Supplement

Why has catchment evaporation increased in the past 40 years? A data-based study in Austria

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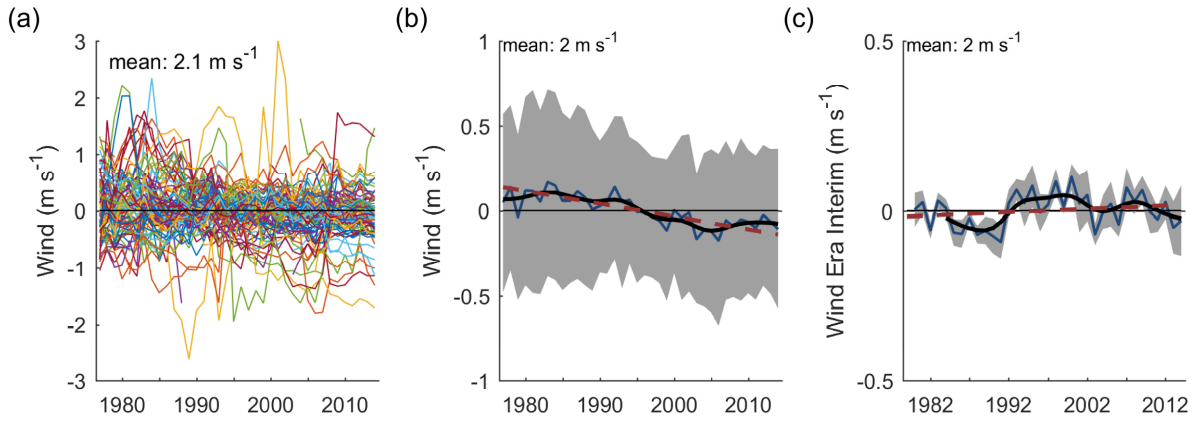
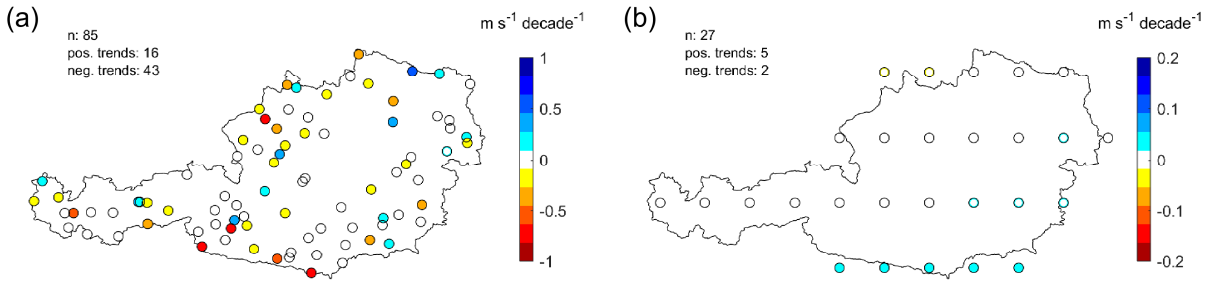
Wind data

Wind data were regarded as not representative with respect to trends. The reasons for this are: i) annual anomalies of wind speed data from 85 stations in Austria appear unrelated to each other (Supplementary Figure S 1a) and temporal trends over 1977–2014 do not show any spatial pattern (Supplementary Figure S 2a); ii) averaged anomalies of annual wind speeds from station data and ERA Interim data (Dee et al., 2011) show for most part of the series opposing patterns (Supplementary Figure S 2); and iii) wind data are known to be prone to inhomogeneities (Böhm, 2008). We therefore used uniform monthly wind speeds averaged over all years and over all stations in Austria.



