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Comparison of Actual Evapotranspiration assessment by satellite-based models (SEBS/ LSA SAF) and hydrological modeling (BBH)

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Actual evapotranspiration (AET) is a key component of the energy balance and hydrological regime of catchments. Estimating actual evapotranspiration (AET) in agricultural semi-arid regions is important for crop yield and drought assessment. The SEBS model, a physically-based model of energy balance, and the BBH-model, a conceptual water balance model, are used to estimate AET at the 10-day scale in Northern Tunisia using in situ and remote sensing data. Their estimates were compared to those obtained from a satellite product LSA SAF, based on the soil-vegetation-atmosphere model TESSEL. Comparisons are performed at two spatial scales: at the level of the pixel, and aggregating pixels from the same watershed. Eight gauged watersheds were considered with an area varying between 52 and 416 km². The spatial and temporal study of the coefficient of variation of AET indicates that the AET is coherently related to the spatial and temporal variation of ecosystems. Results indicate that the summer and autumn seasons are the most unstable period and the south part is the most unstable area. The comparison of AET-LSA SAF within AET-SEBS estimations results in R^2 under 0.6 at the pixel scale and R^2 varying from 0.2 to 0.5 at the basin scale. The SEBS model estimations overvalue those of LSA SAF, with an MAE = 20 mm 10-day^{-1} for almost basin. The comparison of AET-LSA SAF and AET-BBH at the basin scale shows an acceptable coefficient of determination (R^2 = 0.6) at the level of basins situated in the north part of the study area. By cons, a nonsignificant R^2 was obtained at the level of the basin in the south. The MAE is about 6.5 mm 10-day^{-1} with a general overestimation of AET-BBH comparing to AET-LSA SAF. A good coefficient of determination (R^2=0.7) was found when comparing the AET-SEBS and AET-BBH estimations for the basin situated in the south part. The MAE = 16 mm 10-day^{-1} and the RMSE = 18 mm 10-day^{-1} with an overestimation of AET-SEBS comparing to AET-BBH. These results are encouraging and may help stakeholders to have a range of AET estimations using three different sources and approaches.