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Short Comminucation

Comparative study of different methods of evapotranspiration estimation in Kashmir Valley

SHAKEEL AHMAD BHAT[1*], BASHIR PANDIT[1], MEHRAJ U DIN DAR[2], SYED ROUHULLAH ALI[1],REHANA JAN[3] and SHAFAT KHAN[4]

[1] Division of Agricultural Engineering, SKUAST Kashmir

[2]Department of Soil and Water Engineering, Punjab Agricultural University

[3] Division of Soil Science, SKUAST-Kashmir

[4] Indian Institute of Technology, Kharagpur

[*]Email:wakeelbhat@gmail.com

Evapotranspiration constitutes the most significant component of the hydrologic budget apart from precipitation. It is an important climaticfactor and its accurate estimates are needed to determine the water requirement of crops for irrigation scheduling. The Food and Agriculture Organization (FAO) recommends the use the FAO-56 Penman Monteith method for estimating reference evapotranspiration (ET_o) (Allen *et al.,* 1998). This method is the most widely used in the world and has been proven to accurately estimate ET in different climates (Khandelwal *et al.* 1999; Mehta and Pandey 2015). For determination of crop evapotranspiration and yield responses to water, various models are used. Several researchers have used the CROPWAT, HYDRUS 1D/ 2D models for analyzing crop water and requirements in different parts of the world.

In the present study five methods Priestley-Taylor model, Hargreaves model, Makkins model, Blaney-Criddle

Table 1: Mean reference evapotranspiration (ET_o) in $mmday^{-1}$ for the year 2015 calculated by different models

Months	FAO-56 PM (CROPWAT)	Blaney-Criddle	Hargreaves	Makkins	Priestly-Taylor	Ivanov
Jan	0.76	1.92	2.13	0.76	0.92	0.76
Feb	1.20	2.17	2.19	0.99	1.04	0.86
Mar	2.25	3.16	2.82	1.76	2.11	0.87
Apr	2.86	3.63	6.32	1.98	2.73	1.57
May	3.70	4.21	9.18	2.86	3.66	1.94
Jun	4.30	5.36	10.67	2.93	4.15	2.88
Jul	4.42	6.09	11.60	2.90	4.24	3.01
Aug	3.64	5.92	10.04	2.71	4.02	2.79
Sep	2.90	5.10	8.14	2.31	3.29	1.55
Oct	2.03	4.53	6.20	1.53	2.37	1.10
Nov	1.12	3.86	4.51	1.22	1.46	0.87
Dec	0.76	2.32	3.02	0.85	1.28	0.81

Table 2: Summary statistics of regression and error ($mmday^{-1}$) analysis between standard and estimated ET_o

	R^2	RMSE	MBE	Intercept	Slope	F-test
Makkinks	0.97	0.49	-0.59	-0.53	1.59	375
Priestly-Taylor	0.96	0.53	0.11	-0.25	1.05	253
Hargreaves	0.87	3.2	3.91	0.17	0.36	71.8
Ivanov	0.86	0.67	-0.90	0.22	1.43	62.5
Blaney-Criddle	0.73	1.46	1.53	-0.73	0.80	28.1

model and Ivanov model were compared against FAO 56 Penmen-Monteith using daily data of obtained from Division of Agronomy, SKUAST-K for year 2015. The comparative evaluation of models was performed using regression analysis (R^2) and error analysis (RMSE, MBE). The comparative evaluation performed can be used as guideline for selection of alternative or less data dependent methods in case of non-availability of data.

The monthly mean ET_0 values estimated by each of the six methods for the year 2015 are shown in Table 1. Results obtained from the regression of ET_o estimated by each of the five different models against FAO-PM method are presented in Table 2. The best method is the one with the smallest RMSE and the highest coefficients of determination R^2. It is revealed that the most acceptable method for computing ET_o is Makkinks method (R^2=97%, RMSE 0.49) which requires only radiation and temperature data. The results of Priestley-Taylor model has shown second best performance (R^2 =0.96, RMSE = 0.53 and MBE: 0.11) among the other methods followed by Hargreaves method (R^2=87%) and Ivanov method (R^2=86%) respectively. Blaney-Criddle equation is least suitable method for estimation of evapotranspiration for present location due to lowest R^2 (0.73) and highest RMSE (1.46). The value of F test revealed that in all the selected methods the values were significant at 5% level of significance. Makkinks method gave the best result for F-test with highest value of 375 compared to other methods.

REFERENCES

Allen R., Pereira L.S., Raes, D and Smith, M. (1998). Crop evapotranspiration: guidelines for computing crop requirements. FAO Irrigation and Drainage Paper No. 56. FAO, Rome, Italy.P.300.

Khandelwal, M.K., Shekh A.M., Pandey, V. and Zaman, M.S. (1999). Selection of appropriate method for computation of potential evapotranspiration and assessment of rain water harvesting potentials of Gujarat. *J. Agrometeorol.,* 1 (2):163-166.

Mehta Rashmi and Pandey V. (2015). Reference evapotranspiration (ET_o)and crop water requirement (ET_c) of wheat and maize in Gujarat. *J. Agrometeorol.,* 17 (1):107-113.

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