EVALUATION OF DAILY SPI AND SPEI INDICES FOR NEAR-REAL TIME DROUGHT MONITORING OVER CONUS

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INTRO

- Standardized Precipitation Index (SPI) and Standardized Precipitation Evapotranspiration Index (SPEI) drought indices are computed over CONUS using NClimGrid.
- NClimGrid provides maximum, minimum, and average daily temperatures and daily precipitation derived from GHCN-D at a 5-km grid resolution from 1951 to the present.
- SPI only uses precipitation as an input while SPEI also uses potential evapotranspiration (PET).

METHODS

- 1. Daily SPI and SPEI are computed for different time scales (30-, 90-, 180-, 270-, 365-, 730-day).
- The differences between SPI and SPEI are being evaluated with respect to the accumulation period and various SPI (McKee, Guttman) and PET (Thornthwaite, Hargreaves, ...) formulations.



RESULTS

- SPI and SPEI indices computed from NClimGrid provide 70 years of high-resolution daily drought conditions over CONUS.
- Cloud computing environment allows for fast processing time when compared to local clusters. SPI and SPEI computation time is reduced by two orders of magnitude (<10-min). Daily updates take less than one minute.
- The flexible framework allows for the use of other precipitation products (satellite, radar, in-situ) and other data sets (temperature, soil moisture, groundwater) to derive more complex droughts indices (agricultural drought, hydrological drought).



SPI & SPEI Comparison (McCook, NE)



SPI and SPEI comparison for McCook (NE) and equivalency with U.S. Drough Monitor (USDM) drought classification: Abnormally dry (D0: $-0.8 < SPI \leq -0.3$) moderate drought (D1: $-1.3 < SPI \leq -0.8$), severe drought (D2: $-1.6 < SPI \leq -1.3$) extreme drought (D3: $-2.0 < SPI \leq -1.6$), and exceptional drought (D4: SPI < -2.0).



SPI & SPEI Cloud-Based Computing



Task breakdown for the SPI source code adapted to the AWS cloud. The computational process is divided into three phases: input file preparation (preprocessing), drought indices computation (rainfall accumulation periods, distribution parameters, SPI and SPE computation), and output files finalization (size reduction, retiling, concleanation).

DISCUSSION

- Preliminary results indicate longer drought duration, and higher rainfall deficit with SPEI in particular, for the most severe drought conditions (D3 or D4).
- SPEI distribution parameters display similar behavior regardless of the PET model considered. Differences with SPI distribution parameters depend on seasonal precipitation cycle.
- Currently evaluating a drought relief module to estimate the amount of rainfall needed to alleviate drought conditions (i.e., improvement in drought classification).

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