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Predicting avalanche danger in northern Norway using statistical models

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Table S1: List of the Norwegian avalanche warning regions (excluding Svalbard). For type-A regions daily warnings are issued, while for type-B regions warnings are only issued if the danger level exceeds 3. The area is given in km^2. See Fig. S1 for a map of the individual regions.

Region code	Region name	Type	Area
3005	Øst-Finnmark	B	17954
3006	Finnmarkskysten	A	19964
3007	Vest-Finnmark	A	13728
3008	Finnmarksvidda	B	15062
3009	Nord-Troms	A	9392
3010	Lyngen	A	2842
3011	Tromsø	A	6195
3012	Sør-Troms	A	8203
3013	Indre Troms	A	7372
3014	Lofoten og Vesterålen	A	12105
3015	Ofoten	A	7580
3016	Salten	A	10279
3017	Svartisen	A	13718
3018	Helgeland	A	18111
3019	Nord-Trøndelag	B	27304
3020	Sor-Trøndelag	B	21009
3021	Ytre Nordmøre	B	4566
3022	Trollheimen	A	8099
3023	Romsdal	A	6312
3024	Sunnmøre	A	7970
3025	Nord-Gudbrandsdalen	B	6036
3026	Ytre Fjordane	B	6253
3027	Indre Fjordane	A	5716
3028	Jotunheimen	A	6586
3029	Indre Sogn	A	6679
3030	Ytre Sogn	B	2703
3031	Voss	A	7779
3032	Hallingdal	A	4241
3033	Hordalandskysten	B	8161
3034	Hardanger	A	7134
3035	Vest-Telemark	A	8083
3036	Rogalandskysten	B	8526
3037	Heiane	A	8636
3038	Agder sør	B	13343
3039	Telemark sør	B	8600
3040	Vestfold	B	3132
3041	Buskerud sør	B	10535
3042	Oppland sør	B	13078
3043	Hedmark	B	26999
3044	Akershus	B	4989
3045	Oslo	B	474
3046	Østfold	B	4802

Continued on next page

Table S1 continued from previous page

Region code	Region name	Type	Area
	average study region	A	6801
	average type-A regions	A	8988
	average type-B regions	B	10712
	average A & B	A & B	9850

