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Estimation of evapotranspiration in heterogeneous landscape using simplified surface energy balance Operational

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Abstract: Evapotranspiration (ET) has important practical significance in water resources planning and management, irrigation scheduling and environmental issues as well as hydrological model parameterization. The objective of this study is to map ET using thermal-based Simplified Surface Energy Balance Operational (SSEBop) model across a heterogeneous landscape in the Mara basin. We used level three clear sky Moderate Resolution Imaging Spectroradiometer (MODIS) land surface temperature at 1km spatial scale. Since the study area has poor weather monitoring network, the weather parameter required to derive the reference evapotranspiration and evaporative fraction is retrieved from Global Land Data Assimilation System (GLDAS) dataset. The analyses have been carried out from 2002-2010. As it turns out from the analysis, on average ET accounts about 66% of the annual rainfall in the basin, indicating a higher green water flux from the hydrologic cycle. Given the heterogeneity in the land cover, the estimated ET shows a higher spatial variability. Higher ET fluxes are noted for water body, wetland and forested surfaces while sparsely vegetated areas show lower estimates. The estimated ET reveals a pronounced temporal dynamics with relatively higher fluxes peaks in March and October. This result is consistent with seasonal rainfall distribution in the region, indicating the physical consistency of the ET estimates. Furthermore, the SSEBop ET estimates compare fairly well with MOD16 Nile Basin estimates and show a good correlation with the Normalized Vegetation Index (NDVI). The promising results from this study also highlight the potential of globally available, public domain reanalysis climate products for ET mapping in data poor regions.

Keywords: Mara basin; evapotranspiration; MODIS; GLDAS; SSEBop