SUPPLEMENTARY MATERIAL

Delta Blue Intensity chronologies from Siberian larch reveal robust summer temperature signals across northern Eurasia

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Table S1. The increase in average temperature every 10 years for the period 1961–2020. **PUR** refers to Polar Urals, **IGA** to Igarka, **CHO** to Chokurdakh, **NUR** to Northern Urals, **TUR** to Tura, **SKH** to Suntar-Khayata. Coefficients in bold are significant at $p < 0.001$, underlined coefficients are significant at $p < 0.01$ and in italic are significant at $p < 0.05$

Site	JUN	JUL	AUG	SEP	JUN_JUL	JUN_AUG	JUN_SEP	YEAR
PUR	**0.75**	0.21	*0.29*	0.23	**0.48**	**0.42**	**0.37**	**0.47**
IGA	**0.90**	0.04	0.12	0.18	**0.47**	**0.35**	**0.31**	**0.49**
CHO	*0.35*	0.22	<u>0.45</u>	**0.47**	*0.29*	**0.34**	**0.37**	**0.54**
NUR	0.25	0.09	*0.36*	0.13	0.17	*0.23*	*0.21*	**0.26**
TUR	**0.80**	0.11	0.16	0.11	**0.45**	**0.35**	**0.29**	**0.49**
SKH	*0.32*	*0.29*	*0.24*	0.15	**0.31**	**0.28**	**0.25**	**0.25**

Table S2. Frequency of missing years in TRW chronologies. **PUR** refers to Polar Urals, **IGA** to Igarka, **CHO** to Chokurdakh, **NUR** to Northern Urals, **TUR** to Tura, **SKH** to Suntar-Khayata.

Site	Missing years	No. trees missing year	Total No. trees	% of trees with missing years
PUR	1986	7	25	28
	1995	4	25	16
	1997	7	25	28
IGA	1997	11	31	35
	1999	9	31	29
CHO	1962	1	43	2
	1975	2	43	5
	1978	1	43	2
	1979	1	43	2
NUR	1967	21	23	91
	1969	6	23	26
	2014	4	23	17
TUR	1989	4	20	20
	1995	7	20	35
	1997	7	20	35
SKH	1979	8	29	28
	1982	5	29	28

Table S3. Wide and narrow rings classified as narrow (wide) when the z-score of its mean TRW index fell below a defined threshold of zTRW < -1 or above zTRW < +1. In red, years in which narrow rings occur simultaneously in three or more sites; in green, years in which wide rings occur simultaneously in three or more sites.

Site	Narrow rings	Wide rings
PUR	1966, 1968, 1973, 1975, 1980, 1986, 1995, 1997, 2009, 2020	1964, 1991, 1993, 1998, 2007, 2008, 2012
IGA	1966, 1968, 1971, 1974, 1995, 1997, 1999, 2007, 2010, 2020, 2021	1967, 1994, 1996, 1998
CHO	1962, 1972, 1978, 1979, 1984, 1992, 1996, 2014, 2017	1973, 1974, 1977, 1999
NUR	1966, 1968, 1969, 1986, 1994, 2003, 2005, 2007, 2014	1964, 1987, 1988, 1989, 2012, 2013
TUR	1961, 1969, 1989, 1995, 1997, 1999, 2007, 2010, 2020	1976, 1979, 1996, 1998, 2001, 2008, 2011, 2012, 2018
SKH	1962, 1968, 1972, 1979, 1982, 1994, 2004, 2007	1995, 2006, 2008

Table S4. Distance (km) between study sites. **PUR** refers to Polar Urals, **IGA** to Igarka, **CHO** to Chokurdakh, **NUR** to Northern Urals, **TUR** to Tura, and **SKH** to Suntar-Khayata.