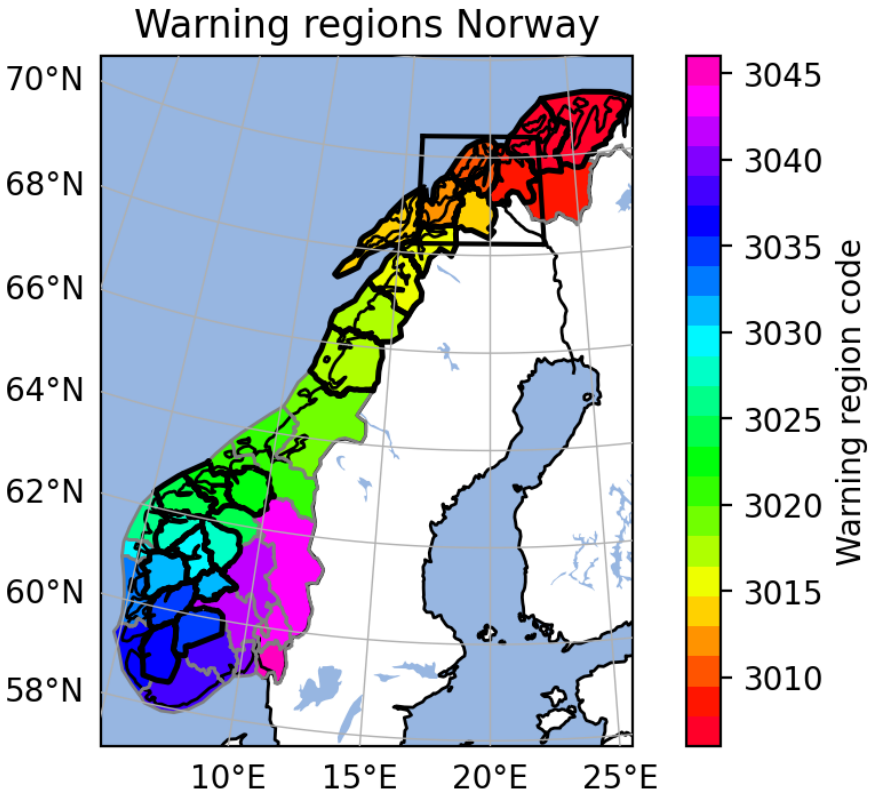

Figure S1. Map of the Norwegian avalanche warning regions. The regions encapsulated with thick black lines correspond to type A (warnings are issued daily) and those with gray lines correspond to type B (warnings only issued when the danger level exceeds 3). The black rectangle indicates our study region in northern Norway. The colour corresponds to the region code (see Table S1).

Table S2. As Table 3 but for the balanced test data.

ADL	Prec.	Rec.	F1	Support
1	0.74	0.49	0.59	917
2	0.44	0.63	0.52	917
3	0.42	0.60	0.50	917
4	0.88	0.42	0.57	917
Acc.			0.54	3668
Macro avg	0.62	0.54	0.54	3668
Weighted avg	0.62	0.54	0.54	3668

Table S3. As Table 5 but for the balanced test data.

	Prec.	Rec.	F1	Support
non-AvD	0.74	0.82	0.78	1227
AvD	0.80	0.72	0.76	1227
Acc.			0.77	2454
Macro avg	0.77	0.77	0.77	2454
Weighted avg	0.77	0.77	0.77	2454

Table S4. Slope, Pearson correlation R, and p value (Wald test with a t distribution) of linear regressions from the avalanche-day frequency (ADF) hindcast with the random forest model from 1970 to 2024 for all regions (see Figs. 7 and S6).

	Full	Winter	Spring
Nord-Troms			
Slope	-0.02 $\pm$ 0.11	-0.14 $\pm$ 0.09	0.12 $\pm$ 0.08
R	-0.03	-0.20	0.20
p	0.85	0.14	0.16
Lyngen			
Slope	-0.01 $\pm$ 0.12	-0.19 $\pm$ 0.10	0.18 $\pm$ 0.08
R	-0.01	-0.27	0.29
p	0.95	0.05	0.03
Tromsø			
Slope	-0.11 $\pm$ 0.11	-0.24 $\pm$ 0.09	0.13 $\pm$ 0.08
R	-0.14	-0.35	0.24
p	0.32	0.01	0.09
Sør-Troms			
Slope	-0.10 $\pm$ 0.12	-0.21 $\pm$ 0.10	0.11 $\pm$ 0.08
R	-0.12	-0.29	0.20
p	0.39	0.04	0.16
Indre Troms			
Slope	0.10 $\pm$ 0.12	-0.06 $\pm$ 0.10	0.17 $\pm$ 0.07
R	0.12	-0.09	0.30
p	0.37	0.51	0.03

