



Tropentag, September 19-21, 2016, Vienna, Austria

“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

FAZLULLAH AKHTAR¹, BERNHARD TISCHBEIN², USMAN KHALID AWAN³, UMAR WAQAS LIAQAT⁴

¹University of Bonn, Center for Development Research (ZEF), Germany

²University of Bonn, Center for Development Research (ZEF), Germany

³International Center for Agricultural Research in the Dry Areas (ICARDA), Cairo, Egypt,

⁴Hanyang University, Seoul, Korea, Department of Civil and Environmental Engineering, College of Engineering, Pakistan

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 crop water requirements of diverse cropping patterns at the region. 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 estimates was 552 ± 76 mm throughout the entire period while the minimum and maximum AET recorded was 428 ± 76 mm) and 728 ± 76 mm values 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 spring (May-June) seasons were 215 ± 68 and 340 ± 29 mm respectively. The higher AET in spring season is due to the fact that dominant wheat and barley crops which are cultivated over 10% and 3.3% of the land area of the Nangarhar province respectively. Referred to as the food basket of Afghanistan, Nangarhar province provides favourable climate for various vegetables compared to the rest of KRB. 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, Kabul River Basin, surface energy balance system

Contact Address: Fazlullah Akhtar, University of Bonn, Center for Development Research (ZEF), Walter-Flex-Str. 3, 53113 Bonn, Germany, e-mail: fakhtar@uni-bonn.de