	NUR	**PUR**	**IGA**	**TUR**	**SKH**
PUR	871				
IGA	1620	898			
TUR	2163	1589	735		
SKH	4102	3375	2496	1996	
CHO	3890	3063	2293	2061	920

Table S5. Correlations between tree-ring width (TRW), latewood blue intensity (LWBI) and delta blue intensity (DBI) residual chronologies for the period 1961–2020. **PUR** refers to Polar Urals, **IGA** to Igarka, **CHO** to Chokurdakh, **NUR** to Northern Urals, **TUR** to Tura, and **SKH** to Suntar-Khayata. Coefficients in bold are significant at $p < 0.01$

		NUR	PUR	IGA	TUR	SKH
TRW	PUR	**0.26**				
	IGA	0.11	**0.45**			
	TUR	0.13	0.25	**0.47**		
	SKH	0.21	0.30	-0.09	0.16	
	CHO	-0.03	-0.22	-0.25	-0.33	-0.11
LWBI	PUR	0.24				
	IGA	0.05	**0.62**			
	TUR	-0.04	**0.42**	**0.72**		
	SKH	-0.07	-0.03	-0.12	-0.13	
	CHO	0.20	0.02	-0.03	-0.10	0.11
DBI	PUR	0.27				
	IGA	-0.07	**0.44**			
	TUR	0.01	0.25	**0.59**		
	SKH	0.08	0.01	-0.16	-0.20	
	CHO	0.17	-0.11	-0.20	-0.22	0.13

Table S6. Gleichläufigkeit coefficient (GLK) value between tree-ring width (TRW), latewood blue intensity (LWBI) and delta blue intensity (DBI) residual chronologies for the period 1961–2020. **PUR** refers to Polar Urals, **IGA** to Igarka, **CHO** to Chokurdakh, **NUR** to Northern Urals, **TUR** to Tura, and **SKH** to Suntar-Khayata. Values in bold are significant at $p < 0.05$

		NUR	PUR	IGA	TUR	SKH
TRW	PUR	**64**				
	IGA	54	**63**			
	TUR	49	59	**73**		
	SKH	51	53	46	49	
	CHO	47	53	46	42	53
LWBI	PUR	**69**				
	IGA	48	53			
	TUR	53	**61**	**81**		
	SKH	53	47	44	42	
	CHO	48	42	46	41	58
DBI	PUR	**64**				
	IGA	48	**66**			
	TUR	52	**63**	**73**		
	SKH	57	39	42	53	
	CHO	53	42	39	29	59

Table S7. Start (day of the year, DOY), end (DOY) and the length (in days) of the optimal time windows for temperature sensitivity over the 1961–2020 period, derived from daily moving window correlations for tree-ring width (TRW), latewood blue intensity (LWBI) and delta blue intensity (DBI). **PUR** refers to Polar Urals, **IGA** to Igarka, **CHO** to Chokurdakh, **NUR** to Northern Urals, **TUR** to Tura, and **SKH** to Suntar-Khayata.

Site	Parameter	Onset (DOY)	End (DOY)	Window length	Correlation
PUR	TRW	164 (June 13th)	193 (July 12th)	30	0.62
	LWBI	161 (June 10th)	214 (July 30th)	53	0.61
	DBI	161 (June 10th)	198 (July 17th)	38	0.70
IGA	TRW	158 (June 7th)	204 (July 23rd)	47	0.57
	LWBI	157 (June 6th)	205 (July 24th)	49	0.50
	DBI	157 (June 6th)	205 (July 24th)	49	0.60
CHO	TRW	156 (June 5th)	199 (July 18th)	44	0.71
	LWBI	162 (June 11th)	216 (August 4th)	55	0.71
	DBI	163 (June 12th)	214 (August 2nd)	52	0.70
NUR	TRW	153 (June 2nd)	196 (July 15th)	44	0.62
	LWBI	156 (June 5th)	227 (August 15th)	72	0.39
	DBI	150 (May 30th)	228 (August 16th)	79	0.53
TUR	TRW	153 (June 2nd)	189 (July 8th)	37	0.56
	LWBI	160 (June 9th)	190 (July 9th)	31	0.55
	DBI	160 (June 9th)	190 (July 9th)	31	0.58
SKH	TRW	147 (May 27th)	176 (June 25th)	30	0.46
	LWBI	152 (June 1st)	180 (June 29th)	29	0.46
	DBI	151 (May 31st)	180 (June 29th)	30	0.46

