Biogeosciences

Supplement of

Above-treeline ecosystems facing drought: lessons from the 2022 European summer heat wave

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Supplement tables and figures

Supplement Table S1: Breakdown of MODIS pixels and ERA5-land cells per bioclimate cluster with indication of land cover (from 100m-resolution Copernicus Global Land Cover) and long-term average MODIS-derived NDVImax value for the 2000-2022 period.

|		Number of MODIS pixels	Number of ERA5 cells	Land cover (CGLS_LC)		Mean NDVImax (2000-2022)		
				Herbaceous vegetation	Sparse vegetation	[0.15-0.35[	[0.35-0.55[	[0.55-0.75[
Bioclimate cluster	1	36205 (41.8%)	143	31491 (87%)	4714 (13%)	7495 (20.7%)	13583 (37.5%)	15127 (41.8%)
	2	42471 (35%)	163	33261 (78.3%)	9210 (21.7%)	11370 (26.8%)	16236 (38.2%)	14865 (35%)
	3	23264 (80.7%)	117	22431 (96.4%)	833 (3.6%)	419 (1.8%)	4082 (17.5%)	18763 (80.7%)
	4	40897 (61.1%)	203	36900 (90.2%)	3997 (9.8%)	3493 (8.5%)	12436 (30.4%)	24968 (61.1%)
	5	55179 (33.3%)	226	42820 (77.6%)	12359 (22.4%)	15804 (28.6%)	20988 (38%)	18387 (33.3%)
	6	29302 (72%)	201	27215 (92.9%)	2087 (7.1%)	1340 (4.6%)	6875 (23.5%)	21087 (72%)
	Total	227318	1053	194118 (85.4%)	33200 (14.6%)	39921 (17.6%)	74200 (32.6%)	113197 (49.8%)

5

Supplement Table S2. Estimates, confidence intervals (*CI*) and significance (*p*) of the fixed effects of the selected linear mixed-effect model. Note that because of missing data, the number of ERA5 cells is slighlty lower than the one reported in Supp. Table 1.

|	**NDVImax**		
Predictors	*Estimates*	*CI*	*p*
(Intercept)	-0.03	-0.04 – -0.02	**<0.001**
MSE	0.12	0.06 – 0.17	**<0.001**
WBA	0.2	0.14 – 0.26	**<0.001**
T2M	0.15	0.09 – 0.21	**<0.001**
WBA * T2M	-0.02	-0.03 – -0.01	**0.001**
$N_{era5.cell}$	1041		
N_{CLUST}	6		
Observations	23943		

10

15 **Supplement Table S3. Performance and estimates of the linear mixed-effect model for different NDVI curve fitting methods. The comparison was made for the retained model structure as shown in Table 1. The line in bold refers to the method used for the main figures. All fixed effects were significant, irrespective of the curve fitting method. See Material and methods for details.**

Type of smoother	Parameter (frame for SG, lambda for WH)	Number of iterations	Marginal variance (%)	Conditional variance (%)	Predictors			
					MSE	WBA	T2M	WBA * T2M
Savitzky-Golay (SG)	7	3	9.3	14.1	0.13	0.20	0.15	-0.01
	7	**5**	**9.1**	**14.7**	**0.12**	**0.20**	**0.15**	**-0.02**
	14	3	8.8	13.9	0.13	0.19	0.15	-0.01
	14	5	8.6	14.3	0.11	0.19	0.15	-0.02
Whittaker (WH)	5	3	8.7	13.2	0.12	0.17	0.13	-0.01
	5	5	8.6	13.1	0.11	0.17	0.13	-0.01
	10	3	9.0	13.4	0.12	0.18	0.14	-0.01
	10	5	8.7	13.4	0.11	0.18	0.14	-0.02

