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The response of annual minimum temperature on the eastern central Tibetan Plateau to large volcanic eruptions over the period 1380–2014 CE

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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 S1 and S2).

Table S1. Correlation coefficients for total annual precipitation and annual T_{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_{mean}.

Table S2. Correlation coefficients for the annual T_{max} and T_{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 S2).

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 S1). 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 S3), increased to the 0.01 significance level. The corrected values were chosen for the following study.

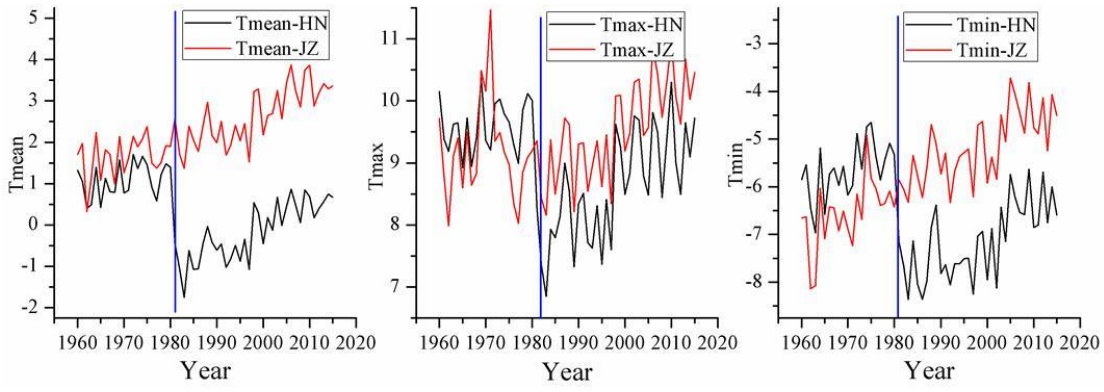

Figure S1. Changes in annual temperatures at the HN and JZ stations. HN: Henan; JZ: Jiuzhi.

Table S3. Correlations between the original and corrected annual HN station temperatures and those of other stations.

	DR	XH	JZ	MQ	HZ
Original T_{mean}	0.164	0.021	0.026	0.214	0.004
Corrected T_{mean}	0.802**	0.681**	0.748**	0.812**	0.686**
Original T_{max}	0.458**	0.576**	0.522**	0.643**	0.398**
Corrected T_{max}	0.797**	0.874**	0.761**	0.898**	0.764**
Original T_{min}	0.08	–0.212	–0.032	–0.035	–0.092
Corrected T_{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_{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 S4.

Table S4. Interpolated values for missing climate data.

Station	Year	Month	Climate factor	Station number	Selected station	Interpolated value	R	R^2	R^2_{adj}*
JZ	1962	April	P	83	4	37.8mm	0.792	0.627	0.598
JZ	1962	April	T_{mean}	83	3	1.6°C	0.976	0.952	0.949
JZ	1962	April	T_{max}	81	3	11.4°C	0.911	0.831	0.821
JZ	1962	April	T_{min}	82	3	–5.4°C	0.893	0.798	0.786
JZ	1962	May	P	78	5	71.7mm	0.789	0.623	0.584
JZ	1962	May	T_{mean}	79	6	4.0°C	0.982	0.965	0.961
JZ	1962	May	T_{max}	79	3	11.3°C	0.879	0.773	0.760
JZ	1962	May	T_{min}	80	2	–1.1°C	0.954	0.911	0.907
XH	1960	January	T_{max}	82	14	–1.7°C	0.993	0.987	0.982

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