Supplementary Material for "Overcoming model instability in tree-ring-based temperature reconstructions using a multi-species method: A case study from the Changbai Mountains, northeastern China"

Liangjun Zhu[1, 2], Shuguang Liu[1], Haifeng Zhu[3], David J. Cooper[4], Danyang Yuan[2], Yu Zhu[1], Zongshan Li[5], Yuandong Zhang[6], Hanxue Liang[7], Xu Zhang[8], Wenqi Song[2], Xiaochun Wang[2,*]

[1]National Engineering Laboratory for Applied Technology of Forestry & Ecology in South China, College of Life Science and Technology, Central South University of Forestry and Technology, Changsha 410004, China

[2]Center for Ecological Research and Key Laboratory of Sustainable Forest Ecosystem Management-Ministry of Education, School of Forestry, Northeast Forestry University, Harbin 150040, China

[3]Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing 100864, China

[4]Department of Forest and Rangeland Stewardship, Colorado State University, Fort Collins, CO 80523, USA

[5]State Key Laboratory of Urban and Regional Ecology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China

[6]Key Laboratory of Forest Ecology and Environment of National Forestry and Grassland Administration, Research Institute of Forest Ecology, Environment and Protection, Chinese Academy of Forestry, Beijing 100091, China

[7]Institute of Loess Plateau, Shanxi University, Taiyuan 030006, China

[8]College of Forestry, Northwest A&F University, Yangling 712100, China

Correspondence to: Xiaochun Wang (wangx@nefu.edu.cn)

Supplementary Tables and Figures

Table S1. Site description and statistical characteristics for each chronology from the Changbai Mountains.

Site code	Species	Long. (°E)	Lat. (°N)	Elev. (m)	C/T	Rbar	EPS
LBSPK	*P. koraiensis*	128.041	44.076	908	109/61	0.27	0.94
LBSFM	*F. mandshurica*	128.041	44.076	908	62/41	0.30	0.91
MLPK	*P. koraiensis*	128.117	43.973	950	34/34	0.19	0.80
DHPK	*P. koraiensis*	127.840	42.942	1095	66/35	0.59	0.92
HSFM	*F. mandshurica*	127.534	42.683	704	39/22	0.22	0.77
LSHPK	*P. koraiensis*	127.795	42.517	853	42/22	0.24	0.80
LSHFM	*F. mandshurica*	127.795	42.517	853	43/22	0.49	0.93
CBSFM	*F. mandshurica*	128.117	42.417	718	38/22	0.44	0.94

Notes: C/T = Core /Tree number; R_{bar} = the mean correlation coefficient between all tree-ring series used in a chronology; EPS = Expressed population signal statistic.

23 **Table S2. Correlation matrix among the site and regional chronologies during the common period (1858-2011).**

	DHPK	LBSPK	LSHPK	MLPK	CBSFM	HSFM	LBSFM	LSHFM	PK	FM
LBSPK	0.47**									
LSHPK	0.47**	0.47**								
MLPK	0.47**	0.56**	0.48**							
CBSFM	0.10	0.25**	0.08	0.32**						
HSFM	0.16	0.22**	0.04	0.31**	0.71**					
LBSFM	0.11	0.35**	0.08	0.35**	0.58**	0.75**				
LSHFM	0.11	0.01	-0.06	0.25**	0.74**	0.79**	0.65**			
PK	0.78**	0.81**	0.76**	0.78**	0.24**	0.23**	0.29**	0.09		
FM	0.14	0.22**	0.03	0.35**	0.86**	0.93**	0.83**	0.91**	0.23**	
ALL	0.56**	0.64**	0.48**	0.70**	0.72**	0.76**	0.73**	0.67**	0.76**	0.81**

24 **Notes:** Tree-ring indices of combined *P. koraiensis* (PK), combined *F. mandshurica* (FM), and mixed species (ALL) were calculated

