

Supplemental Material: Comparing forest measurements from tree rings and a space-based index of vegetation activity in Siberia

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Sample Preparation and Quality Control/Assurance

TRW and MXD for the original 26 pairs of data sets were obtained at the Institute of Forest, Siberian Branch, Russian Academy of Sciences in Krasnoyarsk, Russia using techniques of X-ray microdensitometry based on those of Lenz et al. (1976) and a Dendro 2003 workstation from Walesch Electronic of Effretikon, Switzerland. TRW for the material from Buryatia was measured and dated using a LINTABTM measuring stage and TSAP-WinTM software from Rinntech of Heidelberg, Germany.

The individual core data for each species/site/variable combination were screened for quality of cross-dating and measurement using the program COFECHA (Holmes 1983), with an emphasis on data for the period commencing in AD 1880. Anomalies flagged by this software were further investigated with the user-developed MATLAB function LOCKDOWN (David M. Meko, personal communication, December 8, 2011), specifically developed for “graphical quality control of dating/measurement by correlation analysis.” Some anomalies were clearly artifacts of data handling and differing protocols and it was possible to correct these. Others could not be so corrected and the series containing them were omitted from the data sets used. As a further assurance, we screened each series using the expressed population signal (EPS) chronology stripping method (Fowler and Boswijk 2003) where series that do not contribute to an overall improvement in the EPS are left out. This analysis confirmed the quality control above as the

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stripping removed zero series in 21/38 of sites, 1 series in 15/38 of cases, and 3 series in 2 sites (table S1).

Table S1: Effects of EPS stripping on the 38 chronologies. The original number of series is given by n.orig while the number remaining after the EPS stripping procedure is given by n.strip. EPS numbers follow respectively.

Site	n.orig	n.strip	eps.orig	eps.strip
BALi.TRW	12	11	0.927	0.931
BALi.MXD	11	11	0.887	0.887
BAVg.TRW	15	14	0.969	0.97
BAVg.MXD	19	19	0.973	0.973
KH1o.TRW	43	43	0.973	0.973
KH1o.MXD	46	46	0.974	0.974
KH1s.TRW	39	39	0.982	0.982
KH1s.MXD	39	38	0.973	0.974
KH9o.TRW	43	42	0.97	0.971
KH9o.MXD	47	46	0.972	0.973
KH9s.TRW	30	29	0.961	0.963
KH9s.MXD	27	26	0.948	0.949
KHAs.TRW	20	20	0.978	0.978
KHAs.MXD	19	18	0.954	0.955
KOTg.TRW	34	34	0.976	0.976
KOTg.MXD	32	32	0.971	0.971
NSSc.TRW	18	18	0.966	0.966
NSSc.MXD	19	19	0.966	0.966
NURo.TRW	11	11	0.896	0.896
NURo.MXD	15	15	0.95	0.95
NURs.TRW	16	16	0.959	0.959
NURs.MXD	10	7	0.937	0.942
PL5o.TRW	22	22	0.943	0.943
PL5o.MXD	12	11	0.912	0.913
PURo.TRW	29	29	0.943	0.943
PURo.MXD	26	26	0.961	0.961
PURs.TRW	23	22	0.973	0.975
PURs.MXD	22	22	0.971	0.971
SURo.TRW	31	30	0.961	0.962
SURo.MXD	31	31	0.975	0.975
SURs.TRW	21	21	0.977	0.977
SURs.MXD	27	26	0.983	0.985
TURg.TRW	27	26	0.961	0.962
TURg.MXD	19	16	0.908	0.911
ZOTi.TRW	44	43	0.951	0.952

ZOTi.MXD	40	40	0.953	0.953
ZOTo.TRW	18	18	0.921	0.921
ZOTo.MXD	18	17	0.911	0.912

All subsequent analysis was performed in the R statistical programming environment (R Core Team 2013) using the contributed packages `dpIR` (Bunn 2008, Bunn et al. 2012) for tree-ring analysis and raster (Hijmans and van Etten 2013) for processing the NDVI data.

