Supplement of Clim. Past, 15, 1223–1249, 2019
https://doi.org/10.5194/cp-15-1223-2019-supplement

Climate of the Past
Open Access
EGU

Supplement of

Mid-Holocene climate change over China: model–data discrepancy

Yating Lin et al.

Correspondence to: Haibin Wu (haibin-wu@mail.iggcas.ac.cn)

Supplementary Information

Table S1. Biome assignment rules in BIOME4 (ajusted from Dallmeyer et al., 2017)

NO.	BIOME	Domain PFT	Subpft	Additional Environment Limits	Mega-biomes
1	**Tropical evergreen forest**	Tropical evergreen trees	-	-	***Tropical forest***
		Tropical deciduous trees	-	number of green days>300	
2	**Tropical semi-deciduous forest**	Tropical deciduous trees	-	250<number of green days<300	
3	**Tropical deciduous forest/woodland**	Tropical deciduous trees	-	number of green days<250	
4	**Temperate deciduous forest**	Temperate deciduous trees	No temperate broadleaved or boreal evergreen tree present	-	***Temperate Forest***
		Temperate deciduous trees	Boreal evergreen trees present	Twm>21	
		Boreal evergreen trees	Temperate deciduous trees present	GDD5>900 and Tcm>-19, Twm>21	
		Boreal deciduous trees	Temperate deciduous trees	-	
5	**Temperate conifer forest**	Cool conifer	No temperate broadleaved trees present, no boreal deciduous trees subdominant	-	
		Cool conifer	Temperate deciduous trees with nearly similar NPP	-	
7	**Cool mixed forest**	Temperate deciduous trees	Boreal evergreen trees present	Twm<21 and Tcm>-15	
		Boreal evergreen trees	Temperate deciduous trees present	GDD5>900 and Tcm>-19, Twm<21	
8	**Cool conifer forest**	Boreal evergreen trees	No temperate deciduous trees present	GDD5>900 and Tcm>-19	
16	**Temperate broadleaved savanna**	Shrubs	Temperate deciduous trees present	-	
6	**Warm mixed forest**	Temperate broadleaved trees	-	-	***Warm mixed forest***
		Temperate deciduous trees	No boreal trees, but temperate broadleaved trees present	-	
		Temperate deciduous trees	No boreal trees, but cool conifer present	Tcm>3 and GDD5>3000	
		Cool conifer	Temperate broadleaved trees present	-	
9		Temperate deciduous trees	Boreal evergreen trees present	Twm<21 and Tcm<-15	

	Cold mixed forest	Cool conifer	Boreal deciduous trees	-	***Boreal forest***
		Boreal evergreen trees	Temperate deciduous trees present	GDD5<900 and Tcm<-19	
		Boreal deciduous trees	Cool conifer	-	
		Boreal deciduous trees	-	GDD5>900 and Tcm>-19	
10	**Evergreen taiga/montane forest**	Boreal evergreen trees	No temp deciduous trees present	GDD5<900 and Tcm<-19 and NPP>350	
		Boreal deciduous trees	Boreal evergreen trees	-	
11	**Deciduous taiga/montane forest**	Boreal deciduous trees	No temperate deciduous or cool conifer	GDD5<900 and Tcm<-19	
18	**Boreal parkland**	Boreal evergreen tress	-	GDD5<900 and Tcm<-19 and NPP<350	
		Shrubs	Boreal trees present	Twm<21	
		Boreal deciduous trees	-	-	
13	**Tropical xerophytic shrubland**	Woody desert	-	grass LAI>1 and Tmin>0	***Grassland and dry shrubland***
		Shrubs	Tropical trees present	woody LAI<4	
14	**Temperate sclerophyll woodland**	Shrubs	Temperate broadleaved trees present	-	
19	**Tropical grassland**	C4 tropical grass	-	-	
20	**Temperate grassland**	C3/C4 temperate grass	-	GDD0>800	
12	**Tropical savannah**	Shrubs	Tropical trees present	woody LAI>4	***Savanna and dry woodland***
15	**Temperate xerophytic shrubland**	Woody desert	-	grass LAI>1 and Tmin<0	
17	**Open conifer woodland**	Shrubs	Cool conifer present	-	
21	**Desert**	Woody desert	-	grass LAI<1	***Desert***
		Temperate or Tropical trees or conifer	-	NPP<100	
		C3/C4 temperate grass	No boreal trees present	-	
22	**Steppe–tundra**	C3/C4 temperate grass	-	GDD0<800	***Tundra***
		Cold herbaceous	-	-	
23	**Shrub tundra**	Tundra shrub	-	GDD0>500	
24	**Dwarf shrub tundra**	Tundra shrub	-	200<GDD0<500	
25	**Prostrate shrub tundra**	Tundra shrub	-	GDD0<200	

26	**Cushion forb lichen moss tundra**	Lichen/forb	-	-	

Table S2. Transfer matrix from BIOME4 typology to the pollen biome scores

BIOME4 type	**Pollen biome type**																
	CLDE	CLMX	COCO	COMX	DESE	STEP	TAIG	TEDE	TUND	XERO	HODE	SAVA	TDFO	TRFO	TSFO	WAMX	TXWS
TrEgFo	0	0	0	0	0	0	0	0	0	0	0	0	5	15	10	0	0
TrSeDeFo	0	0	0	0	0	0	0	0	0	0	0	0	10	10	15	0	5
TrDeFo	0	0	0	0	0	0	0	0	0	0	0	5	15	5	10	0	0
TdDeFo	0	5	5	10	0	0	0	15	0	0	0	0	0	0	0	0	0
TeCoFo	0	0	15	10	0	0	0	5	0	0	0	0	0	0	0	0	0
WaMxFo	0	0	0	0	0	0	0	10	0	10	0	0	0	0	0	15	0
CoMxFo	0	0	10	15	0	0	0	10	0	0	0	0	0	0	0	0	0
CoCoFo	0	0	15	10	0	0	5	0	0	0	0	0	0	0	0	0	0
ClMxFo	10	15	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0
EgTaig	5	10	5	0	0	0	15	0	0	0	0	0	0	0	0	0	0
DeTaig	10	5	0	0	0	0	15	0	5	0	0	0	0	0	0	0	0
TrSav	0	0	0	0	0	5	0	0	0	0	0	15	5	0	0	0	10
TrXsSl	0	0	0	0	0	10	0	0	0	0	0	5	0	0	0	0	15
TeXsSl	0	0	0	0	0	5	0	0	0	15	0	0	0	0	0	5	0
TeScWo	0	0	0	0	0	5	0	0	0	15	0	5	0	0	0	10	0
TeBlSav	0	0	0	0	0	5	0	5	0	5	0	15	0	0	0	5	0
OpCoWo	0	0	10	0	0	5	0	0	0	0	0	0	0	0	0	0	0
BoprKl	0	0	5	0	0	10	10	0	0	5	0	0	0	0	0	0	0
TrGrl	0	0	0	0	0	15	0	0	0	0	5	5	0	0	0	0	0
TeGrlc	0	0	0	0	5	15	0	0	5	0	0	0	0	0	0	0	0
TeGrlw	0	0	0	0	5	15	0	0	0	5	0	5	0	0	0	0	0
HotDesert	0	0	0	0	0	10	0	0	0	0	15	0	0	0	0	0	0
Desert	0	0	0	0	15	10	0	0	0	0	0	0	0	0	0	0	0
ShTund	5	0	0	0	0	14	5	0	15	0	0	0	0	0	0	0	0
DShTund	0	0	0	0	0	5	0	0	15	0	0	0	0	0	0	0	0
PsShTund	0	0	0	0	0	5	0	0	15	0	0	0	0	0	0	0	0
FoLimoss	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
Barren	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LIce	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

We divided temperate grassland into cool temperate grassland (TeGrlc) and warm temperate grassland (TeGrlw), and desert into cold desert (Desert) and hot desert (Hot Desert), based on the minimum temperature (22^{o}C) of the mean temperature of the warmest month (Prentice et al. 1992). The full name of the BIOME4 types and pollen biome types are listed as below:

Barren	barren land	CLDE	cold deciduous forest
BoPrkl	boreal parkland	CLMX	cold mixed forest
ClMxFo	cold mixed forest	COCO	cool coniferous forest
CoCoFo	cool evergreen needleleaf forest	COMX	cool mixed forest
CoMxFo	cool mixed forest	DESE	desert
Desert	desert	HODE	hot desert
DeTaig	cold deciduous forest	SAVA	savanna
DshTund	erect dwarf-shrub tundra	STEP	steppe
EgTaig	cold evergreen needleleaf forest	TAIG	taiga
FoliMoss	cushion-forb lichen, and moss tundra	TDFO	tropical dry forest
HotDesert	hot desert	TEDE	temperate deciduous forest
LIce	land ice	TRFO	tropical rain forest
OpCoWo	temperate evergreen needleleaf open woodland	TSFO	tropical seasonal forest
PsShTund	prostrate dwarf-shrub tundra	TUND	tundra
ShTund	low and high shrub tundra	TXWS	tropical xerophytic woods/scrub
TeBlSav	temperate deciduous broadleaved savanna	WAMX	broadleaved evergreen/warm mixed forest
TeCoFo	temperate evergreen needleleaf forest	XERO	xerophytic woods/scrub
TeDeFo	temperate deciduous broadleaf forest		
TeGrlc	cool temperate grassland		
TeGrlw	warm temperate grassland		
TeScWo	temperate sclerophyll woodland and shrubland		
TeXsSl	temperate xerophytic shrubland		
TrSeDefo	tropical deciduous broadleaf forest and woodland		
TrEgFo	tropical evergreen broadleaf forest		
TrGrl	tropical grassland		
TrSav	tropical savanna		
TrSeDeFo	tropical semi-evergreen broadleaf forest		
TrXsS1	tropical xerophytic shrubland		
WaMxFo	warm-temperate evergreen broadleaf and mixed forest		

Table S3. The ranges of input parameters for simulation at modern, mid-Holocene periods

Parameter	*Modern*	*Mid-Holocene*
$\Delta Tjan$	[-10,10]℃	[-10,10]℃
$\Delta Tjul$	[-10,10]℃	[-10,10]℃
$\Delta Pjan$	[-90,100]%	[-90,100]%
$\Delta Pjul$	[-90,100]%	[-90,100]%
CO_2	340ppmv	270ppmv
Iterative number	2000	3000

Table S4. The biome score from IVM for each pollen site collected from published paper

Site	**Biome**	**lati**	**long**	TRFO	TSFO	TDFO	CLDE	TAIG	CLMX	COCO	COMX	TEDE	WAMX	XERO	TUND	STEP	DESE
Sujiawan	COMX	35.54	104.52	1.30	2.20	3.40	7.50	9.80	9.70	11.00	12.00	11.60	10.70	7.50	6.00	8.40	6.00
Xiaogou	COMX	36.10	104.90	1.40	1.40	0.00	6.80	14.70	12.20	20.00	20.80	13.00	9.00	6.80	1.30	5.10	4.50
Dadiwan	STEP	35.01	105.91	0.80	3.30	7.40	4.30	4.30	7.60	5.10	8.80	11.30	8.30	3.70	10.10	15.30	10.20
Sanjiaocheng	DESE	39.01	103.34	0.00	0.00	3.50	1.40	2.90	1.40	2.90	3.50	2.00	2.00	1.40	11.60	12.90	13.90
Chadianpo	TEDE	36.10	114.40	0.00	0.00	3.40	10.20	10.20	10.20	10.20	12.50	15.70	13.30	7.80	5.80	6.00	2.70
Qindeli	COMX	48.08	133.25	0.00	2.20	3.50	12.50	17.40	14.70	12.50	21.60	18.90	11.20	2.10	7.80	7.80	6.40
Fuyuanchuangye	TEDE	47.35	133.03	0.00	6.30	8.20	7.10	8.70	17.60	8.70	25.40	34.30	18.30	1.50	11.40	6.80	2.40
Jingbo Lake	TEDE	43.83	128.50	0.00	2.30	3.30	8.40	8.40	11.30	8.40	22.80	27.50	20.40	4.20	5.20	3.50	2.60
Hani Lake	TEDE	42.22	126.52	0.00	3.10	3.10	4.90	4.90	9.00	4.90	17.00	24.70	18.80	3.00	5.20	2.50	2.50
Jinchuan	TEDE	42.37	126.43	0.00	2.40	2.90	3.50	3.50	6.70	3.50	15.90	22.50	17.40	1.60	7.60	1.80	1.30
Maar Lake	TEDE	42.30	126.37	0.00	3.30	3.30	1.70	1.70	6.60	1.70	15.50	25.10	19.70	1.10	0.60	0.00	0.00
Maar Lake	TEDE	42.30	126.37	0.00	3.30	3.30	1.70	1.70	6.60	1.70	15.50	25.10	19.70	1.10	0.60	0.00	0.00
Xie Lake SO4	WAMX	37.38	122.52	3.50	3.50	0.00	6.70	6.70	6.70	6.70	16.90	17.70	19.70	4.10	2.60	4.70	4.70
Nanhuiheming	WAMX	31.05	121.58	4.60	4.60	1.40	6.50	6.50	6.50	6.50	9.90	10.70	15.30	11.10	3.50	7.80	6.40
Toushe	WAMX	23.82	120.88	8.50	10.00	6.70	6.00	6.00	7.50	6.00	10.10	17.10	20.00	4.20	11.20	6.50	1.40
Dongyuan Lake	WAMX	22.17	120.83	14.60	14.60	5.60	0.00	0.00	0.00	0.00	2.60	6.80	15.40	0.00	7.10	5.60	0.00
Yonglong CY	WAMX	31.78	120.44	7.30	7.30	1.70	6.40	6.40	8.10	8.10	11.00	11.00	16.50	12.00	4.90	4.90	3.10

Hangzhou HZ3	TEDE	30.30	120.33	1.40	2.70	2.60	11.10	12.60	13.90	14.10	18.70	19.90	15.20	9.20	4.80	5.10	3.80
Xinhua XH1	WAMX	32.93	119.83	8.10	8.80	7.00	1.10	1.10	1.80	1.10	1.80	5.40	12.70	4.00	8.50	12.50	6.20
ZK01	WAMX	31.77	119.80	9.30	9.40	5.20	1.60	1.60	2.20	1.60	2.20	4.30	13.00	5.40	7.20	9.50	3.50
Chifeng	TEDE	43.97	119.37	0.00	1.70	1.70	4.50	4.50	7.40	4.50	12.40	15.30	7.90	0.00	5.10	11.30	10.90
SZK1	WAMX	26.08	119.31	6.40	6.40	2.20	5.00	5.00	5.00	5.00	5.00	12.10	18.50	8.80	2.20	5.40	3.20
Gucheng	WAMX	31.28	118.90	12.20	12.20	4.30	5.90	5.90	5.90	5.90	8.40	8.70	18.50	7.90	6.80	6.60	2.40
Lulong	TEDE	39.87	118.87	0.00	0.00	0.90	5.20	6.30	5.20	6.30	10.00	12.00	11.10	4.20	4.20	9.00	9.80
Hulun Lake	STEP	48.92	117.42	0.00	0.00	1.90	4.80	5.20	5.60	5.20	10.00	10.50	5.60	0.80	7.50	14.50	12.50
CH-1	WAMX	31.56	117.39	12.10	15.20	6.50	2.10	2.10	2.10	2.10	2.60	5.20	16.70	7.40	7.30	8.00	4.60
Sanyi profile	STEP	43.62	117.38	0.00	0.00	1.90	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	3.60	15.20	13.30
Xiaoniuchang	COMX	42.62	116.82	0.00	0.00	0.00	9.70	11.60	9.70	11.60	19.70	17.80	9.70	1.60	8.10	4.70	4.70
Haoluku	COMX	42.87	116.76	0.00	0.00	0.00	4.60	5.40	5.20	5.40	11.30	10.50	5.30	0.00	4.60	9.90	9.90
Liuzhouwan	COMX	42.71	116.68	0.00	0.00	0.00	10.60	10.60	10.60	10.60	14.60	14.60	11.30	7.30	3.30	6.40	6.40
Poyang Lake 103	WAMX	28.87	116.25	13.30	13.30	0.00	0.00	0.00	0.00	0.00	0.00	0.90	13.60	4.90	0.00	3.70	3.70
Baiyangdian	TEDE	38.92	115.84	0.00	0.00	0.00	7.90	10.20	10.20	10.20	18.10	21.90	16.60	5.00	3.00	8.30	10.20
Bayanchagan	TEDE	42.08	115.35	0.00	1.80	4.60	7.00	8.20	11.60	9.40	17.50	19.80	12.10	3.90	6.60	10.70	8.80
Huangjiapu	STEP	40.57	115.15	2.30	2.30	0.90	1.90	1.90	1.90	1.90	4.50	4.50	4.10	0.40	4.70	13.60	12.70
Dingnan	TSFO	24.68	115.00	10.50	21.90	11.30	6.10	6.10	11.90	6.10	11.90	17.70	16.70	1.70	5.00	3.60	2.20
Guang1	STEP	36.02	114.53	0.00	0.70	3.80	1.90	1.90	2.60	1.90	4.80	6.10	5.40	1.90	3.50	17.40	10.30
Angulinao	COMX	41.33	114.35	0.00	0.00	1.00	7.10	9.40	7.50	9.40	13.40	11.60	9.20	5.10	4.10	10.70	10.60
Yangyuanxipu	STEP	40.12	114.22	0.00	0.00	5.30	2.60	3.60	2.60	3.60	3.60	2.60	2.60	2.60	7.00	17.20	10.20
Shenzhen Sx97	WAMX	22.75	113.78	12.80	12.80	1.80	0.50	0.50	0.50	0.50	0.50	4.10	13.40	7.10	6.60	4.40	2.60
GZ-2	TSFO	22.71	113.51	9.80	13.90	8.10	6.10	6.10	6.10	6.10	6.10	6.10	11.20	7.10	4.00	4.00	0.00
Daihai99a	COMX	40.55	112.66	0.00	0.00	1.00	6.50	6.50	8.20	6.50	12.70	12.70	8.90	4.40	3.10	10.20	10.10
Daihai	COMX	40.55	112.66	0.00	0.00	0.90	6.70	7.00	8.20	7.00	13.20	12.90	9.20	4.50	3.00	10.10	9.90
Sihenan profile	STEP	34.80	112.40	0.00	0.00	3.10	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	3.10	14.30	11.20
Diaojiaohaizi	COMX	41.30	112.35	0.00	0.00	0.00	11.30	11.30	11.30	11.30	17.20	17.20	12.90	6.90	4.30	4.80	6.10
Ganhaizi	TEDE	39.00	112.30	0.00	0.00	0.00	10.40	10.40	10.40	10.40	16.50	17.80	14.70	7.30	3.20	4.30	4.30
Jiangling profile	WAMX	30.35	112.18	4.50	6.50	6.30	4.80	4.80	4.80	4.80	6.80	9.20	13.20	6.80	7.70	11.20	6.90
Helingeer	DESE	40.38	111.82	1.20	2.40	1.20	0.00	0.00	0.00	0.00	1.20	1.20	1.20	0.00	1.20	8.00	9.40
Shennongjia2	WAMX	31.75	110.67	7.70	7.70	3.10	4.40	4.40	4.70	4.40	6.80	16.50	24.50	7.90	7.00	3.10	0.00
Huguangyan Maar Lake B	TSFO	21.15	110.28	18.30	20.20	9.30	0.00	0.00	0.90	0.00	1.70	6.50	17.80	2.90	8.50	8.20	0.80
Yaoxian	STEP	35.93	110.17	0.00	0.00	0.00	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	10.10	12.30	12.30
Jixian	STEP	36.00	110.06	0.00	0.00	2.20	2.50	2.50	2.50	2.50	3.20	3.20	2.50	1.80	8.40	18.70	14.50

