
Modeling Soil Moisture Dynamics in the Yufeng Watershed of Taiwan

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Abstract Text:

The soil moisture dynamics respond to the magnitude of precipitation intensity, air temperature and landscape conditions. They play a key role in controlling the heat exchange and water balance, and are important considerations for forest and watershed managers. However, soil moisture information is very limited in many watershed areas in Taiwan. To provide soil moisture estimations, we constructed a physically-based model with the STELLA Architect, a system dynamics software. We modeled multiple processes in different soil textures in an hourly time frame, considering infiltration, percolation, overland flow, saturation, and evaporation, to simulate soil moisture at various depths. Modeling results were calibrated and validated with field measurements in the Yufeng watershed during January to June 2019. Our results showed that the delay time of infiltration and soil-gravel mixture content were sensitive to the soil moisture estimations. Simulation results were further arranged to deliver a soil moisture profile providing practical visualization in the distribution and dynamics of soil moisture with depth and time. We believe that this physically-based modeling approach will be useful to forecasting potential changes of soil moisture, and offer important information for managers to cope with climate change.