Table S1. Comparison of measures of spatial autocorrelation and synchrony in temperature between systems. S1 and S2 are the two systems that are compared, and differences are given as S1 – S2. Terr = Terrestrial, Lim = Limnic, CoSe = Coastal Sea, OpOc = Open Ocean. Number behind the system abbreviation refers to depths for the aquatic systems. $D_{I,0}$ = the distance (kilometres) of the spatial scaling of the autocorrelation in mean temperature over the study period (1980-2015). $\overline{\rho}$ = the mean correlation in temperature (first order differentials) of pairs of locations < 650 km apart. $\lambda_{\overline{\rho}}$ = the distance (km) when the predicted relationship between distance and correlation falls below $\overline{\rho}$. The predicted relationship was based on a spline function with df = 5. Difference between system 1 and system 2 are given with 95% credible intervals in parentheses. Comparisons where the 95% CI does not include zero are marked with bold. Differences are based on pairwise distances for locations < 650 km for all systems, in order to allow for comparison when the range of distances differs between systems and seasons.

		Winter			Summer		
S 1	S 2	$D_{I,0}$ (km)	$\overline{\rho}$	$\lambda_{\overline{\rho}}$ (km)	$D_{I,0}$ (km)	$\overline{\rho}$	$\lambda_{\overline{\rho}}$ (km)
Terr	Lim 1	**477 (355; 541)**	**0.624 (0.533; 0.709)**	**274 (241; 310)**	**188 (59; 316)**	**0.270 (0.189; 0.349)**	**154 (103; 207)**
Terr	Lim 2	**458 (252; 566)**	**0.723 (0.656; 0.773)**	**274 (224; 310)**	**220 (75; 391)**	**0.270 (0.182; 0.354)**	**145 (69; 207)**
Terr	Lim 5	**465 (178; 596)**	**0.762 (0.712; 0.808)**	**274 (207; 310)**	**381 (218; 495)**	**0.554 (0.487; 0.615)**	**129 (86; 172)**
Terr	Lim 15	**501 (239; 618)**	**0.672 (0.589; 0.754)**	**292 (241; 328)**	**368 (207; 484)**	**0.579 (0.519; 0.634)**	**205 (138; 276)**
Terr	CoSe 1	**440 (248; 620)**	**0.363 (0.134; 0.561)**	**252 (69; 362)**	166 (-74; 446)	0.209 (-0.050; 0.402)	169 (-18; 362)
Terr	CoSe 50	417 (-26; 590)	**0.138 (0.029; 0.208)**	**242 (52; 362)**	**333 (158; 516)**	**0.407 (0.194; 0.556)**	**273 (155; 379)**
Terr	CoSe 100	385 (-17; 563)	**0.430 (0.199; 0.616)**	**287 (0; 362)**	**374 (266; 531)**	**0.336 (0.189; 0.457)**	**285 (52; 379)**
Terr	CoSe 300	442 (-8; 614)	**0.332 (0.169; 0.459)**	**296 (17; 379)**	**487 (316; 595)**	**0.230 (0.062; 0.338)**	**285 (103; 379)**
Terr	OpOc 1	**214 (70; 336)**	**0.370 (0.290; 0.460)**	**130 (34; 207)**	**188 (91; 273)**	**0.132 (0.042; 0.210)**	**135 (69; 190)**
Terr	OpOc 50	**202 (59; 331)**	**0.347 (0.284; 0.414)**	**122 (17; 207)**	**141 (12; 261)**	**0.352 (0.264; 0.422)**	**194 (103; 242)**