Shennongjia Dajiu Lake	TEDE	31.49	110.00	7.50	9.10	3.90	4.50	4.50	9.60	4.50	13.80	25.20	24.70	4.50	5.10	3.80	0.30
Qigainur	DESE	39.50	109.85	0.00	1.40	3.70	6.50	7.10	7.90	7.10	10.40	11.20	8.80	5.50	7.50	11.20	12.50
Beizhuangcun	STEP	34.35	109.53	0.00	0.00	1.40	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	3.60	14.20	12.80
Lantian	STEP	34.15	109.33	0.00	0.00	0.20	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	3.40	14.00	13.80
Bahanniao	COMX	39.32	109.27	0.00	0.00	1.90	8.40	9.00	8.40	9.00	11.40	10.80	10.80	8.40	1.90	5.60	5.60
Midiwan	STEP	37.65	108.62	0.00	0.00	0.00	2.30	3.00	2.30	3.00	3.90	3.20	2.30	1.40	7.70	15.00	13.10
Jinbian	STEP	37.50	108.33	1.90	3.70	1.90	0.00	0.00	0.00	0.00	1.90	1.90	1.90	0.00	1.90	13.50	13.50
Xindian	STEP	34.38	107.80	2.00	3.30	4.70	3.00	5.30	8.50	9.50	12.50	11.60	8.00	3.00	8.00	16.90	12.10
Nanguanzhuang	STEP	34.43	107.75	4.20	8.40	8.20	4.00	4.00	4.00	4.00	15.20	15.20	15.20	4.00	15.40	18.40	10.40
Xifeng	TEDE	35.65	107.68	1.00	1.00	2.70	9.50	9.50	9.50	9.50	12.70	14.40	12.20	6.70	10.80	12.00	9.30
Jiyuan	DESE	37.13	107.40	2.40	4.70	2.40	0.00	0.00	0.00	0.00	2.40	2.40	2.40	0.00	2.40	14.30	16.10
Jiacunyuan	STEP	34.27	106.97	0.00	0.00	0.00	2.30	2.30	2.30	2.30	4.50	4.50	4.50	2.30	1.90	15.90	11.00
Dadiwan	STEP	35.01	105.91	0.80	3.30	7.40	4.30	4.30	7.60	5.10	8.80	11.30	8.30	3.70	10.10	15.30	10.20
Maying	COMX	35.34	104.99	1.20	1.20	2.00	6.90	8.80	8.00	10.00	10.90	9.70	9.70	6.90	7.10	10.60	10.00
Huiningxiaogou	COMX	36.10	104.90	1.40	1.40	0.00	6.80	14.70	12.20	20.00	20.80	13.00	9.00	6.80	1.30	5.10	4.50
Sujiawan	COMX	35.54	104.52	1.30	2.20	3.40	7.50	9.80	9.70	11.00	12.00	11.60	10.70	7.50	6.00	8.40	6.00
QTH02	STEP	39.07	103.61	0.00	0.00	1.40	2.40	2.40	2.40	2.40	3.00	3.00	3.00	2.40	6.90	18.20	17.40
Laotanfang	STEP	26.10	103.20	1.20	2.40	6.90	6.40	6.40	6.40	6.40	7.60	7.60	7.60	6.40	7.80	12.10	5.50
Hongshui River2	STEP	38.17	102.76	0.10	0.10	2.50	5.10	10.50	6.00	10.50	13.40	8.90	8.00	4.30	7.60	14.10	11.90
Ruoergai	STEP	33.77	102.55	0.00	0.00	1.70	4.30	7.40	7.40	10.50	10.50	7.40	4.30	4.30	9.20	12.40	11.90
Hongyuan	TAIG	32.78	102.52	0.00	0.00	0.60	5.50	10.90	5.50	10.90	10.90	5.50	5.50	5.50	5.40	8.80	9.90
Dahaizi	TEDE	27.50	102.33	9.40	11.60	2.20	8.90	10.90	15.70	15.70	21.40	22.20	21.90	6.00	1.70	0.00	0.00
Shayema Lake	TEDE	28.58	102.22	9.90	12.20	3.40	9.70	10.70	15.60	14.20	18.70	20.10	19.60	11.50	3.30	1.10	0.00
Luanhaizi	COMX	37.59	101.35	0.00	0.00	2.50	5.40	9.20	5.40	9.20	13.20	9.40	5.40	1.40	9.80	10.60	8.10
Lugu Lake	WAMX	27.68	100.80	4.60	5.50	1.70	8.70	9.40	11.60	11.40	18.40	18.60	19.00	10.70	2.60	4.30	0.40
Qinghai Lake	STEP	36.93	100.73	0.00	0.00	2.10	6.40	8.80	6.40	8.80	10.80	8.40	6.40	4.40	6.00	12.10	10.00
Dalianhai	STEP	36.25	100.41	0.00	0.00	3.60	3.60	8.10	3.60	8.10	9.70	6.40	4.90	2.10	8.20	14.80	14.20
Erhai ES Core	WAMX	25.78	100.19	13.90	18.70	6.30	6.30	6.30	10.60	9.90	12.60	13.30	22.00	8.80	2.80	2.80	1.40
Xianmachi profile	TEDE	25.97	99.87	4.50	11.40	6.80	12.50	12.90	25.70	17.40	27.30	35.80	19.10	4.50	1.20	0.00	0.00
TCK1	COMX	26.63	99.72	8.40	8.40	1.10	7.30	10.40	12.00	15.10	19.80	17.20	19.50	8.80	3.30	3.60	1.10
Yidun Lake	COMX	30.30	99.55	0.00	0.00	2.30	8.70	11.30	10.00	12.60	20.20	17.60	12.90	5.20	9.20	6.30	3.60
Kuhai lake	STEP	35.30	99.20	0.00	0.00	4.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.50	16.00	9.70
Koucha lake	TUND	34.00	97.20	0.00	0.90	4.50	2.20	2.20	3.10	2.20	4.40	5.30	2.20	0.00	13.20	12.50	6.60
Hurleg	STEP	37.28	96.90	0.00	0.00	5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.50	16.20	11.40
Basu	COMX	30.72	96.67	0.00	0.00	2.60	7.00	9.90	8.60	11.60	16.20	13.30	7.00	2.40	11.70	8.00	5.40

Tuolekule	STEP	43.34	94.21	0.00	0.00	5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	15.70	11.60
Balikun	STEP	43.62	92.77	0.00	0.00	3.00	2.30	2.30	2.30	2.30	4.60	4.60	2.30	0.00	10.00	16.60	13.80
Cuona	TUND	31.47	91.51	0.70	1.30	5.60	0.80	0.80	0.80	0.80	2.20	2.20	1.50	0.00	13.90	12.70	5.50
Dongdaohaizi2	DESE	44.64	87.58	0.00	0.00	3.10	0.00	1.60	0.00	1.60	1.60	0.00	0.00	0.00	6.80	16.60	19.90
Bositeng Lake	STEP	41.96	87.21	0.00	0.00	3.90	0.60	0.60	0.60	0.60	1.20	1.20	0.60	0.00	5.20	15.30	14.70
Cuoqin	TUND	31.00	85.00	0.00	0.00	2.40	5.50	5.50	5.50	5.50	7.50	7.50	6.10	4.20	11.30	7.10	4.00
Yili	STEP	43.86	81.97	0.60	1.30	3.30	1.50	1.50	1.50	1.50	3.70	3.70	2.20	0.00	8.80	20.00	15.20
Bangong Lake	STEP	33.75	78.67	0.00	0.00	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.70	14.10	10.70

Table S5. Climate change during mid-Holocene derived from IVM at each pollen site

Site	***Biome***	***AnnT1***	***AnnT***	***AnnT2***	***AnnP1***	***AnnP***	***AnnP2***	***MTCO1***	***MTCO***	***MTCO2***	***MTWA1***	***MTWA***	***MTWA2***	***Pjan1***	***Pjan***	***Pjan2***	***Pjul1***	***Pjul***	***Pjul2***
Sujiawan	COMX	-6	-3.6	-1.1	-131	152	332	-8.6	-4	1.9	-5.6	-3.4	-0.3	-81	18.5	99.8	-47	36.3	94
Xiaogou	COMX	-5.5	-2.8	-1.2	3.1	169	358	-7.8	-1.4	2.7	-5.5	-3.7	-1.2	-79	20.4	91.8	1.5	44.7	96.3
Dadiwan	STEP	-3.3	-0.5	1.9	-105	210	450	-0.4	4.6	6.6	-8.1	-4	0.5	-86	5.3	85	-20	40.2	94.7
Sanjiaocheng	DESE	-7.6	-3	-1	135	-99	848	-9.8	0.1	-3	-9.6	-5.1	1.5	-80	13.5	98	0	-99	90.1
Chadianpo	TEDE	-8.5	-3.1	-5.1	-150	347	438	-9.9	-0.8	-0	-9.6	-4.7	-6.2	-76	5.3	99.6	-39	71.6	78.2
Qindeli	COMX	-3.3	2.9	1	-399	287	1361	-5.5	7.5	1.7	-2.8	0.3	2.8	-77	18.8	80.6	-30	47.4	97.1
Fuyuanchuangye	TEDE	-9.1	6	-2.1	-181	312	296	-9.7	6.9	1.1	-9.8	5.5	-2.7	-86	1.4	97.4	-62	54.2	98.8
Jingbo Lake	TEDE	-6.8	4.2	1.2	-26.3	362	397	-9.9	6	7.3	-6.1	3.1	-1.5	-178	25.8	198	-32	73.1	191
Hani Lake	TEDE	-7.6	4.7	1.4	-139	295	-26	-7.9	5.8	8.2	-9.8	4	0.3	-164	26.6	199	-179	39.9	-17
Jinchuan	TEDE	-7.2	4.4	-0.3	237.5	361	441	-9.9	5.3	6.2	-9.5	3.8	0	-56	16	96.2	44.1	53.1	98.2
Maar Lake	TEDE	2.2	4.7	4.4	0	388	622	5.6	6.6	9.6	-1.3	3.5	2	-59	17.2	90	0	53.6	99.9
Maar Lake	TEDE	3.1	4.6	8.8	156.5	387	486	4.1	6.6	8.2	1.4	3.5	9.1	-75	13.3	99.6	32.1	53.3	98.6
Xie Lake SO4	WAMX	1.9	-1	7.7	253.3	363	491	2	-1.6	9.6	-0.2	-0.7	8.7	-53	10.9	93.9	51.4	64.3	99.6
Nanhuiheming Core	WAMX	1.3	1.8	7.1	-98.9	472	651	2.2	1.3	8.5	0	2.2	6.5	-89	-0.6	89.6	-18	43.5	95.2
Toushe	WAMX	1.1	-2.1	7.2	17.9	963	560	2.5	-3.9	8.4	-0.4	-1.1	7.5	-86	-6.5	97	13.9	13.7	86.3
Dongyuan Lake	WAMX	2.4	3.1	7.3	66.9	-159	692	4.8	4.1	9	0	2.5	6.9	-85	8.7	89.6	4.9	-8.4	89.9
Yonglong CY	WAMX	2.3	1	7.3	68.7	353	690	4.7	2.3	9	-0.1	0.2	6.9	-72	9.2	92.5	5.2	38.4	91.6

Hangzhou HZ3	TEDE	-4.4	-4.4	2.5	209.4	487	549	-8.3	-7.7	6.6	-5.5	-2.6	3.1	-81	6.6	99.2	39.9	43.7	92.2
Xinhua XH1	WAMX	-2.8	1.7	6.1	-14.2	408	1054	-3.4	4.4	7.5	-3.2	0	7.9	-75	20.2	97.7	-18	59.3	98.6
ZK01	WAMX	-5.4	2.5	2.2	-437	428	2847	-6.9	2.2	0	-6.8	2.6	6.4	-78	17.8	96	-43	46.5	89.7
Chifeng	TEDE	-0.4	1	5.6	-1704	-67	2642	-0.1	7.5	6	-1.3	-2.8	5.3	-48	25	77.9	-63	-20	67.6
SZK1	WAMX	-3.1	-2.3	4.3	-50.2	396	770	-1.6	-2.8	7.1	-4.6	-2	5.1	-84	11.4	97.6	-14	32.9	91
Gucheng	WAMX	-9.3	1.8	0.3	36.5	530	1126	-9.7	2.4	-4	-9.7	1.5	3.4	-82	12.8	95.7	-14	50.4	97.4
Lulong	TEDE	-1.6	-1.3	4.2	174.1	361	613	0	1.1	8.3	-3.9	-2.7	6	-83	-4	95.5	0	68.7	89.1
Hulun Lake	STEP	-1	6.6	6	-199	128	990	-1.4	5.8	4.9	-3.9	7.1	7.9	-90	13	97.2	-43	51.5	97.7
CH-1	WAMX	1	1.9	1	-67	430	-67	7.5	2.5	7.5	-2.8	1.6	-2.8	-2.1	-2.1	-2.1	-20	46.8	-20
Sanyi profile	STEP	-5.8	5.5	1	-211	184	1260	-9.5	1.9	2.5	-5.4	7.6	1.6	-87	8.2	97.8	-34	64	93.3
Xiaoniuchang	COMX	-2.9	1.8	6.5	0	203	927	-1.7	6.3	5.4	-4.4	-0.9	7.7	-83	22	90.6	7.2	56.3	98.3
Haoluku	COMX	-4.6	1.8	1.1	75.7	138	457	-4.5	6.6	7.3	-4.5	-1	0.7	-88	0.8	80.4	10.3	39.6	91.5
Liuzhouwan	COMX	2.9	2.5	9	0	195	214	2	5.7	9.4	3.4	0.7	9.9	-79	26.1	95.9	0	53.9	89.3
Poyang Lake 103B	WAMX	-2.9	1.9	6.2	-57.6	303	928	-1.8	0.8	8.7	-4.5	2.5	7.6	-88	6.4	99.5	-21	20.9	97.5
Baiyangdian	TEDE	1.5	-2	7.5	39.7	262	273	-3.2	0.4	8.4	4.6	-3.4	9.1	-90	-0.1	84.7	10	41.9	98
Bayanchagan	TEDE	1.3	2.9	2.6	92.6	176	320	4.3	4.5	9.1	-1.9	1.9	-0.1	-79	16.7	90.1	16.1	45.4	99.6
Huangjiapu	STEP	0	2.8	2.5	-58.4	101	210	2.5	-0.7	8.7	-1.8	4.8	0	-43	31.4	79.4	-25	21.2	65.3
Dingnan	TSFO	0	4.6	3.2	94.7	500	289	3.4	5.4	7.4	-1.9	4.2	1.7	-40	33.5	99.6	28.3	34	84.6
Guang1	STEP	-0.5	2.5	4.6	-597	126	1300	-5.8	1.9	4.7	-1.9	2.8	5.9	-73	14.2	99.3	-71	27.3	100
Angulinao	COMX	-4.5	0.3	0.7	3.8	180	528	-5.7	4	8.5	-4.9	-1.9	-0.7	-84	5.9	90.8	3.1	54.6	91.8
Yangyuanxipu	STEP	2.9	1.6	2.9	175.5	132	176	4.5	-1.8	4.5	1.9	3.6	1.9	21.1	21.1	21.1	45.4	34.1	45.4
Shenzhen Sx07	WAMX	-1	-2.6	6.1	-4	550	262	-5.7	-5.3	5.4	-0.4	-1	9.5	-76	5.7	96.4	-5.5	29.5	50.1
GZ-2	TSFO	2	3	8.2	-32.4	437	1075	0.5	3.6	9.2	0	2.6	8.5	-60	18.1	69.2	-28	36.6	95.2
Daihai99a	COMX	-2.7	-0.7	6.5	-97.2	212	384	-5.5	3.9	9.7	-3.9	-3.5	9.4	-86	5.3	98.2	-26	67	88.7
Daihai	COMX	-1	-1.1	2.5	86.1	161	333	1	3.9	7.5	-3.5	-4.2	0.5	-79	-5.7	91.2	25.4	50.1	99
Sihenan profile	STEP	-2	1.1	5.6	-45.2	81.9	243	-7.3	1.9	6.1	0	0.6	6.6	-81	1.5	89.7	-13	19.9	65.9
Diaojiaohaizi	COMX	-6	2.5	2.3	-495	225	1686	-9.8	4.7	0	-7.2	1.2	5.7	-58	28.6	99.4	-47	67.1	96.4
Ganhaizi	TEDE	0	4.6	6.2	-194	399	902	-0.9	3.8	8.8	-1.7	5.1	8.2	-76	-30.9	17	-12	79.3	75.8
Jiangling profile	WAMX	-2.6	1.1	1.5	93.6	413	289	-0.7	3.8	7.8	-5	-0.7	-1.2	-87	7.4	92.1	27.7	43.9	91.4
Helingeer	DESE	-2.7	-2.2	0.8	-135	-220	313	0	-0.4	8.4	-5	-3.2	-3.4	-84	12	96.3	-46	-76	91.6
Shennongjia2	WAMX	-2.5	1.3	4.9	-88.6	558	257	-3.7	-2	6.6	-4	3.1	5.8	-83	-4.5	92.1	-27	31.3	63.9