Table S2: Descriptive statistics for the 21 TRW data sets from Buryatia. All sites are *Pinus sylvestris* and cover the period 1880 to 1998. n: number of cross-dated tree-ring series at each site. \bar{r} : mean interseries correlation. EPS: Expressed Population Signal. ϕ : first order autocorrelation.

Site	Long	Lat	n	\bar{r}	EPS	ϕ
12	107.183	51.367	9	0.597	0.91	0.41
13	107.183	51.367	7	0.633	0.892	0.44
14	107.117	50.95	23	0.67	0.97	0.48
15	107.083	50.667	18	0.679	0.964	0.37
16	107.917	50.8	23	0.698	0.978	0.39
17	108.417	51.283	13	0.664	0.955	0.47
19	108.167	51.317	15	0.58	0.91	0.54
20	107.567	51.283	20	0.64	0.946	0.48
24	106.117	50.883	35	0.649	0.981	0.31
25	107.2	51.067	6	0.585	0.879	0.46
A	107.183	51.667	10	0.641	0.921	0.32
B	106.6	50.967	15	0.593	0.93	0.48
D	106.567	50.933	12	0.71	0.948	0.53
E	106.9	51.467	13	0.621	0.933	0.49
G	106.583	50.6	16	0.667	0.959	0.42
I	109.667	52.15	15	0.647	0.949	0.53
K	108.917	52.1	18	0.695	0.968	0.47
LL	108.233	51.9	11	0.429	0.823	0.68
Q	111.7	52.683	16	0.552	0.914	0.70
V	106.45	50.717	15	0.666	0.945	0.55
Z	110.2	52.333	15	0.668	0.952	0.58

Table S3: Proportion of variance (and standard deviation) of the PCA performed on the seven MXD (top) and TRW (bottom) chronologies used in Figure 3.

MXD	Comp.1	Comp.2	Comp.3	Comp.4	Comp.5	Comp.6	Comp.7
Standard deviation	0.2189	0.08183	0.0787	0.05547	0.04296	0.021266	1.36E-03
Proportion of Variance	0.7239	0.1012	0.09361	0.0465	0.0279	0.006835	2.80E-05
Cumulative Proportion	0.7239	0.82513	0.91874	0.96524	0.99314	0.999972	1.00E+00

TRW	Comp.1	Comp.2	Comp.3	Comp.4	Comp.5	Comp.6	Comp.7
Standard deviation	0.6532	0.3242	0.2576	0.2246	0.2013	0.07849	0.074441
Proportion of Variance	0.6088	0.15	0.0947	0.072	0.05782	0.00879	0.007907
Cumulative Proportion	0.6088	0.7588	0.8535	0.9255	0.9833	0.99209	1

Table S3: Loadings (eigenvectors) on each principal component for the seven MXD (top) and TRW (bottom) chronologies used in Figure 3. Loadings with values less than 0.1 are not shown for clarity.

MXD	Comp.1	Comp.2	Comp.3	Comp.4	Comp.5	Comp.6	Comp.7
BAVg2	0.774	0.554		0.181	0.217		
KH1o2	0.201	-0.45	0.289	0.151	0.382		0.707
KH1s2	0.345	-0.166	0.374	-0.222	-0.67	-0.465	
KH9o2	0.201	-0.451	0.287	0.152	0.378		-0.707
KH9s2	0.284		0.27		-0.264	0.874	
KOTg2	0.325	-0.5	-0.783		-0.172		
TURg2	0.119			-0.932	0.341		

TRW	Comp.1	Comp.2	Comp.3	Comp.4	Comp.5	Comp.6	Comp.7
BAVg1	-0.592	0.623	0.312	-0.159	0.362		
KH1o1	-0.215	-0.407	-0.384	-0.301	0.458	0.393	-0.431
KH1s1	-0.527	-0.381	0.154		-0.428	0.461	0.387
KH9o1	-0.212	-0.279	-0.221	-0.24	0.34	-0.542	0.602

KH9s1	-0.432	-0.232	0.177	-0.318	-0.57	-0.548
KOTg1	-0.267	0.383	-0.807	0.177	-0.313	
TURg1	-0.153	-0.153		0.886	0.401	

