Validaion of land surface model considering groundwater level change

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Kotsuki et al. (2012) developed a global water cycle model in-land to simulate the sustainability of water resources, but groundwater resources are not considered. This study aims to improve land surface model SiBUC, which is main component of the model developed by Kotsuki et al., to simulate groundwater level.

Soil layer consists of three parts (surface layer, root zone and recharge zone) in original model, and another groundwater layer is added at the bottom of soil layer in this study. Soil water content in all layers is simulated based on Richards' equation, and water exchange between the layers is calculated using Darcy's low. In the groundwater layer, saturated and unsaturated zone coexist and water exchange from third to fourth layer is calculated between the center of third layer and unsaturated zone in fourth layer. As for the relationship between soil physical properties, Clapp and Hornberger (1978) is used. Matric potential in unsaturated zone is assumed to change linearly (Takasao et al., 1997). By solving this assumption and Clapp and Hornberger’ s equation, groundwater level is determined depending on soil water content. Base flow is represented as gravitational drainage from fourth layer. Original SiBUC simulates water balance only in vertical direction, but this model can consider horizontal soil water movement using methods developed by Tanaka et al. (1997) and Takasao et al. (1997).

This model is validated using groundwater level data obtained at some observation wells. At a well near river, groundwater recharge from river water is considered by determining slope which is necessary to calculate base flow based on the difference between groundwater level and nearest river water level.

Keywords: land surface model, groundwater

