Analysis of trends in reference evapotranspiration data in a humid climate – Supplementary Material

Milan Gocic and Slavisa Trajkovic

Table S1 Results of the statistical tests for the monthly FAO–56 PM ET₀ over the period 1980–2010 (**bold** characters represent trends identified by three statistical methods together).

Station name	Test	Month											
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Belgrade	p value	0.4364	0.3228	0.4920	0.0191*	0.0274*	0.0287*	0.0020**	0.0182*	0.3085	0.4973	0.0642	0.1736
	Z _s	–0.170	0.476	0.034	2.379*	1.978*	1.904	2.889**	2.413*	0.510	0.001	1.530	–0.952
	Z _D	–0.169	0.656	0.052	2.701*	2.130*	1.957	3.648**	2.614*	0.484	0.019	1.696	–0.910
	b (mm/month)	–0.036	0.076	0.051	0.684	0.836	0.614	0.990	0.937	0.085	0.045	0.365	–0.051
Dimitrovgrad	p value	0.2611	0.3300	0.1894	0.4602	0.3594	0.2177	0.1190	0.0838	0.2420	0.2877	0.0154*	0.1401
	Z _s	–0.646	–0.442	–0.884	0.102	0.374	0.782	1.190	1.394	–0.714	–0.578	2.176*	–1.088
	Z _D	–0.734	–0.674	–0.937	0.117	0.248	0.869	1.265	1.540	–1.108	–0.616	2.331*	–1.141
	b (mm/month)	–0.015	–0.082	–0.176	0.153	0.283	0.185	0.251	0.624	–0.251	–0.101	0.234	–0.027
Kragujevac	p value	0.4286	0.2358	0.3745	0.0505	0.0132*	0.0162*	0.0003**	0.0039**	0.2546	0.3897	0.0162*	0.4973
	Z _s	0.187	0.731	–0.323	1.649	2.227*	2.159*	3.484**	2.668**	–0.663	–0.289	2.159*	0.001
	Z _D	0.103	0.624	–0.389	1.665	2.383*	2.099*	4.482**	3.111**	–0.578	–0.334	2.251*	0.155
	b (mm/month)	0.071	0.104	–0.021	0.377	0.664	0.470	0.695	0.724	–0.067	–0.045	0.202	0.049
Kraljevo	p value	0.0901	0.2177	0.4207	0.3594	0.0485*	0.0197*	0.0027**	0.0049**	0.3974	0.2177	0.0155*	0.2743
	Z _s	1.360	0.782	–0.204	0.374	1.666	2.074*	2.787**	2.583**	–0.272	–0.782	2.549*	0.612
	Z _D	1.260	0.827	–0.328	0.469	1.777	2.253*	3.304**	2.832**	–0.304	–0.705	2.540*	0.594
	b (mm/month)	0.117	0.112	–0.0001	0.365	0.564	0.464	0.720	0.870	–0.072	–0.066	0.202	0.040
Loznica	p value	0.1271	0.1190	0.4920	0.0571	0.0465*	0.0392*	0.0250*	0.0162*	0.4920	0.4207	0.0125*	0.1492
	Z _s	1.156	1.190	–0.034	1.598	1.670	1.768	1.972*	2.142*	–0.034	0.204	2.244*	1.054
	Z _D	1.083	1.496	–0.115	1.533	1.731	1.792	2.233*	2.294*	–0.187	0.336	2.269*	1.134
	b (mm/month)	0.118	0.105	0.028	0.421	0.585	0.383	0.585	0.526	–0.003	0.086	0.114	0.063
Negotin	p value	0.3594	0.2005	0.1401	0.3299	0.0007**	0.0014**	0.0005**	0.0049**	0.2546	0.3974	0.1894	0.3300
	Z _s	–0.374	0.850	1.088	0.442	3.195**	2.991**	3.331**	2.583**	–0.680	0.272	0.884	0.442
	Z _D	–0.486	1.134	1.434	0.172	3.718**	3.629**	4.155**	2.926**	–0.757	0.302	0.930	0.535
	b (mm/month)	–0.045	0.084	0.279	0.143	0.673	0.764	0.932	0.855	–0.003	0.033	0.056	0.018
Nis	p value	0.2177	0.4364	0.4364	0.3300	0.3228	0.0643	0.1112	0.0934	0.4920	0.1736	0.1894	0.4522
	Z _s	0.782	–0.170	0.170	0.442	0.476	1.530	1.224	1.326	–0.034	–0.952	0.884	0.136
	Z _D	0.898	–0.215	0.059	0.616	0.453	1.443	1.021	1.369	–0.083	–0.873	1.062	0.235
	b (mm/month)	0.072	–0.038	0.014	0.008	0.260	0.240	0.330	0.283	–0.650	0.628	0.074	0.027
Novi Sad	p value	0.0721	0.2420	0.2611	0.1401	0.0901	0.1736	0.0091**	0.0182*	0.2119	0.2946	0.0125*	0.1074
	Z _s	–1.462	0.714	–0.646	1.088	1.360	0.952	2.379*	2.413*	–0.816	–0.544	1.972*	–1.258
	Z _D	–1.338	0.783	–0.739	1.143	1.484	1.023	2.888**	2.552*	–0.826	–0.703	2.090*	–1.272
	b (mm/month)	–0.029	0.113	–0.107	0.559	0.713	0.365	0.998	0.591	–0.140	–0.008	0.252	–0.103
Palic	p value	0.1736	0.1587	0.0838	0.0191*	0.0052**	0.0446*	0.0003**	0.0005**	0.1313	0.3228	0.0004**	0.3594
	Z _s	–0.952	1.020	1.394	2.379*	2.586**	1.717	3.484**	3.297**	1.122	0.476	3.365**	–0.374
	Z _D	–0.885	1.007	1.477	2.511*	2.908**	1.655	4.066**	3.414**	1.118	0.350	4.138**	–0.335
	b (mm/month)	–0.043	0.098	0.091	0.746	0.671	0.600	0.920	0.938	0.259	0.022	0.244	–0.083
Sombor	p value	0.1788	0.0262*	0.3372	0.0159*	0.0039**	0.0274*	0.0004**	0.0012**	0.2236	0.0301*	0.0008**	0.2546
	Z _s	0.935	1.944	0.425	2.532*	2.668**	1.921	3.382**	3.042**	0.765	1.887	3.178**	0.663
	Z _D	0.836	2.000	0.479	2.721*	3.077**	2.117*	4.369**	3.460**	0.688	1.885	4.024**	0.580
	b (mm/month)	0.147	0.316	0.110	0.723	0.910	0.524	0.965	0.808	0.140	0.333	0.306	0.060
Vranje	p value	0.3446	0.4207	0.0594	0.4207	0.2546	0.1190	0.2611	0.0392*	0.0778	0.0427*	0.4364	0.1190
	Z _s	0.408	–0.204	–1.564	–0.204	0.680	1.190	0.646	1.768	–1.428	–1.734	–0.170	–1.190

