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Performance of Modified Temperature-Based Reference Crop Evapotranspiration Models Across Different Agro-Climatic Zones in Karnataka State, India

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Reference crop evapotranspiration (ET_0) forms an essential forcing variable in hydrological, agricultural, irrigation and climate models. Among several available methods for ET_0 estimation using regularly recorded climate data, the Food and Agriculture Organization (FAO) Penman-Monteith (PM) equation is popular among researchers due to its accuracy across different environments. However, routine use of the FAO-PM equation is hampered in data-scarce situations because of the requirement of input data pertaining to a large number of climate variables. Therefore, simpler alternative methods for ET_0 estimation such as the Blaney-Criddle (BC) and Hargreaves (HG) have been proposed by previous researchers. However, for routine use of these empirical equations, local calibration of the model parameters may be desirable. Also, a few previous attempts have been made to replace the daily mean temperature with an effective temperature calculated as a weighted average of daily maximum and minimum temperatures. Therefore, the present study was taken up to evaluate the effect of two aspects on the accuracies of the BC and HG models 1) replacing mean temperature with effective temperature defined using different parameterizations 2) local calibration of parameters. For this purpose, climate records for the historical period 2006-2016 of 67 stations located across ten agro-climatic zones of Karnataka State, India were used and the analysis was carried out using a monthly time step. Since measured ET_0 data was unavailable, calibration was performed using PM ET_0 estimates and performance was evaluated using various statistical measures. Overall results showed that the BC equation with mean temperature yielded better results than the ones with effective temperature with calibrated parameters. However, the HG method showed an improvement with the use of effective temperature. Information on the spatial distribution of calibrated parameters was derived which will prove useful to practitioners who wish to derive ET_0 estimates with only temperature inputs.