Supplement of Hydrol. Earth Syst. Sci., 19, 1169–1180, 2015
http://www.hydrol-earth-syst-sci.net/19/1169/2015/
doi:10.5194/hess-19-1169-2015-supplement

Hydrology and Earth System Sciences
Open Access

Supplement of

Technical Note: Higher-order statistical moments and a procedure that detects potentially anomalous years as two alternative methods describing alterations in continuous environmental data

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Table S1 Skewness in probability distributions of daily minimum stream temperature by season and decade at unregulated (sites 1-5) and regulated (sites 6-10) streams.

	season/time period											
site ID	**fall**			**winter**			**Spring**			**summer**		
	80-89	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**
site 1	0.335	-0.225	-0.066	-0.543	-0.662	-0.631	0.865	0.747	0.789	-0.221	-0.142	-0.486
site 2	-0.170	-0.225	-0.115	-0.345	-0.538	-0.574	0.823	0.664	0.772	-0.522	-0.220	-0.764
site 3	0.064	-0.025	-0.142	0.152	0.103	-0.805	0.450	0.549	1.010	0.048	-0.204	-0.630
site 4	-0.355	-0.210	-0.185	0.210	0.138	-0.244	1.059	0.831	1.371	-0.859	-0.604	-0.999
site 5	0.109	-0.060	0.003	-0.074	-0.462	-0.206	0.716	1.044	0.963	-0.922	-0.743	-0.821
site 6	-0.300	0.067	-0.283	0.456	-0.005	-0.034	0.647	0.216	0.195	-0.422	0.153	0.744
site 7	0.031	-0.263	-0.177	-0.353	-0.581	-0.340	0.902	0.763	0.771	-0.421	-0.160	-0.606
site 8	-0.836	-0.529	-0.416	0.002	-0.363	-0.143	0.621	0.340	0.633	-0.361	-0.395	-1.335
site 9	0.853	0.877	0.711	0.781	0.562	0.397	0.444	0.277	0.017	0.414	0.329	0.519
site 10	-0.163	-0.137	-0.103	0.187	0.755	-0.118	0.134	0.138	0.200	-1.161	-0.835	-0.229

Table S2 Skewness in probability distributions of daily mean stream temperature by season and decade at unregulated (sites 1-5) and regulated (sites 6-10) streams.

	season/time period											
site ID	**fall**			**winter**			**Spring**			**summer**		
	80-89	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**
site 1	0.364	-0.192	-0.022	-0.466	-0.579	-0.493	1.026	0.827	0.821	-0.292	-0.191	-0.533
site 2	-0.122	-0.182	-0.108	-0.322	-0.572	-0.557	0.902	0.711	0.713	-0.501	-0.192	-0.732
site 3	-0.001	-0.034	-0.156	0.214	0.072	-0.561	0.449	0.506	1.002	-0.079	-0.259	-0.674
site 4	-0.303	-0.218	-0.155	0.217	0.166	-0.060	1.000	0.778	1.335	-0.874	-0.562	-1.015
site 5	0.124	-0.005	0.084	-0.227	-0.607	-0.351	0.641	1.016	0.882	-1.056	-0.640	-0.934
site 6	-0.199	0.099	-0.252	0.484	0.187	-0.058	0.594	0.229	0.306	-0.468	0.218	0.777
site 7	0.027	-0.265	-0.180	-0.322	-0.622	-0.316	0.980	0.777	0.755	-0.518	-0.286	-0.674
site 8	-0.730	-0.465	-0.389	0.107	-0.286	-0.031	0.702	0.420	0.617	-0.402	-0.432	-1.251
site 9	0.806	0.906	0.626	0.795	0.675	0.416	0.418	0.302	0.024	0.394	0.299	0.437
site 10	-0.182	-0.145	-0.061	-0.012	0.609	-0.128	0.120	0.246	0.202	-1.280	-1.023	-0.872

Table S3 Skewness in probability distributions of daily maximum stream temperature by season and decade at unregulated (sites 1-5) and regulated (sites 6-10) streams.