	Z _D	0.475	-0.222	-1.371	-0.156	0.761	1.215	0.980	1.843	-1.526	-1.699	-0.015	-1.129
	b (mm/month)	0.005	-0.114	-0.383	-0.057	0.344	0.189	0.261	0.304	-0.212	-0.208	-0.005	-0.054
Zlatibor	p value	0.4973	0.1190	0.1271	0.2005	0.0107*	0.0217*	0.0037**	0.0125*	0.2177	0.2946	0.0485*	0.4973
	Z _s	0.001	1.190	-1.156	0.850	2.312*	2.040*	2.685**	2.244*	-0.782	-0.544	1.666	-0.001
	Z _D	0.054	1.336	-1.206	0.889	2.513*	1.962	2.987**	2.644*	-0.971	-0.703	1.890	-0.048
	b (mm/month)	0.005	0.041	-0.160	0.359	0.690	0.420	0.580	0.717	-0.233	-0.090	0.225	-0.022

Notes: b: Slope of linear regression, Z_s: Mann–Kendall test, Z_D: Spearman's Rho test.

* Statistically significant trends at the 5% significance level; and ** Statistically significant trends at the 1% significance level.

Table S2 Results of the statistical tests for the monthly AHARG ET₀ over the period 1980–2010 (**bold** characters represent trends identified by three statistical methods together).

Station name	Test	Month											
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Belgrade	p value	0.2611	0.2420	0.2946	0.0196*	0.0668	0.0207*	0.0166*	0.0178*	0.3974	0.3821	0.0196*	0.4207
	Z _s	−0.646	0.714	−0.544	2.346*	1.513	2.057*	2.481*	2.430*	−0.272	0.306	2.346*	−0.204
	Z _D	−0.678	0.813	−0.630	2.620*	1.571	1.995	2.082*	2.634*	−0.307	0.113	2.467*	−0.230
	b (mm/month)	−0.019	0.079	−0.039	0.394	0.372	0.265	0.458	0.452	−0.032	0.019	0.161	−0.004
Dimitrovgrad	p value	0.3015	0.1635	0.3228	0.0642	0.0196*	0.0182*	0.0003**	0.0139*	0.4443	0.3974	0.0162*	0.1635
	Z _s	0.527	0.986	−0.476	1.530	2.346*	2.413*	3.450**	2.210*	−0.153	0.272	2.515*	0.986
	Z _D	0.452	1.069	−0.412	1.772	2.552*	2.668*	4.246**	2.514*	−0.245	0.193	2.723*	0.914
	b (mm/month)	0.048	0.056	−0.009	0.350	0.498	0.348	0.492	0.600	−0.079	0.006	0.180	0.052
Kragujevac	p value	0.3974	0.1736	0.0721	0.0113*	0.1314	0.0179*	0.0006**	0.0107*	0.1074	0.2946	0.0041**	0.3228
	Z _s	−0.272	0.952	−1.462	2.296*	1.122	2.108*	3.264**	2.312*	−1.241	−0.544	2.652**	0.476
	Z _D	−0.228	0.973	−1.494	2.530*	1.049	2.225*	4.321**	2.605*	−1.334	−0.603	2.732**	0.398
	b (mm/month)	−0.015	0.094	−0.105	0.455	0.428	0.366	0.573	0.607	−0.165	−0.025	0.217	0.023
Kraljevo	p value	0.4681	0.2743	0.1841	0.0359*	0.0485*	0.0668	0.0140*	0.0314*	0.1492	0.4602	0.0173*	0.3446
	Z _s	0.085	0.612	−0.918	1.802	1.666	1.513	2.210*	1.870	−1.054	−0.102	2.447*	0.408
	Z _D	0.077	0.712	−0.853	1.853	1.817	1.430	2.444*	1.988	−1.300	−0.167	2.644*	0.270