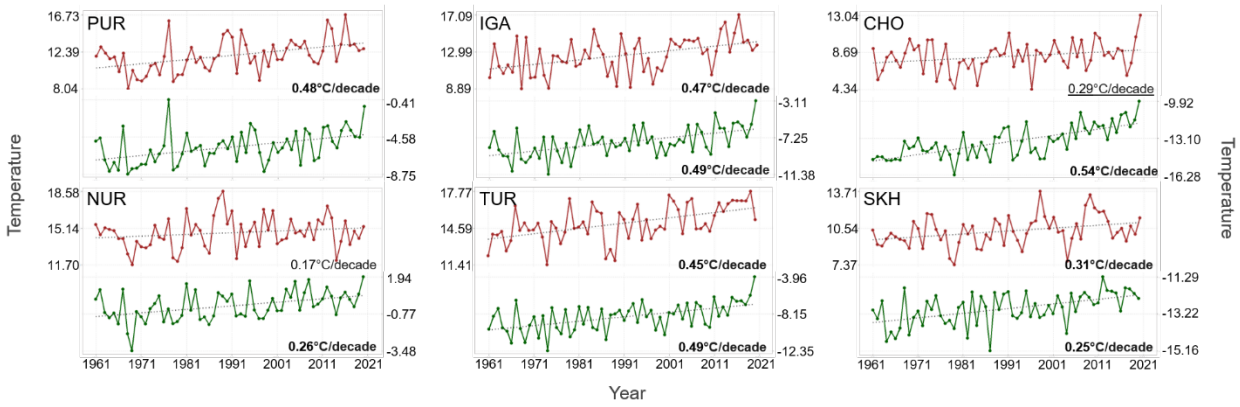

Figure S1. Mean June-July (red) and year(green) temperature for the period 1961–2020. **PUR** refers to Polar Urals, **IGA** to Igarka, **CHO** to Chokurdakh, **NUR** to Northern Urals, **TUR** to Tura, and **SKH** to Suntar-Khayata. Values indicating change in °C per decade are shown in bold type are significant at $p < 0.001$, italic are significant at $p < 0.01$ and underlined are significant at $p < 0.05$.

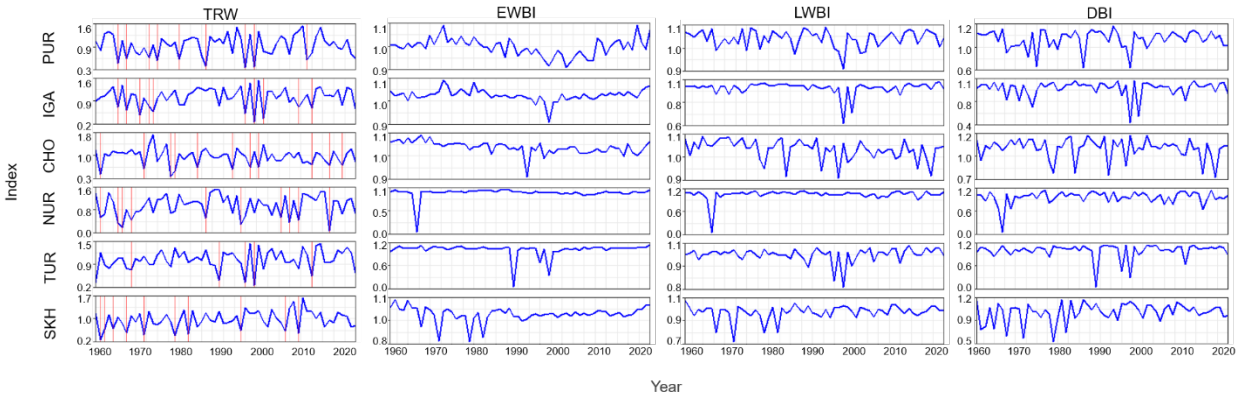

Figure S2. Tree-ring width (TRW), earlywood blue intensity (EWBI), latewood blue intensity (LWBI) and delta blue intensity (DBI) chronologies smoothed with an 11-year spline for the period 1961–2020. **PUR** refers to Polar Urals, **IGA** to Igarka, **CHO** to Chokurdakh, **NUR** to Northern Urals, **TUR** to Tura, and **SKH** to Suntar-Khayata. Red vertical lines indicate narrow rings in TRW chronologies.