Terr	OpOc 100	**190 (37; 316)**	**0.341 (0.275; 0.406)**	**117 (17; 190)**	132 (-6; 258)	**0.322 (0.232; 0.407)**	**185 (17; 259)**

		Winter			Summer		
S 1	S 2	$D_{I,0}$ (km)	$\overline{\rho}$	$\lambda_{\overline{\rho}}$ (km)	$D_{I,0}$ (km)	$\overline{\rho}$	$\lambda_{\overline{\rho}}$ (km)
Terr	OpOc 300	**183 (28; 297)**	**0.471 (0.380; 0.553)**	**143 (17; 241)**	**135 (28; 232)**	**0.339 (0.244; 0.428)**	**242 (190; 276)**
Lim 1	Lim 2	-19 (-213; 79)	**0.099 (0.002; 0.197)**	0 (-52; 52)	32 (-137; 214)	-0.000 (-0.094; 0.090)	-9 (-103; 69)
Lim 1	Lim 5	-17 (-255; 106)	**0.137 (0.046; 0.237)**	-0 (-69; 52)	**193 (11; 326)**	**0.284 (0.216; 0.354)**	-25 (-86; 52)
Lim 1	Lim 15	23 (-227; 122)	0.048 (-0.066; 0.164)	18 (-34; 69)	**180 (23; 315)**	**0.309 (0.241; 0.377)**	51 (-34; 138)
Lim 1	CoSe 1	-34 (-163; 117)	**-0.261 (-0.500; -0.042)**	-22 (-207; 103)	-22 (-271; 273)	-0.061 (-0.317; 0.138)	15 (-190; 241)
Lim 1	CoSe 50	-84 (-517; 91)	**-0.487 (-0.621; -0.370)**	-32 (-224; 103)	141 (-43; 294)	0.138 (-0.082; 0.284)	119 (-17; 241)
Lim 1	CoSe 100	-87 (-493; 77)	-0.195 (-0.430; 0.016)	12 (-276; 103)	**187 (64; 353)**	0.066 (-0.083; 0.193)	131 (-103; 259)
Lim 1	CoSe 300	-28 (-479; 123)	**-0.293 (-0.481; -0.130)**	22 (-259; 121)	**300 (118; 437)**	-0.040 (-0.195; 0.073)	131 (-52; 259)
Lim 1	OpOc 1	**-261 (-394; -149)**	**-0.254 (-0.363; -0.134)**	-144 (-241; -69)	-1 (-109; 113)	**-0.137 (-0.230; -0.045)**	-19 (-103; 69)
Lim 1	OpOc 50	**-281 (-375; -168)**	**-0.277 (-0.377; -0.171)**	**-152 (-259; -69)**	-47 (-198; 91)	0.082 (-0.012; 0.163)	40 (-69; 121)
Lim 1	OpOc 100	**-286 (-392; -183)**	**-0.283 (-0.388; -0.176)**	**-157 (-259; -69)**	-56 (-211; 81)	0.053 (-0.041; 0.147)	31 (-155; 138)
Lim 1	OpOc 300	**-286 (-397; -173)**	**-0.153 (-0.269; -0.039)**	**-131 (-259; -34)**	-54 (-172; 61)	0.069 (-0.030; 0.159)	**88 (17; 155)**
Lim 2	Lim 5	2 (-243; 222)	0.038 (-0.023; 0.106)	-1 (-69; 52)	161 (-45; 316)	**0.284 (0.207; 0.365)**	-16 (-86; 69)
Lim 2	Lim 15	42 (-231; 273)	-0.051 (-0.144; 0.042)	18 (-34; 69)	148 (-61; 304)	**0.309 (0.226; 0.393)**	60 (-17; 155)
Lim 2	CoSe 1	-14 (-158; 186)	**-0.360 (-0.583; -0.159)**	-23 (-207; 103)	-53 (-338; 250)	-0.061 (-0.327; 0.141)	25 (-190; 241)
Lim 2	CoSe 50	-66 (-508; 180)	**-0.585 (-0.695; -0.493)**	-32 (-224; 103)	111 (-80; 299)	0.138 (-0.090; 0.292)	128 (-17; 259)
Lim 2	CoSe 100	-67 (-476; 137)	**-0.293 (-0.518; -0.102)**	12 (-276; 121)	153 (-25; 308)	0.066 (-0.098; 0.200)	140 (-86; 276)

		Winter			Summer		
S 1	S 2	$D_{I,0}$ (km)	$\overline{\rho}$	$\lambda_{\overline{\rho}}$ (km)	$D_{I,0}$ (km)	$\overline{\rho}$	$\lambda_{\overline{\rho}}$ (km)