	b (mm/month)	0.047	0.043	−0.088	0.361	0.409	0.246	0.433	0.463	−0.168	−0.044	0.184	0.018
Loznica	p value	0.4761	0.1587	0.1314	0.0571	0.1314	0.2743	0.1894	0.2177	0.0427*	0.3300	0.0217*	0.3446
	Z _s	0.068	1.020	−1.122	1.598	1.122	0.612	0.884	0.782	−1.734	0.442	2.023*	−0.408
	Z _D	0.213	1.143	−1.007	1.754	1.069	0.526	0.808	0.962	−1.853	0.335	2.088*	−0.462
	b (mm/month)	0.079	0.079	−0.080	0.389	0.307	0.107	0.235	0.213	−0.206	0.034	0.178	−0.016
Negotin	p value	0.2546	0.2177	0.4364	0.1587	0.0207*	0.0179*	0.0016**	0.0154*	0.1841	0.3745	0.0838	0.3300
	Z _s	−0.680	0.782	0.170	1.020	2.057*	2.108*	2.957**	2.176*	−0.918	−0.340	1.394	−0.442
	Z _D	−0.696	0.610	0.183	1.058	2.109*	2.356*	3.797**	2.303*	−1.033	−0.359	1.441	−0.366
	b (mm/month)	−0.006	0.031	0.077	0.194	0.392	0.392	0.639	0.602	−0.162	−0.023	0.166	−0.010
Nis	p value	0.1736	0.2061	0.3445	0.0329*	0.0027**	0.0014**	0.0002**	0.0041**	0.2743	0.1841	0.0041**	0.1230
	Z _s	0.952	0.833	0.408	1.853	2.787**	2.991**	3.501**	2.651**	0.612	0.918	2.651**	1.173
	Z _D	0.871	0.850	0.313	2.191*	3.096**	3.099**	4.461**	3.092**	0.420	0.678	3.096**	1.124
	b (mm/month)	0.098	0.027	0.137	0.238	0.479	0.406	0.583	0.545	0.134	0.055	0.211	0.080
Novi Sad	p value	0.2877	0.1492	0.2236	0.0041**	0.0314*	0.0618	0.0196*	0.0217*	0.3670	0.4920	0.0119*	0.4602
	Z _s	−0.578	1.054	−0.765	2.651**	1.870	1.547	2.346*	2.040*	−0.357	0.034	2.278*	−0.102
	Z _D	−0.550	1.141	−0.758	3.046**	1.986	1.401	2.570*	2.283*	−0.321	0.017	2.543*	−0.187
	b (mm/month)	−0.004	0.100	−0.031	0.490	0.656	0.306	0.482	0.504	−0.011	0.044	0.202	−0.004
Palic	p value	0.2877	0.2743	0.1401	0.0155*	0.1314	0.0901	0.0132*	0.0262*	0.1586	0.2611	0.0154*	0.2740
	Z _s	−0.578	0.612	−1.088	2.549*	1.139	1.343	2.227*	1.964*	−1.003	−0.646	2.176*	−0.612
	Z _D	−0.590	0.719	−1.039	2.797*	1.235	1.149	2.580*	2.104*	−0.904	−0.623	2.228*	−0.471
	b (mm/month)	−0.021	0.029	−0.148	0.333	0.211	0.247	0.267	0.286	−0.923	−0.013	0.154	−0.012
Sombor	p value	0.2358	0.2483	0.1038	0.0044**	0.0465*	0.1357	0.0119*	0.0146*	0.2546	0.3015	0.0207*	0.3156
	Z _s	−0.731	0.697	−1.275	2.634**	1.683	1.105	2.261*	2.193*	−0.663	0.527	2.057*	−0.493
	Z _D	−0.567	0.895	−1.304	2.912**	1.867	1.103	2.580*	2.279*	−0.697	0.459	2.193*	−0.492
	b (mm/month)	−0.0004	0.084	−0.084	0.445	0.450	0.209	0.436	0.387	−0.090	0.083	0.149	−0.009
Vranje	p value	0.0314*	0.2177	0.3085	0.0571	0.0166*	0.0139*	0.0024**	0.0162*	0.3300	0.4522	0.0217*	0.2877

