

1. Supplementary Materials and Methods

S1.1 Calculation of the Standardized precipitation index (SPI)

The standardized precipitation index (SPI) endorsed by the World Meteorological Organization (WMO), can monitor and forecast drought and flood risks all over the world due to its robustness and convenience. [1]. Compared with other indices, the SPI calculates the probability of precipitation occurrence and can identify abnormal dry season and rainy season more accurately than others [2].

The Gamma is commonly used distributions in hydrology to fit the monthly precipitation series in the literatures. Since the gamma distribution is undefinable at $x = 0$, yet precipitation may have zero values, the cumulative probability distribution for a given zero value is as follows:

$$H(x) = q + (1 - q)G(x) \quad (S1)$$

where q denotes the likelihood of no precipitation.

S1.2 Calculation of the Wavelet analysis method

The calculation formula of wavelet analysis is as follows:

$$\psi_{a,b}(t) = |a|^{-\frac{1}{2}} \psi\left(\frac{t-b}{a}\right), \quad a, b \in R, a \neq 0 \quad (S2)$$

$$W_f(a, b) = |a|^{-\frac{1}{2}} \int_{-\infty}^{\infty} f(t) \bar{\psi}\left(\frac{t-b}{a}\right) dt \quad (S3)$$

Where $\psi(t)$ is the base wavelet function, $W_{x(a,b)}$ is the wavelet transform coefficient, which reflects the variation properties of wavelet signal; a is the scale factor reflecting wavelet period length; b is the time factor reflecting the shift over time.