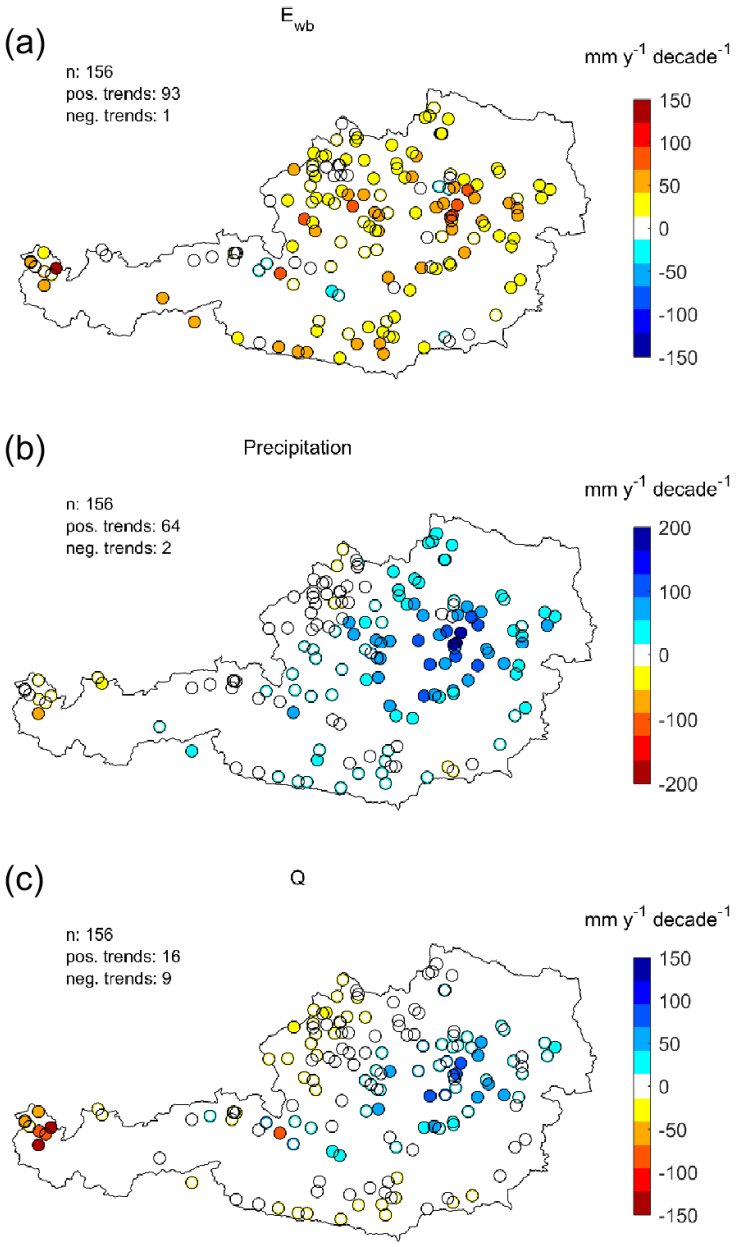
Supplementary Figure S 1 Anomalies of wind speeds (a, b) from station data (85 stations) over 1977–2014 (c) from ERA Interim data over Austria (27 grid points) over 1980–2014. (a) Each line refers to one station. (b, c) The thin blue line shows the mean over all catchments, the grey shaded area the variability between catchments (± 1 standard deviation), the bold black line the smoothed mean, and the red dashed line a trend line.