	season/time period											
site ID	**fall**			**winter**			**Spring**			**summer**		
	80-89	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**
site 1	0.382	-0.161	0.018	-0.396	-0.503	-0.369	1.132	0.889	0.857	-0.374	-0.264	-0.576
site 2	-0.066	-0.154	-0.101	-0.335	-0.608	-0.551	0.945	0.741	0.652	-0.477	-0.185	-0.705
site 3	-0.064	0.010	-0.159	0.265	0.082	-0.339	0.509	0.487	0.899	-0.178	-0.332	-0.766
site 4	-0.292	-0.226	-0.162	0.231	0.195	0.145	0.946	0.725	1.208	-0.840	-0.464	-0.874
site 5	0.147	0.069	0.194	-0.355	-0.697	-0.521	0.569	0.893	0.762	-0.960	-0.398	-0.828
site 6	-0.111	0.134	-0.191	0.461	0.300	-0.049	0.545	0.245	0.397	-0.448	0.291	0.794
site 7	0.032	-0.263	-0.185	-0.300	-0.681	-0.317	1.029	0.787	0.756	-0.550	-0.435	-0.775
site 8	-0.581	-0.380	-0.324	0.213	-0.205	0.077	0.772	0.507	0.618	-0.398	-0.459	-1.025
site 9	0.796	0.972	0.552	0.671	0.747	0.363	0.402	0.333	0.042	0.319	0.231	0.264
site 10	-0.147	-0.070	0.005	-0.111	0.477	-0.063	0.109	0.349	0.219	-0.821	-0.723	-0.551

Table S4 Type of excess kurtosis of probability distributions of daily minimum stream temperature by season and decade at unregulated (sites 1-5) and regulated (sites 6-10) streams.

	season/time period											
site ID	**fall**			**winter**			**spring**			**summer**		
	80-89	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**
site 1	-0.187	-0.268	-0.571	0.768	0.715	0.906	1.193	0.053	0.168	-0.396	-0.428	-0.021
site 2	0.220	-0.240	-0.592	0.119	-0.135	0.671	1.104	0.016	0.208	-0.347	-0.587	0.706
site 3	-0.770	-0.877	-0.806	-0.289	-0.093	1.223	-0.104	-0.269	0.893	-0.598	-0.479	-0.290
site 4	-0.366	-0.480	-0.667	-0.332	0.039	0.065	1.171	0.414	2.004	0.409	-0.046	0.953
site 5	-0.785	-0.983	-0.981	-0.513	-0.038	-0.398	0.172	0.737	0.702	1.288	0.200	0.910
site 6	-0.683	-0.792	-0.790	0.076	0.178	-0.168	0.453	-0.491	-0.052	-0.302	-0.687	0.664
site 7	-0.528	-0.466	-0.639	-0.219	-0.155	0.137	1.275	0.434	0.322	0.056	-0.192	-0.026
site 8	0.960	-0.178	-0.612	0.670	0.314	0.800	-0.140	-0.691	-0.375	0.342	0.660	4.217
site 9	0.037	-0.178	-0.852	0.613	0.314	0.215	-0.955	-0.993	-0.867	-0.896	-0.863	-0.125
site 10	-1.079	-1.066	-1.166	-0.513	2.350	-0.074	-1.052	-0.996	-0.940	2.440	0.958	0.570

Table S5 Type of excess kurtosis of probability distributions of daily mean stream temperature by season and decade at unregulated (sites 1-5) and regulated (sites 6-10) streams.

