

Supplementary Material to

Realistic choice of annual matrices contracts the range of λ_S estimates

Dmitrii O. Logofet ^{1,*}, Leonid L. Golubyatnikov ¹, Elena S. Kazantseva ², and Nina G. Ulanova ²

¹ Laboratory of Mathematical Ecology, A.M. Obukhov Institute of Atmospheric Physics, Russian Academy of Sciences, Moscow 119 017, Russia; danilal@postman.ru, golub@ifaran.ru

² Biological Department, Moscow State University, Moscow, 119234, Russia; nulanova@mail.ru

* Correspondence: danilal@postman.ru

Supplementary to: Statistical Processing of Meteodata

The study allows us to conclude that the $\lambda_1(t; a^\circ)$ variable correlates positively with the average minimum air temperatures in May–June, and it turns out to be the only significant predictor in the models with one factor included (**Table S1**).

Table S1. Results of regression models for the $\lambda_1(t; a^\circ)$ series of *Eritrichium caucasicum*. Notations: n is the number of observations; df, the number of degrees of freedom; R², the coefficient of determination; total_p, the significance level for the entire model; B, the regression coefficient; StE_B, the regression coefficient error; p, the significance level for the factors; FR0, the number of days with freezing at the soil level; n.s., not significant; *, the first level of significance (greater than 90%, less than 95%)

Model	n	df	R ²	total_p	Factors	B	StE_B	p
Min T 05-06	11	9	0.493	0.016*	Min T 05-06	0.100	0.034	0.016*
FR0	8	6	0.497	0.051 n.s.	FR0	0.0073	0.0030	0.051

Supplementary to: Recovering the Transition Matrix from a Sequence of Chain States

A table below illustrates statements (4)–(7) of the main text with its green cells.

Table S2. Associating each successive point, $\theta(k)$, $k = 1960, \dots, 2019$, of the temperature index time series to one of the 11 reference values

