**Supplementary information**

**Manuscript title:**

**Spatial gathering characteristics of drought in the Qinghai-Tibet Plateau**

Number of pages: 6

Number of Tables: 5

**Table S 1.** Drought classification based on the SPEI value

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| --- | --- |
| **Classification** | **SPEI Value** |
| Extreme drought (ED） | SPEI < -2 |
| Severe drought (SD） | -2 ≤ SPEI < -1.5 |
| Moderate drought (MD) | -1.5 ≤ SPEI < -1 |
| Light drought (LD) | -1 ≤ SPEI < -0.5 |
| Near normal (NN) | -0.5 ≤ SPEI < 0.5 |
| Light wet (LW) | 0.5 ≤ SPEI < 1 |
| Moderate wet (MW) | 1 ≤ SPEI < 1.5 |
| Severe wet (SW) | 1.5 ≤ SPEI ≤ 2 |
| Extreme wet (EW) | SPEI > 2 |

**Table S 2.**The Equations of intensity analysis (Aldwaik and Pontius Jr, 2012; Huang et al., 2012)

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Where *J* = number of categories; *i* = index for a category at the initial time; *j* = index for a category at a subsequent time; *m* = index for the losing category in the transition of interest; *n* = index for the gaining category in the transition of interest; *T* = number of time points; *t* = index for a time point, which ranges from 1 to *T*−1; *Yt* = year at time point t; *Ctij* = number of pixels that transition from category *i* at time *Yt* to category *j* at time *Yt+1*; *S*t = annual intensity of change for time interval [*Yt*, *Yt+1*]; *U* = value of uniform line for time intensity analysis; *Gtj* = annual intensity of gross gain of category j for time interval [*Y*t,*Yt+1*]; L*ti* = annual intensity of gross loss of category *i* for time interval [*Yt*,*Yt+1*]; *Rtin* = annual intensity of transition from category *i* to category n during time interval [*Yt*, *Yt+1*], where *i* ≠*n*; *Wtn* = value of uniform intensity of transition to category n from all non-n categories at time *Yt* during time interval [*Yt*, *Yt+1*]; *Qtmj* = annual intensity of transition from category m to category *j* during time interval [*Yt*, *Yt+1*], where *j* ≠*m*; *Vtm* value of uniform intensity of transition from category m to all non-m categories at time *Yt+1* during time interval [*Yt*, *Yt+1*].

**Table S 3.** Grid counts of drought Transition matrix in time intervals. The top to bottom of the cell is the 1980s, 1990s, 2000s, and 2010s, respectively.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Final year of time interval** | | | | | | | | | **Initial total** | **Gross loss** |
|  |  | Extreme  drought | Severe  drought | Moderate drought | Light  drought | Near  normal | Light  wet | Moderate  wet | Severe  wet | Extreme  wet |  |  |
| **Initial**  **year of time interval** | Extreme drought | 12  0  0  0 | 10  0  0  2 | 93  5  15  4 | 98  23  22  30 | 0  0  0  0 | 212  13  30  64 | 119  20  43  12 | 84  2  9  2 | 38  0  0  0 | 666  63  119  114 | 654  63  119  114 |
| Severe drought | 89  4  4  0 | 203  98  14  35 | 818  185  61  250 | 373  185  123  260 | 0  0  0  0 | 567  104  63  428 | 346  98  101  262 | 105  22  70  35 | 34  2  54  1 | 2535  698  490  1271 | 2332  600  476  1236 |
| Moderate drought | 93  68  119  1 | 423  336  177  106 | 1888  987  674  1309 | 800  481  544  634 | 0  0  0  0 | 746  352  513  898 | 540  197  553  534 | 290  77  234  250 | 137  7  117  26 | 4917  2505  2931  3758 | 3029  1518  2257  2449 |
| Light drought | 94  102  128  5 | 849  464  316  144 | 1241  700  651  395 | 1111  839  899  815 | 2044  2593  1874  2130 | 819  938  765  1143 | 674  499  571  741 | 462  211  406  294 | 94  22  92  30 | 7388  6368  5702  5697 | 6277  5529  4803  4882 |
| Near normal | 115  341  242  31 | 1337  917  735  216 | 3405  2772  2506  2438 | 1910  1913  2046  1490 | 4075  5597  4628  4657 | 1723  2533  1946  2191 | 1659  2144  1401  1755 | 1018  710  618  828 | 215  93  231  165 | 15457  17020  14353  13771 | 11382  11423  9725  9114 |
| Light wet | 15  49  48  7 | 234  318  164  122 | 393  675  538  351 | 665  780  1016  556 | 1592  2076  2515  1941 | 827  798  1113  923 | 669  693  953  657 | 353  209  225  460 | 100  43  94  126 | 4848  5641  6666  5143 | 4021  4843  5553  4220 |
| Moderate wet | 6  18  13  9 | 20  103  115  134 | 0  0  0  0 | 298  505  829  416 | 1070  1099  1555  1402 | 732  449  558  757 | 763  268  634  612 | 263  70  207  386 | 40  7  73  82 | 3192  2519  3984  3798 | 2429  2251  3350  3186 |
| Severe wet | 0  0  2  12 | 0  9  50  84 | 22  77  222  149 | 74  207  365  172 | 351  425  556  692 | 209  181  151  494 | 277  87  64  297 | 46  7  15  148 | 12  0  3  24 | 991  993  1428  2072 | 945  986  1413  1924 |
| Extreme wet | 0  0  0  0 | 116  341  330  267 | 0  0  19  9 | 5  15  46  18 | 50  34  49  71 | 19  1  18  82 | 21  0  1  40 | 13  0  0  9 | 1  0  0  0 | 225  391  463  496 | 224  391  463  496 |
| **Final**  **total** |  | 424  582  556  65 | 3192  2586  1901  1110 | 7860  5401  4686  4905 | 5334  4948  5890  4391 | 9182  11524  11177  10893 | 5854  5369  5157  6980 | 5068  4006  4321  4910 | 2634  1308  1784  2412 | 671  174  664  454 | 40219  35898  36136  36120 | 31293  27604  28159  27621 |
| **Gross**  **gain** |  | 412  582  556  65 | 2989  2488  1887  1075 | 5972  4414  4012  3596 | 4223  4109  4991  3576 | 5107  6227  6549  6236 | 5027  4571  4044  6057 | 4305  3738  3687  4298 | 2588  1301  1769  2264 | 670  174  664  454 | 31293  27604  28159  27621 |  |
|  |

**Table S 4.** The first 5 modes of EOF eigenvectors.

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| **Mode** | **Variance contribution rate (%)** | | **Cumulative sums of contribution rate (%)** |
| 1 | | 23.3 | 23.3 |
| 2 | | 20.1 | 43.4 |
| 3 | | 14.2 | 57.6 |
| 4 | | 8.5 | 66.2 |
| 5 | | 4.7 | 70.8 |

**Table S 5.** The contribution rate of first 3 modes of EOF eigenvectors for P, PET, and T.

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| **Tape** | **Mode1** | **Mode2** | **Mode3** |
| P | 58.5% | 8.5% | 6.4% |
| PET | 24.4% | 14.9% | 9.6% |
| T | 54.5% | 9.5% | 7.7% |