20
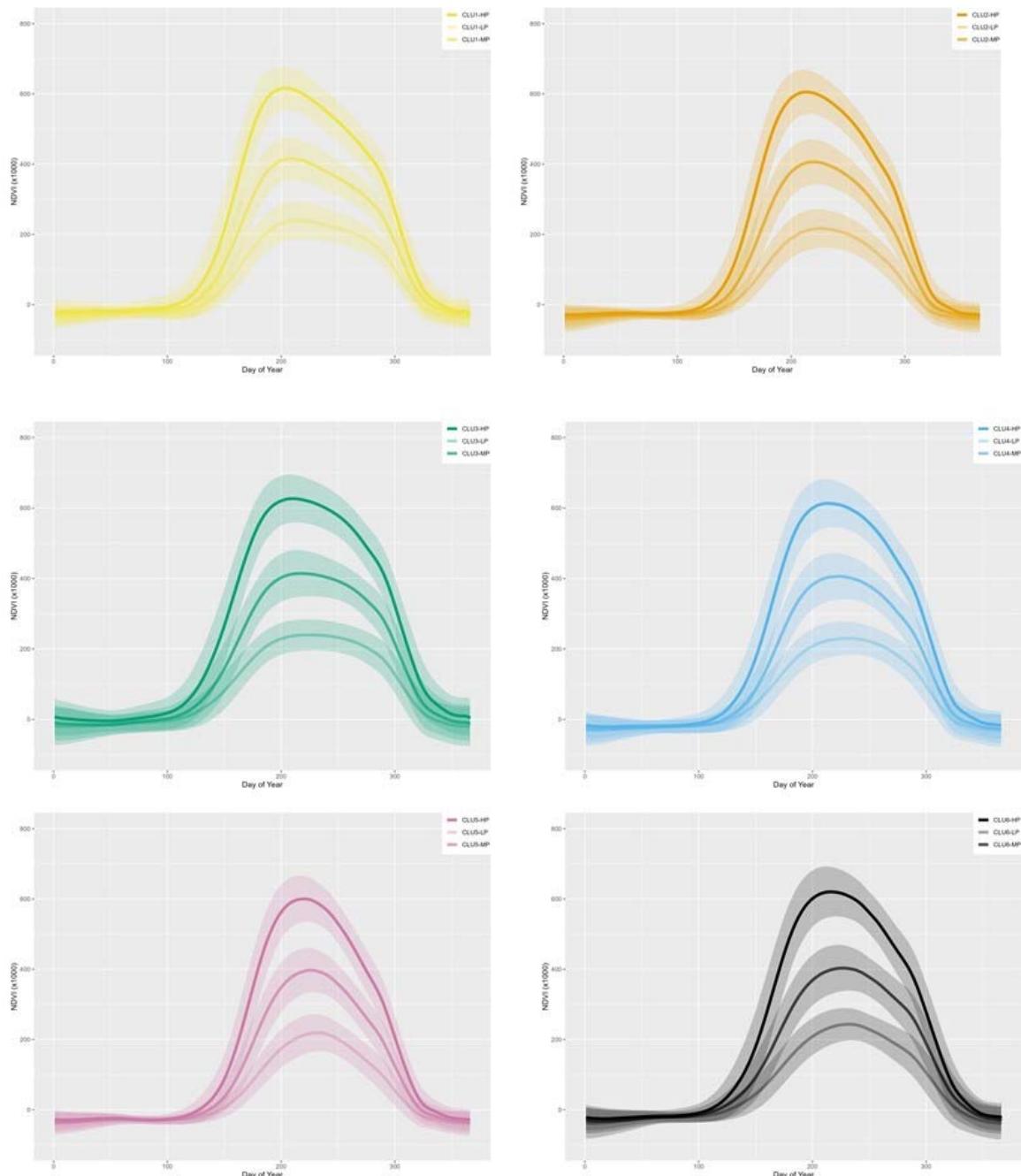
Supplement Figure S1: Mean and standard deviation of the average yearly time course of NDVI for the selected pixels. To ease reading, data are shown for the six bioclimate clusters and for three ranges of long-term average NDVImax. LP: 0.15-0.35; MP: 0.35-0.55; HP: 0.55-0.75. Color legends of clusters are in Figure 1.