Lim 2	CoSe 300	-6 (-454; 266)	**-0.392 (-0.557; -0.244)**	22 (-259; 121)	**266 (60; 411)**	-0.040 (-0.206; 0.087)	140 (-52; 276)
Lim 2	OpOc 1	**-242 (-383; -38)**	**-0.353 (-0.447; -0.258)**	**-145 (-241; -69)**	-32 (-199; 109)	**-0.137 (-0.238; -0.027)**	-10 (-86; 86)
Lim 2	OpOc 50	**-262 (-384; -65)**	**-0.376 (-0.453; -0.290)**	**-152 (-259; -69)**	-79 (-261; 81)	0.082 (-0.017; 0.178)	49 (-69; 138)
Lim 2	OpOc 100	**-266 (-390; -69)**	**-0.382 (-0.462; -0.296)**	**-158 (-259; -69)**	-88 (-260; 60)	0.053 (-0.048; 0.154)	41 (-138; 155)
Lim 2	OpOc 300	**-267 (-403; -70)**	**-0.252 (-0.349; -0.156)**	**-131 (-259; -34)**	-85 (-245; 52)	0.069 (-0.038; 0.176)	**98 (17; 172)**
Lim 5	Lim 15	40 (-251; 305)	**-0.089 (-0.178; -0.003)**	18 (-34; 86)	-13 (-184; 165)	0.025 (-0.025; 0.082)	**76 (0; 155)**
Lim 5	CoSe 1	-15 (-207; 263)	**-0.398 (-0.632; -0.196)**	-22 (-207; 121)	-215 (-461; 91)	**-0.345 (-0.606; -0.148)**	41 (-155; 241)
Lim 5	CoSe 50	-60 (-529; 273)	**-0.624 (-0.740; -0.544)**	-32 (-224; 103)	-53 (-208; 156)	**-0.146 (-0.359; -0.008)**	**144 (17; 259)**
Lim 5	CoSe 100	-71 (-492; 182)	**-0.332 (-0.555; -0.143)**	13 (-276; 138)	-8 (-107; 180)	**-0.218 (-0.357; -0.091)**	156 (-69; 276)
Lim 5	CoSe 300	-9 (-495; 333)	**-0.430 (-0.591; -0.294)**	22 (-259; 121)	102 (-64; 275)	**-0.324 (-0.478; -0.220)**	156 (-34; 276)
Lim 5	OpOc 1	**-244 (-410; 0)**	**-0.392 (-0.473; -0.301)**	**-144 (-241; -52)**	**-194 (-280; -33)**	**-0.421 (-0.502; -0.338)**	6 (-69; 86)
Lim 5	OpOc 50	**-264 (-410; -31)**	**-0.414 (-0.493; -0.339)**	**-152 (-259; -52)**	**-241 (-368; -61)**	**-0.202 (-0.284; -0.126)**	65 (-34; 138)
Lim 5	OpOc 100	**-268 (-417; -15)**	**-0.420 (-0.495; -0.339)**	**-157 (-259; -52)**	**-249 (-388; -81)**	**-0.232 (-0.316; -0.148)**	57 (-121; 138)
Lim 5	OpOc 300	**-269 (-430; -36)**	**-0.290 (-0.382; -0.199)**	**-130 (-276; -17)**	**-247 (-353; -78)**	**-0.215 (-0.311; -0.135)**	**114 (52; 172)**
Lim 15	CoSe 1	-52 (-224; 267)	**-0.309 (-0.545; -0.083)**	-41 (-207; 86)	-200 (-446; 103)	**-0.370 (-0.630; -0.178)**	-36 (-241; 190)
Lim 15	CoSe 50	**-111 (-559; 243)**	**-0.535 (-0.656; -0.426)**	-50 (-241; 86)	-42 (-209; 170)	**-0.171 (-0.391; -0.030)**	68 (-86; 207)
Lim 15	CoSe 100	-104 (-531; 209)	**-0.243 (-0.470; -0.043)**	-6 (-293; 86)	6 (-105; 184)	**-0.243 (-0.381; -0.122)**	80 (-155; 207)

		Winter			Summer		
S 1	S 2	$D_{I,0}$ (km)	$\overline{\rho}$	$\lambda_{\overline{\rho}}$ (km)	$D_{I,0}$ (km)	$\overline{\rho}$	$\lambda_{\overline{\rho}}$ (km)
Lim 15	CoSe 300	-48 (-525; 310)	**-0.341 (-0.513; -0.189)**	4 (-276; 103)	119 (-48; 285)	**-0.349 (-0.501; -0.248)**	80 (-103; 224)
Lim 15	OpOc 1	**-284 (-443; -9)**	**-0.302 (-0.409; -0.182)**	**-163 (-259; -86)**	**-180 (-274; -39)**	**-0.446 (-0.529; -0.364)**	-70 (-172; 17)