	season/time period											
site ID	**fall**			**winter**			**spring**			**summer**		
	80-89	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**
site 1	-0.177	-0.340	-0.551	0.886	0.704	0.770	1.672	0.228	0.188	-0.284	-0.374	0.062
site 2	0.159	-0.301	-0.580	0.194	0.003	0.752	1.291	0.109	0.114	-0.250	-0.509	0.694
site 3	-0.759	-0.872	-0.744	-0.286	-0.006	1.026	-0.091	-0.419	0.582	-0.557	-0.529	-0.114
site 4	-0.370	-0.469	-0.720	-0.427	0.113	0.016	1.054	0.160	1.504	0.586	-0.059	1.251
site 5	-0.893	-1.133	-1.072	-0.319	0.315	-0.116	-0.151	0.750	0.445	1.536	-0.040	0.976
site 6	-0.774	-0.816	-0.828	0.084	-0.047	-0.203	0.214	-0.485	-0.107	-0.336	-0.717	0.704
site 7	-0.544	-0.457	-0.612	-0.095	0.042	0.243	1.463	0.374	0.320	0.239	-0.068	0.195
site 8	0.692	-0.320	-0.639	0.788	0.369	0.860	0.047	-0.591	-0.357	0.227	0.500	3.718
site 9	-0.069	-0.210	-1.000	0.598	0.297	0.403	-1.035	-0.962	-0.887	-0.861	-0.837	-0.345
site 10	-0.958	-1.244	-1.183	-0.501	2.208	-0.658	-1.029	-0.729	-0.921	1.999	1.166	1.753

Table S6 Type of excess kurtosis of probability distributions of daily maximum stream temperature by season and decade at unregulated (sites 1-5) and regulated (sites 6-10) streams.

	season/time period											
site ID	**fall**			**winter**			**spring**			**summer**		
	80-89	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**	**80-89**	**90-99**	**00-09**
site 1	-0.173	-0.398	-0.508	1.133	0.723	0.767	1.962	0.374	0.285	-0.209	-0.331	0.114
site 2	0.098	-0.319	-0.559	0.311	0.133	0.883	1.278	0.164	0.038	-0.148	-0.401	0.678
site 3	-0.771	-0.852	-0.708	-0.275	0.017	0.891	0.031	-0.412	0.281	-0.483	-0.617	0.148
site 4	-0.352	-0.453	-0.681	-0.462	0.159	0.126	0.802	-0.050	0.917	0.667	-0.035	1.544
site 5	-0.954	-1.191	-1.032	-0.052	0.745	0.290	-0.373	0.588	0.190	1.223	-0.249	0.700
site 6	-0.727	-0.822	-0.810	0.058	-0.108	-0.194	0.040	-0.466	-0.131	-0.435	-0.684	0.752
site 7	-0.504	-0.428	-0.572	0.165	0.355	0.473	1.374	0.292	0.289	0.142	-0.019	0.497
site 8	0.441	-0.416	-0.635	1.005	0.500	0.924	0.218	-0.430	-0.302	-0.090	0.150	2.325
site 9	-0.169	0.025	-1.105	0.282	0.371	0.359	-1.015	-0.871	-0.848	-0.797	-0.841	-0.524
site 10	-0.908	-1.235	-1.166	-0.425	1.627	-0.577	-1.011	-0.536	-0.871	0.757	0.493	1.068

Table S7 Anomalous years identified as those outside the 90% (0.9), 95% (0.95) coverage probability.

year/site	site1	site2	site3	site4	site5	site6	site7	site8	site9	site10
1979										
1980										0.90
1981									0.90	
1982			0.95							
1983		0.90	0.95							0.95
1984										
1985					0.90			0.95		
1986			0.90	0.90	0.90					
1987			0.95	0.95	0.95	0.95	0.90			
1988				0.90		0.90				
1989										
1990										
1991										
1992	0.95	0.90		0.95	0.95	0.90	0.95	0.90	0.95	
1993	0.90	0.90					0.90			
1994						0.95			0.90	
1995										0.95
1996										
1997										
1998										

1999						
2000						
2001						
2002						
2003	0.90				0.90	
2004						
2005						
2006						
2007						
2008	0.95	0.95		0.95	0.95	
2009						

