Figure S1. Spatial distribution of multi-year average WHD values estimated by the (a) threshold-based method, (b) logistic-based method, and (c) shape-based method. doy in the color bar denotes the day of year.
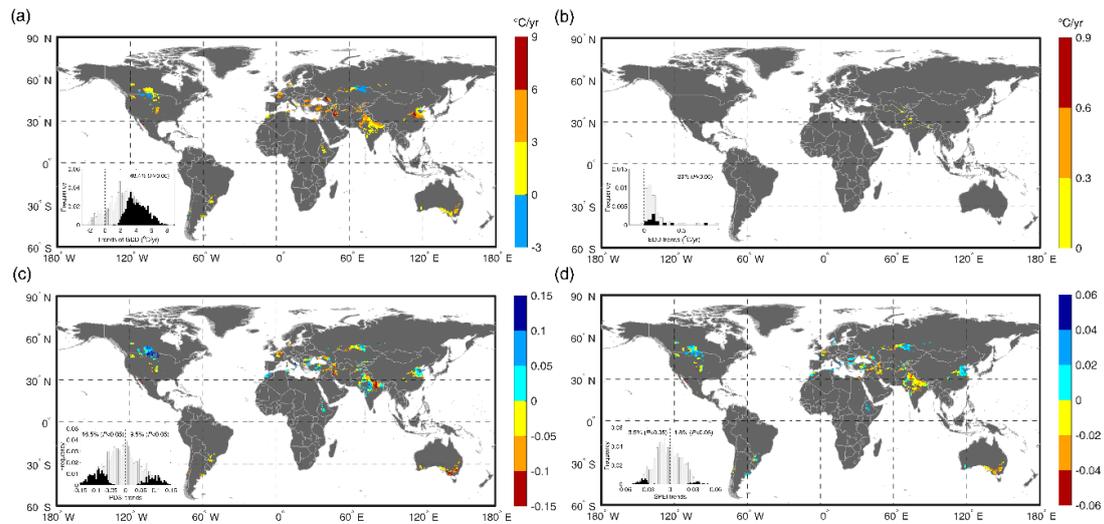
Figure S2. Variation trends in (a) NDD and (b) EDD for the three months before WHD; (c) PDSI and (d) SPEI from the second month before WHD to the current month.
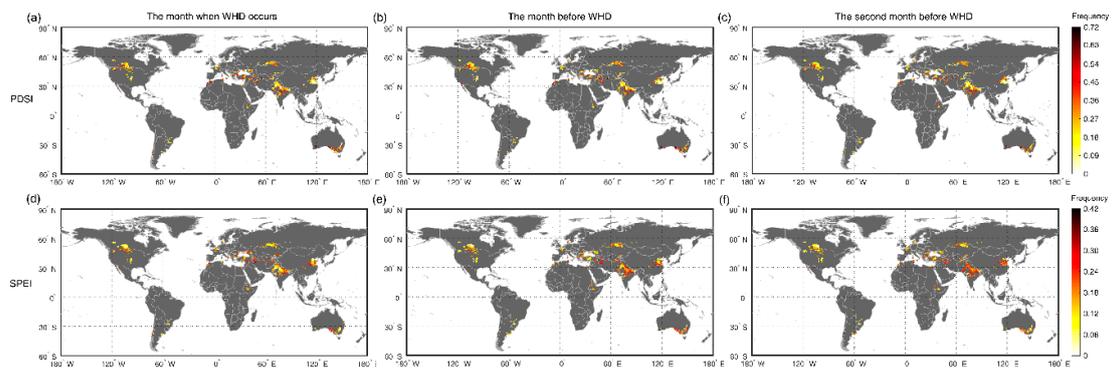

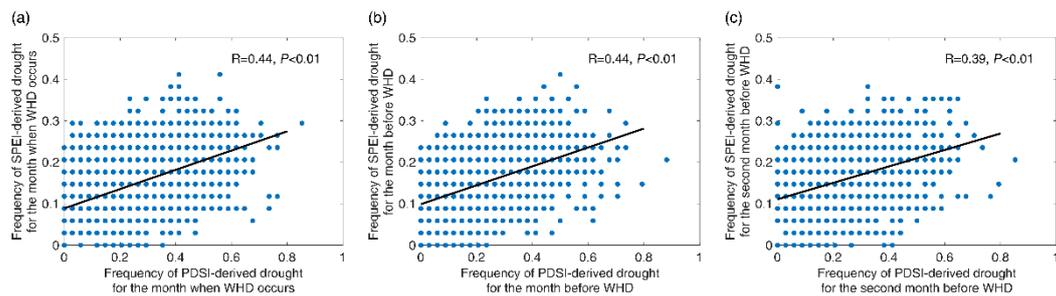**Figure S3.** Frequency of serious drought events. (a)-(c): PDSI; (d)-(f): SPEI.

Figure S4. Correlation of spatial pattern of serious drought events measured by PDSI and SPEI for (a) the month when WHD occurs, (b) the month before WHD, and (c) the second month before WHD.