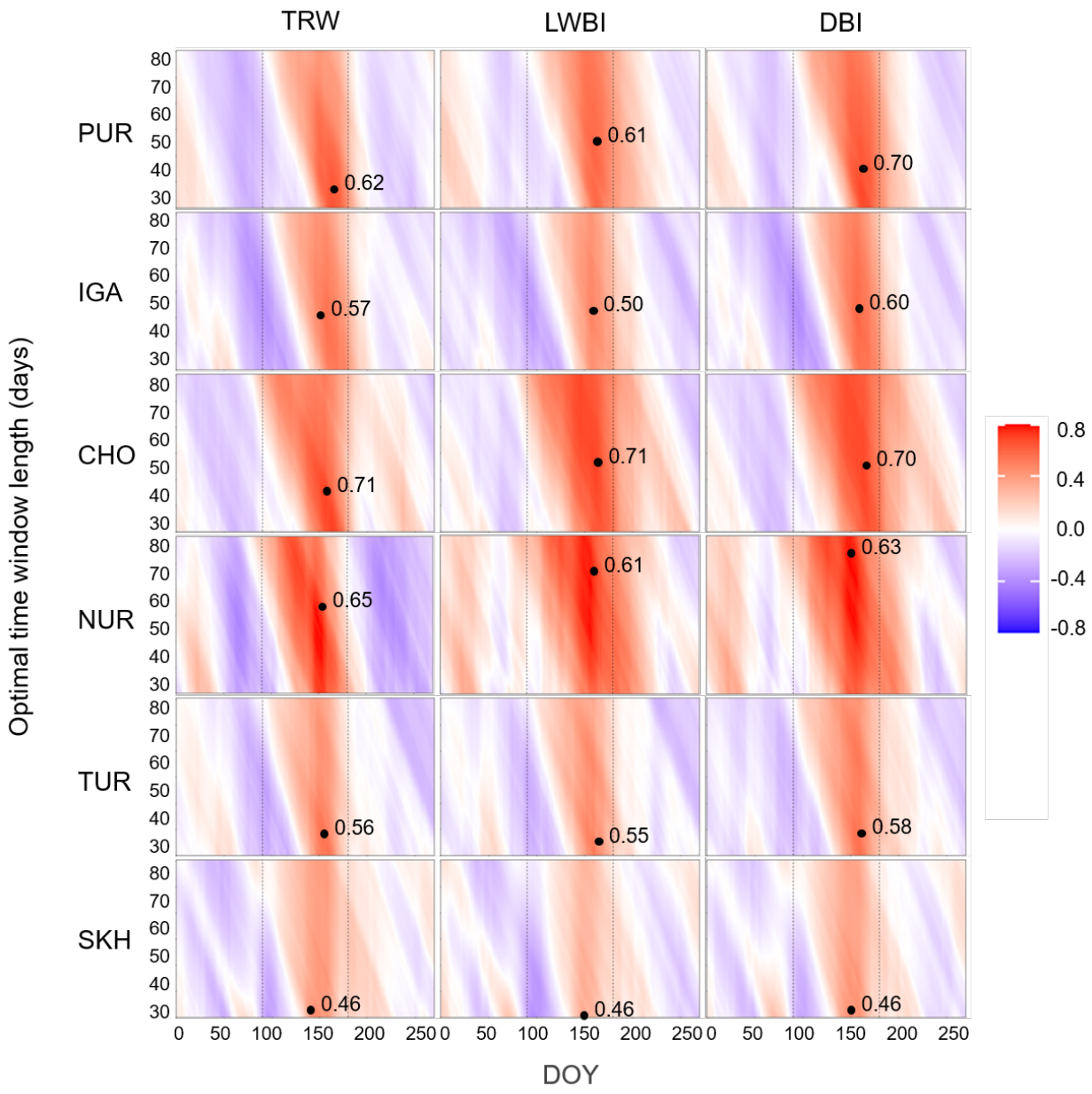

Figure S3. Pearson moving daily correlations between mean daily temperature and TRW, LWBI, and DBI residual chronologies for the 1961–2020 period for all sites except Suntar-Khayata (1967–2020). **PUR** refers to Polar Urals, **IGA** to Igarka, **CHO** to Chokurdakh, **NUR** to Northern Urals, **TUR** to Tura, **SKH** to Suntar-Khayata. Vertical dotted lines mark the quarters of the year. The points and values on the plot show the maximum correlation. The x-scale shows the starting day of optimal window width, the y-scale shows the optimal time window length.

