season. The hydrological model was calibrated and validated for the period 1971 to 2012. During the model calibration stage, the model goodness of fit parameter expressed as Nash-Sutcliffe of 0.89 and R2 of 0.91. During the drought decade in the 1970s, the annual groundwater recharge was almost 20% less than the most recent decade, whereas during the summer months (JJA) in the 1970s the recharge was 41% less than the most recent decade (2001_2010). Potential evapotranspiration showed a slight change in autumn and winter seasons, however, in JJA potential evapotranspiration increased 14-18% in recent two decades in comparison to the previous two decades. In the recent decade, 2001-2010 water losses due to actual evapotranspiration increased by up to 26% in comparison to the 1970s and 1980s periods. For the future time periods (the 2020s, 2050s, 2080s), under UKCP09 low, medium and high emission scenarios, annual river flow decreased by up to 5% by the end of the century, however, during the summer months (JJA) this decrease was above 30% under high emission scenarios. Considering the current land use practices under all emission scenarios, the highest annual decrease in groundwater recharge was up to 5% in the 2080s, which was significant in summer months when groundwater recharge decreased by over 20% under high emission scenarios. Soil moisture deficit (SMD) increased by 5% and 7% respectively in the 2080s under medium and high emission scenarios. One of the main factors which influenced this decrease in river runoff and groundwater recharge was the increase in water losses due to the actual evapotranspiration which increased by up to 25% in second half of this century. Further study will look at the gap in water supply and demands considering the changes in surface and groundwater availability under current and future land-use changes. The finding of the study is helpful for water policy, decision-makers, and planners.