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Comparing Lumped and Distributed Model in Hydrological Services - Impacts of Climate Change - A Case Study in Taiwan

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ABSTRACT

Human has a vested interest in hydrological services; we cannot live without any hydrological services. Unfortunately, hydrological services have been strongly affected by climate change. Therefore, it is crucial to quantify how the hydrological services have been affected by atmospheric change. This study aims to quantify hydrological services by using two models – one is a traditional hydrologic model – SWAT model and another is a new ecosystem model – InVEST model. Our study area is Datuan river watershed, which is located in the northern part of Taiwan. First, we use IPCC fifth assessment report (AR5) scenarios of RCP4.5 and RCP8.5 as components of the future precipitation regimes. Then we use SWAT model and InVEST model to calculate the hydrological services, including water yield, nitrogen retention, phosphorus retention, and sediment retention. Finally, we contrast SWAT model and InVEST model results. SWAT model is a long-term lumped model, and the results show that water yield in both wet season and dry season will be extremely high in the future. Moreover, the simulated results show that water yields derived from the InVEST model will be more significantly affected by climate change than those predicted by the SWAT model. Nitrogen retention, phosphorus retention and sediment retention will be less affected by climate change based on the results from the InVEST model. To sum up, by comparing results between two models, hydrological services analysis indicates that climate change will not only have a huge impact on overall hydrological services, particularly water yield, but also on the distribution of such services.

KEY WORDS: hydrological services, SWAT model, InVEST model, climate change