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Parameter sensitivity analysis and optimization for a global remote-sensing-based evapotranspiration model

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As the only way for water return to the atmosphere from the land surface, terrestrial evapotranspiration (E) is an important link in the Earth's hydrological cycle and energy balance, which closely links the exchange of water carbon and energy between the geosphere and the atmosphere. Therefore, accurate estimation of terrestrial E is critical to understand the world's energy and water cycles. In recent years, remote-sensing based E model has been greatly developed for estimating terrestrial E at continental and global scale. However, the uncertainties of model parameter, structure, and quality of forcing data still resulting in considerable error on final simulation. Based on the data from 179 flux towers, we assessed a typical RS-based E model (PT-JPL) across different biomes. The results showed the model performance exhibited large uncertainties in most cases. Hence, first, we identified the key parameters of PT-JPL model using the Sobol' sensitivity analysis method across biomes. The output of the PT-JPL model was sensitive to three parameters (β, m1, Topt). Second, we used the differential-evolution Markov Chain (DE-MC) scheme to obtain the proper posterior distributions for these three key parameters across a range of biomes. Finally, we evaluated and compared the model with optimized parameters at site, catchment, and global scales. The results indicated that the optimized parameters can provided an efficient way to improve the performance of PT-JPL model.