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Shortcomings of Common Remote Sensing-Based Evapotranspiration Models over Water Bodies

Somayeh Sima (1) and Mostafa Khorsand (2)

(1) Tarbiat Modares University, Civil and Environmental Engineering, Tehran, Iran, Islamic Republic Of (s.sima@modares.ac.ir), (2) Tarbiat Modares University, Civil and Environmental Engineering, Tehran, Iran, Islamic Republic Of Iran (khorsand.m67@gmail.com)

Evapotranspiration (ET) is an important water loss component in a catchment-scale water accounting. Because of the difficulties in direct measurement of ET, numerous physically-based models have been developed to estimate evaporation and evapotranspiration. Among them, the energy balance model outperforms others. Remote sensing-based energy balance models such as SEBAL and SEBS are capable of evaluating ET at regional scale without the need for quantifying complicated relevant hydrological process. Although these models originally were developed for agricultural areas, they include empirically adjusted parameters and equations for application over water bodies. A number of studies on basin-scale application of these models over land & water areas can be find in the literature. However, their accuracy over water bodies is questionable. This in turn, may cause significant errors in basin-scale water accounting, particularly in closed basins. This study discusses the deficiency of the SEBAL and SEBS algorithms in estimation of evaporation losses form a large hyper-saline Lake in an arid climate. Urmia Lake, Iran, with an area about 5000 km2 is an appropriate extreme case to examine performance of the RS-Based algorithms in estimating evaporation from water bodies because of its vast expanse which makes it possible to assess the role of spatial variability of climatological variables over the lake as well as its salinity which let us to study the influence of water quality. Moreover, effect of the temporal upscaling applied in these models to extrapolate instantaneous evaporation estimates to daily evaporation rates was investigated. A daily BREB RS-based model was used as a reference model for comparison. MODIS satellite imageries together with in-situ meteorological data were used in the three models to develop daily evaporation maps during dry & wet seasons. Results showed that SEBAL & SEBS failed to accurately estimate both the lake-averaged daily evaporation rates and spatio-temporal variation of evaporation. The sensitivity of evaporation estimations to the water adjusted parameters and approximations used in the SEBS and SEBAL models were further examined. Based on the finding of this study, the SEBAL and SEBS ET models should be used with cautious over water areas. On the other hand, where evaporation is controlled by the lake water quality the RS-based BREB model is a better alternative in compared to SEBAL and SEBS.
Evapotranspiration, Evaporation, Energy Balance, BREB Model , Lake, Salinity.