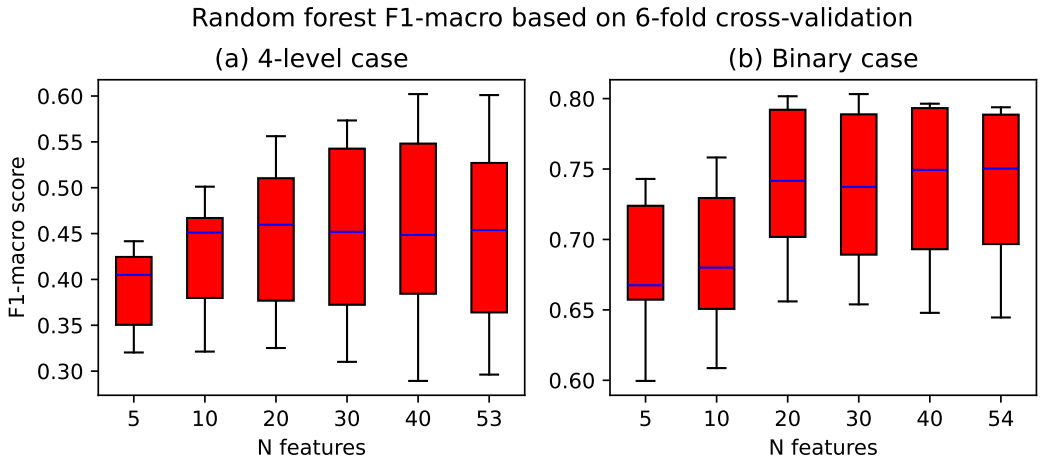

Figure S2. As Fig. 4, but with 6-fold cross-validation.

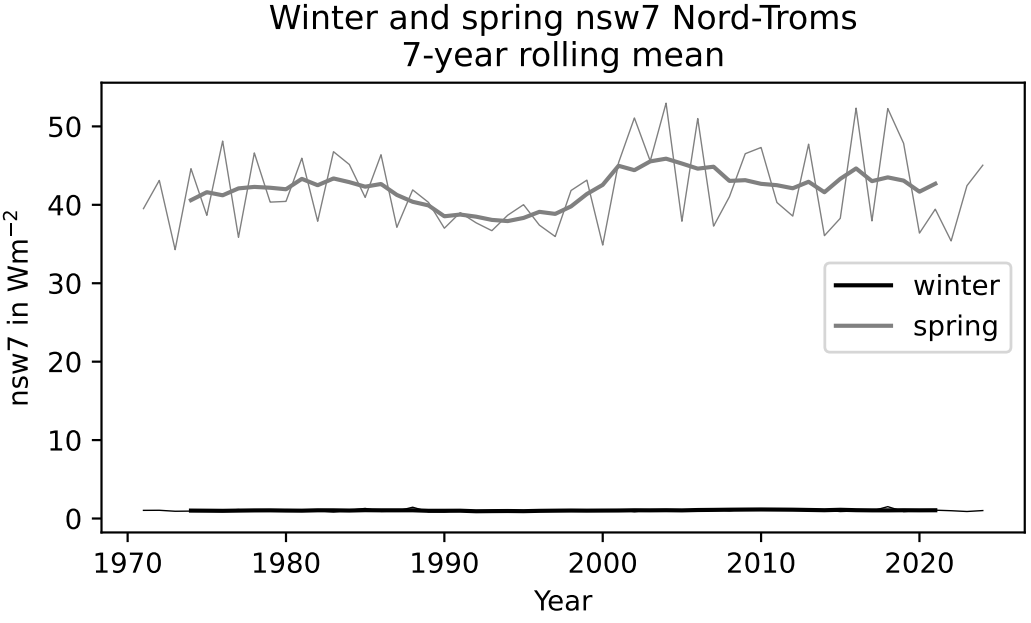

Figure S3. Winter and spring nsw7 in Nord-Troms on (a) an annual basis and (b) for 7-year rolling means.

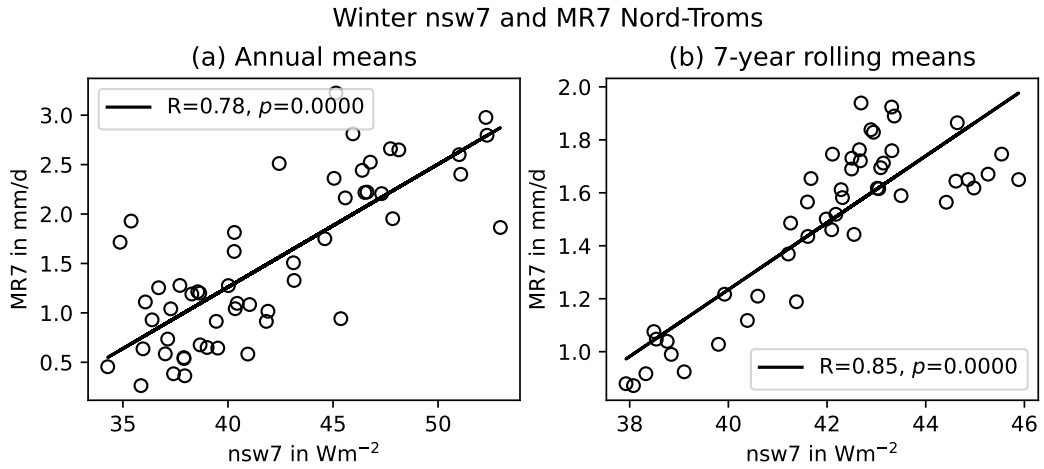

Figure S4. Correlation of spring nsw7 and MR7 in Nord-Troms.