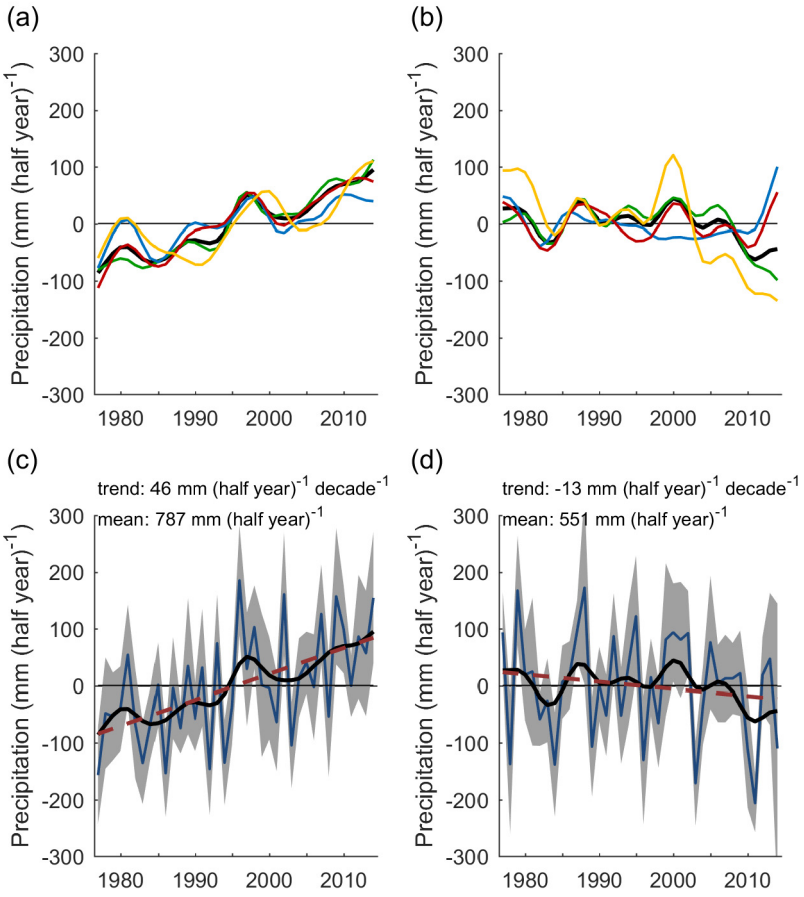
Supplementary Figure S 2: Spatial pattern of trends in wind speed (a) from 85 stations over 1977–2014 (b) from ERA Interim data over Austria over 1980–2014. Filled circles indicate significant trends at $p \leq 0.05$.

Supplementary Table S 1 Trends in summer (May-Oct) pan evaporation of individual stations for three periods. The table includes the mean, standard deviation (Std), and coefficient of variation (CV) of summer pan evaporation over the available period. Stars indicate trend significance: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$