Huguangyan Maar Lake B	TSFO	1.1	0.2	4.4	103.9	969	326	0	0.5	8.7	-0.1	0.1	2.7	-80	6.7	94.8	21.8	56.8	97
Yaoxian	STEP	2.8	-0.1	7.1	318.1	-338	484	-2.1	1.1	9.6	2.6	-1	9.2	-83	13.2	84.6	59.2	-51	95.9
Jixian	STEP	-3.2	2.8	5.2	35.9	-38	795	-0.7	0.3	8.3	-7.4	4.2	5.2	-82	11.9	95.4	-14	-7	98.3
Shennongjia Dajiu Lake	TEDE	-7.8	1.2	1.7	-274	365	-177	-8.3	0.2	8	-7.6	1.7	1	-88	-6.7	95.6	-90	18.8	-56
Qigainur	DESE	-1.7	-1.5	4.8	-725	-217	1782	-9.8	2.4	6.5	-2	-4	9.7	-89	10.1	97.8	-52	-76	99.6
Beizhuangcun	STEP	-4	1	3.3	108.2	-44	1636	-4.2	-1	5.7	-4.3	2.1	4.6	-9.6	48.5	93.5	0	-6.7	98.1
Lantian	STEP	-3.7	3.2	2.6	-442	-95	-146	-8.8	3.6	7.7	-4.5	3	2	-85	14.3	88.2	-70	-17	-15
Bahanniao	COMX	-2.4	-1.2	5.9	-209	-10	59.3	-7.8	3.1	6.2	0	-4	9	-77	3.4	98.1	-51	-4	21.1
Midiwan	STEP	-2.6	3	5	-776	109	1847	-6.1	-0.5	5.7	-5.3	5	7.3	-88	10.9	96.5	-49	28.8	99.5
Jinbian	STEP	-6.7	1	1.7	-263	-141	-144	-3.1	1.3	7.1	-9.6	0.8	0.6	-86	-8.7	78.6	-89	-28	-56
Xindian	STEP	-4.3	1.9	4.9	-164	58.8	96	-7	-1.4	6.8	-3.2	3.8	8.4	-90	-5.3	97.1	-43	11.7	24.6
Nanguanzhuang	STEP	-1.3	3.4	6.1	-319	32.4	91.9	-1.2	4	9.7	-2.7	3	7.8	-82	7.5	99.7	-66	6.1	31.7
Xifeng	TEDE	-4.1	2.1	1.2	-158	380	258	-3.3	4.7	8	-6.2	0.4	-2	-87	1.9	87.1	-69	65.1	94.3
Jiyuan	DESE	-0.9	1.4	5.8	-3.3	-445	181	-8.9	2.4	7.2	1.3	0.8	7.6	-84	-21.3	66.7	-4.9	-81	47.5
Jiacunyuan	STEP	-2.3	4.6	3.1	-256	-252	35.6	-7.5	3.8	7.2	-2	5	2.9	-84	-2	86.9	-66	-31	6.7
Dadiwan	STEP	-3.5	0.6	6.8	-119	354	226	-9.6	1.3	5.1	-2.7	0.1	9.5	-87	-0.2	95.2	-34	67.7	48.8
Maying	COMX	-1.5	-2.9	6.9	-179	118	174	-2.3	-2.9	8.8	-2.3	-2.9	7.5	-83	1.7	99.3	-42	25.4	42.6
Huiningxiaogou	COMX	-2.2	-3.4	7	71.9	84.3	594	3.3	-2.2	6.4	-6	-4.2	8.3	-69	11	92.3	14.7	22.8	99.3
Sujiawan	COMX	-2.3	-3.6	4.1	-500	178	-334	-6.6	-3.4	8.7	-1.6	-3.8	2.7	-86	-43.6	62.1	-90	44.5	-64
QTH02	STEP	0.7	-1.7	7.8	-408	186	-86	-1.6	-1.9	9.6	0	-1.6	9.6	-88	-20	66.7	-77	145	-13
Laotanfang	STEP	-2.2	4.1	3.3	139	125	526	-6.9	-1.1	8.2	-4.2	7	4	-88	9.2	93.7	21.7	123	94.4
Hongshui River2	STEP	-5.9	0.6	-0.1	-300	223	418	-8.4	2	2.6	-4.9	-0.2	0	-88	11.6	96.6	-78	138	100
Ruoergai	STEP	-5	4.7	-1.4	-223	106	332	-5.9	1.9	3.9	-5.7	6.3	-2.2	-87	7.4	95.9	-72	26.1	98.3
Hongyuan	TAIG	-6.1	-3	-0.7	16.6	-31	386	-8.5	-2.6	2.3	-6.3	-3.3	-1.1	-87	9.5	99.1	0.8	-8.9	96.2
Dahaizi	TEDE	-4	3.4	1.1	72.1	261	257	-5.7	6.1	2.4	-4.3	1.9	0.6	-150	6.9	200	65.7	73.5	194
Shayema Lake	TEDE	0.2	-0.5	6.6	62.6	331	178	-9	1.5	6.5	5.1	-1.7	9.9	-174	-1.8	151	62.8	69	189
Luanhaizi	COMX	-1.5	2.8	2.3	105.6	276	281	-4.9	4	7.5	-3.4	2	1.2	-141	59.1	195	64.4	132	190
Lugu Lake	WAMX	0.5	1	7.6	-65.8	380	269	-5.4	1	8.6	2.8	0.9	8.8	-88	9.3	95	-33	67.9	68.5
Qinghai Lake	STEP	-6.2	5.6	-0.1	-262	207	267	-9.6	3.6	3.8	-6	6.7	-1.6	-88	5.9	94.3	-67	103	66.8
Dalianhai	STEP	1.2	3.3	3.9	115.9	98	318	1.8	3.2	7.7	0.6	3.3	2.6	-74	37.8	97.6	20.9	44	94.5
Erhai ES Core	WAMX	-2.5	4	0.9	112.9	540	438	-1.9	3.9	4.2	-4.1	4	0	-23	18.4	94.6	16.9	39.7	97.8

Xianmachi profile	TEDE	0.1	4.8	4.5	-6.1	350	424	-3.3	5.6	8.4	0.4	4.4	4	-146	53.7	199	-12	70.4	194
TCK1	COMX	-1.6	1.9	3.8	158.1	226	557	-7.2	-4.6	7.1	-2.7	5.6	6.8	-89	-2.1	84.1	25.4	49	98.2
Yidun Lake	COMX	3.4	3.6	7.4	137.2	214	319	-1.7	0.5	9	3.4	5.4	8.6	-178	-41.5	136	65.1	53	169
Kuhai lake	STEP	0.4	5.2	6	-6.7	124	179	-3.6	2.1	8.6	-0.3	7.1	6.9	-88	-4.2	83.4	-7.5	40.7	82.2
Koucha lake	TUND	0.6	-3.2	6.2	-123	77.2	1221	0	-2.4	8.8	0	-3.6	9	-61	24.4	98.6	-14	19.6	99.6
Hurleg	STEP	2.4	1.6	6.1	153.4	173	515	0.5	3.9	8.2	1.8	0.2	7.8	-76	28.4	99.3	16.2	131	100
Basu	COMX	0	3.6	4.1	0	20.6	420	-7.1	0.1	0.6	3.7	5.6	8	-88	8.6	89.7	-1.6	5.8	84.5
Tuolekule	STEP	0.7	2.6	5.1	16.1	169	313	-5.5	4.1	5.2	2.8	1.7	8.3	-81	12.4	91	8.1	138	92
Balikun	STEP	2.1	1.3	7.5	5.4	167	264	-3.4	2.7	9.5	2.9	0.4	9.4	-77	4.5	93.3	-1.4	132	85
Cuona	TUND	-5.5	-4.4	-0.3	-205	236	353	-8.6	-3.5	3.3	-4.9	-4.9	-2.7	-83	3.1	96.5	-61	56.9	90.3
Dongdaohaizi2	DESE	0	-3.5	3	17.3	-67	243	0	0	7.4	-0.5	-5.7	1.4	-150	7.4	199	0.7	-82	178
Bositeng Lake	STEP	1.2	0.5	5.8	-264	176	285	-4.3	5.2	5.5	3.3	-2.3	8.2	-86	-3.7	99.4	-67	82.1	70.3
Cuoqin	TUND	1.1	-3.9	4.3	88	1589	238	0.1	-1.3	7.8	-1.2	-5.5	3.8	-139	34.3	177	44.5	106	199
Yili	STEP	-1	-0.9	3.7	107	152	220	-3.2	3.5	7.2	-2.7	-3.5	3.7	-132	37.4	198	75.5	95.6	180
Bangong Lake	STEP	-4.7	3.1	-4.1	78	472	281	-4.5	-3	-3	-5	6.6	-4.7	0	31.8	65.7	9.1	158	70.5
Shengli	TEDE	-7.2	6.3	0.2	-115	314	29.1	-7.9	7.3	7.2	-9.8	5.8	-1.7	-179	-5.5	200	-179	53	40.4
Qingdeli	WAMX	-0.9	6.9	2	38	313	340	1.5	8.1	8.3	-4	6.2	-0.3	-147	16	187	13.6	53.1	160
Changbaishan	TEDE	-5.5	3.3	-1.6	1490	344	1690	-5.5	5	4.3	-6.3	2.3	-4.3	50.5	126	194	23.7	48.8	188
Liuhe	COMX	-4	4.5	1.6	46.6	333	260	-1.6	6.2	7.5	-6.7	3.5	0	-163	-1.1	198	4.9	44.4	166
Shuangyang	TEDE	1.5	3.7	3.9	422.7	387	508	-4.6	5.1	0	4.3	2.8	7.6	597	717	782	32.7	63.2	303
Xiaonan	WAMX	4.2	3.6	8.4	-13.1	364	501	3.4	5.1	9.6	3.4	2.6	9	-59	13.6	76.5	-6	59.8	88.5
Tailai	STEP	4.1	2.8	8.1	27.6	162	466	4.6	-0.7	9.4	2.8	4.8	9	-87	13.9	96	-1.1	40.9	89.5
Sheli	STEP	0.2	2.6	5.4	0	133	656	0.2	-0.8	9.7	-0.2	4.6	6.3	-85	-1.4	89.3	-3.9	34.7	95.4
Tongtu	STEP	1.5	1.3	6.5	0.4	149	632	4.6	-1.2	9.8	0	2.8	6.9	-66	24.4	93.3	0	37.8	92.3
Yueyawan	TEDE	0	-1.6	5.8	187.8	352	581	0.7	-0.2	9.6	-1.7	-2.4	7.3	-72	24.4	99.2	20.4	63.4	92
Beiwangxu	TEDE	0	-1.9	7.2	91.9	354	594	0.2	-1.3	8.8	-1.4	-2.3	6.8	-84	12.6	99.7	17.1	64.9	99.1
East Tai Lake1	WAMX	-1.2	2.9	6.9	-67.5	475	402	-7.7	0.6	9	0.8	4.1	8.2	-88	8.4	99.2	-24	47.5	98.3
Suzhou	WAMX	-1.6	-0.8	5.9	-109	178	371	-9.8	0.2	7.7	0.2	-1.4	9.1	-89	4.7	98.1	-30	15.8	91.3
Sun-Moon Lake	WAMX	-2.9	-0.9	4.8	-28	1008	318	-9.8	-2.7	6.7	0	0.1	4.8	-76	19.5	95.9	-15	28.8	78.4
West Tai Lake	WAMX	-4.3	2.7	1	190.5	603	596	-6.7	1.2	7	-5.5	3.6	1.1	-75	25.8	99.3	22.4	57.9	99.6
Changzhou	WAMX	-6.1	1.6	1.5	165.3	315	578	-9	2	8.1	-5.6	1.4	1.5	-75	15	98	24	30.7	99.4
Dazeyin	TEDE	0	-0.6	5.7	10.9	370	992	-1.7	1.4	3.5	0.5	-1.8	7.7	-81	15.2	89.4	-5.3	73.2	95.2

Hailaer	STEP	-3.3	5.8	5.1	-151	156	742	-2.9	3.7	3.3	-4.4	7	6.7	-76	12.2	95.2	-23	48.6	99.9
Cangumiao	TEDE	-4.3	-0.3	3.7	-73.3	384	2336	-5.5	2.6	0.5	-5	-2	6.2	-75	19.3	93.9	-33	70.4	94.3
Qianhuzhuang	COMX	0.1	-3.5	4.9	203.9	296	1079	-2.7	2.3	4.7	0	-7	7.1	-77	25.8	99.4	-4.6	55.7	95.5
Reshuitang	STEP	-3.4	2.3	5.9	-155	78.5	909	-2.1	4.4	6.2	-6.1	1.1	8.7	-87	13.9	88.9	-31	29.3	97
Yangerzhuang	TEDE	-3.7	-1.8	1.9	84.4	381	524	-5.1	0.8	8	-4.4	-3.4	1	-70	13.7	96.5	10.2	67.7	99.6
Mengcun	COMX	3.4	-2.9	7.9	2.3	283	296	-2	-0.3	8.4	5.3	-4.5	7.9	-87	29.5	73.3	0	53.1	97.7
Hanjiang-CH2	WAMX	-3.2	-3.6	2.9	105.2	294	558	-4	-4.9	7.6	-4.3	-2.8	2.5	-88	19.3	97.1	18.2	18.7	99.7
Hanjiang-SH6	TRFO	-6	3.7	-1.3	147.4	934	464	-4.4	3.6	7.4	-9.3	3.8	-4.9	-90	4	96	24.1	57.4	86.8
Hanjiang-SH5	WAMX	0.6	-4	4.3	-18.6	346	179	-3.3	-4.6	9.1	-0.9	-3.6	3	-84	-5.2	69.5	-14	20.9	69
Hulun Lake	STEP	-5.6	4.9	1	131.2	266	528	-7.4	1.6	7.2	-5.9	6.9	-0.1	-89	25.3	95.3	17.2	115	99.1
Heitutang	STEP	-5.4	3.2	-1.3	103.9	112	492	-6.8	0.7	5.7	-8.1	4.6	-0.8	-88	-5.5	97.7	22.3	31.9	92.8
Zhujiang delta PK16	WAMX	-6.4	-4	0.2	-905	410	1589	-9.8	-5.4	-0	-7.5	-3.2	1.9	-75	11.4	97.1	-82	23.1	99.9
Angulitun	TAIG	0	-5	6.1	416.6	116	1285	-1	-2	8.6	-0.2	-6.9	7.8	-16	38	84.7	20.7	36.1	97.4
Bataigou	STEP	-6.2	4.1	-2.2	-450	138	1281	-7.9	0	-2	-7.3	6.5	0	-84	17	89.8	-56	42.4	95
Dahewan	STEP	2.6	3.3	7.3	88	139	421	-3.6	-0.9	8.7	4.5	5.7	9	-165	5.3	164	33.4	42.2	186
Yutubao	STEP	-0.8	3	6.6	-50.5	173	318	-9.8	0.3	9.1	0.6	4.6	9.5	-88	-3.2	84.1	-17	54.5	96.5
Zhujiang delta K5	WAMX	-6.2	-2.8	-0.5	-687	409	1410	-9.8	-5.4	-1	-7.6	-1.2	0.7	-62	17.9	95.2	-55	27.9	95.5
Da-7	DESE	-7.1	-0.8	-3.2	-80.4	-246	295	-7.7	-0.8	2.4	-8.6	-0.8	-4	-85	3	96.2	-26	-78	95.8
Hahai-1	STEP	0.6	3.3	6.9	44.7	183	223	-8.1	1.4	8.7	3.3	4.4	9.4	-77	-6.7	88.4	8	57	75.3
Wajianggou	STEP	0.7	1.7	6.2	0	84.5	314	-7.1	1.9	6.9	2.6	1.6	8.9	-80	-0.9	92.1	-1.9	25.9	93
Shuidong Core A1	TRFO	-0.8	1.6	6.1	47.2	784	256	-7.1	0.9	7.3	1.8	2	7.6	-88	17.7	85.8	10.3	41.5	93.2
Dajahu	TEDE	-6.4	1.2	1	-441	536	1540	-7	0.1	-3	-8.4	1.8	4.6	-82	-0.7	89.8	-31	29.1	98.6
Tianshuigou	STEP	-6.2	2.3	2.5	-280	81.6	-193	-9.9	1.2	8.2	-4.1	2.9	1	-85	-6.3	91.5	-90	17.2	-64
Mengjiawan	DESE	0.5	-1.3	7	77.2	-266	295	-4.9	1.1	9	0.9	-2.8	8.3	-85	-7	97.6	19	-79	97.1
Fuping BK13	TEDE	-1.7	-3	4.5	-92	335	277	-7.1	-3	7.6	-0.2	-3	3	-88	1.5	96.5	-27	65	95.9
Yaocun	STEP	-2.9	1.8	4.5	0	36.5	1473	-3.5	0.9	5.1	-3.7	2.4	7.6	-34	46	90	-11	3.9	97
Jinbian	STEP	-2.4	-0.4	4.8	-721	-51	1682	-8	1.3	5.7	-5	-1.5	8.7	-89	12.6	95.7	-54	-12	93.3
Dishaogou	DESE	-2.5	-2.1	5.3	-135	-305	272	-5.2	1.1	7.9	-3	-4.3	7	-86	-0.9	92.4	-38	-80	61.2
Shuidonggou	DESE	-4.2	-2.7	1.7	-285	-221	-221	-4.6	0	8.2	-6.9	-4.5	0	-45	-15.8	63.5	-85	-77	-73
Jiuzhoutai	TAIG	-6.2	-5.1	0.8	189.2	105	476	-8.8	-1	4.7	-6.7	-7.8	1	-76	12.3	98.6	30.7	26.5	97.3
Luojishan	WAMX	-2.7	3.7	6.5	-71	268	163	-4	6	5	-2.9	2.4	9.5	-52	18.8	86.7	-27	77.9	40.7