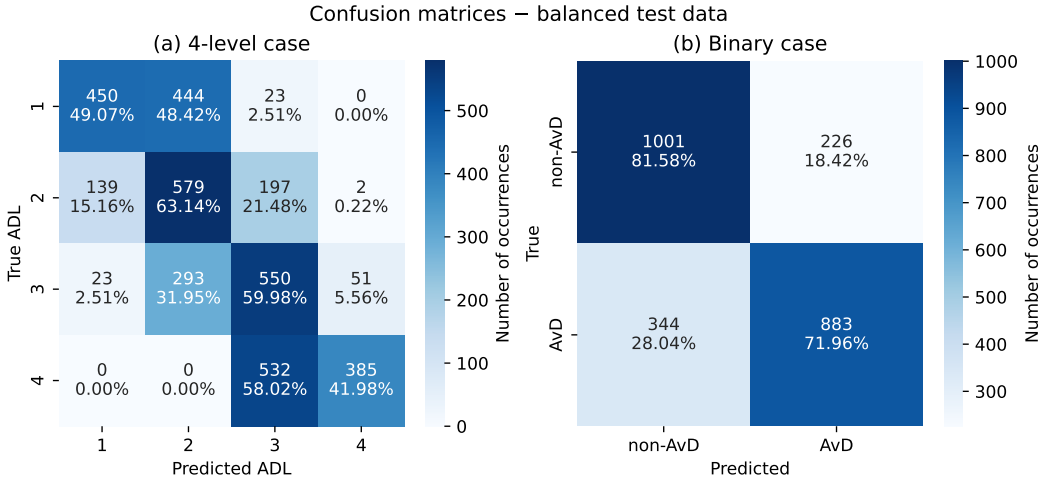

Figure S5. As Fig. 5, but for the balanced test data.