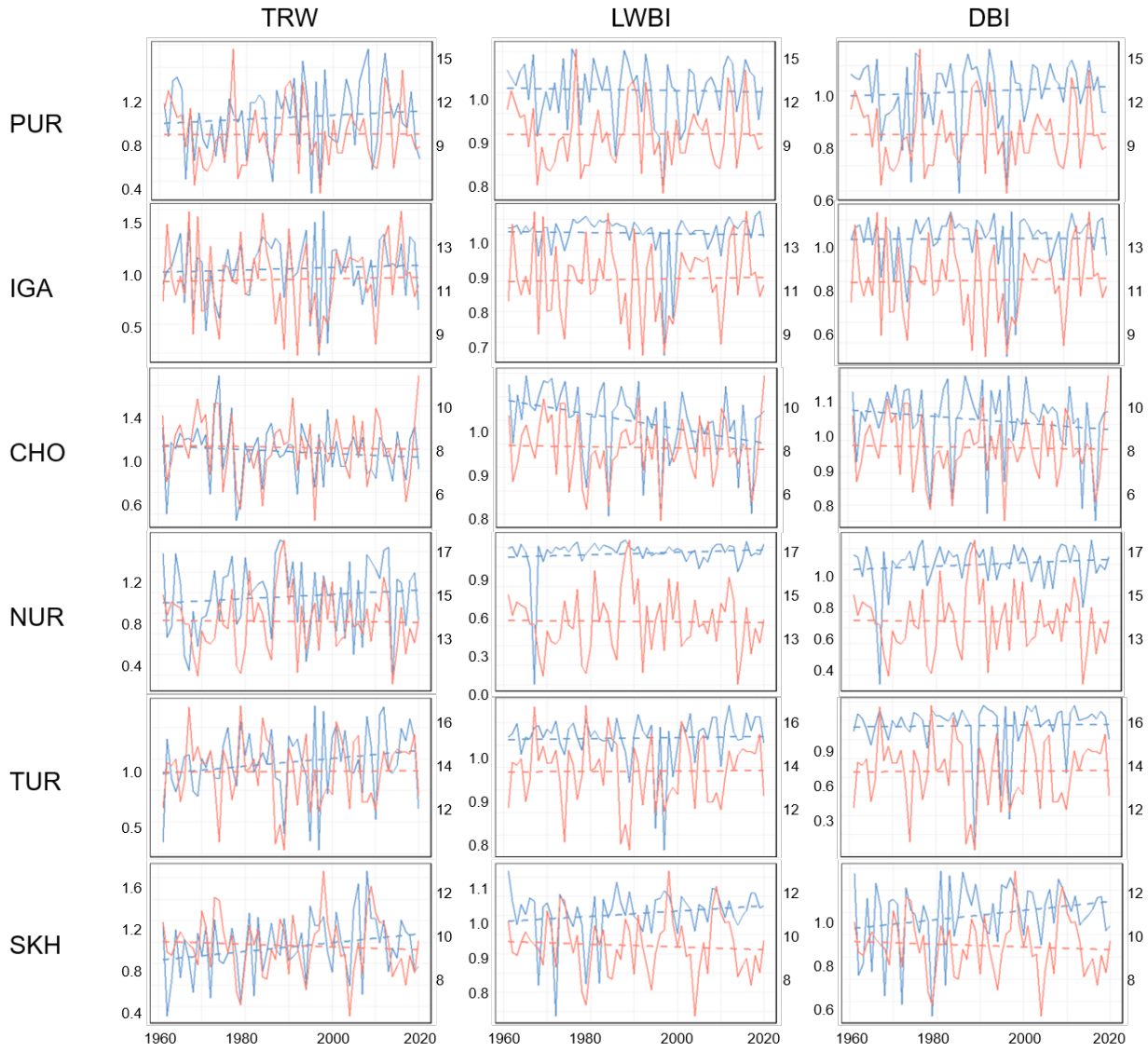

Figure S4. Tree-ring width (TRW), latewood blue intensity (LWBI) and delta blue intensity (DBI) residual chronologies (blue) and mean June-July residual temperature (red) for the period 1961–2020. **PUR** refers to Polar Urals, **IGA** to Igarka, **CHO** to