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Drought trends indicated by evapotranspiration deficit over the contiguous United States during 1896-2013

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Evapotranspiration (ET) has received a great attention in drought assessment as it is closely related to atmospheric water demand. The hypothetical potential ET (ETp) has been predominantly used, nonetheless it does not actually exist in the hydrologic cycle. In this work, we used a complementary method for ET estimation to obtain wet-environment ET (ETw) and actual ET (ETa) from routinely observed climatic data. By combining ET deficits (ETw minus ETa) and the structure of the Standardized Precipitation-Evapotranspiration Index (SPEI), we proposed a novel ET-based drought index, the Standardized Evapotranspiration Deficit Index (SEDI). We carried out historical drought identification for the contiguous United States using temperature datasets of the PRISM Climate Group. SEDI presented spatial distributions of drought areas similar to the Palmer Drought Severity Index (PDSI) and Standardized Precipitation Index (SPI) for major drought events. It indicates that SEDI can be used for validating other drought indices. Using the non-parametric Mann-Kendall test, we found a significant decreasing trend of SEDI (increasing drought risk) similar to PDSI and SPI in the western United States. This study suggests a potential of ET-based indices for drought quantification even with no involvement of precipitation data.