Climate change impact on stream-flow in mountainous regions of Japan

Yoshinobu Sato, Dr. Associate Professor
Water Resources Research Center, Disaster Prevention Research Institute, Kyoto University,
Uji City, Kyoto, Japan

Abstract

The impact of climate change on stream-flow was assessed by hydrological simulations for several major river basins in mountainous regions of Japan using the latest version of a super-high-resolution atmospheric general circulation model (AGCM) with a horizontal resolution of about 20 km. Projections were made using two different datasets, one representing the present climate and the other representing the end of the 21st century assuming the SRES A1B scenario. Stream-flow was estimated by a distributed hydrological model calibrated against observed river discharge in advance. The results showed that even if the amount of precipitation does not change much in the future, stream-flow will change significantly because of the increase in rainfall, decrease in snowmelt, and increase in evapotranspiration with higher air temperature. The impact of climate change on stream-flow will be more significant in the northern part of Japan, especially in the Tohoku and Hokuriku regions. The water balance analysis revealed that the increase of winter flow and decrease of spring flow were induced due to the increase of winter precipitation and the subsequent decrease in snowmelt. The monthly average stream-flow at the end of the 21st century was projected to be more than 200% higher in February and approximately 50 - 60% lower in May compared with the present flow. These results imply that the increase in air temperature has important consequences for the hydrological cycle, particularly in regions where the water supply is currently dominated by snowmelt.

Key words: Climate change, Stream-flow, Mountainous region, AGCM, Distributed hydrological model