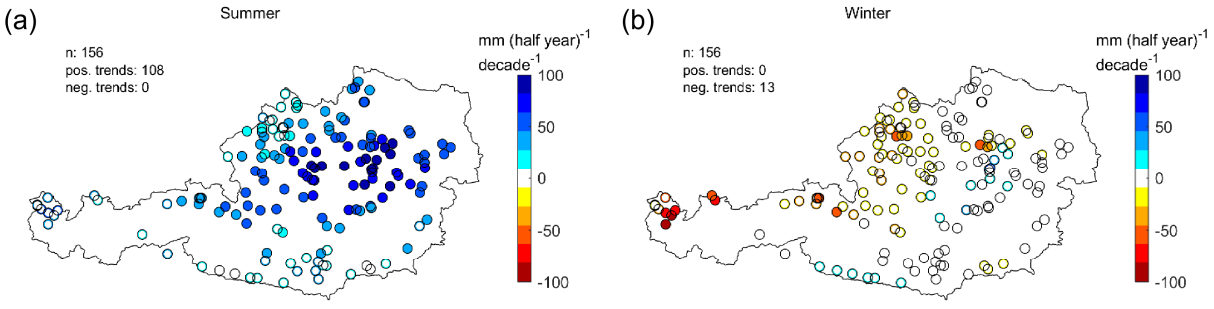
Name	Source	Elev. (m)	East (°)	North (°)	Mean (mm)	Std (mm)	CV (-)	Year start	Year end	Missing data	Trend (% decade^{-1})		
											1979-2005	1983-2015	1993-2015
Elmen-Martinau	HZB Tirol	954	10.54	47.36	348	43	0.12	1982	2014	1983	-0.5	-1	3.1
Leutasch-Kirchplatzl	HZB Tirol	1135	11.14	47.37	373	41	0.11	1982	2014	2007	0.6	5.9**	12.2***
Ladis-Neuegg	HZB Tirol	1350	10.65	47.10	400	39	0.10	1982	2014		5.7	2.6	-4.4
St.Johann	HZB Tirol	667	12.44	47.52	336	51	0.15	1982	2014		12.0***	13.1***	13.5***
Aschau	HZB Tirol	1005	12.31	47.38	290	34	0.12	1982	2014		0.2	-2.6	-3.1*
Stetten	HZB Tirol	179	16.38	48.37	369	63	0.17	1992	2014		-	-	9.3
Franzensdorf	HZB Tirol	152	16.64	48.19	382	52	0.14	1992	2014	2010,2011	-	-	-2.9
Hochberg	HZB Tirol	1672	12.36	46.82	373	44	0.12	1983	2014	2008	13.8***	6.2***	3.4
Prägraten	HZB Tirol	1340	12.38	47.02	346	37	0.11	1983	2014		10.8***	4.4*	-1.2
Matrei	HZB Tirol	1040	12.54	47.00	317	48	0.15	1983	2013	2010	-	12.2***	10.1***
Waidring	HZB NÖ	775	12.55	47.59	303	50	0.17	1993	2014	2011	-	-	14.3**
Lunz	HZB NÖ	611	15.07	47.86	292	48	0.17	1992	2014	2010,2013	-	-	-2.1
Frankenfels	HZB NÖ	468	15.33	47.98	293	61	0.21	1993	2014	2007	-	-	22.5***
Ottenstein	HZB NÖ	554	15.34	48.58	336	35	0.10	1994	2014		-	-	5.9
Pyhra	HZB NÖ	298	15.70	48.15	404	44	0.11	1993	2014	2000,2001	-	-	4.4
Hollenthon	HZB NÖ	685	16.26	47.59	369	53	0.14	1993	2014		-	-	6.5
Retz	ZAMG	242	15.95	48.77	424	63	0.15	1975	2005	1987,1995,1996,1997,1998	6.9	-	-
Schwarzenau	ZAMG	500	15.27	48.75	337	38	0.11	1975	2001	1985,1995,1997,1998,1999	-	-	-
Hörsching	ZAMG	298	14.19	48.24	442	60	0.14	1978	2005	1995,1998,2004	5.2	-	-
Wien	ZAMG	163	16.40	48.25	470	73	0.16	1979	2005	1994,1995,1997,1998	12.6***	-	-
Innsbruck Flugh.	ZAMG	579	11.36	47.26	459	64	0.14	1976	2005	1995,1998,2002	6.4	-	-
Vandans	ZAMG	670	9.86	47.09	317	47	0.15	1979	2005	1983,1995,1998,1999,2000	6.8	-	-
Zeltweg	ZAMG	669	14.78	47.20	389	63	0.16	1978	2004	1981,1982,1984,1995,1998	-	-	-
Klagenfurt	ZAMG	447	14.33	46.65	454	81	0.18	1976	2005	1978,1991,1995,1996,1998,2000	13.8**	-	-



