Evaluation of FAO-56 procedures for estimating reference evapotranspiration using missing climatic data for a Brazilian tropical savanna

Luiz Claudio Valle Junior¹, George Vourlitis², Leone Francisco Curado³, Rafael Palacios⁴, José Nogueira³, Francisco Lobo³, Abu Reza Md. Towfiqul Islam⁵, and Thiago Rodrigues¹

¹Universidade Federal de Mato Grosso do Sul

²California State University San Marcos

³Universidade Federal de Mato Grosso

⁴Universidade Federal do Para

⁵Begum Rokeya University

May 11, 2021

Abstract

Since the Brazilian Cerrado has been heavily impacted by agricultural activities over the last four to five decades, reference evapotranspiration (ET_o) plays a pivotal role in water resources management for irrigation agriculture. The Penman-Monteith (PM) is one of the most accepted models for ET_o estimation, but it requires many inputs that are not commonly available. Therefore, assessing the FAO guidelines to compute ET_o when meteorological data are missing could lead to a better understanding of how climatic variables are related to water requirements and atmospheric demands for a grass-mixed savanna region and which variable impacts the estimates the most. In this study, ET_o was computed from April 2010 to August 2019. We tested twelve different scenarios considering radiation, relative humidity, and/or wind speed as missing climatic data using guidelines given by FAO. When wind speed and/or relative humidity data were the only missing data, the PM method showed the lowest errors in the ET_o estimates and correlation coefficient (r) and Willmott's index of agreement (d) values close to 1.0. When radiation data were missing, computed ET_o was overestimated compared to the benchmark. FAO procedures to estimate the net radiation presented good results during the wet season; however, during the dry season, their results were overestimated, especially because the method could not estimate negative R_n. Therefore, we can infer that radiation data have the highest impact on ET_o for our study area and also regions with similar conditions and FAO guidelines are not suitable when radiation data are missing.

Hosted file

Manuscript (4).pdf available at <https://authorea.com/users/317005/articles/521595-evaluation-of-fao-56-procedures-for-estimating-reference-evapotranspiration-using-missing-climatic-data-for-a-brazilian-tropical-savanna>

Hosted file

Table 1 (2).pdf available at <https://authorea.com/users/317005/articles/521595-evaluation-of-fao-56-procedures-for-estimating-reference-evapotranspiration-using-missing-climatic-data-for-a-brazilian-tropical-savanna>

Hosted file

Table 2 (2).pdf available at <https://authorea.com/users/317005/articles/521595-evaluation-of-fao-56-procedures-for-estimating-reference-evapotranspiration-using-missing-climatic-data-for-a-brazilian-tropical-savanna>