

## Supplementary materials

Correlation coefficients were calculated to better understand the representativeness of the climate data recorded by six proximate meteorological stations (DR, XH, HN, JZ, MQ, and HZ) (Tables 1 and 2).

Table 1. Correlation coefficients for total annual precipitation and annual  $T_{\text{mean}}$ .

	DR	XH	HN	JZ	MQ	HZ
DR	–	0.351** (55)	0.495** (56)	0.396** (57)	0.519** (49)	0.174 (58)
XH	0.781** (55)	–	0.438** (55)	0.323* (55)	0.333* (49)	0.257 (55)
HN	0.164 (56)	0.021 (55)	–	0.588** (56)	0.683** (49)	0.506** (56)
JZ	0.935** (57)	0.849** (55)	0.026 (56)	–	0.763** (49)	0.555** (57)
MQ	0.911** (49)	0.863** (49)	0.214 (49)	0.953** (49)	–	0.608** (49)
HZ	0.772** (58)	0.893** (55)	0.004 (56)	0.867** (57)	0.906** (49)	–

Note: DR: Dari; XH: Xinghai; HN: Henan; JZ: Jiuzhi; MQ: Maqu; HZ: Hezuo

\*\*0.01 significance level; \*0.05 significance level. The number years common to all six datasets are shown in brackets.

Correlation coefficients in upper right are for total annual precipitation.

Correlation coefficients in lower left are for annual  $T_{\text{mean}}$ .

Table 2. Correlation coefficients for the annual  $T_{\text{max}}$  and  $T_{\text{min}}$  recorded at the meteorological stations.

	DR	XH	HN	JZ	MQ	HZ
DR	–	0.789** (55)	0.458** (56)	0.755** (57)	0.900** (49)	0.715** (58)
XH	0.816** (55)	–	0.576** (55)	0.789** (55)	0.923** (49)	0.936** (55)
HN	0.08 (56)	–0.212 (55)	–	0.522** (56)	0.643** (49)	0.398** (56)
JZ	0.927** (57)	0.813** (55)	–0.032 (56)	–	0.833** (49)	0.738** (57)
MQ	0.848** (49)	0.730** (49)	–0.035 (49)	0.926** (49)	–	0.875** (49)
HZ	0.792** (58)	0.787** (55)	–0.092 (56)	0.848** (57)	0.899** (49)	–

Note: DR: Dari; XH: Xinghai; HN: Henan; JZ: Jiuzhi; MQ: Maqu; HZ: Hezuo

\*\*0.01 significance level; \*0.05 significance level. The number years common to all six datasets are shown in brackets. Correlation coefficients in the upper right are for annual  $T_{max}$ . Correlation coefficients in the lower left are for annual  $T_{min}$ .

The significant positive correlations for precipitation and temperature recorded at the six stations indicate that these data are representative of the regional climate. The  $T_{mean}$  and  $T_{min}$  data from station HN does not correlate significantly with the data of other stations. It is notable that the HN  $T_{min}$  is even negatively correlated with data from four of the other five stations (Table 2).

Station HN, which has a relatively long observation interval (1960–2015), is located ~60 km from the sampling site, closer than any of the others. Its poor correlation with the other stations was therefore examined further. Jiuzhi station, which has the highest correlation with the other stations, was chosen for comparison (Figure 1). Temperatures decreased abruptly at HN station in 1981, especially annual  $T_{mean}$  and annual  $T_{min}$ . This was an instrumental error, therefore, we then made the correction. The differences in temperature between the JZ and HN stations over the period was added to the HN station data for the years following 1981. As a result, the correlation coefficients of the original and corrected temperatures, in particular the annual  $T_{mean}$  and  $T_{min}$  values (Table 3), increased to the 0.01 significance level. The corrected values were chosen for the following study.