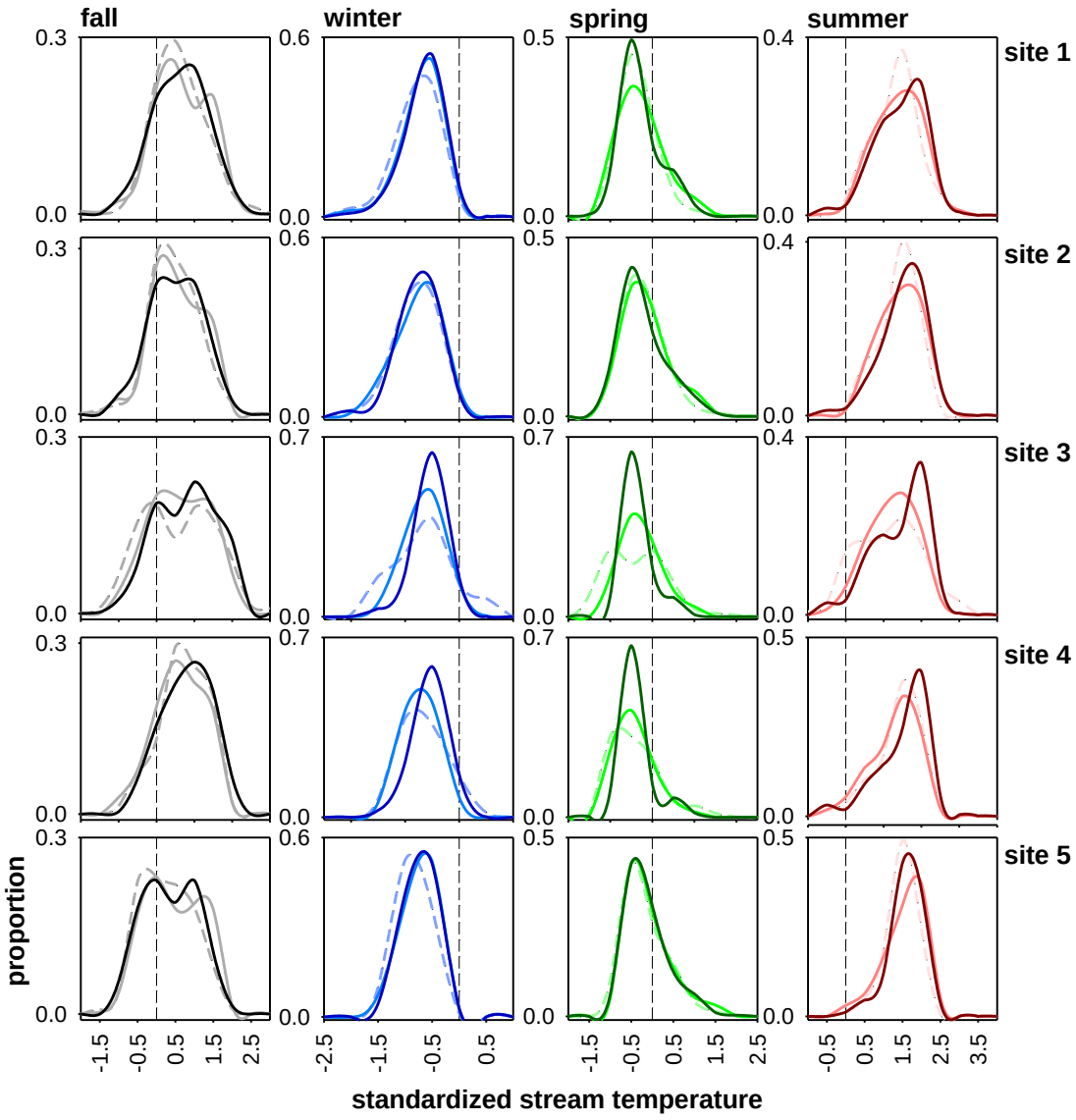

Fig. S1 Density plots of standardized temperatures by decade (period 80-89 dashed line; period 90-99 solid lighter color; period 00-09 dark color) and season (winter – blue line; spring – green line; summer – red line; fall – black line) using time series of daily minimum in unregulated streams.