RM-F	COMX	-3.5	1.3	4	-172	192	130	-7	-1.4	9.1	-5.2	2.8	1.6	-74	0.3	99.6	-58	50.3	24.5
Hongyuan	TUND	-5.4	-5.8	1.3	-340	7.7	-268	-6.8	-3.8	6.2	-7.7	-7	0.2	-89	-38.8	30.8	-90	2.1	-59
Wasong	COCO	-7.1	-1	1.5	-256	156	-172	-7.7	-4.7	6.9	-9.6	1.1	0.4	-82	-14.4	64.6	-90	35.8	-59
Guhu Core 28	COMX	-7.9	-1	-1.6	-146	253	367	-6.8	-5.8	4.5	-9.9	1.8	-5.8	-87	12.2	100	-52	46.5	95
Napahai Core 34	COMX	3.2	0.8	4.1	227.9	311	281	3.2	-4	8.3	1.1	3.6	2.8	-37	24.3	63.6	73.8	59.3	81
Lop Nur	DESE	-1.5	-3	3.8	-78.2	-162	405	-7.5	1.6	3.6	0.4	-5.9	5.8	-76	-4.4	96	-19	-117	99.7
Chaiwobao1	DESE	-7.8	-3.7	-2.6	-168	-210	268	-9.3	-2.1	3.7	-7.9	-4.8	-5.9	-66	-0.9	99.2	-49	-140	60.4
Chaiwobao2	DESE	-2.7	-3.2	1.5	-92.6	-208	438	-9.8	-1	4.7	-0.7	-4.5	4.4	-71	27.8	99.1	-30	-143	99.1
Manasi	DESE	-3.4	-1.4	1.1	-89.4	-108	542	-9.1	3	-3	-0.2	-4	4.9	-87	4.9	90	-18	-77	99.2
Wuqia	DESE	-1.5	-3.8	3	0	-109	479	-7.7	0.3	0.1	0.3	-6.4	6.2	-73	36.2	94	0	-146	97.6
Madagou	STEP	-5.9	-3.5	0	-194	239	-106	-3.8	-1.2	6	-9.7	-4.9	-2.2	-175	-9.5	188	-178	225	-44
Tongyu	STEP	-9.1	3.7	0.8	-214	103	-195	-9.6	2.4	7.2	-9.8	4.5	0.9	-170	-72.7	46.4	-176	29.6	-102
Nanjing	TEDE	-6.9	-4.3	2.1	-210	430	-200	-7.4	-5.7	7.2	-8.1	-3.5	0.5	-180	-91.3	31.8	-169	50	-105
Banpo	COMX	-3.7	-7.1	0.7	-178	190	-0.4	-1.8	-5.1	7.3	-6.2	-8.2	-1.2	-169	-36.3	193	-172	33.6	24.5
QL-1	COMX	-7.3	-1	-0.4	-110	559	-99	-6	-3	6.7	-9.9	0.1	-1.9	-178	-31.2	107	-178	36.7	-101
Dalainu	TAIG	-5.2	-5.4	-1.3	156.7	65.7	300	-5.2	-4	2.9	-7.1	-6.2	-1.7	-588	228	687	-160	22	771
Qinghai	TAIG	1	-3	5.9	-33.2	192	188	-7.7	-1.6	8.7	2.1	-4	6.9	-78	6.5	80.8	-4.9	90	58.5

In this table, we give the biome type at 6 ka for each pollen site used in our study. From third column, all the climate values (AnnT, AnnP, MTCO, MTWA, Pjan and Pjul) represent the climate changes during mid-Holocene (MH), compared to preindustrial (PI). The units for temperature and precipitation anomaly (MH-PI) are K and mm, respectively. Besides the median values (AnnT, AnnP, MTCO, MTWA, Pjan and Pjul), we also show the values bias on data reconstruction by giving the median value (for instance, column named MTCO) and values indicating the 5% (MTCO1)-95% (MTCO2) uncertainty bands.

Table S6. The simulated values for annual and seasonal temperature from each model

Model	AnnT1	AnnT2	AnnT3	AnnT4	AnnT5	MTCO1	MTCO2	MTCO3	MTCO4	MTCO5	MTWA1	MTWA2	MTWA3	MTWA4	MTWA5
CCSM4	-1.03	-0.83	-0.71	-0.52	-0.27	-3.19	-2.08	-1.68	-1.47	-0.98	-0.60	0.25	0.69	1.04	2.25
CSIRO-Mk3-6-0	-0.87	-0.31	-0.19	-0.05	0.63	-1.83	-0.96	-0.77	-0.42	1.75	-0.22	0.65	1.27	1.52	2.64
FGOALS-s2	-1.19	-0.73	-0.50	-0.23	0.11	-2.17	-1.87	-1.52	-1.16	-0.47	-1.02	-0.11	0.54	1.28	2.28
HadGEM2-CC	-0.69	-0.33	-0.10	0.12	0.34	-4.16	-1.78	-1.47	-1.19	-0.19	-0.37	1.09	1.41	2.21	3.59
IPSL-CM5A-LR	-0.79	-0.38	-0.13	0.03	0.40	-1.57	-1.10	-1.01	-0.82	-0.30	-0.67	0.19	1.11	1.64	2.58
MPI-ESM-P	-1.27	-0.71	-0.40	-0.24	0.38	-2.43	-1.66	-1.23	-0.95	-0.45	-1.14	0.33	1.06	1.84	2.90
BCC-CSM1-1	-1.01	-0.44	-0.30	-0.22	0.08	-1.99	-1.63	-1.49	-1.39	-0.75	-0.63	0.89	1.73	2.03	2.83

CNRM-CM5	-0.42	-0.18	0.16	0.33	1.77	-1.58	-1.09	-0.71	-0.41	1.28	-0.27	0.73	1.48	2.00	3.12
FGOALS-g2	-1.97	-1.20	-0.98	-0.70	-0.36	-2.89	-2.45	-2.31	-1.99	-0.84	-1.50	0.15	0.72	1.22	1.95
GISS-E2-R	-1.25	-0.44	-0.31	-0.17	0.20	-1.66	-1.06	-0.79	-0.59	-0.16	-0.50	0.54	0.76	1.03	1.66
HadGEM2-ES	-0.34	0.16	0.54	0.76	1.30	-3.80	-1.26	-0.70	-0.20	0.95	-0.14	1.50	2.14	2.67	4.40
MIROC-ESM	-1.95	-0.89	-0.62	-0.41	0.41	-3.23	-2.12	-1.59	-1.22	0.36	-0.86	0.23	0.89	1.48	3.23
MRI-CGCM3	-0.81	-0.40	-0.30	-0.18	0.25	-1.57	-1.09	-0.87	-0.63	0.00	-0.49	0.20	0.79	1.42	2.46

In this table, we give the simulated values of annual and seasonal temperature from each model used in our study. From second column, all the climate values represent the temperature changes during mid-Holocene (MH), compared to preindustrial (PI). The units for temperature anomaly (MH-PI) are K. Besides the median values (AnnT3, MTCO3, MTWA3), we also give the values indicating the 5% (for instance, column named AnnT1)-95% (AnnT5) uncertainty bands and the 25% (AnnT2)-75% (AnnT4) range.

Table S7. The simulated values for annual and seasonal precipitation from each model

Model	Pann 1	Pann 2	Pann 3	Pann 4	Pann 5	Pjan 1	Pjan 2	Pjan 3	Pjan 4	Pjan 5	Pjul 1	Pjul 2	Pjul 3	Pjul 4	Pjul 5
CCSM4	-204.01	-46.87	10.15	48.78	138.92	-17.12	-3.59	-1.46	-0.60	5.30	-44.26	-5.84	2.70	20.00	82.60
CSIRO-Mk3-6-0	-107.21	-28.55	15.73	52.74	380.99	-9.95	-2.52	-1.49	-0.94	35.19	-73.08	-2.38	6.84	15.27	119.89
FGOALS-s2	-134.24	-68.80	15.12	17.39	360.68	-22.62	-5.82	-2.45	-0.38	13.27	-18.11	-9.19	-5.16	2.81	101.30
HadGEM2-CC	-221.65	-87.05	1.04	19.15	232.56	-22.48	-4.15	-1.19	-0.36	7.13	-79.19	-2.98	4.87	11.03	60.38
IPSL-CM5A-LR	-91.01	-22.32	32.40	63.72	256.82	-13.89	-4.65	-2.33	-1.34	15.93	-37.12	-3.69	9.98	25.68	87.66
MPI-ESM-P	-124.27	-34.13	36.50	85.28	437.87	-25.79	-3.53	-1.98	-0.76	7.38	-15.71	-2.50	9.14	26.70	108.32
bcc-csm1-1	-213.30	-75.17	9.65	37.55	466.31	-13.22	-7.12	-4.41	-2.91	0.84	-39.00	-14.22	0.73	16.30	137.07
CNRM-CM5	-222.98	0.68	46.08	75.46	239.51	-29.39	-3.89	-2.05	-0.46	16.90	-26.96	1.84	12.48	18.59	75.68
FGOALS-g2	-160.31	-33.88	-25.12	54.86	236.81	-7.97	-4.02	-2.64	-2.24	-0.75	-38.20	-4.65	7.13	16.64	71.05
GISS-E2-R	-406.26	-2.95	9.47	34.02	515.95	-33.84	-3.35	-1.22	-0.31	13.38	-34.13	-2.22	7.29	15.98	122.65
HadGEM2-ES	-277.31	-33.91	15.88	8.57	257.44	-14.02	-3.41	-0.78	-0.24	12.99	-81.43	-10.75	-3.73	1.49	74.69
MIROC-ESM	-168.19	-120.60	-83.95	-53.86	287.64	-7.64	-2.06	-1.33	-0.41	4.54	-33.24	-20.65	-7.05	-1.19	98.71
MRI-CGCM3	-214.27	-1.58	28.76	65.02	369.04	-27.30	-5.98	-1.49	-0.38	1.65	-25.30	9.66	15.82	27.42	113.69

In this table, we give the simulated values of annual and seasonal precipitation from each model used in our study. From second column, all the climate values represent the precipitation changes during mid-Holocene (MH), compared to preindustrial (PI). The units for precipitation anomaly (MH-PI) are mm. Besides the median values (AnnP3, Pjan3, Pjul3), we also give the values indicating the 5% (for instance, column named AnnP1)-95% (AnnP5) uncertainty bands and the 25% (AnnP2)-75% (AnnP4) range.

Table S8. Vegetation setting for the mid-Holocene among models in PMIP3

Model	*L A I*	*Stomatal Resistance Function Of*	*Vegetation Time Variation*
CCSM4	Prognostic	CO_2 | Light | Temperature | Water availability	Prescribed (varying from parameters)
MIROC-ESM	Prescribed	CO_2 | Light | Temperature | Water availability	Prescribed (varying from parameters)
BCC-CSM1.1	Prognostic	CO_2 | Light | Temperature | Water availability	Prescribed (varying from parameters)
CNRM-CM5	Prescribed	Light | Temperature | Water availability	Fixed (not varying)
CSIRO-MK3.6.0	Prescribed	Light | Temperature | Water availability	Prescribed (varying from parameters)
GISS-E2-R	Prescribed	CO_2 | Light | Temperature | Water availability	Fixed (not varying)
IPSL-CM5A-LR	Prognostic	CO_2 | Light | Temperature | Water availability	Prescribed (varying from parameters)
MPI-ESM-P	Prognostic	CO_2 | Water availability	Fixed (not varying)
MRI-CGCM3	Prescribed	CO_2 | Light | Water availability	Prescribed (varying from parameters)
HadGEM2-ES	Prognostic	CO_2 | Light | Temperature | Water availability	Dynamical (varying from simulation)
HadGEM2-CC	Prognostic	CO_2 | Light | Temperature | Water availability	Dynamical (varying from simulation)
FGOALS-g2	Prescribed	no data	Prescribed (varying from parameters)
FGOALS-s2	Prescribed	no data	Prescribed (varying from parameters)

Table S9. Previous reconstruction of temperature anomaly during mid-Holocene over China

Site	*Lati*	*Long*	*Tann*	*Reference*
Qingpu	31.13	121.18	-0.61	Cai et al.,2001
Fanjingshan	27.90	108.71	3.08	Qiao et al.,1996
Daqingshan	41.12	112.57	-0.66	Song and Sun,1997
Dajiuhu	31.49	110.00	5.79	Huang et al.,2013
Zhujiang	22.70	113.50	-0.49	Zhao et al.,2014
Tangke	33.45	108.92	-0.40	Guo et al.,2012
Shennongjia	31.60	110.13	0.60	Zhu et al.,2008
Dajiuhu2	31.60	110.00	2.40	Liu et al.,2000
Luanhaizi	37.59	101.35	0.16	Herzschuh et al.,2010
Ximencuo	33.38	101.10	1.77	Herzschuh et al.,2014
Bayanchagan	41.65	115.21	0.20	Jiang et al.,2010
Tianchi	35.26	106.31	-2.38	Li et al.,2014
Chencuo Lake	28.93	90.60	-1.92	Lu et al.,2011
Koucha	34.00	97.20	0.78	Herzschuh et al.,2009
Qigai Nuur	39.58	109.89	-1.07	Sun and Feng,2013
Chadianpo	36.10	114.40	-1.21	Xu et al.,2010
Hulun	48.93	117.35	0.12	Wen et al.,2010
Daihai Lake	40.55	112.66	0.59	Xu et al.,2010
Hulun lake	49.13	117.51	0.20	Wen et al.,2010
Huiduipo	34.57	109.02	1.10	Sun et al.,2016
Weinan	34.24	109.30	1.50	Lu et al.,2007
Weinan	34.24	109.30	2.50	Wu et al.,1994
Zoige DC	33.90	102.55	warmer	Liu et al.,1995
Renjiahutong	35.75	109.42	warmer	Zhou et al.,1994
Barkol Lake	43.70	92.83	warmer	Xue and Zhong,2008
Bosten Lake	42.08	87.05	warmer	Zhong and Shu,2001
Moon Lake	47.51	120.87	warmer	Liu et al.,2014
Baiyangdian	38.85	116.00	warmer	Xu et al.,2003
Erhai Lake	25.78	100.19	warmer	Zhou et al.,2003
Hulu river	35.00	106.00	warmer	Mo et al.,1996
Dongge cave	25.28	108.08	warmer	Zhang et al.,2003
Xiangshui	25.25	110.92	warmer	Zhang et al.,2003
Maohebei	39.50	119.17	warmer	Li and Liang,1985
Daziying	39.70	118.99	warmer	Li and Liang,1985
Hani	42.23	126.52	warmer	Yu et al.,2008
Dagushan	39.92	123.66	warmer	CQPD in IGCAS,1977
Mianyang	30.20	113.22	warmer	Yang et al.,1995
Angulinao	41.35	114.39	warmer	Zhai et al.,2000
Diaojiao	41.30	112.35	warmer	Song et al.,1996
Poyang Lake	29.03	116.14	warmer	Ma et al.,2004
Ritu	33.39	79.73	warmer	Wang et al.,2010
Qinghai Lake	36.55	99.60	warmer	Kong et al.,1990
Hulun Lake	48.90	116.50	warmer	Yang et al.,1995

Ulungur Lake	47.22	87.15	warmer	Jiang et al.,2007
Tanghongling	48.35	129.67	warmer	Yang and Wang,2002
Aibi Lake	44.88	82.88	warmer	Wu et al.,1996
Xianrendong	25.83	103.50	warmer	Zhang et al.,2009
Gushantun	42.00	126.00	warmer	Wang and Liu,2001
Changbaishan	42.00	128.00	warmer	Zhao et al.,2002
Gonong Core	34.63	92.15	warmer	Li et al.,1995
Juyanze Lake	41.89	101.85	colder	Herzschuh et al.,2004
Dadiwan	35.01	105.91	warmer	An et al.,2003
Sujiawan	35.54	104.52	warmer	An et al.,2003
Dahu	24.68	115.00	warmer	Xiao et al.,2007
Dingxi	35.52	104.54	warmer	Feng et al.,2005
Bangong Core	33.67	79.00	warmer	Gasse et al.,1996
Sumxi Core	34.62	81.03	warmer	Gasse et al.,1991
Bayanchagan	41.65	115.21	warmer	Guiot et al.,2008
Zigetang	32.00	90.90	warmer	Herzschuh et al.,2006
Dahu	24.25	115.03	warmer	Zhou et al.,2004
Jingbo Lake	43.90	128.80	warmer	Li et al.l.,2011
Daihai Lake	40.58	112.69	warmer	Xiao et al.,2004
Naleng Lake	31.10	99.75	warmer	Kramer et al.,2010
Nam Co Lake	30.84	90.90	warmer	Li et al.,2008
Longzhong	35.30	105.20	warmer	Tang and An,2007
Shanbao cave	31.67	110.43	warmer	Shao et al.,2006
Dongganchi	39.53	115.78	warmer	Zhang and Kong, 1999
KB	40.40	110.00	warmer	Sun et al.,2006
JJ	38.50	109.60	warmer	Sun et al.,2006
TYG	39.00	110.12	warmer	Sun et al.,2006
Balikun Lake	43.62	92.77	warmer	Tao et al.,2010
Guliya	35.28	81.48	warmer	Thompson et al.,1997
Haoluku Lake	42.96	116.76	warmer	Wang et al.,2001
Huguangyan	21.15	110.28	warmer	Wang et al.,2007
Zigê Tangcuo	32.08	90.84	warmer	Wu et al.,2007
Badain Jaran	39.50	102.00	warmer	Yang et al.,2010
Daihai Lake	40.58	112.69	warmer	Xu et al.,2010
SGDL	42.69	115.95	warmer	Zhou et al.,2008
303 Road	43.69	116.64	warmer	Zhou et al.,2008
LW	41.41	114.97	warmer	Zhou et al.,2008
207 Road	43.18	116.14	colder	Zhou et al.,2008
HSHN	43.25	116.13	warmer	Zhou et al.,2008
Baxie	35.58	103.57	warmer	Zhou et al.,1994
Baimapo	34.17	109.32	warmer	Zhou et al.,2008
Beizhuang	34.50	109.50	warmer	Zhou et al.,1994
Hanjiang	23.48	116.68	warmer	Zheng et al.,1990
Qingfeng	33.45	119.92	warmer	Zhao et al.,1994
Dunde	38.10	96.42	warmer	Wei and Lin,1994