	Z _S	1.870	0.782	−0.510	1.598	2.481*	2.210*	2.821**	2.142*	−0.459	0.136	2.039*	0.578
	Z _D	1.988	0.826	−0.535	1.848	2.794*	2.2261*	3.153**	2.577*	0.527	0.011	2.089*	0.716
	b (mm/month)	0.105	0.0001	−0.113	0.194	0.441	0.215	0.310	0.381	0.005	0.002	0.148	0.014
Zlatibor	p value	0.1271	0.0427*	0.4207	0.0007**	0.00002**	0.0007**	0.00003**	0.0017**	0.2420	0.1894	0.0055**	0.2546
	Z _S	1.156	1.734	−0.204	3.195**	4.113**	3.195**	4.011**	2.940**	0.714	0.884	2.579**	0.680
	Z _D	1.072	1.861	−0.346	3.861**	5.351**	3.829**	5.351**	3.423**	0.665	0.725	2.929**	0.563
	b (mm/month)	0.059	0.094	−0.019	0.480	0.872	0.482	0.594	0.714	0.030	0.057	0.158	0.017

Notes: b: Slope of linear regression, Z_S: Mann–Kendall test, Z_D: Spearman’s Rho test.

* Statistically significant trends at the 5% significance level; and ** Statistically significant trends at the 1% significance level.