Estimation of remotely sensed spatio-temporal evapotranspiration using atmospheric land exchange inverse model: a comparative analysis of Skardu and Tando Jam, Pakistan

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Understanding regional scale hydrology and spatio-temporal changes in various components of the climate system involves mapping variability in Evapotranspiration (ET) on both temporal and spatial scales. In this connection, the current research aims to assess the spatio-temporal variability and distribution of ET utilizing a two source energy balancing approach on remotely sensed imagery. In order to accomplish this, the Atmosphere-Land Exchange Inverse (ALEXI) Model, a two-source energy balance model, was utilized to on Landsat-8 imagery. The two-source approach, for calculating energy balance, have the capacity to distinguish between soil and vegetation and, hence, separate fluxes are estimated. In this study, ALEXI was used to predict the latent heat flux using the following variables: LAI (Leaf Area Index), Rn (net radiation), LST (Land Surface Temperature), and albedo.

The focus was given to compare the mentioned approach under varying climatic conditions of Pakistan. For this purpose, two different regions have been selected, namely Skardu (cold snowy with dry and hot summer) and Tando Jam (desert hot climate with dry winters). The model showed satisfactory results under both climatic conditions with correlation coefficient (r) of 0.83 and 0.81 at Tando Jam and Skardu, respectively. The present study reveals an increasing ET trend at Skardu from the year 2013 towards 2020 for both modelled and station ET. At Tando Jam region, a slightly decreasing trend was exhibited for both modelled and station ET. Overall, the two source energy balance of ALEXI proved to be applicable under these two climatic conditions of Pakistan. The approach should be extended to other regions of the country and must be test with other sensors as well.

Keywords: LAI; Net Radiation; Energy Balance; Climatic Conditions; Validation