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Snow-melt Runoff Simulation for Dam Reservoir in the Heavy Snow Region

Yoshinobu SATO (1), Akihiro MURAI (2), and Tetsuya SUMI (2)

(1) Faculty of Agriculture, Ehime University, Matsuyama, Japan (satogon@gmail.com), (2) Disaster Prevention research Institute, Kyoto University, Uji, Japan (sumi.tetsuya.2s@kyoto-u.ac.jp)

Increases in land surface temperature will have a significant affect on the hydrological cycle, particularly in regions where the available water resources are mainly dominated by the melting snow or ice. Thus, to clarify the impact of climate change on river discharge in cold and mountainous region is becoming one of the urgent issues for policy making and planning for the integrated river water management under the inevitable warming climate. However, in order to study climate change impacts on water resources in the heavy snow region, snow-melt runoff simulation for dam reservoir should be improved. Because, the available meteorological data for runoff simulation is quite limited, especially in a mountainous regions in Japan. In this study, we analyzed the inflow into the Okutadami Dam in the Agano River basin located in the northern mountainous region in Japan by a distributed hydrological model (Hydro-BEAM: Hydrological river Basin Environment Assessment Model). The Okutadami dam has an important role as one of the largest hydro-power generation dam in Japan. The result of our initial simulation underestimated the inflow significantly, especially in snow melting season, because of small input precipitation. We firstly modified the input precipitation by the JMA (Japan Meteorological Agency)'s climatic value 2010 (monthly 1km2 averaged mesh based precipitation dataset during the period from 1981 to 2010). Due to the modification, simulated annual mean river discharge (water balance) was improved significantly. Secondly, we modified the threshold temperature which distinguishes rainfall and snowfall improved the reproducibility slightly. Lastly, we modified the monthly discharge variation (seasonal change pattern) in snow melting period by considering the effect of heat supply by rainfall on snow surface layer. Consequently, we found that the calculated inflow to the Okutadami dam agreed well the observation. These methods will contribute to clarify the hydrological impact of climate change for the snow dominated mountainous region.