Erhai Lake	25.78	100.19	warmer	Zhang et al.,2000
Donghai	30.95	121.87	warmer	Zhang et al.,2006
Heqing Basin	26.77	100.21	warmer	Jiang et al.,1998
Jiuzhoutai	36.07	103.75	warmer	Chen et al.,1991
Guliya	35.28	81.48	warmer	Yao et al.,1997
Hongshui	38.18	102.76	warmer	Zhang et al.,2000
Liuzhouwan	42.71	116.68	warmer	Wang et al.,2001
Weinan	34.24	109.30	warmer	Lu et al.,2007
Weinan	34.24	109.30	warmer	Wu et al.,1994

Table S10. Previous reconstruction of precipitation anomaly during mid-Holocene over China

Site	***Lati***	***Long***	***Pann***	***Reference***
Qingdai	31.13	121.18	46.40	Cai et al.,2000
Daihai	40.59	112.67	117.91	Xu et al.,2003
Fanjingshan	27.90	108.71	-34.00	Qiao et al.,1996
Daqingshan	41.12	112.57	50.00	Song and Sun,1997
Zhujiang	22.70	113.50	70.00	Zhao et al.,2014
Tangke	33.45	108.92	-5.68	Guo et al.,2012
Caisuqi	40.73	111.18	250.00	Wang et al.,1998
Dajiuhu2	31.60	110.00	239.00	Liu et al.,2000
Gonghai	38.90	112.23	195.00	Chen et al.，2015
Xingyun Lake	24.34	102.78	267.00	Chen et al.，2014
Luanhaizi	37.59	101.35	45.20	Herzschuh et al.,2010
Ximencuo	33.38	101.10	18.75	Herzschuh et al.,2014
Sihailong	42.28	126.60	-23.27	Stebich et al.,2015
Bayanchagan	41.65	115.21	156.97	Jiang et al.,2010
Tianchi	35.26	106.31	265.00	Li et al.,2014
Chencuo Lake	28.93	90.60	10.86	Lu et al.,2011
Hoton Nur	48.62	88.35	195.40	Rudaya et al.,2009
Koucha	34.00	97.20	-20.70	Herzschuh et al.,2009
Yidun	30.30	99.55	62.95	Shen et al.,2006
Qigai Nuur	39.58	109.89	15.23	Sun and Feng,2013
Chadianpo	36.10	114.40	-17.95	Xu et al.,2010
Donggeicuona	35.35	98.44	-3.82	Wang et al.,2014
Hulun	48.93	117.35	17.46	Wen et al.,2010
Daihai Lake	40.55	112.66	152.00	Xu et al.,2010
Kuhai	35.30	99.20	-23.87	Wischnewski et al.,2011
Rencuo	30.73	96.68	48.00	Tang et al.,1998;2004
Hidden	29.81	92.54	164.14	Tang et al.,2004
Hulun Lake	49.13	117.51	25.00	Wen et al.,2010
Aibi Lake	44.88	82.88	72.00	Wu et al.,1996
Heshang cave	30.45	110.42	101.50	Hu et al.,2008

Hidden	29.81	92.54	141.00	Tang et al.,2000
Ren cave	30.73	96.68	159.00	Tang et al.,2000
Huiduipo	34.57	109.02	277.80	Sun et al.,2016
Weinan	34.24	109.30	125.00	Lu et al.,2007
Weinan	34.24	109.30	200.00	Wu et al.,1994
Zoige DC	33.90	102.55	Wetter	Liu et al.,1995
Renjiahutong	35.75	109.42	Wetter	Zhou et al.,1994
Barkol lake	43.70	92.83	Wetter	Xue and Zhong,2008
Bosten lake	42.08	87.05	Wetter	Zhong and Shu,2001
Moon lake	47.51	120.87	Wetter	Liu et al.,2014
Baiyangdian	38.85	116.00	Wetter	Xu et al.,2003
Erhai lake	25.78	100.19	Wetter	Zhou et al.,2003
Hulu river	35.00	106.00	Wetter	Mo et al.,1996
Dongge cave	25.28	108.08	Wetter	Zhang et al.,2003
Xiangshui	25.25	110.92	Wetter	Zhang et al.,2003
Maohebei	39.50	119.17	Wetter	Li and Liang,1985
Daziying	39.70	118.99	Wetter	Li and Liang,1985
Hani	42.23	126.52	Wetter	Yu et al.,2008
Dagushan	39.92	123.66	Wetter	CQPD in IGCAS,1977
Mianyang	30.20	113.22	Wetter	Yang et al.,1995
Angulinao	41.35	114.39	Wetter	Zhai et al.,2000
Diaojiao	41.30	112.35	Wetter	Song et al.,1996
Poyang lake	29.03	116.14	Wetter	Ma et al.,2004
Ritu	33.39	79.73	Wetter	Wang et al.,2010
Qinghai lake	36.55	99.60	Wetter	Kong et al.,1990
Hulun lake	48.90	116.50	Wetter	Yang et al.,1995
Ulungur lake	47.22	87.15	Wetter	Jiang et al.,2007
Tanghongling	48.35	129.67	Wetter	Yang and Wang,2002
Aibi lake	44.88	82.88	Wetter	Wu et al.,1996
Xianrendong	25.83	103.50	Wetter	Zhang et al.,2009
Gushantun	42.00	126.00	Wetter	Wang and Liu,2001
Changbaishan	42.00	128.00	Wetter	Zhao et al.,2002
Gonong Core	34.63	92.15	Wetter	Li et al.,1995
Juyanze lake	41.89	101.85	drier	Herzschuh et al.,2004
Dadiwan	35.01	105.91	Wetter	An et al.,2003
Sujiawan	35.54	104.52	Wetter	An et al.,2003
Yiema lake	39.10	103.67	Wetter	Chen et al.,1999
Dahu	24.68	115.00	Wetter	Xiao et al.,2007
Dingxi	35.52	104.54	Wetter	Feng et al.,2005
Bangong Core	33.67	79.00	Wetter	Gasse et al.,1996
Sumxi Core	34.62	81.03	Wetter	Gasse et al.,1991
Bayanchagan	41.65	115.21	Wetter	Guiot et al.,2008
Zigetang	32.00	90.90	Wetter	Herzschuh et al.,2006
Dahu	24.25	115.03	Wetter	Zhou et al.,2004
Juyan lake	41.80	101.80	Wetter	Chen et al.,2008
Jingbo lake	43.90	128.80	Wetter	Li et al.l.,2011

Daihai lake	40.58	112.69	Wetter	Xiao et al.,2004
Heshang cave	30.45	110.42	Wetter	Hu et al.,2008
Siling Core	31.60	89.05	Wetter	Kashiwaya et al.,1995
Naleng lake	31.10	99.75	Wetter	Kramer et al.,2010
Baahar Nuur	39.10	109.20	Wetter	Feng et al.,2005
Nam Co lake	30.84	90.90	Wetter	Li et al.,2008
Zhuyeze lake	39.17	104.16	Wetter	Long et al.,2012
Qingtu lake	39.05	103.67	Wetter	Long et al.,2007,2010
Bosten lake	41.95	86.78	Wetter	Mischke and Wunnemann,2006
Kouka lake	34.01	97.24	Wetter	Mischke et al.,2008
Wutonggou	44.39	87.86	Wetter	Li and Fan,2011
Longzhong	35.30	105.20	Wetter	Tang and An,2007
Manas lake	45.75	86.00	Wetter	Rhodes et al.,1996
Shanbao cave	31.67	110.43	Wetter	Shao et al.,2006
Dongganchi	39.53	115.78	Wetter	Zhang and Kong, 1999
KB	40.40	110.00	Wetter	Sun et al.,2006
JJ	38.50	109.60	Wetter	Sun et al.,2006
TYG	39.00	110.12	Wetter	Sun et al.,2006
Balikun lake	43.62	92.77	Wetter	Tao et al.,2010
Guliya	35.28	81.48	Wetter	Thompson et al.,1997
Haoluku lake	42.96	116.76	Wetter	Wang et al.,2001
Huguangyan	21.15	110.28	Wetter	Wang et al.,2007
Zigê Tangcuo	32.08	90.84	Wetter	Wu et al.,2007
Badain Jaran	39.50	102.00	Wetter	Yang et al.,2010
Daihai lake	40.58	112.69	Wetter	Xu et al.,2010
SGDL	42.69	115.95	Wetter	Zhou et al.,2008
303 Road	43.69	116.64	Wetter	Zhou et al.,2008
LW	41.41	114.97	Wetter	Zhou et al.,2008
207 road	43.18	116.14	drier	Zhou et al.,2008
HSHN	43.25	116.13	Wetter	Zhou et al.,2008
Baxie	35.58	103.57	Wetter	Zhou et al.,1994
Baimapo	34.17	109.32	Wetter	Zhou et al.,2008
Beizhuang	34.50	109.50	Wetter	Zhou et al.,1994
Hanjiang	23.48	116.68	Wetter	Zheng et al.,1990
Qingfeng	33.45	119.92	Wetter	Zhao et al.,1994
Dunde	38.10	96.42	Wetter	Wei and Lin,1994
Erhai Lake	25.78	100.19	drier	Zhang et al.,2000
Donghai	30.95	121.87	Wetter	Zhang et al.,2006
Heqing Basin	26.77	100.21	drier	Jiang et al.,1998
Jiuzhoutai	36.07	103.75	Wetter	Chen et al.,1991
Hongshui	38.18	102.76	Wetter	Zhang et al.,2000
Liuzhouwan	42.71	116.68	Wetter	Wang et al.,2001
Weinan	34.24	109.30	Wetter	Lu et al.,2007
Weinan	34.24	109.30	Wetter	Wu et al.,1994

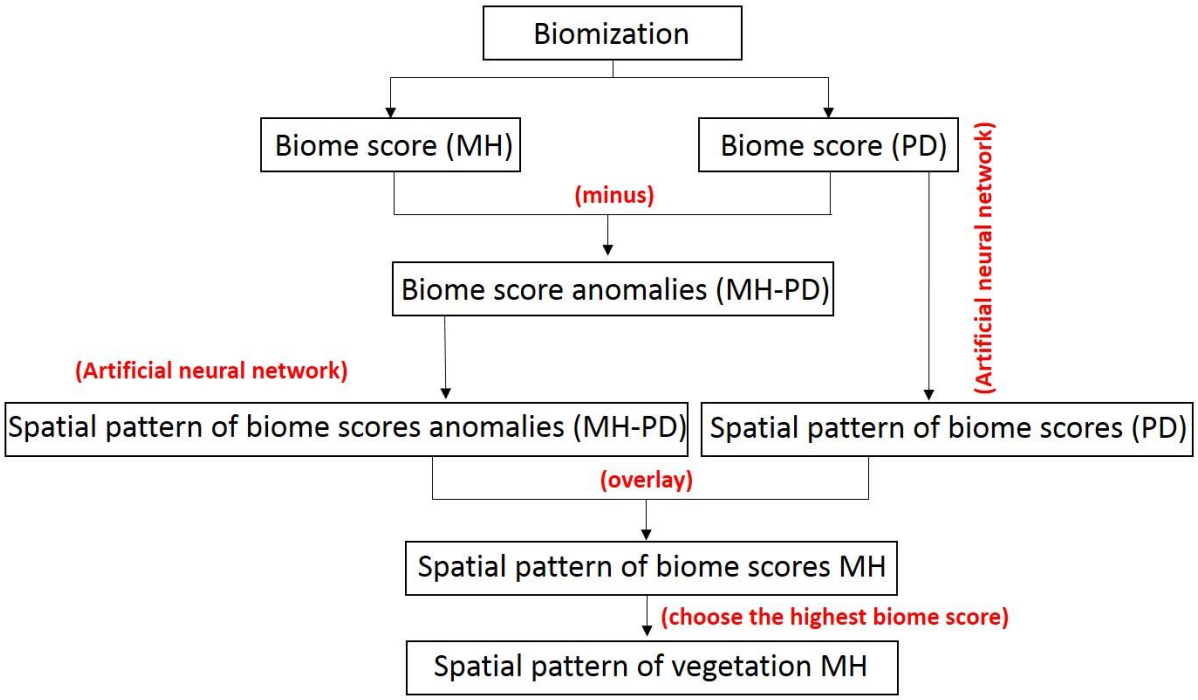

Figure S1. The schematic diagram of artificial neural network (ANN)

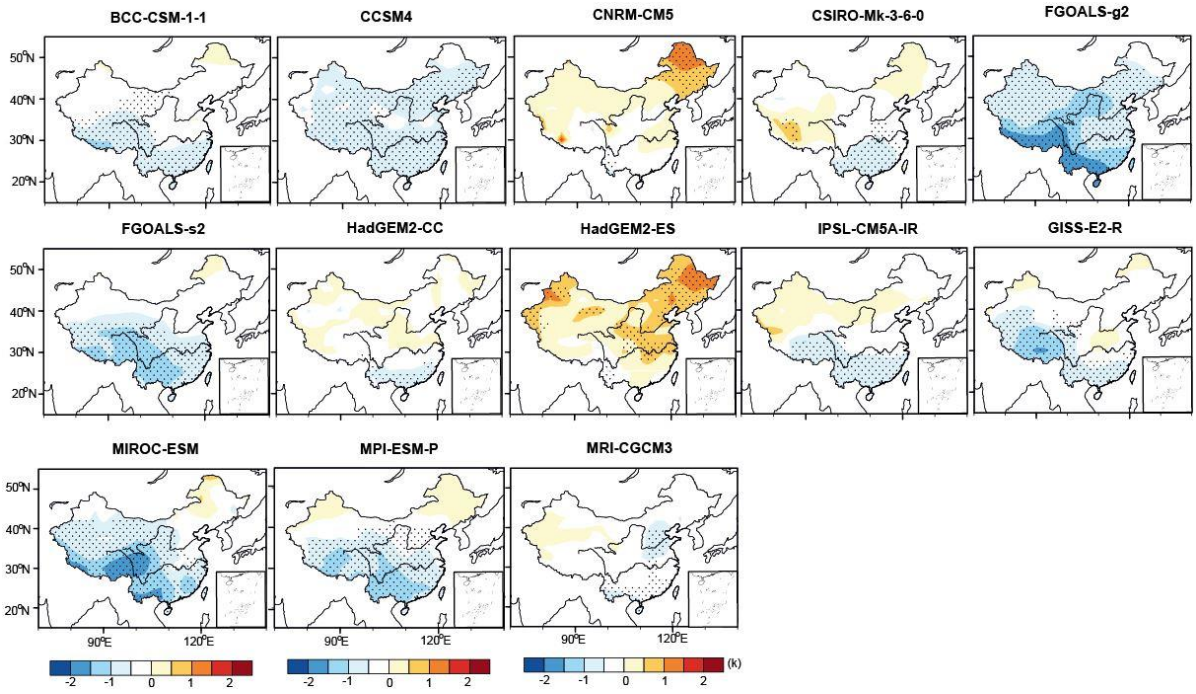

Figure S2. Annual temperature anomaly (MH-PI) calculated as the last 30-year means of each model, the area with points pass the t-test (for 95% confidence interval)

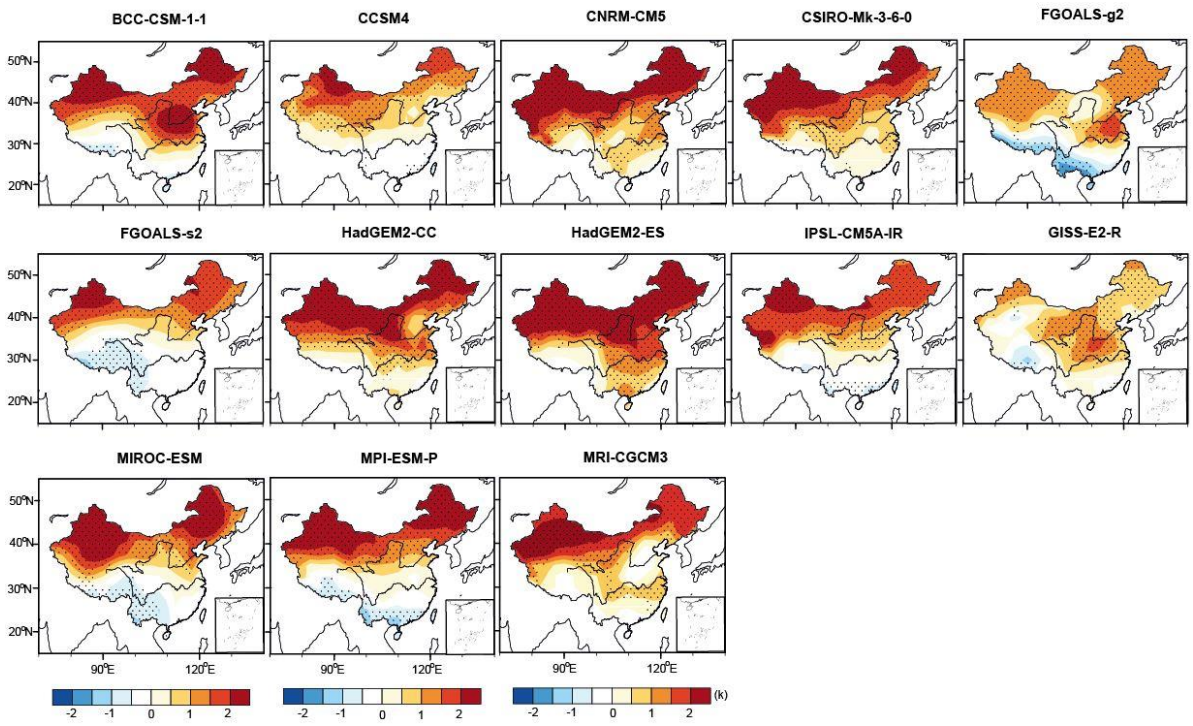

Figure S3. MTWA temperature anomaly (MH-PI) calculated as the last 30-year means of each model, the area with points pass the t-test (for 95% confidence interval)

