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Simulation of Evapotranspiration using an Optimality-based Ecohydrological Model

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Accurate estimation of evapotranspiration (ET) is essential in understanding the effect of climate change and human activities on ecosystem and water resource. As an important tool for ET estimation, most of the traditional hydrological or ecohydrological models treat ET as a physical process, controlled by energy, vapor, pressure and turbulence. It is at times questionable as transpiration, major component of ET, is biological activity closely linked to photosynthesis by stomatal conductivity. Optimality-based ecohydrological models consider the mutual interaction of ET and photosynthesis based on optimality principle. However, as a rising generation of ecohydrological models, so far there are only a few applications of the optimality-based model in different ecosystems. The ability and reliability of this kind of models for ecohydrological modeling need to be validated in more ecosystems. The objective of this study is to validate the optimality hypothesis for water-limited ecosystem. To achieve this, the study applied an optimality-based model Vegetation Optimality Model (VOM) to simulate ET and its components based on optimality principle. The model is applied in a semiarid watershed. The simulated ET and soil waster were compared with long term measurement data in Kendall and Lcukyhill sites in the watershed. The result showed that the temporal variations of simulated ET and soil water are in good agreement with observed data. Temporal dynamic of soil evaporation and transpiration and their response to precipitation events can be well captured with the model. This could come to a conclusion the optimality-based ecohydrological model could be a potential approach to simulate ET.