2. Supplementary Figures

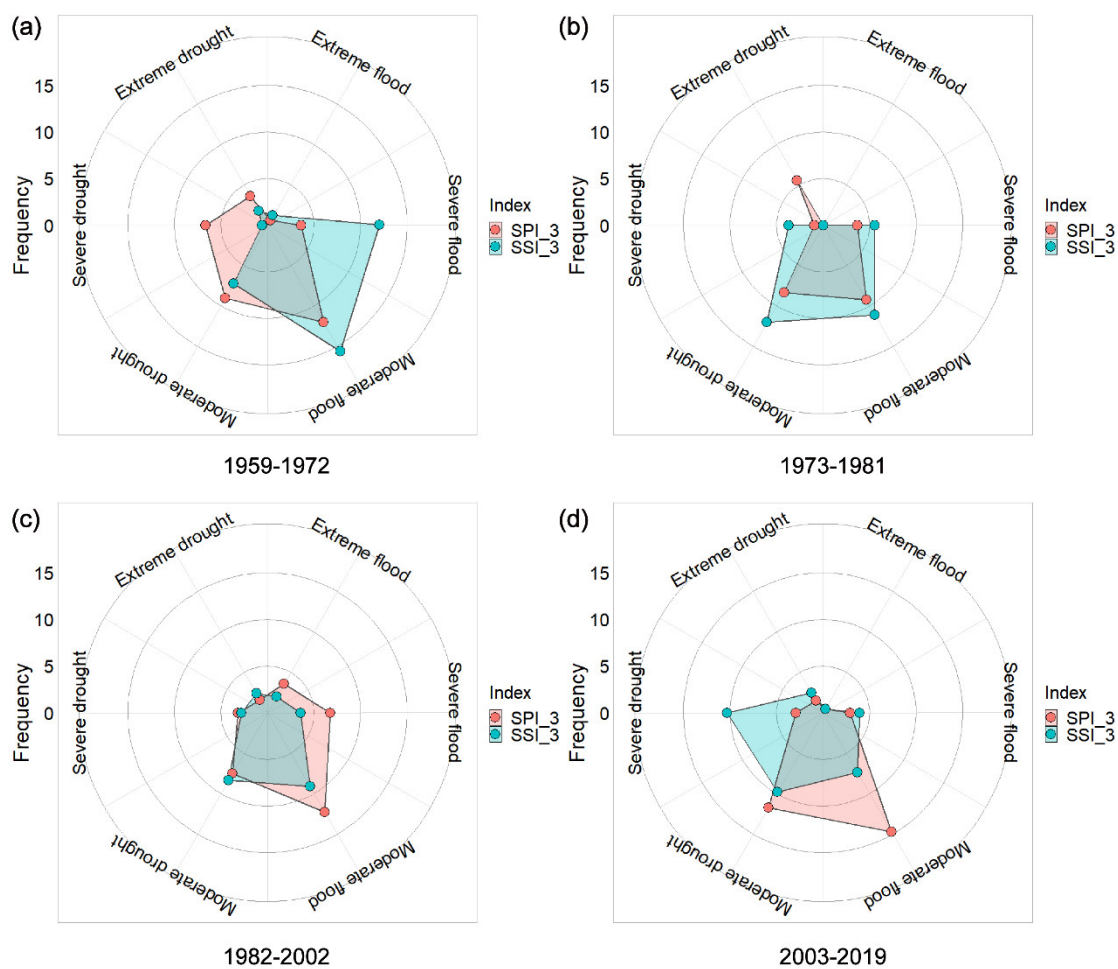


Figure S1. The frequency of different drought and flood events levels revealed by counting 3-month SPI/SSI: (a) 1959–1972, (b) 1973–1981 and (c) 1982–2002, and (d) 2003–2019.

