Climate Change Impacts on Groundwater Recharge in the Yom and Nan River basins, Northern Thailand

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Climate change is real and is now an international problem. It has a broad and spatially distributed impact on multiple sectors. The number of extreme weather events has surged and there have been many natural disasters because of the level of CO_2 concentration and uncertainty in weather circulation, influencing the change of the hydrologic cycle. It is generally known that surface water and groundwater affect an occurrence of several natural disasters directly such as floods and droughts. In the Yom and Nan River basins, flood and drought have occurred frequently because of the climate change impact and non-systematic management in the conjunctive use of both sources of water. Therefore, this study aims to assess the climate change impact on surface water and groundwater of the Yom and Nan River basins, located in the Northern Thailand. The surface water and groundwater regimes are generated by a fully coupled SWAT-MODFLOW model. Besides, Nash–Sutcliffe model Efficiency (NSE) and Root Mean Square Error (RMSE) are applied to investigate the efficiency of the model. For analyzing the future scenarios, the output of Global Climate Models (GCMs) from Coupled Model Intercomparison Project Phase 5 (CMIP5) is applied with consideration on the Representative Concentration Pathway (RCP) 2.6 and 8.5 to mainly focus on the difference between minimum and maximum of Green House Gas (GHG) emissions scenarios. The consequences of climate change impacts on hydro-meteorology are complicated. These impacts are uncertain and difficult to predict. Therefore, understanding how potential climate change effects alter the distribution and availability of hydro-meteorological variables at a regional or basin scale is crucial and necessary to frame resilient measures to provide and formulate better water resource management adaptations. The amount of surface water and groundwater during the reference (1981–2005) and near future (2021–2045) periods are compared to investigate their change influenced by climate change. The results show that the air temperature and rainfall in the near future are not different from the present period under scenario RCP 2.6. The annual water yield and percolation during 1981–2005 (reference period) and 2021–2045 (near future period) was compared with amount of water demand, reported by the Department of Water Resources. The water demand of the Yom and Nan river basins, amounting to 3575 and 4638 MCM per year, it can be considered that there are 11 water shortage years and two years that needed percolated water for the water supply in the Yom river basin. In the Nan river basin, there is neither a water shortage year nor a year which needed percolated water. This might be an influence of water management operated by the Sirikit dam. This produces an amount of surface water and groundwater between both periods that is much similar. However, the air temperature and rainfall tend to show a rising trend under scenario RCP 8.5, affecting the amount of runoff and groundwater significantly. Furthermore, the change of the amount of water from both sources directly impacts water availability, when evaluating the water demand for consumption, industry, and agriculture. These results are very useful and can be applied as primary information for sustainable water management in the near future.

