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Hungarian University of Agricultural and life science- Szent István Campus, Gödöllő

Agricultural Water Management Engineering

Master Degree

Evaluation of Water Productivity and Wheat Yield Using Remote Sensing WaPOR database and AquaCrop model for Gezira Scheme in Sudan

Primary Thesis Adviser: Dr. Istvan Waltner

Associate professor

Author: Elsadig Bashir Mohammed Omer

JINON8

Institute of Environmental Sciences, Department of Water Management and Climate Adaptation

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THESIS SUMMARY

Thesis title: Assessment of Water Productivity and Wheat Yield Using Remote Sensing WaPOR database and AquaCrop model for Gezira Scheme in Sudan.

Author: Elsadig Bashir Mohammed Omer

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Primary Adviser: Dr. Waltner Istvan, Assistant Professor, Department of Water Management

Water productivity (WP) is an essential performance measure for managing and evaluating agricultural land on a continental scale. Increasing food demand due to rapid population increase, combined with severe competition from other sectors and concerns about climate change, has put enormous pressure on agricultural water. To satisfy upcoming food demands, the agriculture sector must use its water resources more effectively. The aim of this study is to evaluate WaPOR data, by comparing it with data collected from the field and AquaCrop model, in specific for using WaPOR to evaluate water productivity for selected farms in the Gezira scheme in Sudan. The comparison was conducted for selected farms in Sudan's Gezira irrigation scheme. Furthermore, AquaCrop is a crop growth model developed by the FAO to assess the impact of environmental factors and management practices on crop production and food security. The FAO has developed a free database called WaPOR that uses satellite data to monitor agricultural water productivity at different scales (level-1: 250m, level-2: 100m, and level-3: 30m) to improve sustainable agricultural production. Based on a case study of the study area, level^3 (30m) water productivity data components of the WaPOR database were evaluated and compared with AquaCrop model output, and observed field data was applied to the AquaCrop model using 6 plots selected from the study area. Based on a case study of the Gezira irrigation scheme, the study evaluated the level 3 (30m) water productivity data components of the WaPOR database and compared them to AquaCrop model output and observed field data for six plots. The results showed that WaPOR's values were consistently underestimated in comparison to measured data and model output. The

actual evapotranspiration (ETa) values for WaPOR and AquaCrop were found to be significantly in good agreement. However, the yield values for WaPOR were lower than the simulated and measured yield. WaPOR is compared plot-by-plot to AquaCrop values for wheat crop yield, above-ground biomass (AGB), and Crop water productivity. The analysis revealed that WaPOR's values estimates have consistently been underestimated in comparison to measured data and model output. The actual evapotranspiration ETa values for WaPOR and AquaCrop were found to be significantly in good agreement (278–553 and 369–415 mm respectively). However, the yield values for WaPOR (1.9-4.3 ton/ha) were lower than the simulated and measured yield (4.6-5.7 and 4.4-5.6 ton/ha, respectively). The results revealed that there is a strong correlation between AquaCrop model simulated values and the observed field data in terms of wheat yield, biomass production, and CWP with R2 range 0.90, 0.84, and 0.96 respectively. We also found that the model simulated ETa well, with a correlation coefficient of 0.76. Analysis of WaPOR database and AquaCrop model did not give a significant correlation for both CWP and AGB. is lower than the model estimate. To have a better understanding of potential limitations, it is recommended that future studies involve a sensitivity analysis for WaPOR and ground truth with yield data. It is also recommended to ground truth AquaCrop with yield and soil data to achieve precise site descriptions. In addition, this study does not take into account the range of crops. Therefore, for future researchers, I suggest creating a Python or R program that can be linked with the AquaCrop model to obtain more precise and accurate results.