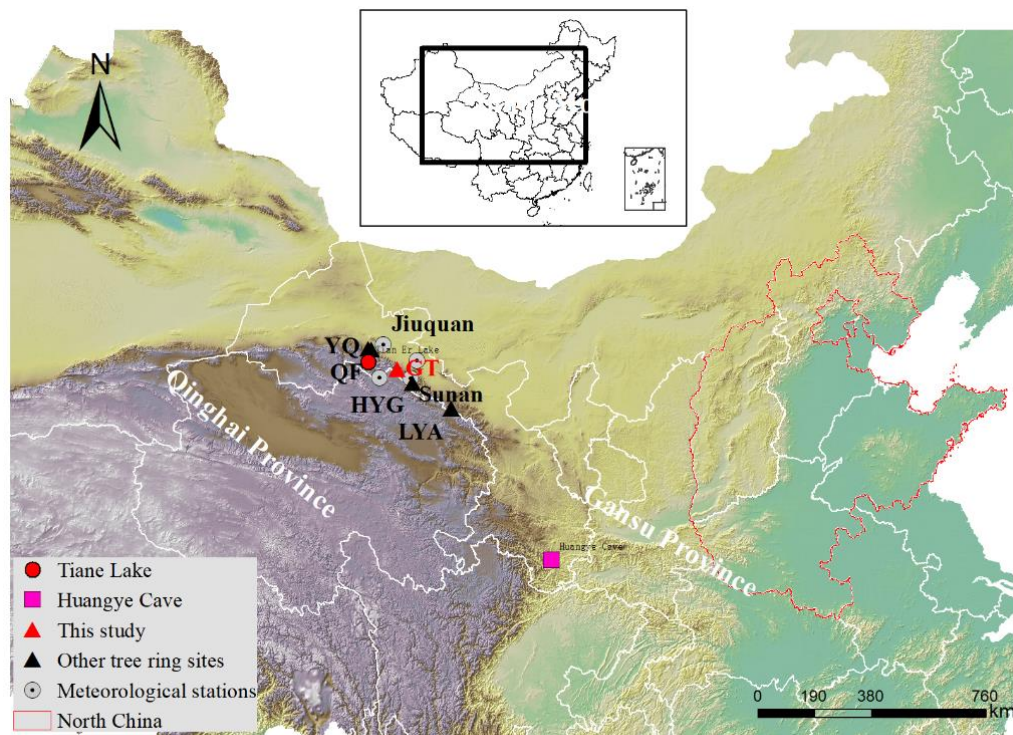


## Supplementary Materials

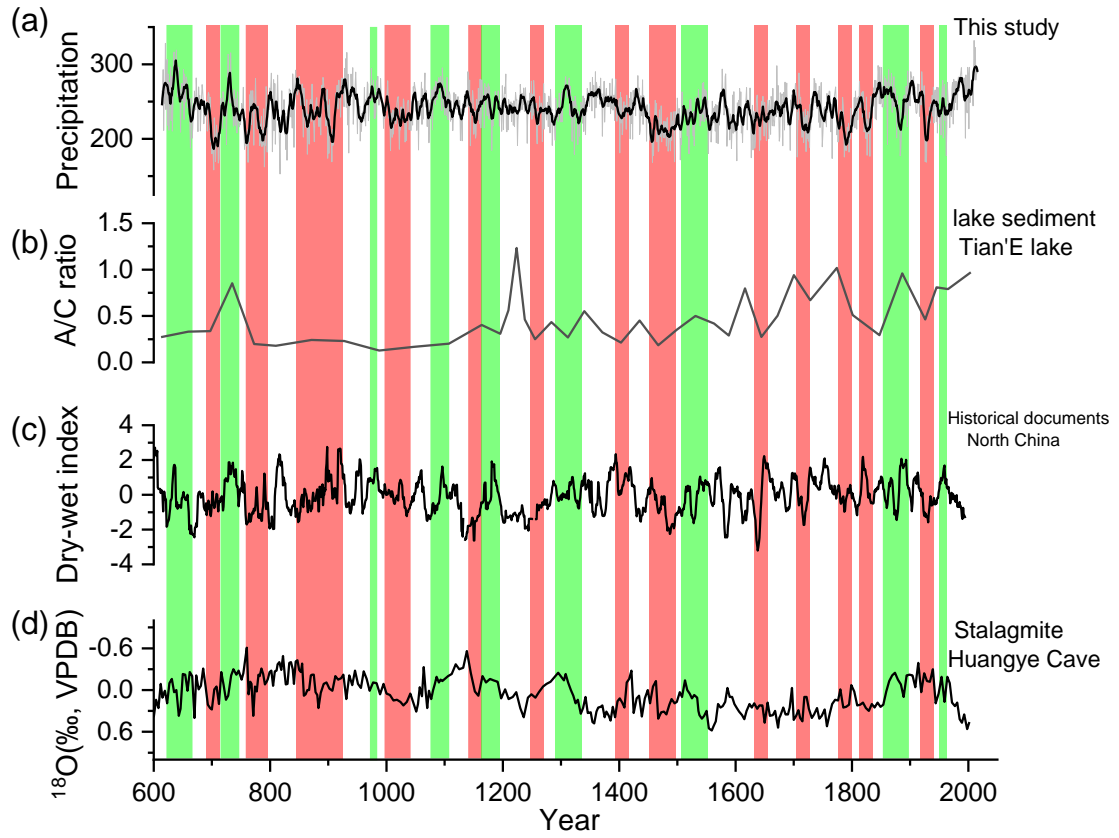
**Table S1.** Calibration and verification statistics of the reconstruction model.

Calibration period				Verification period						
Time span	months	r	F	Time span	r	ST	FST	PMT	RE	CE
1958 ~ 2016	P8-C7	0.59	30.0	1958 ~ 2016	0.56	45+/14- <sup>**</sup>	42+/16- <sup>**</sup>	2.76	0.30	0.30
	P7-C6	0.63	36.6		0.59	47+/12- <sup>**</sup>	40+/18- <sup>**</sup>	2.8	0.35	0.35
1957~ 2016	C5-C6	0.58	29.9	1957~ 2016	0.54	37+/22-	41+/19- <sup>**</sup>	3.45	0.30	0.30
1958 ~ 1988	P8-C7	0.59	15.38	1989 ~ 2016	0.57	21+/7- <sup>*</sup>	21+/6- <sup>**</sup>	2.55	0.34	0.26
	P7-C6	0.66	22.8		0.59	20+/8- <sup>*</sup>	17+/10-	2.98	0.16	0.06
1957~1986	C5-C6	0.74	33.5	1987~2016	0.53	13+/16-	19+/11-	2.07	-0.05	-0.05
1989 ~ 2016	P8-C7	0.57	12.8	1958 ~ 1988	0.59	22+/9- <sup>*</sup>	21+/9- <sup>*</sup>	2.64	0.37	0.32
	P7-C6	0.59	13.77		0.66	23+/8- <sup>*</sup>	22+/8- <sup>*</sup>	2.82	0.39	0.35
1987~2016	C5-C6	0.53	10.7	1957~1986	0.74	23+/6- <sup>**</sup>	22+/8- <sup>**</sup>	2.52	0.33	0.33

P8-C7: August of the previous year to July of the current year. P7-C6: July of the previous year to June of the current year. C5-C6: May-June in the current year. r: correlation coefficient. F: significance test indicators for regression equations. ST: Sign test. FST: First-order sign test. RE: Error reduction. CE: Effective coefficient. PMT: Product mean test. <sup>\*\*</sup>p<0.01, <sup>\*</sup>p<0.05.



**Figure S1.** Locations of tree-ring based series and other proxy-based dry-wet series



**Figure S2.** Comparison among our reconstruction presented in this paper (a) and other moisture-related series from the Jiuquan area (b. Zhang et al. 2018 [37]), northern China (c. Zheng et al. 2006 [38]), and Huangye Cave in central China (d. Tan et al. 2010 [39]). Red columns indicate spatially extensive drought periods; green columns indicate spatially extensive pluvial periods.