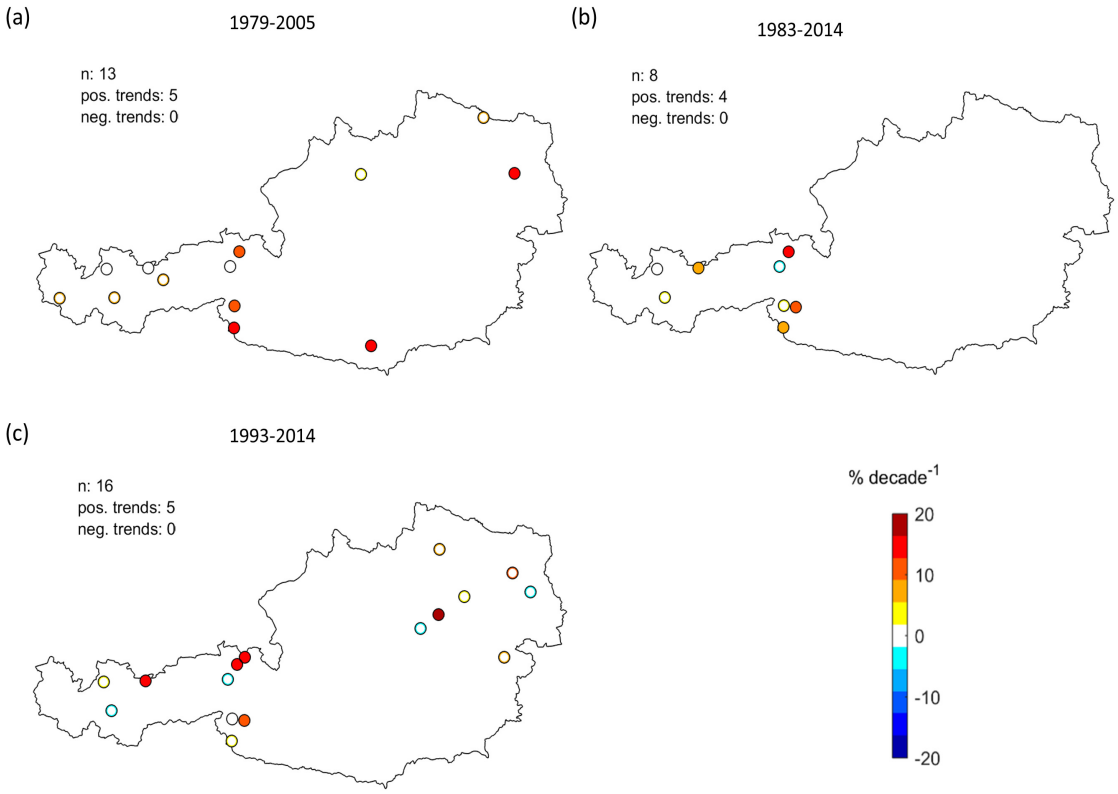
Supplementary Figure S 3 Spatial pattern of trends in (a) E_{wb}, (b) precipitation and (c) discharge over 1977–2014. Each circle indicates the outlet of one catchment. Filled circles indicate significant trends at $p \leq 0.05$.



