Comparison of the Standardized Precipitation-Evapotranspiration Index values calculated using various evapotranspiration models

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One of the most commonly used drought indices is the Standardized Precipitation-Evapotranspiration Index (SPEI). Initially, the Thornthwaite equation was proposed for calculating potential evapotranspiration (ETP) in SPEI. Later, the authors of SPEI suggested the FAO-56-Penman-Monteith equation for estimating evapotranspiration. Although FAO-56-Penman-Monteith is a standard equation, and many organizations and experts recommend it, the main problem is that it does not give precise and correct results in the absence of reliable data. If the data needed for the FAO-56-Penman-Monteith equation are not available, SPEI authors recommend the Hargreaves equation as the first choice or the Thornthwaite equation. Thus, different ETP methods give different values of SPEI. The aim of this study is to test whether ETP influences SPEI results in the observed area. The values of SPEI based on FAO-56-Penman-Monteith equation (SPEI-PM) were compared to the values of SPEI based on modified Hargreaves (SPEI-H), Thornthwaite (SPEI-TH), and Turc (SPEI-TU) equations. The study area was the central part of Vojvodina province of Serbia where drought often occurs and significantly affects crop yields. We analyzed the occurrence of drought for the period of 45 years. SPEI indices are calculated for one, three, and six-month timescales. Differences between the three indices were analyzed using R^2 (Coefficient of determination) and MAD (Mean Absolute Difference). Results show that the R^2 values are all high and very similar for all comparisons, but the highest value of R^2 (0.98) is between the SPEI-PM and SPEI-H, for all three timescales. Also, the lowest value of the MAD is between SPEI-PM and SPEI-H (0.15) for all three timescales. Results indicate that all indices generally provide similar results; however, the performance of the SPEI-H is considered to be the most accurate. The study represents a result of the research activity carried out on projects: Interreg-IPA WATERatRISK(HUSRB/1602/11/0057) and COST Action (CA17109).