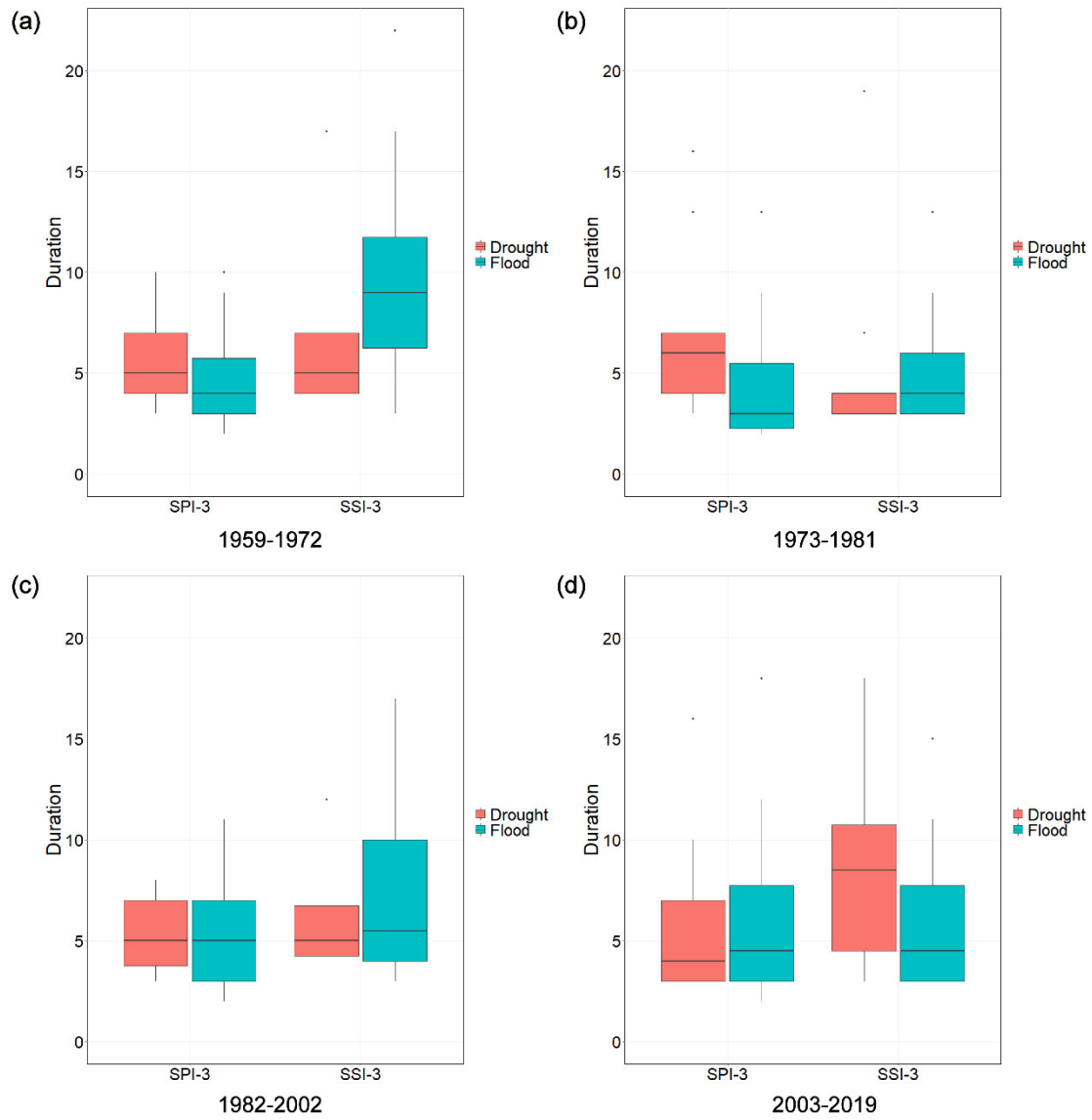


Figure S2. The duration of drought and flood events revealed by counting 3-month SPI/SSI: (a) 1959–1972, (b) 1973–1981 and (c) 1982–2002, and (d) 2003–2019.

3. Supplementary Tables.

Table S1. Validation of SPI and SSI for major DTL drought events in the last 59 years.

| Drought Year | SPI | | | | | SSI | | | | |
|--------------|---------|---------|---------|----------|----------|---------|---------|---------|----------|----------|
| | 1-Month | 3-Month | 6-Month | 12-Month | 24-Month | 1-Month | 3-Month | 6-Month | 12-Month | 24-Month |
| 1963 | * | * | * | | | | | | | |
| 1972 | * | * | * | * | * | * | * | * | * | |
| 1973 | * | * | | | * | | | | | |
| 1978 | * | | * | * | | | | | * | |
| 1979 | * | * | | * | * | * | * | * | * | |
| 1980 | | | | | * | * | * | | | |
| 1981 | * | * | * | * | | | | | | |
| 1986 | * | | | * | * | * | | * | * | |
| 2006 | | | | | | * | * | * | * | |
| 2007 | * | * | | | | * | * | * | * | * |
| 2011 | * | * | * | * | | * | * | * | * | * |

| | | | | | |
|------------------------------------------------------------|---|---|---|---|---|
| 2012 | * | * | * | * | * |
| Note: * indicates that SPI/SSI can identify drought events | | | | | |

Table S2. Validation of SPI and SSI for major DTL flood events in the last 59 years.

| Flood Year | SPI | | | | | SSI | | | | |
|----------------------------------------------------------|-------------|-------------|-------------|--------------|--------------|-------------|-------------|-------------|--------------|--------------|
| | 1- Month | 3- Month | 6- Month | 12- Month | 24- Month | 1- Month | 3- Month | 6- Month | 12- Month | 24- Month |
| 1964 | * | * | * | | | * | * | * | * | * |
| 1969 | * | * | * | | | * | * | * | * | * |
| 1970 | * | * | | * | * | * | * | * | * | * |
| 1973 | * | * | * | * | | * | * | * | * | |
| 1975 | | * | * | | | * | * | | | |
| 1977 | * | | | | | * | * | | | |
| 1980 | * | * | | | | * | * | | | |
| 1983 | | | * | * | | | * | * | * | |
| 1988 | * | * | | | | * | * | | | |
| 1990 | * | | * | | * | | | | | |
| 1991 | * | * | | | * | * | | | | |
| 1993 | * | * | | | | * | | | | |
| 1994 | | | | | | | | | | |
| 1995 | * | * | * | * | * | * | * | | | |
| 1996 | * | * | | * | * | * | * | | | |
| 1998 | * | * | * | * | | * | * | * | * | |
| 2002 | * | * | * | * | * | * | | | | |
| 2016 | * | | * | | | * | * | * | | |
| Note: * indicates that SPI/SSI can identify flood events | | | | | | | | | | |

References

1. Seiler, R.A.; Hayes, M.; Bressan, L. Using the standardized precipitation index for flood risk monitoring. *Int. J. Climatol.* **2002**, *22*, 1365–1376. <https://doi.org/10.1002/joc.799>.
2. Wang, Y.; Chen, X.; Chen, Y.; Liu, M.; Gao, L. Flood/drought event identification using an effective indicator based on the correlations between multiple time scales of the Standardized Precipitation Index and river discharge. *Theor. Appl. Climatol.* **2017**, *128*, 159–168. <https://doi.org/10.1007/s00704-015-1699-0>.