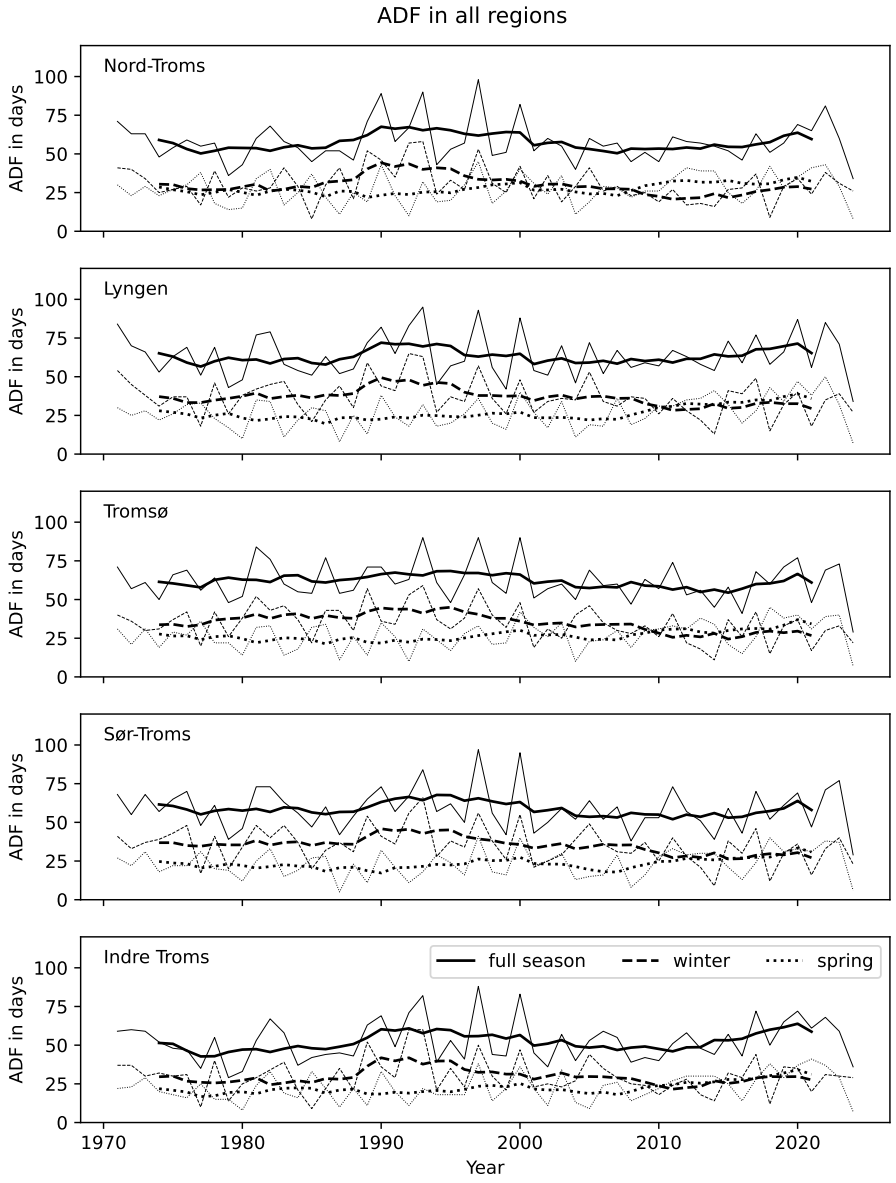

Figure S6. As Fig. 7, but for all warning regions.

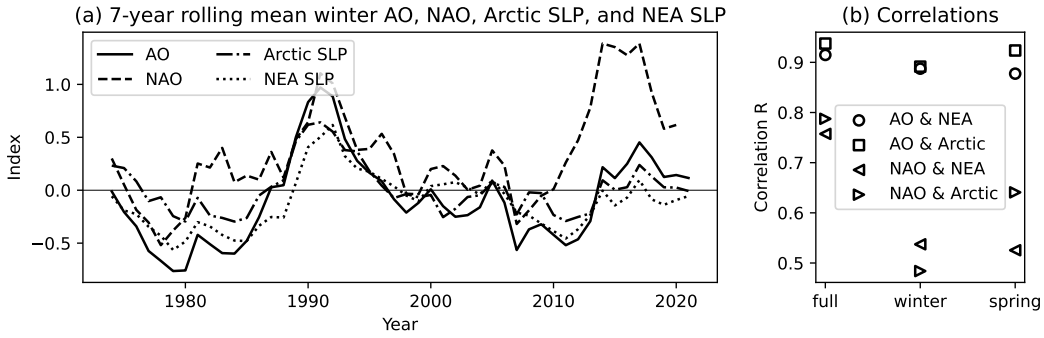

Figure S7. (a) Time series and (b) correlations of Arctic Oscillation (AO) and North Atlantic Oscillation (NAO) with Arctic ($>$ 75 °N) and north-east Atlantic (NEA; 70-80 °N, 10-20 °E) sea-level pressure (SLP). The values correspond to 7-year rolling means. The SLP data are taken from the ERA5 reanalysis. Note that all correlations exhibit p values < 0.01 based on a Wald test with a t distribution.

