Climate change and river discharge simulation research in a snowy region, Japan

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In Japan, snowfall amounts have fallen sharply in some Japan regions. Japan Meteorological Agency reported that the annual maximum snow depth has significantly decreased until the beginning of the 1990s since the peak at the beginning of 1980s. Though slight upward trend is observed since then, it remains at levels much lower than those of the early 1980s. This downtrend can be attributed mainly to the dramatic rise in mean winter temperatures from northern to western Japan since the mid-1980s, resulting in a noticeable decrease in river discharge in spring. Moreover, it was predicted that the snowfall amounts will be decreasing further for all of Japan's regions except Hokkaido due to the temperature rises around 2.8 ℃ in the end of the 21st century. To clarify the possible effects of climate change on water resources, we had a numerical investigation of river discharge by using runoff data derived by a regional climate model with a approximately 5-km resolution as input data to a hydrological model. Six rivers (Oyabe, Sho, Jinzu, Jyoganji, Kurobe and Agano) located in snowy region were selected in this study. The river basin area ranges from 368 km2 to 7,710 km2. A hindcast experiment, which to reproduce the current climate was carried out for the two decades, 1980s and 1990s. A future hydrological response to global warming under the 2030s and 2070s conditions was investigated using a pseudo-global-warming method. The results showed that the characteristic of river discharge in seasonal variation could be represented and there were overestimated compared with measured one. Compared with the reproduced discharges of 1980s and 1990s, the discharges will be increased by in winter season from December to March under the climate change projection of 2030s and 2070s.