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Standardized Precipitation Index (SPI) for Global Land Surface

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Abstract: The Standardized Precipitation Index (SPI) is commonly used to monitor drought and anomalous wet periods. It was formulated by Tom McKee, Nolan Doesken, and John Kleist of the Colorado Climate Center, Colorado State University (McKee et al. 1993). The SPI at a given location is based only on the long-term precipitation record for a desired period. The long-term precipitation time series is fitted to a gamma probability distribution, which is then transformed into a normal distribution so that the mean SPI is zero. Theoretically, the SPI is the number of standard deviations by which the observed value would lie above or below the long-term mean, for a normally distributed random variable. Thus, the index can be used to compare precipitation across a region with different climates. The SPI can be calculated for multiple time scales, which allows assessment of impacts on different water resources. For example, soil moisture responds to precipitation departures on a short time scale, while stream flow responds to anomalies on a longer time scale. Precipitation amounts that indicate wet conditions at one time scale could indicate dry conditions at another time scale.

This dataset includes the SPI at three-, six-, and 12-month scales for global land surfaces. It was produced for a study to determine the relationship between climate variability and armed conflict in Sub-Saharan Africa (O'Loughlin et al. 2012). The precipitation data (1949-2012) are resampled from the original University of East Anglia Climate Research Unit (CRU) global time series, TS3.21, monthly $0.5^\circ \times 0.5^\circ$ grids to our study unit of analysis, $1^\circ \times 1^\circ$ grids, thereby facilitating regression with environmental and socio-economic variables.

The SPI is the universal meteorological drought index recommended by the World Meteorological Organization (WMO) as described in the Lincoln Declaration on Drought Indices (http://www.wmo.int/pages/prog/wcp/agm/meetings/wies09/documents/Lincoln_Declaration_Drought_Indices.pdf). A drought period is defined when the SPI is negative and reaches a threshold value of -1.0 or less while wet periods are defined for $SPI \geq 1.0$. Based on McKee et al. (1995), SPI values are typically grouped into seven categories:

SPI	Classification
≤ -2.00	Extreme Drought
-1.50 to -1.99	Severe Drought
-1.00 to -1.49	Moderate Drought
-0.99 to 0.99	Near Normal
1.00 to 1.49	Moderately Wet
1.50 to 1.99	Severely Wet
2.00 ≥	Extremely Wet

Temporal Range: 1949 to 2012

Variables: Three-month, Six-month, and 12-month SPI

Vertical Level: Ground surface

Temporal Frequency: Monthly Climatology, Every month

Data Type: Grid

Spatial Coverage: Longitude Range: Westernmost=180W Easternmost=180E
Latitude Range: Southernmost=90S Northernmost=90N

Data Contributors: National Center for Atmospheric Research (NCAR)

Related Resources: Colorado Climate Center, SPI maps and software,
<http://ccc.atmos.colostate.edu/standardizedprecipitation.php>
Monthly Precipitation Data from the CRU TS 3.21,
<http://badc.nerc.ac.uk/data/cru/>

Publications: McKee, T.B., N.J. Doesken, and J. Kleist, 1993. The relationship of drought frequency and duration to time scales. Proc. Eighth Conference on Applied Climatology, Amer. Meteor. Soc., Jan 17-23, 1993, Anaheim CA, 179-186.

McKee, T. B., N. J. Doesken, and J. Kleist, 1993. Drought monitoring with multiple time scales. Proc. Ninth Conference on Applied Climatology, Amer. Meteor. Soc., Dallas, TX, 233-236.

O' Loughlin, J., A. Linke, F. Witmer, A. Laing, A. Gettelmann, J. Dudhia, 2012: Climate variability and conflict risk in East Africa: 1990-2009. *Proc. Natl. Acad. Sci.* Nov 6;109(45):18344-9. doi: 10.1073/pnas.1205130109. Epub 2012 Oct 22.

[<http://www.pnas.org/content/early/2012/10/17/1205130109>]

Total volume: 152MB

Data formats: NetCDF

More Details (if needed)
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The SPI is calculated from monthly precipitation observations and is expressed as SPI_n, where n is the number of months of accumulation. Each time series is analogous to a moving average in that a new value is calculated each month. For example, the SPI₆ compares the moving six-month precipitation record against the long-term (since 1949) distribution for the same six-month period.