

Water balance change at a transiting subtropical forest in Jeju Island

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Abstract

Jeju island has a humid subtropical climate and this climate zone is expected to migrate northward toward the main land, Korea Peninsula, as temperature increases are accelerated. Vegetation type has been inevitably shifted along with the climatic change, having more subtropical species native in southeast Asia or even in Africa. With the forest composition shift, it becomes more important than ever to analyze the water balance of the forest with the ongoing as well as upcoming climate change. Here, we implemented the Ecosystem Demography Biosphere Model (ED2) by initializing the key variables using forest inventory data (diameter at breast height in 2012). Out of 10,000 parameter sets randomly generated from prior distribution distributions of each parameter (i.e., Monte-Carlo Method), we selected four behavioral parameter sets using remote-sensing data (LAI-MOD15A2H, GPP-MOD17A2H, and ET-MOD16A2, 8-days at 500-m during 2001 - 2005), and evaluated the performances using eddy-covariance carbon flux data (2012 Mar.-Sep. 30-min) and remote sensing data between 2006-2020. We simulated each of the four RCP scenarios (2.6, 4.5, 6.0, and 8.5) from four climate forcings (GFDL-ESM2M, HadGEM2-ES, IPSL-CM5A-LR, and MIROC5 from ISIMIP2b). Based on those 64 simulation sets, we estimate the changes in water balance resulting from the forest composition shift, and also uncertainty in the estimates and the sensitivity of the estimates to the parameters, climate forcings, and RCP scenarios.

Keywords : Climate change; Forest type transition; Invasive species; Water balance; Evapotranspiration; Hydrological cycle; Water resource management

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