Assessment of Future Climate Change Impact on Groundwater Level using SWAT-MODFLOW in Geum River Basin of South Korea

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(a) Purpose of study or research hypothesis
Predict the impact of future GWL (groundwater level) change by using HadGEM3-RA RCP 4.5 and 8.5 scenarios using SWAT-MODFLOW

(b) Key issue(s) or problem(s) addressed
The present annual groundwater use in South Korea is about 3.7 billion tons, which is about 10% of total water use and 35% of total developable groundwater resources. Nationally, The GWL are expected to decline by 0.58 m over the next 20 years. The groundwater use in Geum river basin (9,645.5 km2) has been increased 11.6% even from 2005 to 2015.

(c) Methodology or approach used
In order to estimate the future GWL, the SWAT (Soil and Water Assessment Tool) was calibrated using the daily watershed inflow and storage of two dams (DCD and YDD), daily inflow and storage of three weirs (SJW, GJW, and BJW), and five GWL observation sites (JSJS, OCCS, BEMR, CASS, and BYBY). In addition, the SWAT-MODFLOW (integrated hydrological model that couples SWAT land surface processes with spatially-explicit groundwater flow processes) was calibrated using the same data and compared with the SWAT results and used to evaluate the future GWL behavior of Geum River basin.

(d) Results or conclusions derived from the project
The calibration period of SWAT was set to five years (2005~09) and its validation period was set to eight years (2010~18). The Nash–Sutcliffe efficiency (NSE) and the coefficient of determination (R2) of two dam inflows were 0.55~0.70 and 0.67~0.75 respectively. For the inflow of three weirs, the average NSE was 0.57–0.77 and R2 was 0.62–0.81. The average R2 for the five locations GWL ranged from 0.53 to 0.61. The SWAT-MODFLOW will be calibrated and we will evaluate the future impact on watershed scale GWL distribution. This study will provide guideline on the groundwater use impact on groundwater level due to future climate change.

(e) Implications of the project relevant to congress themes
By predicting the impact of future climate change on groundwater hydrology, it can suggest the proper groundwater resource management in a watershed scale through assessing the spatiotemporal change of GWL distributions.

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