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The hydroclimatological response to global warming based on the dynamically downscaled climate change scenario

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Given the discernable evidences of climate changes due to human activity, there is a growing demand for the reliable climate change scenario in response to future emission forcing. One of the most significant impacts of climate changes can be that on the hydrological process. Changes in the seasonality and increase in the low and high rainfall extremes can severely influence the water balance of river basin, with serious consequences for societies and ecosystems. In fact, recent studies have reported that East Asia including the Korean peninsula is regarded to be a highly vulnerability region under global warming, in particular for water resources. As an attempt accurately assess the impact of climate change over Korea, we performed a downscaling of the ECAHM5-MPI/OM global projection under the A1B emission scenario for the period 1971-2100 using the RegCM3 one-way double-nested system. Physically based long-term (130 years) fine-scale (20 km) climate information is appropriate for analyzing the detailed structure of the hydroclimatological response to climate change. Changes in temperature and precipitation are translated to the hydrological condition in a direct or indirect way. The change in precipitation shows a distinct seasonal variations and a complicated spatial pattern. While changes in total precipitation do not show any relevant trend, the change patterns in daily precipitation clearly show an enhancement of high intensity precipitation and a reduction of weak intensity precipitation. The increase of temperature enhances the evapotranspiration, and hence the actual water stress becomes more pronounced in the future climate. Precipitation, snow, and runoff changes show the relevant topographical modulation under global warming. This study clearly demonstrates the importance of a refined topography for improving the accuracy of the local climatology. Improved accuracy of regional climate projection could lead to an enhanced reliability of the interpretation of the warming effect, especially when viewed in the linkage climate change information and impact assessment studies.