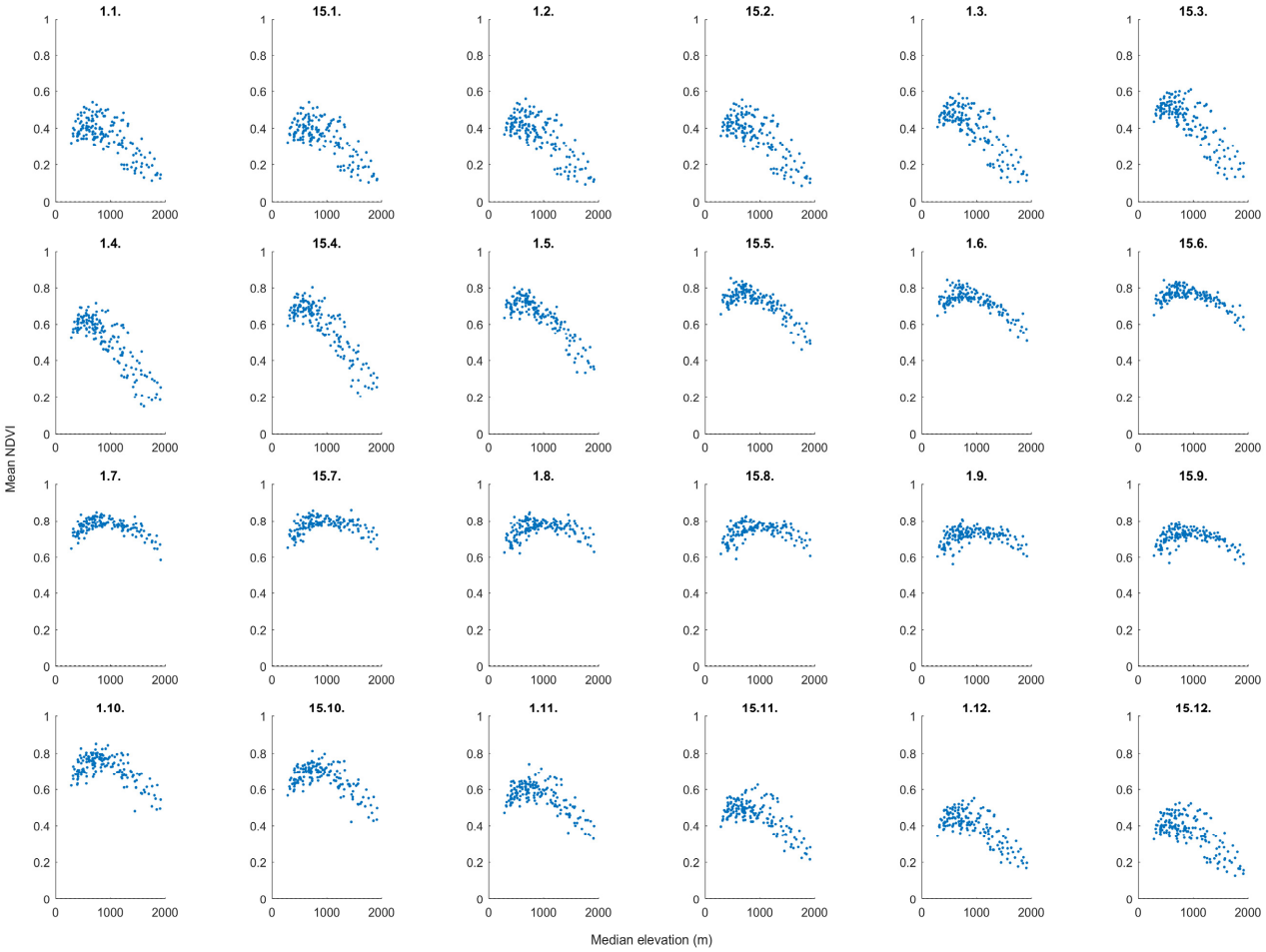
Supplementary Figure S 4 Anomalies of (a, c) summer precipitation (May–Oct), (b, d) winter precipitation (Nov–Apr) over 1977–2014. (a)–(b) mean anomalies by region. Data smoothed using a Gaussian filter with a standard deviation of 2 years. (c)–(d) mean anomalies over all catchments. The thin blue line shows the mean over all catchments, the grey shaded area the variability between catchments (± 1 standard deviation), the bold black line the smoothed mean, and the red dashed line the trend.