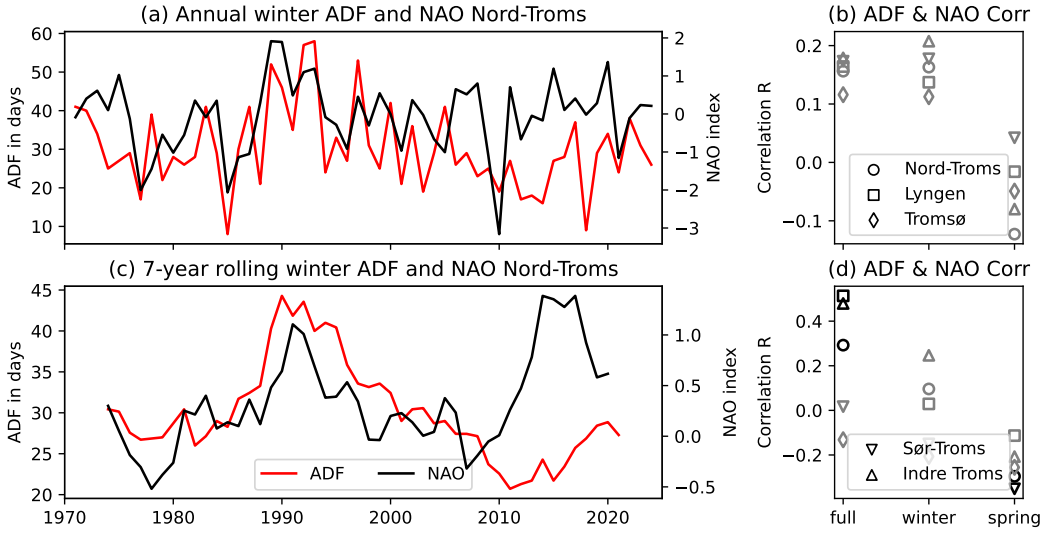

Figure S8. As Fig. 8, but for the North Atlantic Oscillation (NAO) instead of the Arctic Oscillation (AO).

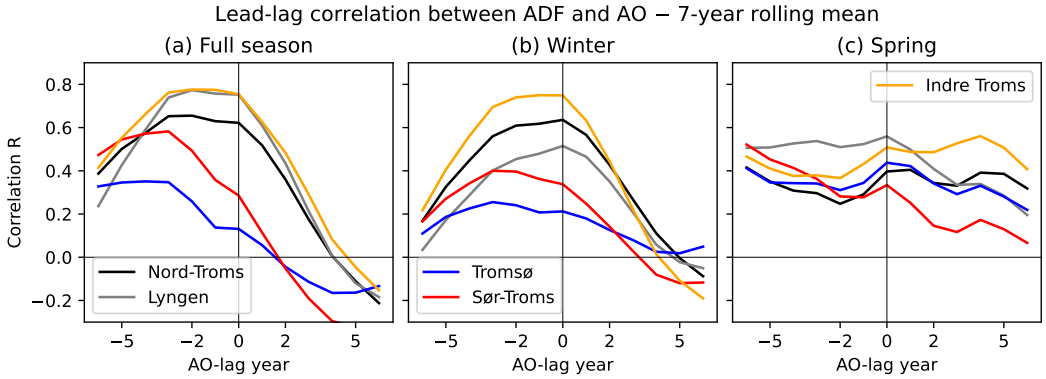

Figure S9. Lead-lag correlations between Arctic Oscillation (AO) and avalanche-day frequency (ADF) for (a) full season, (b) winter, and (c) spring for 7-year rolling means.

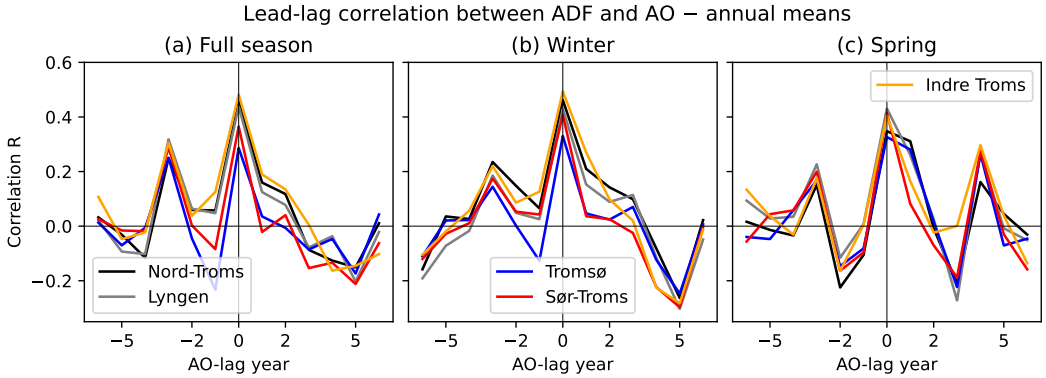

Figure S10. As Fig. S9, but for annual means.