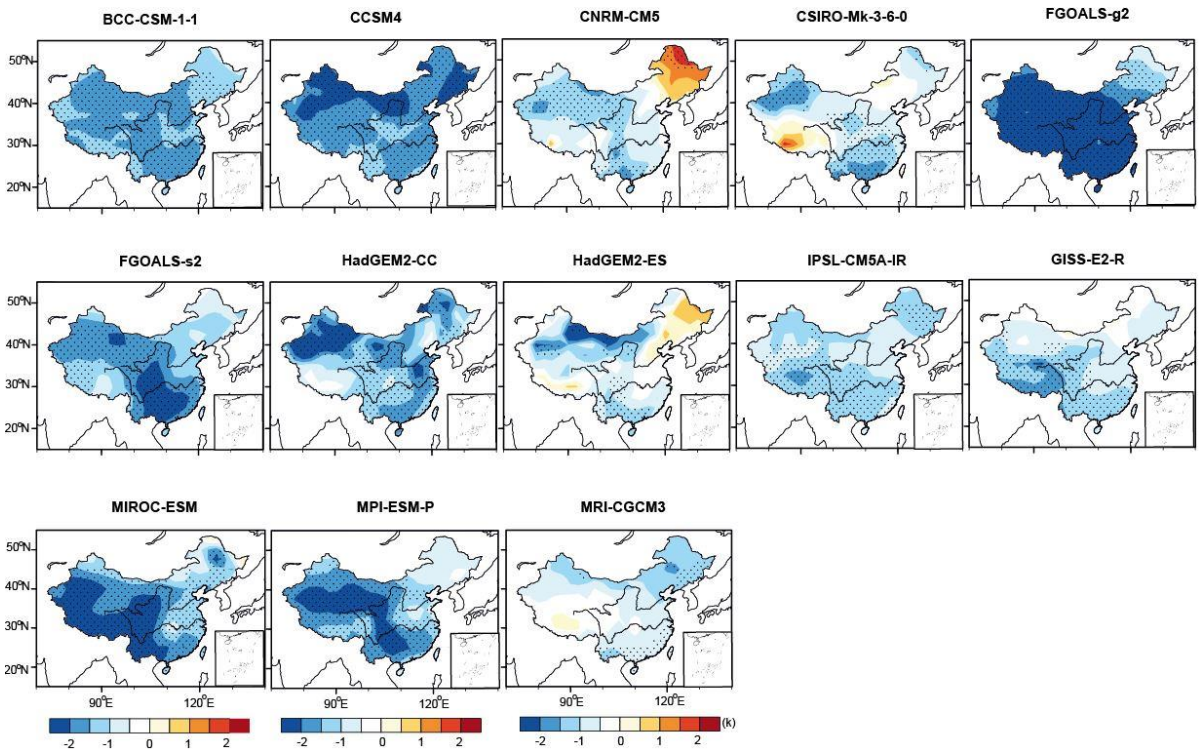

Figure S4. MTCO temperature anomaly (MH-PI) calculated as the last 30-year means of each model, the area with points pass the t-test (for 95% confidence interval)

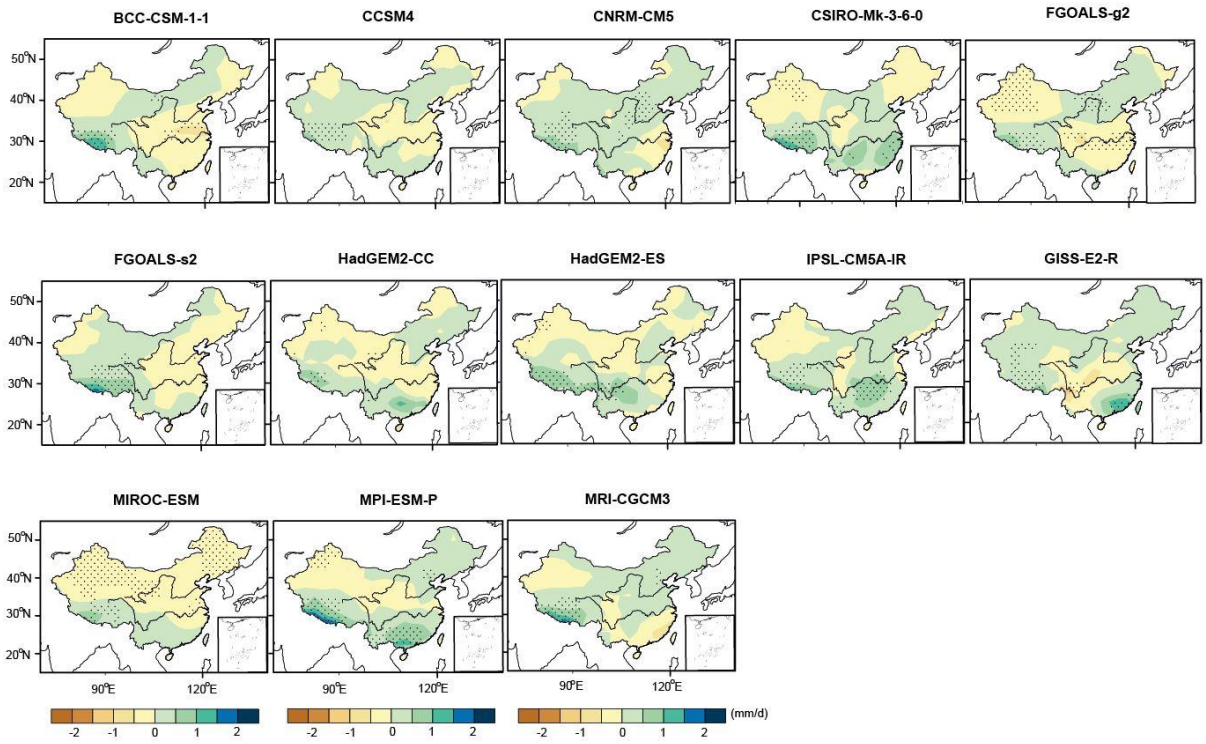

Figure S5. Annual precipitation anomaly (MH-PI) calculated as the last 30-year means of each model, the area with points pass the t-test (for 95% confidence interval).

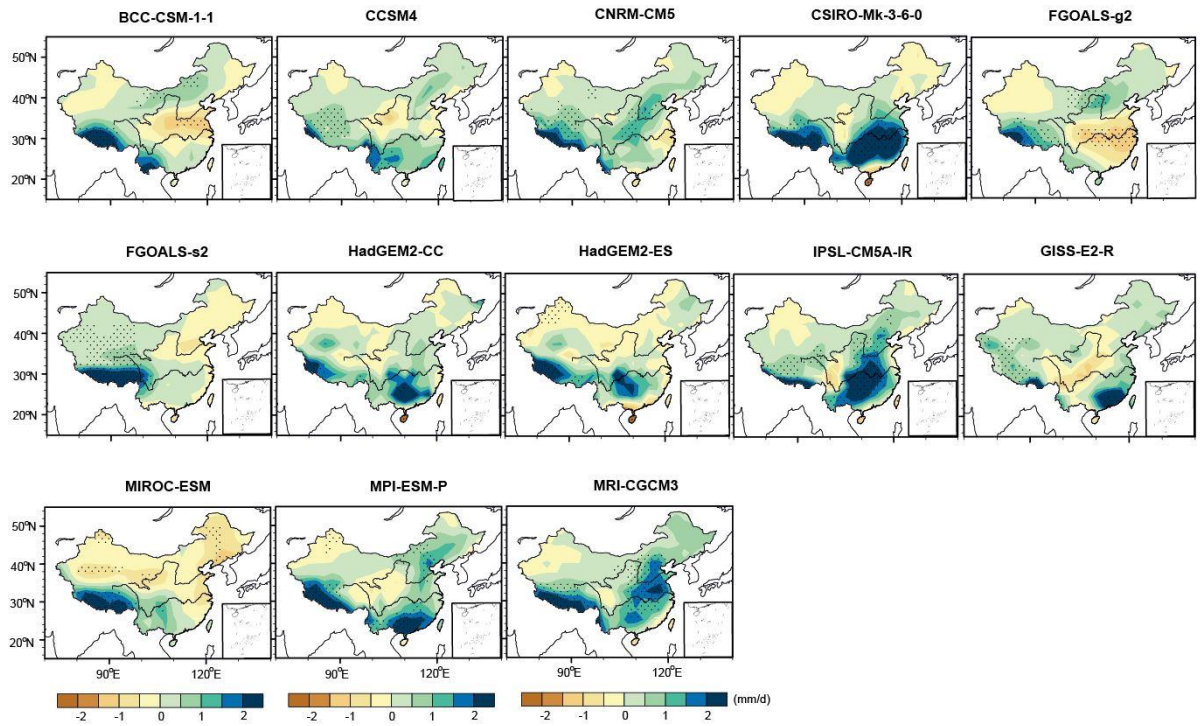

Figure S6. Summer (JJA) precipitation anomaly (MH-PI) calculated as the last 30-year means of each model, the area with points pass the t-test (for 95% confidence interval).

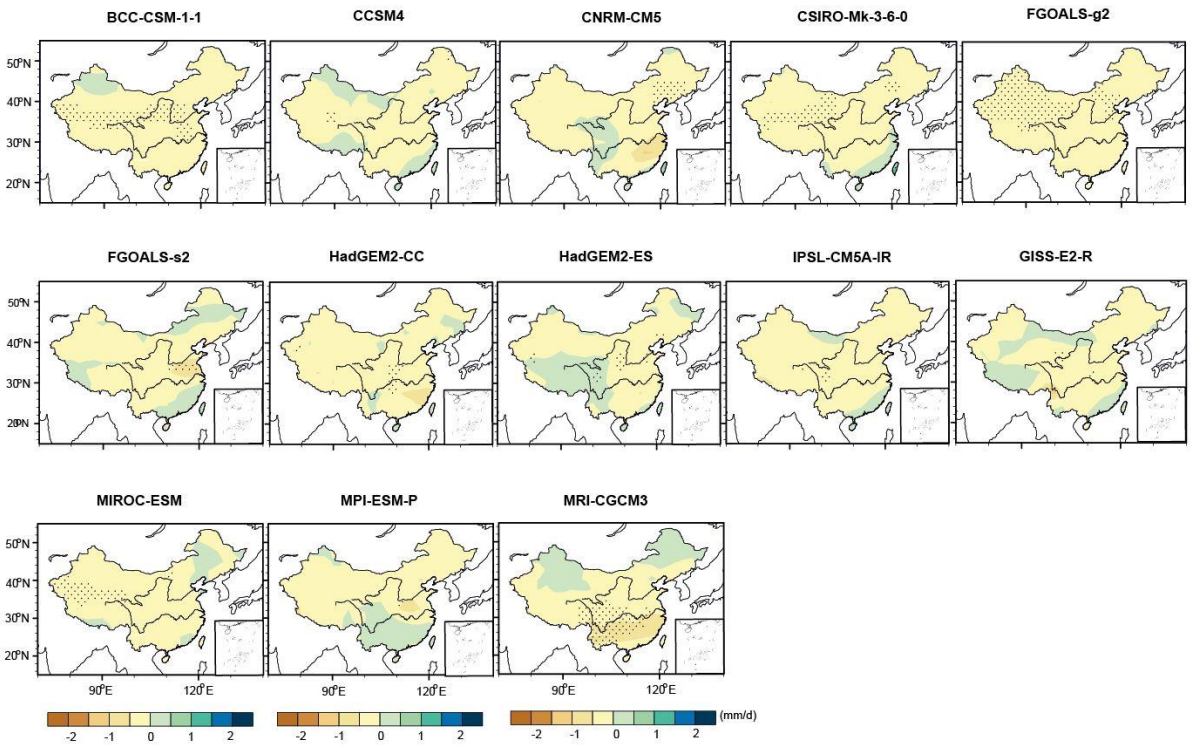

Figure S7. Winter (DJF) precipitation anomaly (MH-PI) calculated as the last 30-year means of each model, the area with points pass the t-test (for 95% confidence interval).

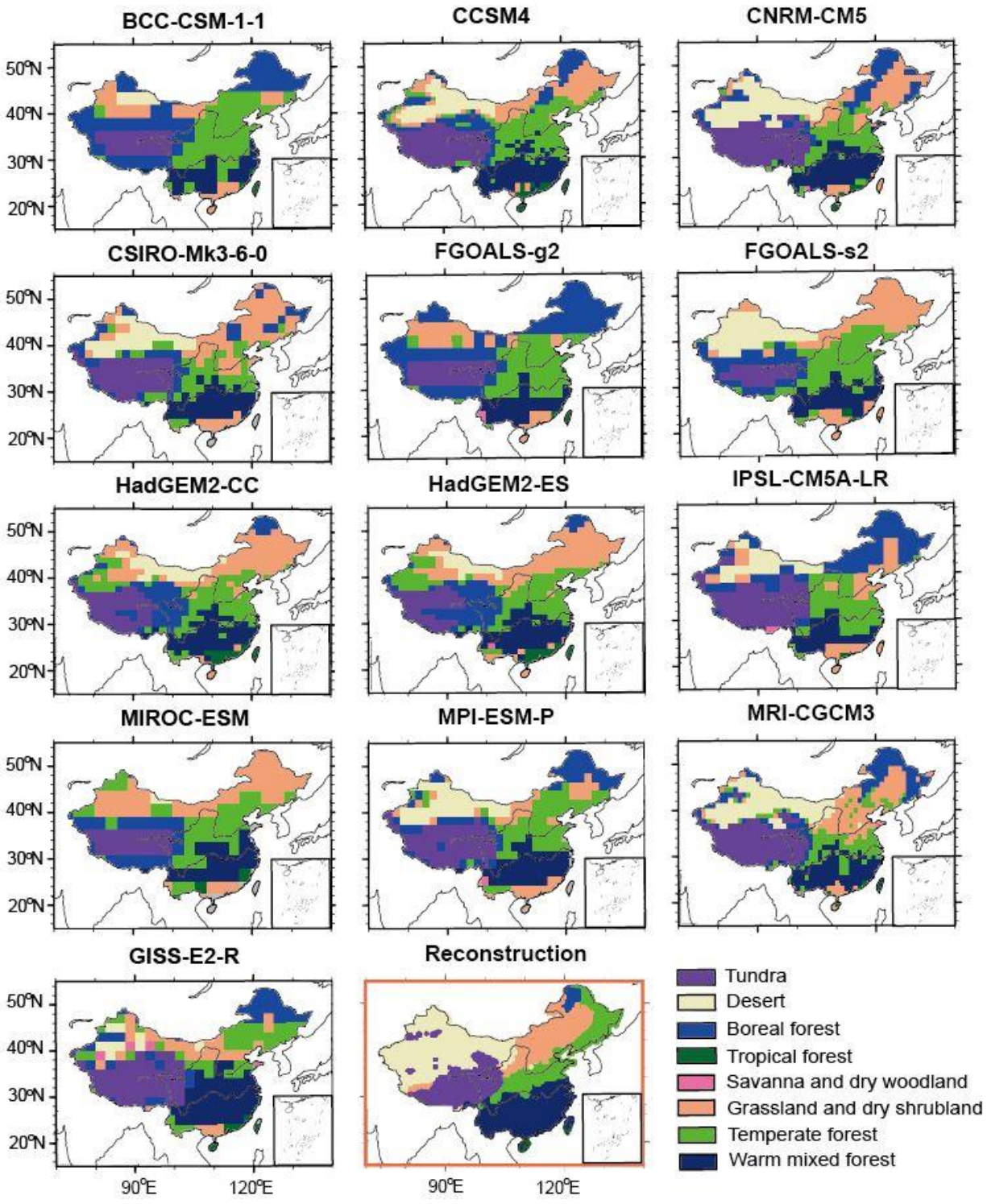

Figure S8. Comparison of interpolated megabiomes distribution (plot in red rectangle) with the simulated spatial pattern from BIOME4 of each model for pre-Industrial.

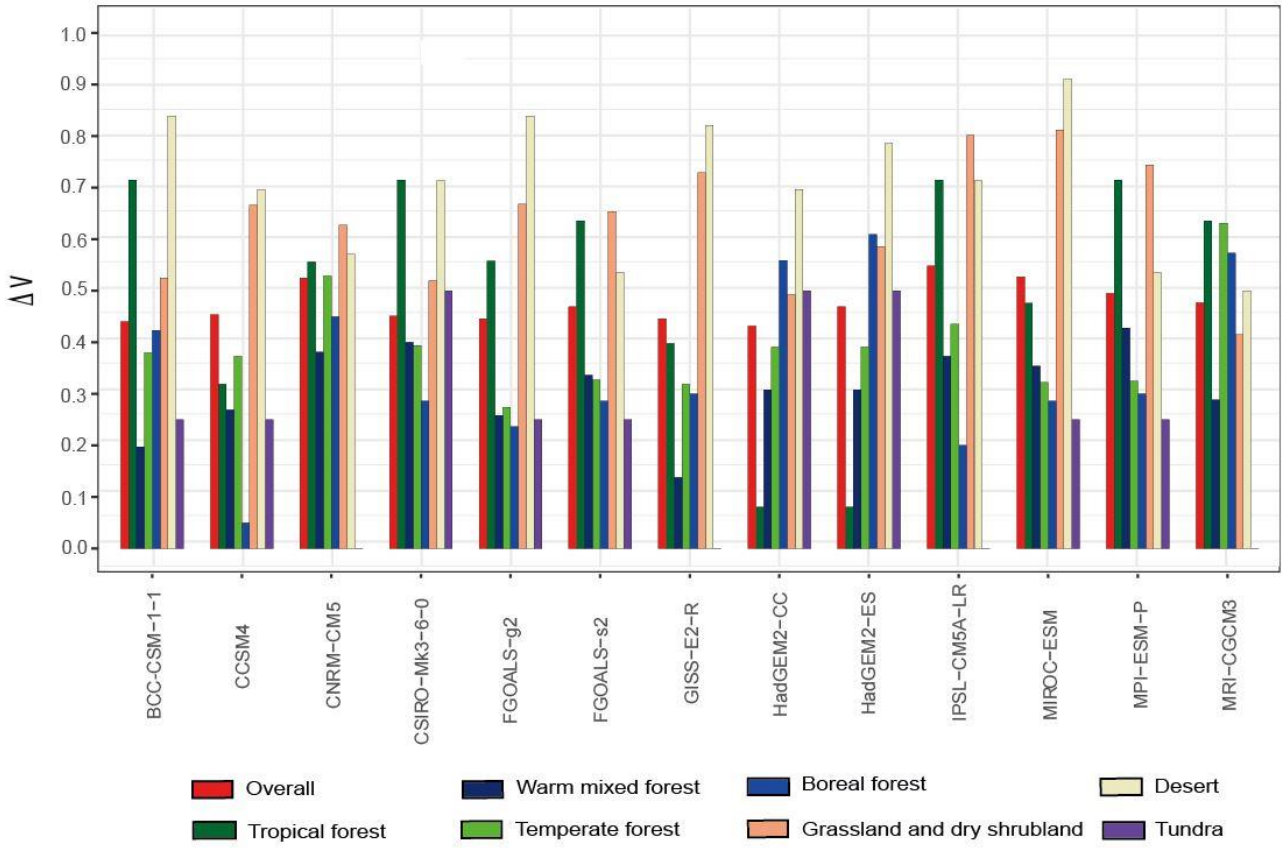

Figure S9. The ΔV values of overall and each megabiomes for all 13 models during mid-Holocene, compared to the reconstruction.