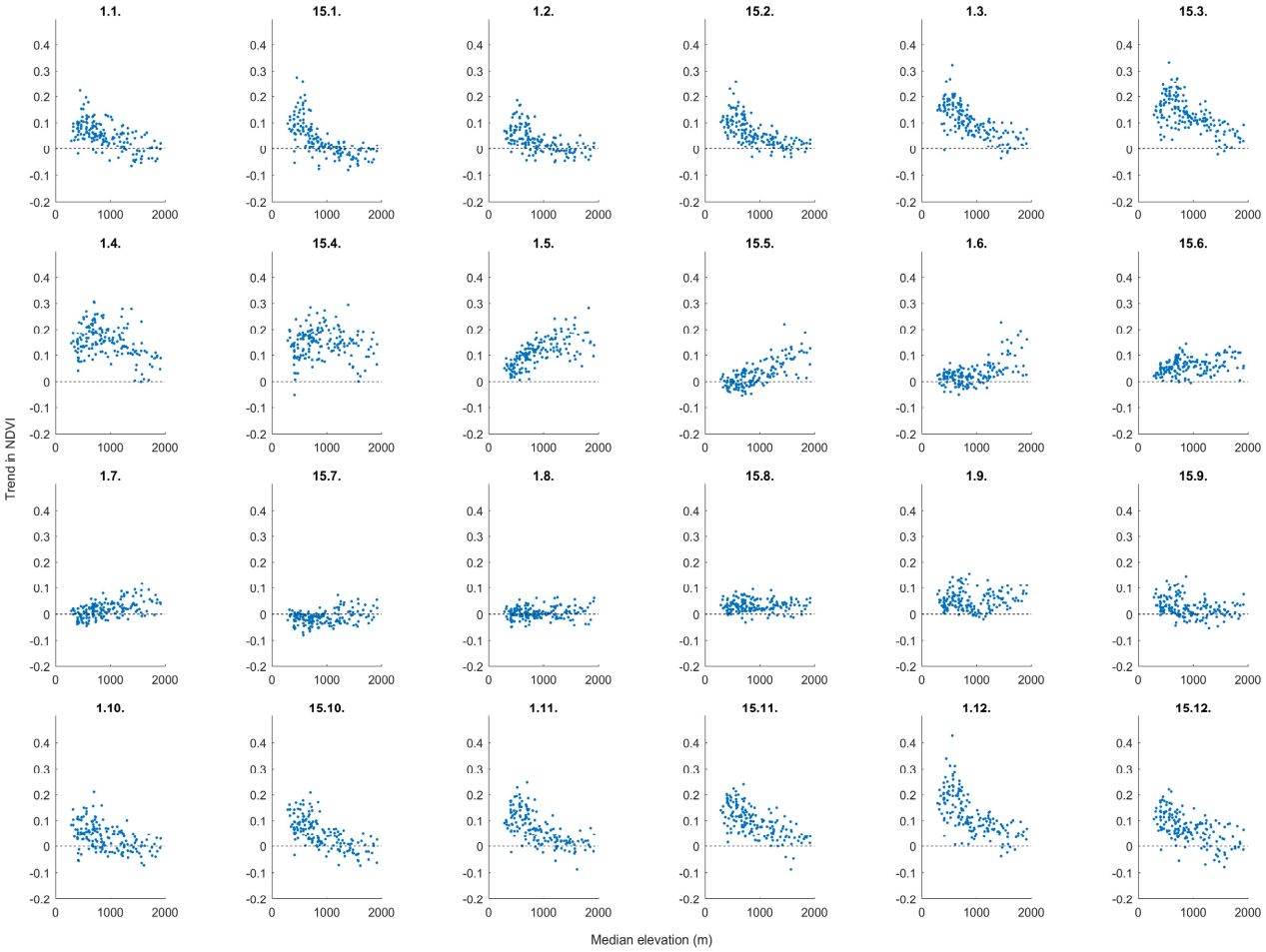
Supplementary Figure S 5 Spatial pattern of trends in (a) summer precipitation (May–Oct), and (b) winter precipitation (Nov–Apr) over 1977–2014. Each circle indicates the outlet of one catchment. Filled circles indicate significant trends at $p \leq 0.05$.



Supplementary Figure S 6 Trends in summer pan evaporation over three different periods. Filled circles indicate significant trends at $p \leq 0.05$.



Supplementary Figure S 7 Scatterplots of catchment average NDVI (*y*-axis) versus median catchment elevation (*x*-axis) over the course of the year (different plots).



Supplementary Figure S 8 Scatterplots of catchment average NDVI trend over 1982–2014 (*y*-axis) versus median catchment elevation (*x*-axis) over the course of the year (different plots).

References

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