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A COMPARISON OF FIVE METHODS FOR REFERENCE EVAPOTRANSPIRATION ESTIMATION IN THE WEST, CENTRAL, EASTERN, AND SOUTHERN SERBIA

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INTRODUCTION

Current climate conditions are often characterized by frequent water shortage during periods when plants are most sensitive to drought stress.

Soil moisture plays a key role in pedogenic processes as well as in supplying plants with water.

Therefore, it is necessary to determine crop water requirements for the irrigaton systems design and to organize adequate irrigation scheduling.

MATERIALS AND METHODS

The International Commission on Irrigation & Drainage (ICID) and the Food and Agriculture Organization of the UN (**FAO**) deem the Penman-Monteith method (FAO56-PM) as the most suitable for estimating reference evapotranspiration (ET_O).

Reference evapotranspiration depends on climate parameters such as air temperature and humidity, wind speed, and net radiation but also on geographical factors which describe the position of a certain site – latitude and elevation.

This research aims to assess the possibility for the application of several ETo methods in the climate conditions of **West, Central, Eastern, and Southern Serbia.**

Hargreaves, adjusted Hargreaves, Turc, and Jensen-Haise method were compared with the Penman-Monteith which was the referent method in this study.

The meteorological data used in this research were monthly data (**2000-2019**) collected from **17** representative meteorological stations at a district scale. The methods were compared using **mean absolute error** (MAE).

RESULTS

Turc and the adjusted Hargreaves method showed *the lowest deviation* from the reference (MAE=0.08 mm·day^{-1}, 0.14 mm·day^{-1} respectfully), while the Hargreaves method had shown the highest deviation (MAE=0.74 mm·day^{-1}).

Generally, the **lowest deviation** was obtained for the *Bor, Mačva, and Kolubara* districts (0.23 mm·day^{-1}, 0.26 mm·day^{-1} and 0.29 mm·day^{-1} respectively).

Turc method had shown the lowest deviation in the Toplica district, while Hargreaves deviated the most.

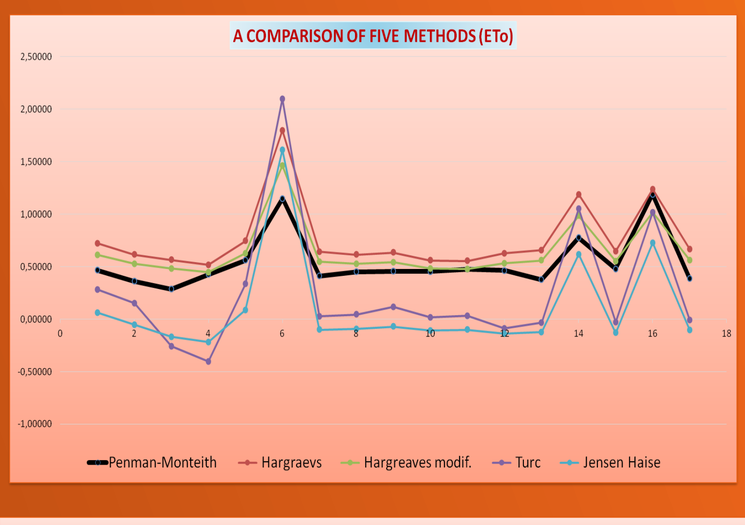

Fig 1. Study area location

CONCLUSION

The results of the research indicate that the **adjusted Hargreaves and Turc** methods can be used to calculate ETo *in case of missing data*.

The adjusted Hargreaves is the most reliable in almost all districts, although it utilizes only air temperature data.

Table 1. Regions, Administrative districts and location of meteorological stations that were used in the research

Region	Administrative district	Station	ETo (mm·day^{-1}) Penman-Monteith	Hargraevs	Hargreaves modif.	Turc	Jensen Haise
WEST SERBIA	KOLUBARSKI	Valjevo	0,46555	0,72224	0,61235	0,28152	0,06163
	MAČVANSKI	Loznica	0,35912	0,61423	0,52679	0,15299	-0,05372
	MORAVIČKI	Požega	0,28623	0,56446	0,48188	-0,25886	-0,16751
	ZLATIBORSKI	Užice	0,42624	0,51749	0,44572	-0,40242	-0,21771
CENTRAL SERBIA	PODUNAVSKI	Smederevska Palanka	0,56060	0,74451	0,62839	0,33449	0,08529
	POMORAVSKI	Ćuprija	1,14871	1,79898	1,46388	2,09868	1,61185
	RASINSKI	Kruševac	0,41133	0,64350	0,54766	0,02771	-0,10047
	RAŠKI	Kraljevo	0,44933	0,61530	0,52721	0,04487	-0,09492
	ŠUMADIJSKI	Kragujevac	0,45594	0,63421	0,54135	0,11790	-0,07033
EASTERN SERBIA	BORSKI	Negotin	0,45369	0,56020	0,48327	0,01669	-0,10814
	BRANIČEVSKI	Veliko Gradište	0,47663	0,55393	0,47812	0,03038	-0,10054
	ZAJEČARSKI	Zaječar	0,46376	0,62709	0,53120	-0,08785	-0,13722
SOUTHERN SERBIA	JABLANIČKI	Leskovac	0,37586	0,65835	0,55967	-0,03427	-0,12211
	NIŠAVSKI	Niš	0,77529	1,18678	0,98514	1,05202	0,61551
	PČINJSKI	Vranje	0,47882	0,64609	0,55209	-0,02998	-0,13033
	PIROTSKI	Dimitrovgrad	1,18861	1,23705	1,01657	1,01805	0,72577
	TOPLIČKI	Kuršumlija	0,38855	0,66624	0,56370	-0,00692	-0,10345

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