$k \backslash t$	$\theta(k) - \theta(t)$											$ \theta(k) - \theta(t) $	t_{next}
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		
1960	2.0	-0.1	1.3	-0.8	-1.7	-1.3	0.3	1.4	1.8	-3.0	-1.2	0.1	2010
1961	6.4	4.3	5.7	3.6	2.7	3.1	4.7	5.8	6.2	1.4	3.2	1.4	2018
1962	4.3	2.2	3.6	1.5	0.6	1.0	2.6	3.7	4.1	-0.7	1.1	0.6	2013
1963	5.0	2.9	4.3	2.2	1.3	1.7	3.3	4.4	4.8	0.0	1.8	0.0	2018
1964	3.6	1.5	2.9	0.8	-0.1	0.3	1.9	3.0	3.4	-1.4	0.4	0.1	2013
1965	6.9	4.8	6.2	4.1	3.2	3.6	5.2	6.3	6.7	1.9	3.7	1.9	2018
1966	0.4	-1.7	-0.3	-2.4	-3.3	-2.9	-1.3	-0.2	0.2	-4.6	-2.8	0.2	2017
1967	-2.2	-4.3	-2.9	-5.0	-5.9	-5.5	-3.9	-2.8	-2.4	-7.2	-5.4	2.2	2009
1968	0.4	-1.7	-0.3	-2.4	-3.3	-2.9	-1.3	-0.2	0.2	-4.6	-2.8	0.2	2017
1969	-1.1	-3.2	-1.8	-3.9	-4.8	-4.4	-2.8	-1.7	-1.3	-6.1	-4.3	1.1	2009
1970	-0.4	-2.5	-1.1	-3.2	-4.1	-3.7	-2.1	-1.0	-0.6	-5.4	-3.6	0.4	2009
1971	1.9	-0.2	1.2	-0.9	-1.8	-1.4	0.2	1.3	1.7	-3.1	-1.3	0.2	2010
1972	1.3	-0.8	0.6	-1.5	-2.4	-2.0	-0.4	0.7	1.1	-3.7	-1.9	0.4	2015
1973	-0.9	-3.0	-1.6	-3.7	-4.6	-4.2	-2.6	-1.5	-1.1	-5.9	-4.1	0.9	2009
1974	0.3	-1.8	-0.4	-2.5	-3.4	-3.0	-1.4	-0.3	0.1	-4.7	-2.9	0.1	2017
1975	1.8	-0.3	1.1	-1.0	-1.9	-1.5	0.1	1.2	1.6	-3.2	-1.4	0.1	2015
1976	-1.9	-4.0	-2.6	-4.7	-5.6	-5.2	-3.6	-2.5	-2.1	-6.9	-5.1	1.9	2009
1977	0.5	-1.6	-0.2	-2.3	-3.2	-2.8	-1.2	-0.1	0.3	-4.5	-2.7	0.1	2016
1978	-0.1	-2.2	-0.8	-2.9	-3.8	-3.4	-1.8	-0.7	-0.3	-5.1	-3.3	0.1	2009
1979	3.1	1.0	2.4	0.3	-0.6	-0.2	1.4	2.5	2.9	-1.9	-0.1	0.1	2019
1980	-0.3	-2.4	-1.0	-3.1	-4.0	-3.6	-2.0	-0.9	-0.5	-5.3	-3.5	0.3	2009
1981	-0.6	-2.7	-1.3	-3.4	-4.3	-3.9	-2.3	-1.2	-0.8	-5.6	-3.8	0.6	2009
1982	0.5	-1.6	-0.2	-2.3	-3.2	-2.8	-1.2	-0.1	0.3	-4.5	-2.7	0.1	2016
1983	-1.6	-3.7	-2.3	-4.4	-5.3	-4.9	-3.3	-2.2	-1.8	-6.6	-4.8	1.6	2009
1984	-0.4	-2.5	-1.1	-3.2	-4.1	-3.7	-2.1	-1.0	-0.6	-5.4	-3.6	0.4	2009
1985	1.2	-0.9	0.5	-1.6	-2.5	-2.1	-0.5	0.6	1.0	-3.8	-2.0	0.5	2011
1986	-4.3	-6.4	-5.0	-7.1	-8.0	-7.6	-6.0	-4.9	-4.5	-9.3	-7.5	4.3	2009
1987	1.9	-0.2	1.2	-0.9	-1.8	-1.4	0.2	1.3	1.7	-3.1	-1.3	0.2	2010
1988	-4.5	-6.6	-5.2	-7.3	-8.2	-7.8	-6.2	-5.1	-4.7	-9.5	-7.7	4.5	2009
1989	-1.5	-3.6	-2.2	-4.3	-5.2	-4.8	-3.2	-2.1	-1.7	-6.5	-4.7	1.5	2009
1990	0.5	-1.6	-0.2	-2.3	-3.2	-2.8	-1.2	-0.1	0.3	-4.5	-2.7	0.1	2016
1991	0.8	-1.3	0.1	-2.0	-2.9	-2.5	-0.9	0.2	0.6	-4.2	-2.4	0.1	2011
1992	-1.7	-3.8	-2.4	-4.5	-5.4	-5.0	-3.4	-2.3	-1.9	-6.7	-4.9	1.7	2009
1993	1.5	-0.6	0.8	-1.3	-2.2	-1.8	-0.2	0.9	1.3	-3.5	-1.7	0.2	2015
1994	-1.2	-3.3	-1.9	-4.0	-4.9	-4.5	-2.9	-1.8	-1.4	-6.2	-4.4	1.2	2009
1995	-0.2	-2.3	-0.9	-3.0	-3.9	-3.5	-1.9	-0.8	-0.4	-5.2	-3.4	0.2	2009
1996	2.2	0.1	1.5	-0.6	-1.5	-1.1	0.5	1.6	2.0	-2.8	-1.0	0.1	2010
1997	1.2	-0.9	0.5	-1.6	-2.5	-2.1	-0.5	0.6	1.0	-3.8	-2.0	0.5	2015
1998	2.2	0.1	1.5	-0.6	-1.5	-1.1	0.5	1.6	2.0	-2.8	-1.0	0.1	2010
1999	-4.1	-6.2	-4.8	-6.9	-7.8	-7.4	-5.8	-4.7	-4.3	-9.1	-7.3	4.1	2009
2000	-1.1	-3.2	-1.8	-3.9	-4.8	-4.4	-2.8	-1.7	-1.3	-6.1	-4.3	1.1	2009
2001	-1.6	-3.7	-2.3	-4.4	-5.3	-4.9	-3.3	-2.2	-1.8	-6.6	-4.8	1.6	2009
2002	1.0	-1.1	0.3	-1.8	-2.7	-2.3	-0.7	0.4	0.8	-4.0	-2.2	0.3	2011
2003	0.5	-1.6	-0.2	-2.3	-3.2	-2.8	-1.2	-0.1	0.3	-4.5	-2.7	0.1	2016
2004	1.8	-0.3	1.1	-1.0	-1.9	-1.5	0.1	1.2	1.6	-3.2	-1.4	0.1	2015
2005	1.7	-0.4	1.0	-1.1	-2.0	-1.6	0.0	1.1	1.5	-3.3	-1.5	0.0	2015
2006	-0.7	-2.8	-1.4	-3.5	-4.4	-4.0	-2.4	-1.3	-0.9	-5.7	-3.9	0.7	2009
2007	-2.6	-4.7	-3.3	-5.4	-6.3	-5.9	-4.3	-3.2	-2.8	-7.6	-5.8	2.6	2009
2008	0.5	-1.6	-0.2	-2.3	-3.2	-2.8	-1.2	-0.1	0.3	-4.5	-2.7	0.1	2016
2009	0.0	-2.1	-0.7	-2.8	-3.7	-3.3	-1.7	-0.6	-0.2	-5.0	-3.2	0.0	2009
2010	2.1	0.0	1.4	-0.7	-1.6	-1.2	0.4	1.5	1.9	-2.9	-1.1	0.0	2010
2011	0.7	-1.4	0.0	-2.1	-3.0	-2.6	-1.0	0.1	0.5	-4.3	-2.5	0.0	2011
2012	2.8	0.7	2.1	0.0	-0.9	-0.5	1.1	2.2	2.6	-2.2	-0.4	0.0	2012
2013	3.7	1.6	3.0	0.9	0.0	0.4	2.0	3.1	3.5	-1.3	0.5	0.0	2013
2014	3.3	1.2	2.6	0.5	-0.4	0.0	1.6	2.7	3.1	-1.7	0.1	0.0	2014
2015	1.7	-0.4	1.0	-1.1	-2.0	-1.6	0.0	1.1	1.5	-3.3	-1.5	0.0	2015
2016	0.6	-1.5	-0.1	-2.2	-3.1	-2.7	-1.1	0.0	0.4	-4.4	-2.6	0.0	2016
2017	0.2	-1.9	-0.5	-2.6	-3.5	-3.1	-1.5	-0.4	0.0	-4.8	-3.0	0.0	2017
2018	5.0	2.9	4.3	2.2	1.3	1.7	3.3	4.4	4.8	0.0	1.8	0.0	2018
2019	3.2	1.1	2.5	0.4	-0.5	-0.1	1.5	2.6	3.0	-1.8	0.0	0.0	2019