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Validating earth observation based- surface heat fluxes in Miombo vegetation using the Bowen Ratio-Distributed Temperature Sensing Approach

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As water demand increases and climate change impacts are felt, the need to efficiently manage water resources in the Zambezi River Basin, Southern Africa, has heightened. To answer to this challenge satellite earth observation (SEO)-based hydrological modelling is widely promoted and is being used in the region, albeit without or with limited validation of the SEO-based model inputs in most cases. One significant water balance parameter is evaporation, which is highly influenced by the vegetation type. The Zambezi River Basin is predominantly Miombo vegetation, the vastest transboundary dry forest biome in southern Africa, stretching over seven countries covering more than 2.7 million km2. Though a number of studies have been done on the Miombo ecosystem, none, to our best knowledge, has attempted to characterise the surface heat fluxes (i.e. sensible heat flux, latent heat flux, evaporative fraction etc.) at field level. In this study we use the Bowen Ratio-Distributed Temperature Sensing (BR-DTS) method to characterise field-based surface heat fluxes in Miombo vegetation. The results of the BR-DTS method are used to validate the surface heat fluxes outputs of two of the commonly used land surface flux models, the Surface Energy Balance System (SEBS) and the Surface Energy Balance Algorithm for Land (SEBAL) in Miombo vegetation. We investigate the impacts of radiometric calibration, atmospheric correction, spectral and spatial resolution, and seasonality on the SEBS and SEBAL models land surface fluxes estimation in Miombo vegetation. MODIS and Landsat satellite data are employed in the study. Furthermore, the study seeks to observe correlations and thus indicator parameters that can be used to improve SEBS and SEBAL models' satellite-based inputs for enhanced water fluxes assessment in Miombo vegetation. Finally, the study will discuss what empirical relations can be used to assess land surface fluxes in the Miombo vegetation and similar environments in the absence of field data.