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"Solidarity in a competing world — fair use of resources"

Estimation of Actual Evapotranspiration Using Remote Sensing Based Surface Energy Balance System at the Data Scarce Kabul River Basin of Afghanistan

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Abstract

Irrigated agriculture plays a vital role in providing food and economic gains to the people of Afghanistan. Winter snowfall in the upstream of the Kabul River Basin (KRB) is the only source of water supply to meet the water requirements of diverse crops. Mismanagement of the available water resources also triggers conflicts among the water users and adversely affects the ecosystem services in the KRB. For improved irrigation performance, accurate estimation of consumptive water use at a high spatial and temporal scale is key to strategic planning and operational water management. In this study the consumptive water use (actual evapotranspiration (AET)), an important irrigation performance indicator was estimated at the lower reaches of KRB (Nangarhar province). These estimations were undertaken at strategically important seasonal and annual time intervals, covering a period of 2003–2013 in the data-scarce environment of KRB. The Global Land Data Assimilation System (GLDAS) and Moderate-Resolution Imaging Spectroradiometer (MODIS) products were used as input parameters to Surface Energy Balance System (SEBS) for estimating AET. As a result, the annual average AET estimated was 552±76 mm for the entire period while the minimum and maximum AET recorded was 428±76 mm and 728±76 mm in the year 2004 and 2006, respectively. The relatively lower AET in 2004 attests to the prevailing drought conditions in the country during that period. Similarly, the decadal average AET for winter (October-April) and summer (May-September) seasons were 215±68 and 340±29 mm respectively. The higher AET in summer season is due to the fact of dominant wheat and barley crops' cultivation over 10 % and 3.3 % of the land area of the Nangarhar province respectively. The decadal AET estimation at segregated spatial units as under this study can be efficiently utilised as an assessment marker of irrigation performance in sub-units of the large KRB. It provides guidelines for the regional water stakeholders to identify the bottleneck in water allocation for optimised strategic and operational performance.

Keywords: Actual evapotranspiration, data scarcity, surface energy balance system

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