Chokurdakh, **NUR** to Northern Urals, **TUR** to Tura, and **SKH** to Suntar-Khayata.

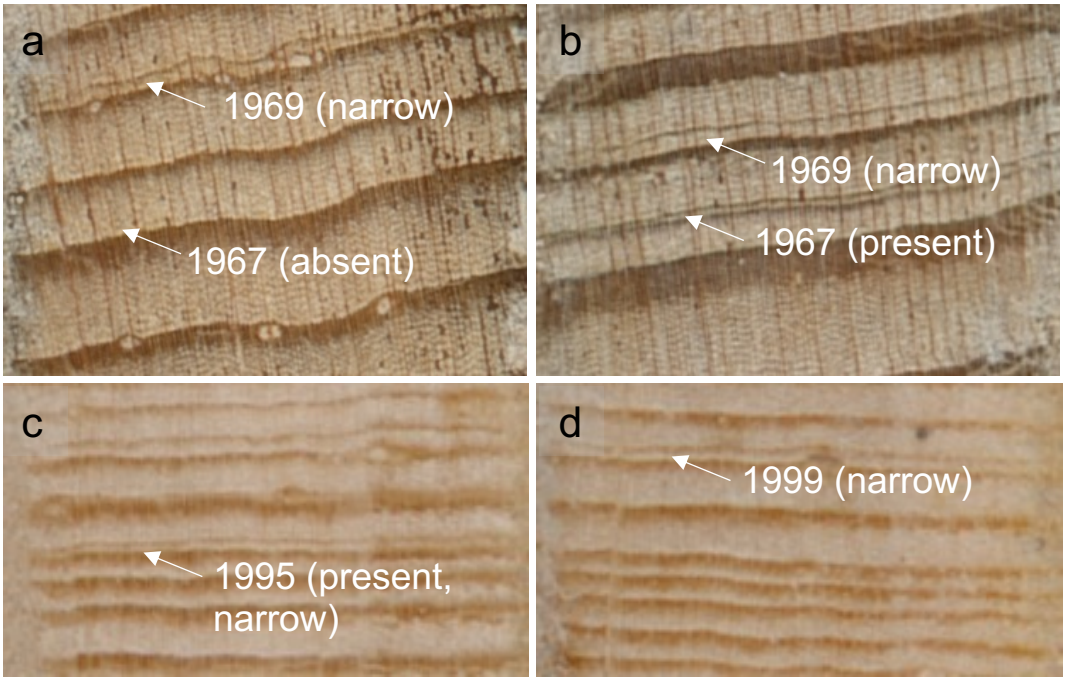

Figure S5. Example of wood cores of *Larix sibirica* at NUR (a, b) and *Larix gmelinii* at TUR (c, d), showing narrow rings and the missing or present rings.