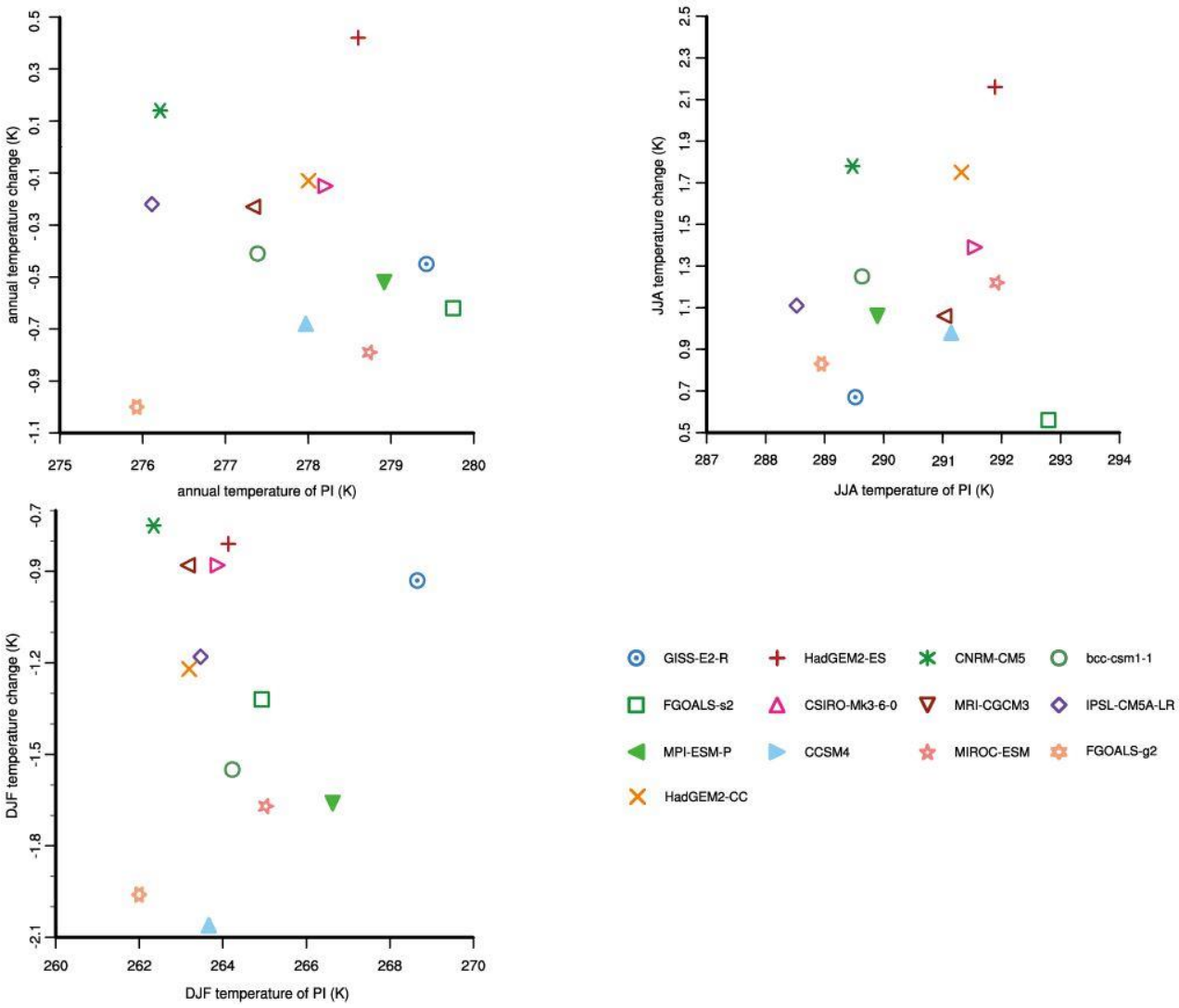

Figure S10. The relationship between PI temperature and temperature anomaly (MH-PI)

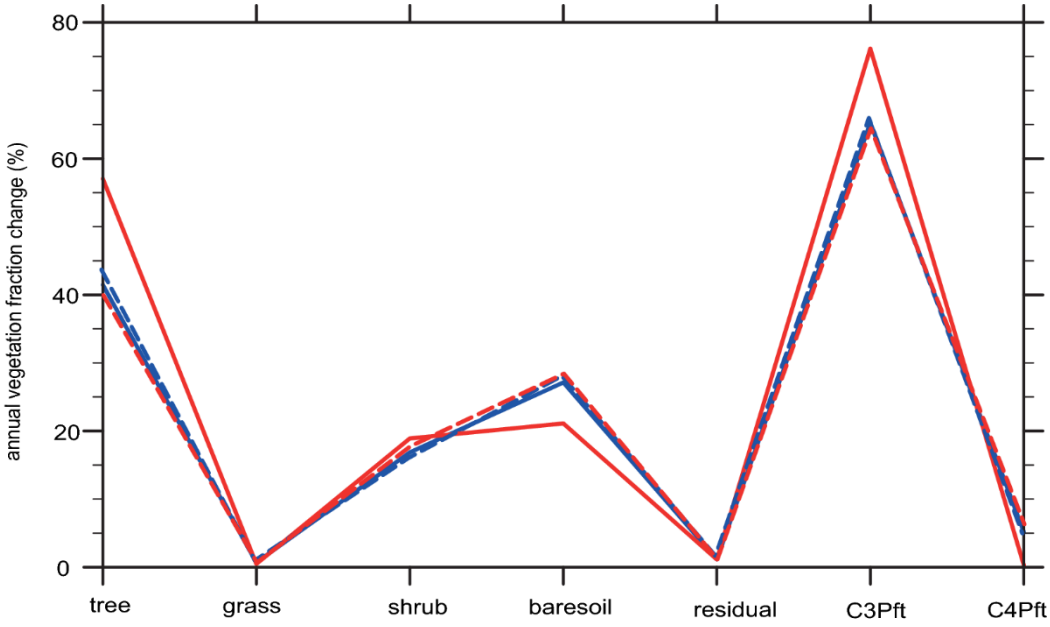

Figure S11. Annual vegetation fraction change (PI: blue line; MH: red line) calculated as the last 30-year means of HadGEM2-ES (PI: blue solid line; MH: red solid line) and HadGEM2-CC (PI: blue dash line; MH: red dash line).

Reference

An, C., Feng, Z., and Tang, L.: Evidence of a humid mid-Holocene in the western part of Chinese Loess Plateau, Chinese Science Bulletin, 48, 2472-2479, 2003.

Cai, Y., Chen, Y., Chen, Z., Zhang, W., and Guo, Z.: Climate fluctuation of the western Shanghai district by correspondence analysis since 8.5 ka B.P., Journal of Lake Science, 13, 118-126, 2001 (in Chinese with English abstract).

Chen, F., Chen, X., Chen, J., Zhou, A., Wu, D., Tang, L., Zhang, X., Huang, X., and Yu, J.: Holocene vegetation history, precipitation changes and Indian Summer Monsoon evolution documented from sediments of Xingyun Lake, south-west China, Journal of Quaternary Science, 29, 661-674, 2014.

Chen, F., Li, J., and Zhang, W.: Loess stratigraphy of the Lanzhou profile and its comparison with deep-sea sediment and ice core record, Geojournal, 24, 201-209, 1991.

Chen, F., Shi, Q., and Wang, J.: Environmental changes documented by sedimentation of Lake Yiema in arid China since the late Glaciation, Journal of Palaeolimnology, 22, 159-169, 1999.

Chen, F., Wu, W., Holmes, J. A., Madsen, D. B., Zhu, Y., Jin, M., and Oviatt, C. G.: A mid-Holocene drought interval as evidenced by lake desiccation in the Alashan Plateau, Inner Mongolia China, Chinese Science Bulletin, 48, 1401-1410, 2003.

Chen, F., Yu, Z., Yang, M., Ito, E., Wang, S., Madsen, D. B., Huang, X., Zhao, Y., Sato, T., Birks, H. J. B., Boomer, I., Chen, J., An, C., and Wunnemann, B.: Holocene moisture evolution in arid central Asia and its out-of-phase relationship with Asian monsoon history, Quaternary Science Reviews, 27, 351-364, 2008.

Dallmeyer, A., Claussen, M., Ni, J., Cao, X., Wang, Y., Fischer, N., Pfeiffer, M., Jin, L., Khon, V., Wagner, S., Haberkorn, K., and Herzschuh, U.: Biome changes in Asia cinse the mid-Holocene-and analysis of difference transient Earth system model simulations, Climate of the Past, 13, 107-134, 2017.

Feng, Z., Wang, W., Guo, L., Khosbayar, P., Narantsetseg, T., Jull, A. J. T., An, C., Li, X., Zhang, H., and Ma, Y.: Lacustrine and eolian records of Holocene climate changes in the Mongolian Plateau: preliminary results, Quaternary International, 136, 25-32, 2005.

Gasse, F., Arnold, M., Fontes, J. C., Fort, M., Gibert, E., Huc, A., Li, B., Li, Y., Liu, Q., Melieres, F., Campo, E.V., Wang, F., and Zhang Q.: A 13,000-year climate record from western Tibet, Nature, 353, 742-745, 1991.

Gasse, F., Fontes, J. C., Campo, E. V., and Wei, K.: Holocene environmental changes in Bangong Co basin (Western Tibet). Part 4: Discussion and conclusions, Palaeogeography, Palaeoclimatology, Palaeoecology, 120, 79-92, 1996.

Guiot, J., Wu, H., Jiang, W., and Luo, Y.: East Asian Monsoon and paleoclimatic data analysis: a vegetation point of view, Climate of the Past, 4, 137-145, 2008.

Guo, C., Luo, F., Luo, C., Feng, S., Sun, Q., Yang, Z., and Zhang, J.: Holocene pollen record in the Tangke peat profile pf Sichuan and its palaeoclimatic significance. Acta Palaeontologica Sinica, 51, 351-358, 2012 (in Chinese with English abstract).

Herzschuh, U., Birks, H. J. B., Mischke, S., Zhang, C., and Bohner, J.: A modern pollen–climate calibration set based on lake sediments from the Tibetan Plateau and its application to a Late Quaternary pollen record from the Qilian Mountains, Journal of Biogeography, 37, 752-766, 2010.

Herzschuh, U., Borkowski, J., Schewe, J., Mischke, S., and Tian, F.: Moisture-advection feedback supports strong early-to-mid Holocene monsoon climate on the eastern Tibetan Plateau as inferred from a pollen-based reconstruction, Palaeogeography, Palaeoclimatology, Palaeoecology, 402, 44-54, 2014.

Herzschuh, U., Kramer, A., Mischke, S., and Zhang, C.: Quantitative climate and vegetation trends since the late glacial on the northeastern Tibetan Plateau deduced from Koucha Lake pollen spectra, Quaternary Research, 71, 162-171, 2009.

Herzschuh, U., Tarasov, P., Wunnemann, B., and Hartmann, K.: Holocene vegetation and climate of the Alashan Plateau, NW China, reconstructed from pollen data, Palaeogeography, Palaeoclimatology, Palaeoecology, 211, 1-17, 2004.

Herzschuh, U., Winter, K., Wunnemann, B., Li, S.: A general cooling trend on the central Tibetan Plateau throughout the Holocene recorded by the Lake Zigetang pollen spectra, Quaternary International, s154-155, 113-121, 2006.

Hu, C., Henderson, G. M., Huang, J., Xie, S., Sun, Y., and Johnson, K. R.: Quantification of Holocene Asian monsoon rainfall from spatially separated cave records, Earth and Planetary Science Letters, 266, 221-232, 2008.

Huang, K., Wei, J., Chen, B., Zhang, H., Zheng, Z., Cao, L., and Zheng, Y.: Research progress of pollen-based quantitative palaeoclimate reconstruction using Modern Analogue Technique, Quaternary Sciences, 33, 1069-1079, 2013 (in Chinese with English abstract).

Jiang, Q., Shen, J., Liu, X., and Zhang, E.: Holocene climate reconstruction of Ulungur Lake (Xinjiang, China) inferred from ostracod species assemblages and stable isotopes, Quaternary Sciences, 27, 382-391, 2007 (in Chinese with English abstract).

Kashiwaya, K., Masuzawa, T., Morinaga, H., Yaskawa, K., and Yuan, B., Lin J., and Gu, Z.: Changes in hydrological conditions in the central Qing-Zang (Tibetan) Plateau inferred from lake bottom sediments, Earth and Planetary Science Letters, 135, 31-39, 1995.

Kong, Z., Du, N., Shan, F., Tong, G., Luo, S., and Fan, S.: Vegetation and climatic changes in the last 11000 years in Qinghai Lake—Numberical analysis based on palynology in core QH85-14C, Marine Geology & Quaternary Geology, 10, 79-90, 1990 (in Chinese with English abstract).

Kramer, A., Herzschuh, U., Mischke, S., and Zhang, C.: Holocene treeline shifts and monsoon variability in the Hengduan Mountains (southeastern Tibetan Plateau), implications from palynological investigations, Palaeogeography, Palaeoclimatology, Palaeoecology, 286, 23-41, 2010.

Li, B., Li, Y., Kong, Z., and Shan, F., Zhu, L.: Environmental changes during last 20 ka in the Gounongcuo Regions, Kekexili, Tibet, Chinese Science Bulletin, 39, 1727-1728, 1994.

Li, C., Wu, Y., and Hou, X.: Holocene vegetation and climate in Northeast China revealed from Jingbo Lake sediment, Quaternary International, 229, 67-73, 2011.

Li, J., Zhao, Y., Xu, Q., Zheng, Z., Lu, H., Luo, Y., Li, Y., Li, C., and Seppa, H.: Human influence as a potential source of bias in pollen-based quantitative climate reconstructions, Quaternary Science Reviews, 99, 112-121, 2014.

Li, S., and Fan, A.: OSL chronology of sand deposits and climate change of last 18 ka in Gurbantunggut Desert, northwest China, Journal of Quaternary Science, 26, 813-818, 2011.

Li, W., and Liang, Y.: Vegetation and environment of the hypsithermal interval of Holocene in eastern Hebei Plain, Acta Botanica Sinica, 27, 640-651, 1985 (in Chinese with English abstract).

Lin, X., Zhu, L., Wang, Y., Wang, J., Xie, M., Ju, J., Mausbacher, R., Schwalb, A.: Environmental changes reflected by n -alkanes of lake core in Nam Co on the Tibetan Plateau since 8.4 kaB.P., Chinese Science Bulletin, 53, 3051-3057, 2008.

Liu, G., Shen, Y., Wang, R., and Wang, S.: The vegetation and climatic changes in Zoige during the last 20000 years determined by pollen records, Journal of Glaciology and Geocryology, 17, 132-137, 1995 (in Chinese with English abstract).

Liu, H., Tang, C., and Liu, S.: The construction and application of pollen-climate transfer function in Shennongjia Mountain region, Journal of Central China Normal University (Nature Science), 34, 454-459, 2000 (in Chinese with English abstract).

Liu, Q., Li, Q., Wang, L., and Chu, G.: Stable carbon isotope record of bulk organic matter from a sediment core at Moon Lake in the middle part of the Daxing'an Mountain Range, Northeast China during the last 21ka, Quaternary Science, 30, 1069-1077, 2010 (in Chinese with English abstract).

Long, H., Lai, Z., Fuchs, M., Zhang, J., and Li, Y.: Timing of Late Quaternary palaeolake evolution in Tengger Desert of northern China and its possible forcing mechanisms, Global and Planetary Change, 92-93, 119-129, 2012.

Long, H., Lai, Z., Wang, N., and Li. Y.: Holocene climate variations from Zhuyeze terminal lake records in East Asian monsoon margin in arid northern China, Quaternary Research, 74, 46-56, 2010.

Long, H., Tan. H., Wang, N., Tan. L., and Li, Y.: Mid-Holocene climate variations recorded by palaeolake in marginal area of East Asian Monsoon: A multi-proxy study, Chinese Geographical Science, 17, 325-332, 2007.

Lu, H., Wu, N., Liu, K., Jiang, H., and Liu, T.: Phytoliths as quantitative indicators for the reconstruction of past environmental conditions in China II: Palaeoenvironmental reconstruction in the Loess Plateau, Quaternary Science Reviews, 26, 759-772, 2007.

Lu, H., Wu, N., Liu, K., Zhu, L., Yang, X., Yao, T., Wang, L., Li, Q., Liu, X., Shen, C., Li, X., Tong, G., and Jiang, H.: Modern pollen distributions in Qinghai-Tibetan Plateau and the development of transfer functions for reconstructing Holocene environmental changes, Quaternary Science Reviews, 30, 947-966, 2011.

Ma, Z., Huang, J., Wei, Y., Li, J., and Hu, C.: Organic carbon isotope records of the Poyang Lake sediments and their implications for the paleoclimate during the last 8ka, Geochimica, 33, 279-285, 2004 (in Chinese with English abstract).