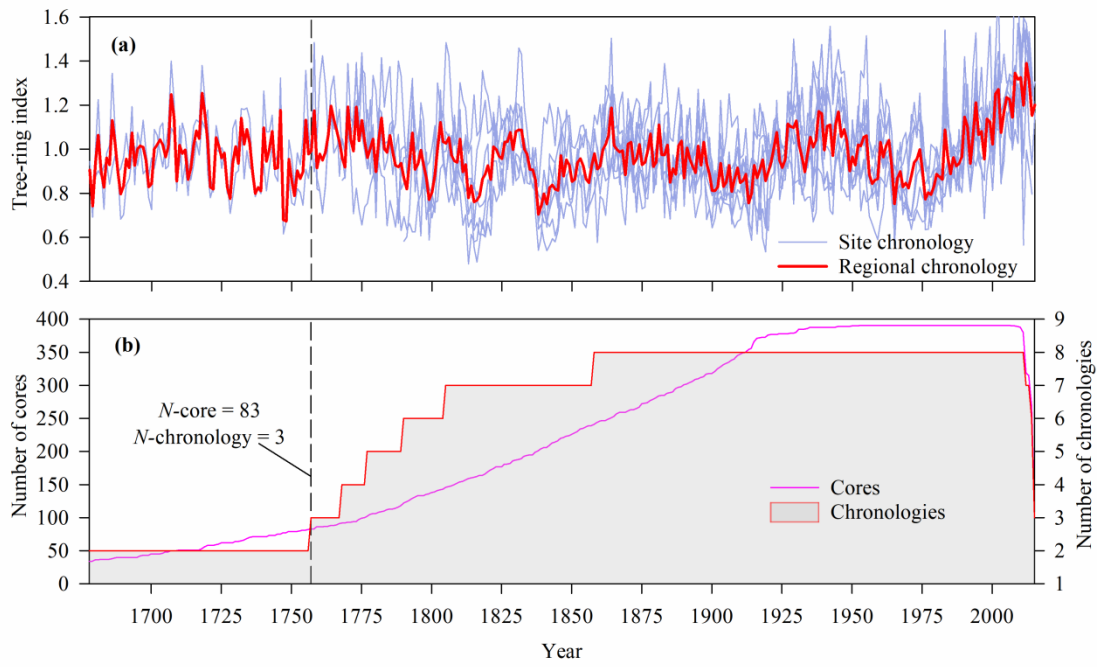
25 using a simple arithmetic average.

26

Table S3. Correlations between the growing-season minimum temperature reconstruction and the monthly Atlantic Multidecadal Oscillation index from previous April to current September.

	R	*n*
Apr	0.29	159
May	0.36	159
Jun	0.38	159
Jul	0.40	159
Aug	0.42	159
Sep	0.43	159
Oct	0.40	159
Nov	0.30	159
Dec	0.28	159
JAN	0.25	160
FEB	0.25	160
MAR	0.23	160
APR	0.23	160
MAY	0.29	160
JUN	0.34	160
JUL	0.37	160
AUG	0.40	160
SEP	0.45	160

Notes: All the correlation coefficients in the table are significant at the 0.01 level.

	R	*n*

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31 **Figure S1. The (a) single-site and regional tree-ring-width chronologies and (b) the sample depth of the regional chronology**

32 **for the northern Changbai Mountains. The regional chronology's reliable portion is from 1757 to 2015, with cores ≥83 and site**

33 **chronologies ≥3.**
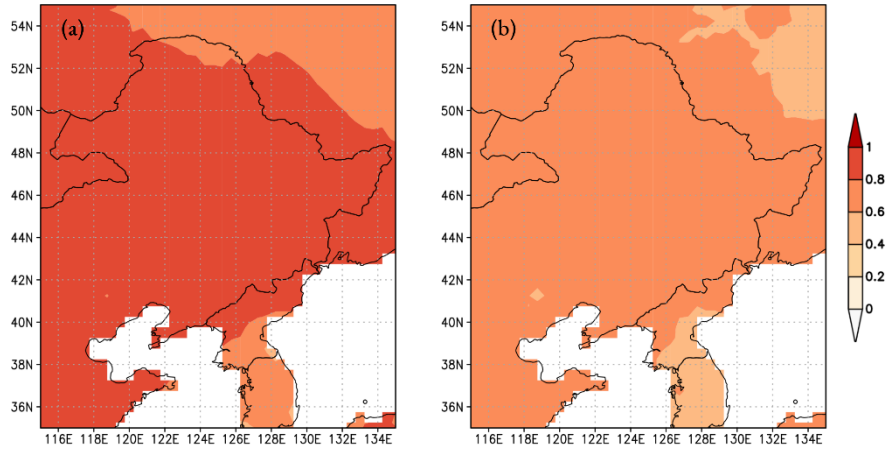
Figure S2. Spatial correlation fields of (a) actual and (b) reconstructed growing-season (April-September) minimum temperatures for the northern Changbai Mountains with April-September averaged CRU TS4.04 minimum temperatures for the period 1958-2015. Maps with filled *p*-values > 5% were masked out.