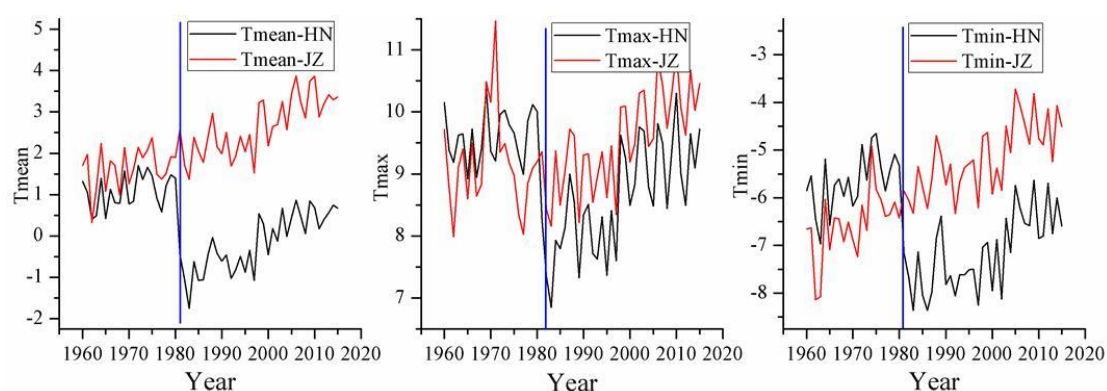


Figure 1. Changes in annual temperatures at the HN and JZ stations. HN: Henan; JZ: Jiuzhi.

Table 3. Correlations between the original and corrected annual HN station temperatures and those of other stations.

	DR	XH	JZ	MQ	HZ
Original $T_{\text{mean}}$	0.164	0.021	0.026	0.214	0.004
Corrected $T_{\text{mean}}$	0.802**	0.681**	0.748**	0.812**	0.686**
Original $T_{\text{max}}$	0.458**	0.576**	0.522**	0.643**	0.398**
Corrected $T_{\text{max}}$	0.797**	0.874**	0.761**	0.898**	0.764**
Original $T_{\text{min}}$	0.08	-0.212	-0.032	-0.035	-0.092
Corrected $T_{\text{min}}$	0.871**	0.648**	0.843**	0.773**	0.745**

Note: Dari: DR; XH: Xinghai; JZ: Jiuzhi; MQ: Maqu; HZ: Hezuo; \*\* = 0.01 significance level

In addition, the interpolation approach was used to estimate the missing values for April and May 1962 at the JZ station, and for January 1960  $T_{\text{max}}$  at the XH station. The procedure is described below.

Meteorological stations with complete data records in Qinghai, Gansu, and Sichuan Provinces were selected, and stepwise regression was used to interpolate the missing data for JZ and XH. The results are shown in Table 4.

Table 4. Interpolated values for missing climate data.

Station	Year	Month	Climate factor	Station number	Selected station	Interpolated value	R	R <sup>2</sup>	R <sup>2</sup> <sub>adj</sub> *
JZ	1962	April	P	83	4	37.8mm	0.792	0.627	0.598
JZ	1962	April	$T_{\text{mean}}$	83	3	1.6°C	0.976	0.952	0.949
JZ	1962	April	$T_{\text{max}}$	81	3	11.4°C	0.911	0.831	0.821
JZ	1962	April	$T_{\text{min}}$	82	3	-5.4°C	0.893	0.798	0.786
JZ	1962	May	P	78	5	71.7mm	0.78	0.62	0.584

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JZ	1962	May	T <sub>mean</sub>	79	6	4.0°C	0.98 2	0.96 5	0.961
JZ	1962	May	T <sub>max</sub>	79	3	11.3°C	0.87 9	0.77 3	0.760
JZ	1962	May	T <sub>min</sub>	80	2	-1.1°C	0.95 4	0.911	0.907
XH	1960	January	T <sub>max</sub>	82	14	-1.7°C	0.99 3	0.98 7	0.982

Note: JZ: Jiuzhi; XH: Xinghai; \*  $R^2_{adj}$  = adjusted  $R^2$