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Understanding the role of the radiometric indices in temporal evapotranspiration estimation in arid environments

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ABSTRACT

In water budget assessment, evapotranspiration (ET) proved as one of the most significant features whose reputation boosts in arid climates. Indirect approaches to estimate ET are complex in their calculation requiring different algorithms but an indirect approach was taken in this study which enables us to develop relationships, which are less complex and less time-consuming. In this study, an association between ET, observed by the Global Land Data Assimilation System of National Aeronautics and Space Administration and vegetation indices (VI) taken by Landsat 8 images were generated. Quarterly images were taken for the period of two years (2018–2019) to make an empirical relationship by linear regression analysis between ET and VI's specifically named as, soil adjusted vegetation index (SAVI), normalized difference vegetation index (NDVI), and normalized difference water index (NDWI). The resultant equation represents the relationship in terms of R^2 enabling to evaluate each index with ET. NDVI was found averagely associated with ET estimation because of its low regression value, in general, it goes minimum up to 0.56 for August 2019. However, it remains approximately consistent between 0.60 and 0.65 for all month except October 18 in which its values go to 0.72. Similarly, SAVI was also analyzed and got much better correlation for both years sustaining near or above 0.65 with a maximum value of 0.78, so this index performed well then NDVI. Likewise, to other indices, NDWI was also studied and got very splendid results of correlation than other two indices. This index sustains its values of R^2 among 0.85–0.91 for maximum months of the years indicating its highest relationship with ET. It can be concluded that NDWI derived relations were more promising than the other two for ET calculation.

Keywords: Evapotranspiration; Vegetation indices; Normalized difference vegetation index; Normalized difference water index; Soil adjusted vegetation index; Global Land Data Assimilation System

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