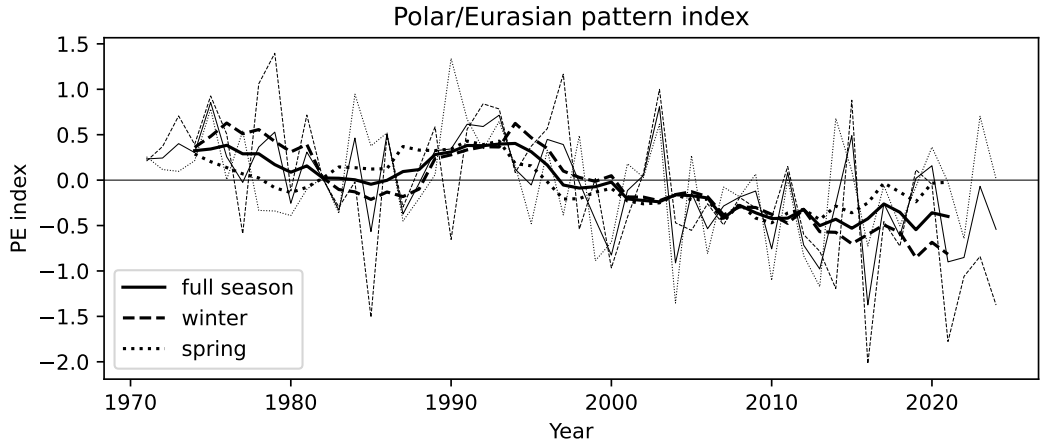

Figure S11. Polar/Eurasian pattern index for full season (continuous), winter (dashed), and spring (dotted). Shown are annual means (thin) and 7-year rolling means (thick). The index was downloaded from https://www.cpc.ncep.noaa.gov/data/teledoc/poleur.shtml.

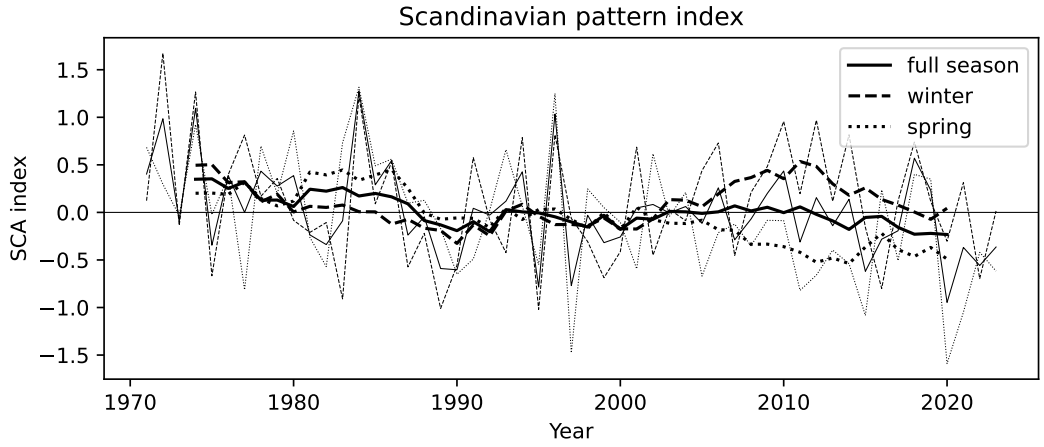

Figure S12. Scandinavian pattern index for full season (continuous), winter (dashed), and spring (dotted). Shown are annual means (thin) and 7-year rolling means (thick). The index was downloaded from https://psl.noaa.gov/data/timeseries/month/SCAND/.