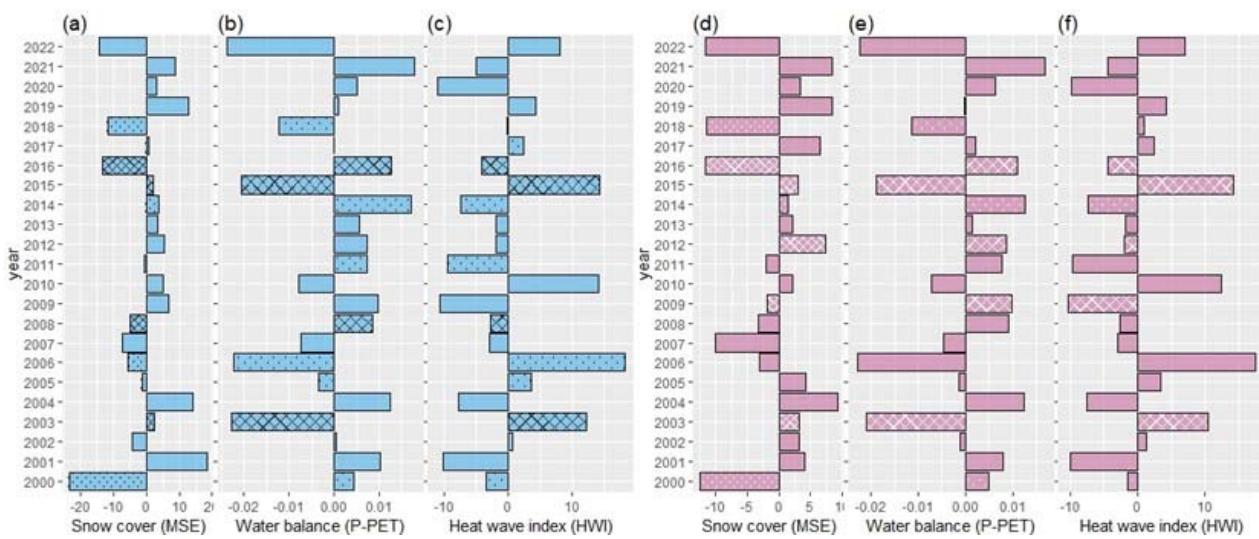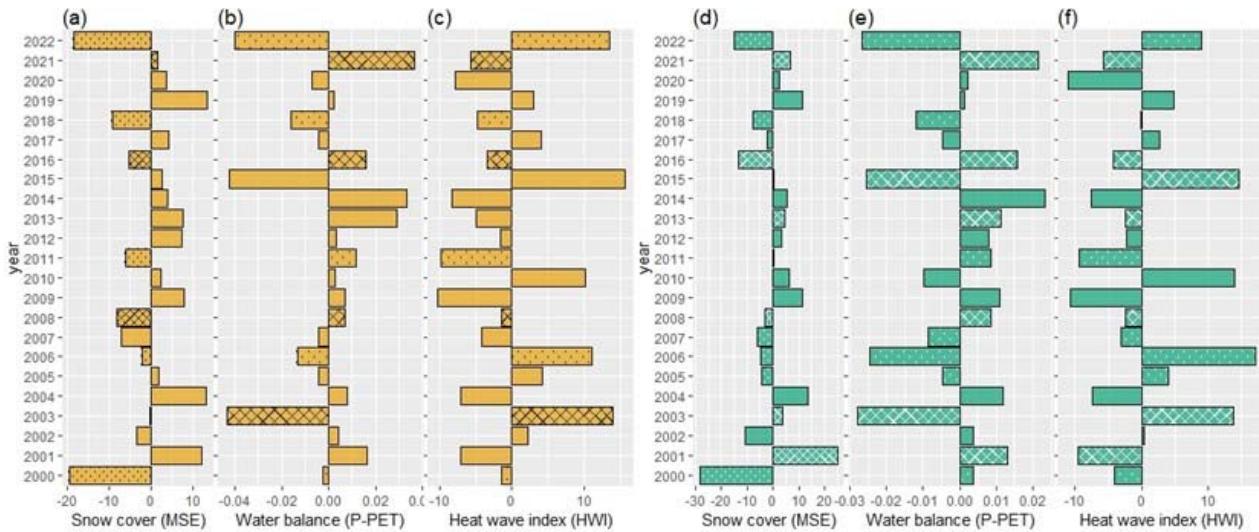
Supplement Figure S2: Anomalies of snow cover duration and early summer meteorological variables for clusters 2,3,4 and 5. Crosshatched (dotted) bars indicate significant positive (negative) NDVImax anomalies. Color legends of clusters are in Figure 1.