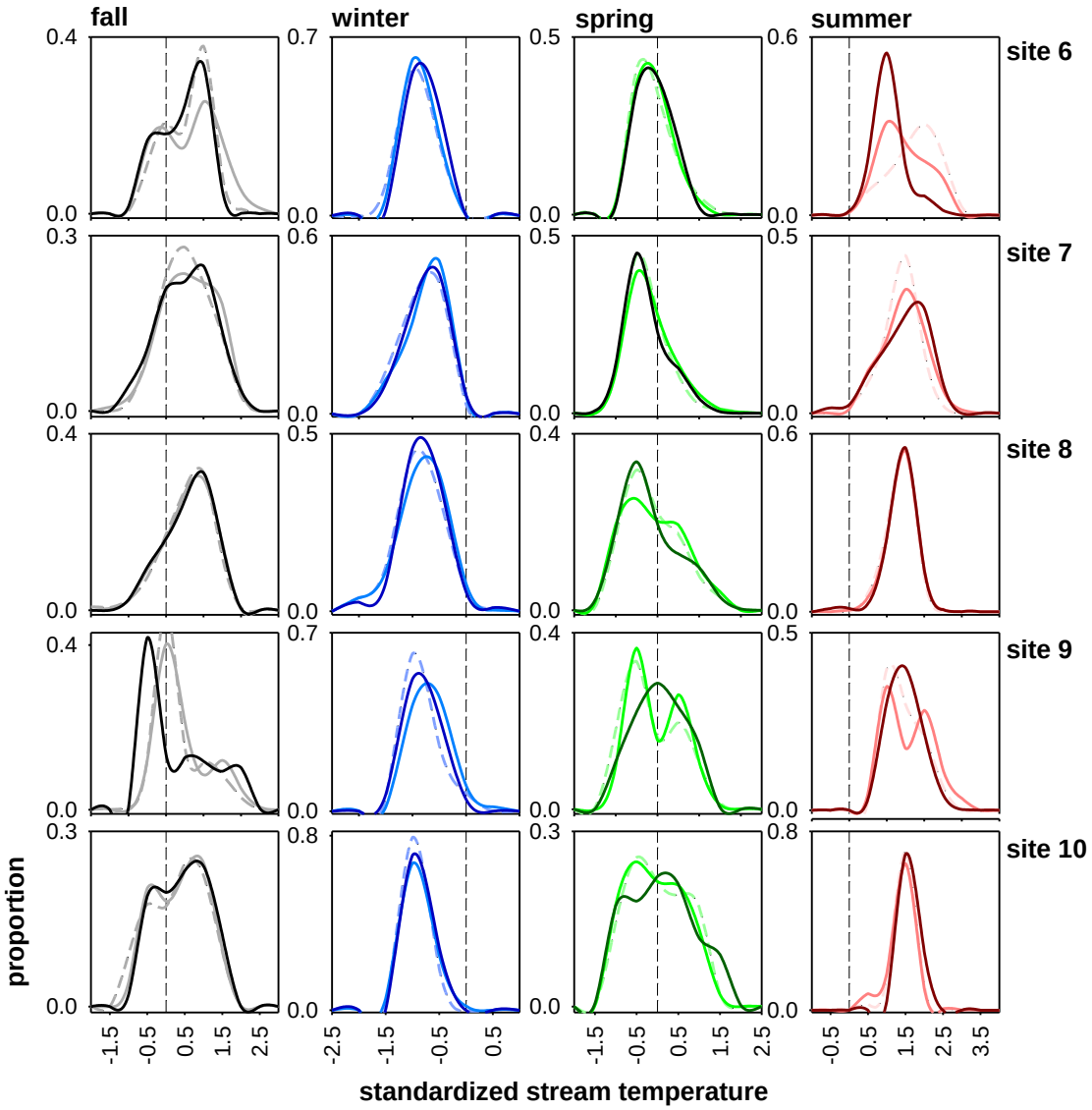

Fig. S2 Density plots of standardized temperatures by decade (period 80-89 dashed line; period 90-99 solid lighter color; period 00-09 dark color) and season (winter – blue line; spring – green line; summer – red line; fall – black line) using time series of daily minimum in regulated streams.