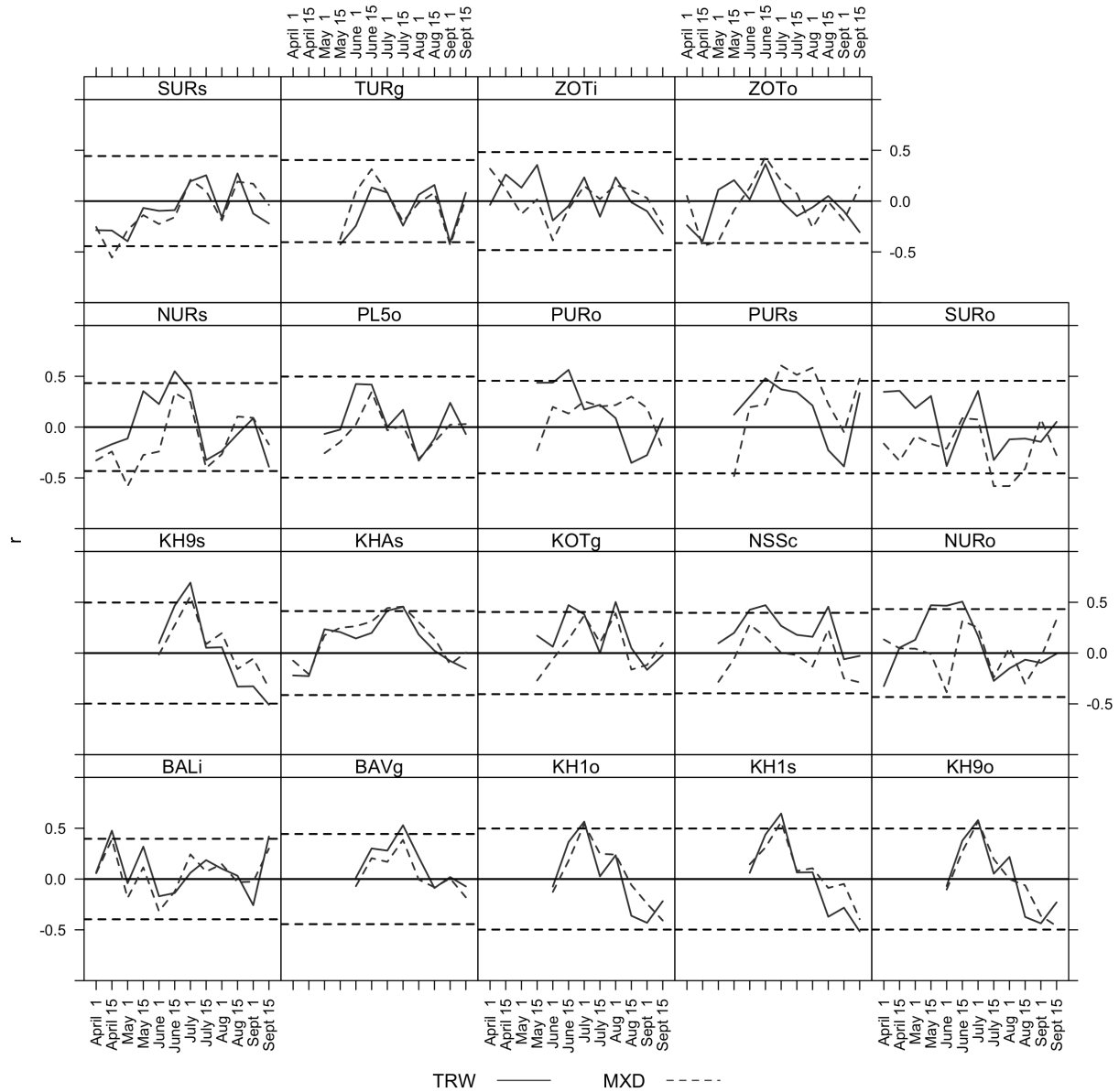


Figure S1: Correlations were calculated between NDVI and tree growth ($r_{tree|NDVI}$) fortnightly over the spring and summer (significant correlations at 95% confidence are shown by the dashed horizontal lines). In contrast to Figure 2 of the main text, these tree-ring data were standardized with the mean of each series rather than with a spline.

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