Members of Quaternary Pollen Data Base in Institute of Geochemistry, Chinese Academy of Science: The evolution of the environment since 10000 years in the south of Liaoning Province, Science in China, 6, 603-614, 1977 (in Chinese).

Mischek, S., Kramer, M., Zhang, C., Shang, H., Herzschuh, U., and Erzinger, J.: Reduced early Holocene moisture availability in the Bayan Har Mountains, northeastern Tibetan Plateau, inferred from a multi-proxy lake record, Palaeogeography, Palaeoclimatology, Palaeoecology, 267, 59-76, 2008.

Mischke, S., and Wunnemann, B.: The Holocene salinity history of Bosten Lake (Xinjiang, China) inferred from ostracod species assemblages and shell chemistry: Possible palaeoclimatic implications, Quaternary International, s154-155, 100-112, 2006.

Mo, D., Li, F., Li, S., and Kong, Z.: A preliminary study on the paleoenvironment of the Middle Holocene in the Hulu River area in Gansu Province and its effects on human activity, Acta Geographica Sinica, 51, 59-69, 1996 (in Chinese with English abstract).

Qiao, Y., Chen, P., Shen, C., Sun, Y., Zhou, Q., and Jiang, M.: Quantitative reconstruction of vegetation and climate of Fanjingshan section in Guizhou during last 10000 years, Geochimica, 25, 445-457, 1996 (in Chinese with English abstract).

Rhodes, T., Gasse, F., Lin, R., Fontes, J., Wei, K., Bertrand, P., Gibert, E., Melieres, F., Tucholka, P., Wang, Z., and Cheng, Z.: A Late Pleistocene-Holocene lacustrine record from Lake Manas, Zunggar (northern Xinjiang, western China), Palaeogeography, Palaeoclimatology, Palaeoecology, 120, 105-121, 1996.

Rudaya, N., Tarasov, P., Dorofeyuk, N., Solovieva, N., Kalugin, I., Andreev, A., Daryin, A., Diekmann, B., Riedel, F., Tserendash, N., and Wagner, M.: Holocene environments and climate in the Mongolian Altai reconstructed from the Hoton-Nur pollen and diatom records: a step towards better understanding climate dynamics in Central Asia, Quaternary Science Reviews, 28, 540-554, 2009.

Shao, X., Wang, Y., Cheng, H., Kong, X., Wu, J., and Edwards, R. L.: Long-term trend and abrupt events of the Holocene Asian monsoon inferred from a stalagmite $\delta^{18}O$ record from Shennongjia in Central China, Chinese Science Bulletin, 51, 221-228, 2006.

Shen, C., Liu, K., Tang, L., and Overpeck, J, T.: Quantitative relationships between modern pollen rain and climate in the Tibetan Plateau, Review of Palaeobotany and Palynology, 140, 61-77, 2006.

Song, C., and Sun, X.: Establishment of the transfer functions of the pollen-climate factors in Northern China and the quantitative climatic reconstruction at DJ core, Acta Botanica Sinica, 39, 554-560, 1997 (in Chinese with English abstract).

Song, C., Wang, B., and Sun, X.: Implication of paleovegetational changes in Diaojiao Lake, Inner Mongolia, Acta Botanica Sinica, 38, 568-575, 1996 (in Chinese with English abstract).

Stebich, M., Rehfeld, K., Schlutz, F., Tarasov, P. E., Liu, J., Mingram, J.: Holocene vegetation and climate dynamics of NE China based on the pollen record from Sihailongwan Maar Lake, Quaternary Science Reviews, 124, 275-289, 2015.

Sun, A., and Feng, Z.: Holocene climatic reconstructions from the fossil pollen record at Qigai Nuur in the southern Mongolian Plateau, The Holocene, 23, 1391-1402, 2013.

Sun, J., Li, S., Han, P., and Chen, Y.: Holocene environmental changes in the central Inner Mongolia, based on single-aliquot-quartz optical dating and multi-proxy study of dune sands, Palaeogeography, Palaeoclimatology, Palaeoecology, 233, 51-62, 2006.

Sun, N., Li, X., Dodson, J., Zhou, X., Zhao, K., and Yang, Q.: The quantitative reconstruction of temperature and precipitation in the Guanzhong Basin of the southern Loess Plateau between 6200 BP and 5600 BP, The Holocene, 26, 1200-1207, 2016.

Tang, L., and An, C.: Pollen records of Holocene vegetation and climate changes in the Longzhong Basin of the Chinese Loess Plateau, Progress in Natural Science, 17, 1445-1456, 2007.

Tang, L., Shen, C., Kong, Z., Wang, F., and Liao, G.: Pollen evidence of climate during the Last Glacial Maximum in eastern Tibetan Plateau, Journal of Glaciology and Geocryology, 20, 133-140, 1998 (in Chinese with English abstract).

Tang, L., Shen, C., Liao, G., Yu, S., and Li, C.: The climate change in southeast part of Tibetan Plateau since the Last Glacial Maximum: Pollen records from the southeast part of Tibetan Plateau, Science in China Series D-Earth Sciences, 34, 436-442, 2004 (in Chinese with English abstract).

Tang, L., Shen, C., Liu, K., and Overpeck, J.T., Changes in South Asian monsoon: New high-resolution paleoclimatic records from Tibet, China, Chinese Science Bulletin, 45, 87-91, 2000.

Tao, S., An, C., Chen, F., Tang, L., Wang, Z., and Lv. Y.: Pollen inferred vegetation and environmental changes since 16.7ka BP at Lake Balikun, Xinjiang, Chinese Science Bulletin, 73, 10-19, 2010.

Thompson, L. G., Yao, T., Davis, M. E., Henderson, K. A., Thompson, E. M., Lin, P., Beer, J., Synal, H. A., Dai, J. C., and Bolzan, J. F.: Tropical Climate Instability: The Last Glacial Cycle from a Qinghai-Tibetan Ice Core, Science, 276, 1821-1825, 1997.

Wang, B., Song, C., Cheng, Q., and Sun, X.: Palaeoclimate reconstruction by adopting the pollen-climate response surface model to analysis the Chasuqi deposition section, Acta Botanica Sinica, 40, 1067-1074, 1998 (in Chinese with English abstract).

Wang, H., Liu, H., Cui, H., Abrahamsen, N.: Terminal Pleistocene/Holocene palaeoenvironmental changes revealed by mineral-magnetism measurements of lake sediments for Dali Nor area, southeastern Inner Mongolia Plateau, China, Palaeogeography, Palaeoclimatology, Palaeoecology, 170, 115-132, 2001.

Wang, H., Liu, J., and Wang, C.: Paleoenvironment of ostracods and pollen record since Middle Holocene in Rutog area, Tivet, Acta Geologica Sinica, 84, 1680-1689, 2010 (in Chinese with English abstract).

Wang, J., and Liu, J.: The records of amino acids and organic carbon isotope for Holocene megathermal in Changbaishan area, Acta Micropalaeontologica Sinica, 18, 392-398, 2001 (in Chinese with English abstract).

Wang, S., Lu, H., Liu, J., and Jorg, F. W. N.: The early Holocene optimum inferred from a high-resolution pollen record of Huguangyan Maar Lake in southern China, Chinese Science Bulletin, 52, 2829-2836, 2007.

Wang, Y., Herzschuh, U., Shumilovskikh, L. S., Mischke, S., Birks, H. J. B., Wischnewski, J., Bohner, J., Schlutz, F., Lehmkuhl, F., Diekmann, B., Wunnemann, B., and Zhang, C.: Quantitative reconstruction of precipitation changes on the NE Tibetan Plateau since the Last Glacial Maximum - extending the concept of pollen source area to pollen-based climate reconstructions from large lakes, Climate of the Past, 10, 21-39, 2014.

Wei, K., and Lin, R.: An enquiry into palaeoclimatic information from oxygen isotopic profile of Dunde ice core in Qilianshan, Geochimica, 23, 311-320, 1994 (in Chinese with English abstract).

Wen, R., Xiao, J., Chang, Z., Zhai, D., Xu, Q., Li, Y., and Itoh, S.: Holocene precipitation and temperature variations in the East Asian monsoonal margin from pollen data from Hulun Lake in northeastern Inner Mongolia, China, Boreas, 39, 262-272, 2010.

Wen, R., Xiao, J., Chang, Z., Zhai, D., Zhou, L., Xu, Q., Li, Y., and Itoh, S.: Holocene vegetation and climate change reflected by the pollen record of Hulun Lake, north eastern Inner Mongolia, Quaternary Science, 30, 1105-1115, 2010 (in Chinese with English abstract).

Wischnewski, J., Mischke, S., Wang, Y., Herzschuh, U.: Reconstructing climate variability on the northeastern Tibetan Plateau since the last Lateglacial-a multi-proxy, dual-site approach comparing terrestrial and aquatic signals, Quaternary Science Reviews, 30, 82-97, 2011.

Wu, J., Wang, S., and Wang, D.: Characters of the evolution of climate and environment of Holocene in Aibi Lake basin in Xinjiang, Oceanologia et Limnologia Sinica, 27, 524-530, 1996 (in Chinese with English abstract).

Wu, N., Lv, H., Sun, X., Guo, Z., Liu, J., and Han, J.: Climate transfer function from opal phytolith and its application in paleoclimate reconstruction of China loess-paleosol sequence, Quaternary Science, 3, 270-279, 1994 (in Chinese with English abstract).

Wu, Y., Andreas, L., Bernd, W., Li, S., and Wang, S.: Holocene climate change in the Central Tibetan Plateau inferred by lacustrine sediment geochemical records, Science in China Series D: Earth Science, 50, 1548-1555, 2007.

Xiao, J., Lu, H., Zhou, W., Zhao, Z., and Hao, R.: Evolution of vegetation and climate since the last glacial maximum recorded at Dahu peat site, South China, Science in China Series D: Earth Sciences, 50, 1209-1217, 2007.

Xiao, J., Xu, Q., Nakamura, T., Yang, X., Liang, W., Inouchi, Y.: Holocene vegetation variation in the Daihai Lake region of north-central China: a direct indication of the Asian monsoon climatic history, Quaternary Science Reviews, 23, 1669-1679, 2004.

Xu, Q., Chen, S., Kong, Z., and Du, N.: Preliminary discussion of vegetation succession and climate change since the Holocene on the Baiyangdian Lake district, Acta Phytoecologica et Geobotanica Sinica, 12, 143-151, 1988 (in Chinese with English abstract).

Xu, Q., Li, Y., Bunting, M. J., Tian, F., and Liu, J.: The effects of training set selection on the relationship between pollen assemblages and climate parameters: Implications for reconstructing past climate, Palaeogeography, Palaeoclimatology, Palaeoecology, 289, 123-133, 2010.

Xu, Q., Xiao, J., Li, Y., Tian, F., and Nakagawa, T.: Pollen-Based quantitative reconstruction of Holocene climate changes in the Daihai Lake Area, Inner Mongolia, China, Journal of Climate, 23, 2856-2868, 2010.

Xu, Q., Xiao, J., Nakamura, T., Yang, X., Yang, Z., Liang, W., Inoue, M., and Yang, S.: Quantitative reconstructed climatic changes of Daihai Basin by pollen data, Marine Geology & Quaternary Geology, 23, 99-108, 2003 (in Chinese with English abstract).

Xue, J., and Zhong, W.: Holocene climate change recorded bu lacustrine sediment in Barkol Lake and its regional comparison, Quaternary Science, 28, 610-620, 2008 (in Chinese with English abstract).

Yang, X., Ma, N., Dong, J., Zhu, B., Xu, B., Ma, Z., and Liu, J.: Recharge to the Inter-Dune Lakes and Holocene Climatic Changes in the Badain Jaran Desert, Western China, Quaternary Research, 73, 10-19, 2010.

Yang, X., Wang, S., Xue, B., and Tong, G.: Vegetation development and environmental changes in Hulun Lake since Late Pleistocene, Acta Palaeonologica Sinica, 34, 647-656, 1995 (in Chinese with English abstract).

Yang, X., Zhu, Y., Jiang, X., Wu, Y., and Wang, S.: Environmental changes from spore-pollen record of Mianyang region over the past 10000 years, Journal of lake Science, 10, 23-29, 1998 (in Chinese with English abstract).

Yang, Y., and Wang, S.: Study on mire development and palaeoenvironment change since 9.0 ka B.P. in the east part of the Xiaoxing'anling Mountains, Journal of Mountain Science, 20, 129-134, 2002 (in Chinese with English abstract).

Yang, Y., and Wang, S.: Study on mire development and paleoenvironment change since 8.0 ka B.P. in the northern part of the Sanjiang Plain, Scientia Geographica Sinica, 23, 32-38, 2003 (in Chinese with English abstract).

Yao, T., Jiao, K., Tian, L., Yang, Z., Shi, W., and Thompson, L. G.: Climatic variations since the Little Ice Age recorded in the Guliya Ice Core, Science in China Series D: Earth Science, 39, 587-596, 1996.

Yu, C., Luo, Y., and Sun, X.: A high-resolution pollen records from Ha'ni Lake, Jilin, Northeast China showing climate changes between 13.1 cal.ka B.P. and 4.5 cal.ka B.P., Quaternary Science, 28, 929-938, 2008 (in Chinese with English abstract).

Zhai, Q., Qiu, W., Li, R., Zhao, Y., and Zheng, L.: The Middle and Kate Holocene lacustrine sediments and its climate significance of Angulinao-Bojianhaizi Lakes, Inner Mongolia, Journal of Palaeogeography, 2, 84-91, 2000 (in Chinese with English abstract).

Zhang, H., Ma, Y., Wunnemann, B., and Pachur, H. J.: A Holocene climatic record from arid northwestern China, Palaeogeography, Palaeoclimatology, Palaeoecology, 162, 389-401, 2000.

Zhang, H., Qin, J., Lin, Y., Pu, X., and Liu, C.: A study on climate change pattern of the Middle Holocene in Xundian, Yunnan, Tropical Geography, 29, 515-519, 2009 (in Chinese with English abstract).

Zhang, J., and Kong, Z.: Study on vegetation and climate changes in Beijing region since Late Pleistocene, Chinese Geographical Science, 9, 243-249, 1999.

Zhang, M., Cheng, H., Lin, Y., Qin, J., Zhang, H., Tu, L., Wang, H., and Feng, Y.: High resolution paleoclimate environment records from a stalagmite of Dongge Cave since 15000a in Libo, Guangzhou Province, China, Geochimica, 33, 65-74, 2004 (in Chinese with English abstract).

Zhang, M., Yuan, D., Lin, Y., Qin, J., Zhang, C., and Cheng, H.: High resolution climatic records of stalagmite from Xiangshui cave in Guilin since 6.00 ka B.P., Acta Geoscientia Scinica, 24, 439-444, 2003 (in Chinese with English abstract).

Zhang, Y.: Palynological assemblages and paleovegetation and paleoclimate of the Holocene in eastern Shanghai, Journal of Paleogeography, 8, 35-41, 2006 (in Chinese with English abstract).

Zhao, H., Leng, X., and Wang, S.: Distribution, accumulation rate of peat in the Changbaishan Mountains and climate change in Holocene, Journal of Mountain Science, 20, 513-518, 2002 (in Chinese with English abstract).

Zhao, X., Luo, C., Chen, S., Huang, C., Zheng, Z., Dong, H., Zeng, M., Chen, W., Liu, F., Li, Y., and Shao, L.: Quantitative reconstruction of Holocene climate based on pollen data from drill hole QZK6 in Pearl River delta, Geological Bulletin of China, 33, 1621-1628, 2014 (in Chinese with English abstract).

Zhao, X., Tang, L., Shen, C., and Wang, S.: Holocene climatic and sea-level changes in Qingfeng section, Jianhu Country, Jiangsu Province, Acta Oceanological Sinica, 16, 78-88, 1994 (in Chinese with English abstract).

Zheng, Z.: Holocene pollen analysis and environmental research in the Chanshan Plain, Tropical Oceanology, 9, 31-38, 1990 (in Chinese with English abstract).

Zhnag, Z., Wu, R., Wang, S., Shen, J., Wu, Y., and Li, S.: Environmental evolution recorded by lake sediments from Erhai Lake, Yunnan Province in Holocene megathermal, Oceanologica et Limnologia Sinica, 31, 210-214, 2000 (in Chinese with English abstract).

Zhong, W., and Shu, Q.: Palaeoclimatic and palaeohydrologic oscillations since about 12.0 ka B.P. at Bosten Lake, southern Xinjiang, Oceanologica et Limnologia Sinica, 32, 213-220, 2001 (in Chinese with English abstract).

Zhou, J., Wang, S., and Lu, J.: Climatic and environmental changes from the sediment record of Erhai Lake over the past 100000 years, Journal of Lake Science, 15, 104-111, 2003 (in Chinese with English abstract).

Zhou, W., An, Z., and Head, M. J.: Stratigraphic Division of Holocene Loess in China, Radiocarbon, 36, 37-45, 1994.

Zhou, W., Yu, X., Jull, A. J. T., Burr, G., Xiao, J., Lu, X., and Xian, F.: High-resolution evidence from southern China of an early Holocene optimum and a mid-Holocene dry event during the Past 18,000 Years, Quaternary Research, 62, 39-48, 2004.

Zhou, Y., Lu, H., Joseph, M., Miao, X., James, S., and Ronald, G.: Optically stimulated luminescence dating of aeolian sand in the Otindag dune field and Holocene climate change, Science in China Series D: Earth Science, 51, 837-847, 2008.

Zhu, C., Chen, X., Ma, C., Zhu, Q., Li, Z., and Xu, W.: Spore-pollen-climate factor transfer function and paleoenvironment reconstruction in Dajiuhu, Shennongjia, Central China, Chinese Science Bulletin, 53 (Suppl. I), 42-49, 2008.

Zhu, L., Wang, J., Lin, X., Ju, J., Xie, M., Li, M., Wu, Y., Daut, G., Mausbacher, R., and Schwalb, A.: Environmental changes reflected by core sediments since 8.4ka in Nam Co, Central Tibet of China, Quaternary Sciences, 27, 588-597, 2007 (in Chinese with English abstract).