Lim 15	OpOc 50	**-305 (-444; -48)**	**-0.325 (-0.417; -0.224)**	**-170 (-276; -69)**	**-227 (-359; -72)**	**-0.227 (-0.307; -0.153)**	-11 (-121; 86)
Lim 15	OpOc 100	**-308 (-459; -39)**	**-0.331 (-0.434; -0.231)**	**-176 (-276; -86)**	**-236 (-389; -71)**	**-0.256 (-0.337; -0.175)**	-20 (-207; 86)
Lim 15	OpOc 300	**-310 (-464; -21)**	**-0.201 (-0.312; -0.088)**	**-149 (-276; -34)**	**-233 (-341; -78)**	**-0.240 (-0.333; -0.162)**	37 (-34; 121)
CoSe 1	CoSe 50	-58 (-584; 186)	**-0.225 (-0.436; -0.000)**	-10 (-259; 241)	170 (-162; 417)	0.198 (-0.082; 0.479)	104 (-172; 345)
CoSe 1	CoSe 100	-50 (-433; 163)	0.067 (-0.242; 0.359)	35 (-294; 259)	208 (-119; 458)	0.127 (-0.119; 0.406)	115 (-172; 379)
CoSe 1	CoSe 300	1 (-527; 215)	-0.032 (-0.294; 0.232)	44 (-276; 259)	**317 (17; 559)**	0.021 (-0.219; 0.301)	115 (-190; 379)
CoSe 1	OpOc 1	**-226 (-417; -63)**	0.007 (-0.216; 0.238)	-122 (-293; 69)	20 (-287; 242)	-0.077 (-0.282; 0.207)	-35 (-259; 172)
CoSe 1	OpOc 50	**-247 (-449; -84)**	-0.016 (-0.221; 0.207)	-130 (-310; 69)	-27 (-308; 227)	0.143 (-0.057; 0.413)	24 (-207; 241)
CoSe 1	OpOc 100	**-251 (-442; -93)**	-0.022 (-0.238; 0.207)	-135 (-310; 69)	-34 (-317; 212)	0.113 (-0.090; 0.374)	16 (-293; 259)
CoSe 1	OpOc 300	**-253 (-448; -96)**	0.108 (-0.104; 0.348)	-108 (-310; 103)	-31 (-327; 201)	0.130 (-0.073; 0.391)	73 (-138; 276)
CoSe 50	CoSe 100	-20 (-507; 519)	**0.292 (0.051; 0.508)**	45 (-276; 293)	47 (-136; 232)	-0.072 (-0.279; 0.159)	12 (-241; 190)
CoSe 50	CoSe 300	42 (-507; 574)	**0.194 (0.021; 0.366)**	54 (-276; 276)	157 (-15; 298)	-0.178 (-0.377; 0.055)	12 (-207; 207)
CoSe 50	OpOc 1	-176 (-404; 282)	**0.232 (0.124; 0.366)**	-112 (-293; 103)	-142 (-340; 12)	**-0.275 (-0.433; -0.052)**	-138 (-276; 17)
CoSe 50	OpOc 50	-199 (-412; 247)	**0.209 (0.119; 0.328)**	-120 (-293; 86)	**-189 (-365; -25)**	-0.055 (-0.211; 0.173)	-79 (-224; 69)
CoSe 50	OpOc 100	-200 (-424; 245)	**0.204 (0.112; 0.319)**	-125 (-310; 86)	**-196 (-373; -29)**	-0.085 (-0.243; 0.144)	-88 (-293; 86)

		Winter			Summer		
S 1	S 2	$D_{I,0}$ (km)	$\overline{\rho}$	$\lambda_{\overline{\rho}}$ (km)	$D_{I,0}$ (km)	$\overline{\rho}$	$\lambda_{\overline{\rho}}$ (km)
CoSe 50	OpOc 300	-198 (-436; 257)	**0.334 (0.220; 0.465)**	-99 (-294; 121)	**-194 (-378; -25)**	-0.068 (-0.233; 0.165)	-31 (-155; 103)
CoSe 100	CoSe 300	54 (-470; 554)	-0.098 (-0.340; 0.166)	10 (-311; 328)	114 (-49; 210)	-0.106 (-0.293; 0.051)	-0 (-224; 259)
CoSe 100	OpOc 1	-173 (-392; 256)	-0.060 (-0.269; 0.174)	-157 (-293; 121)	**-186 (-321; -105)**	**-0.203 (-0.339; -0.049)**	-150 (-276; 86)
CoSe 100	OpOc 50	-195 (-391; 213)	-0.083 (-0.274; 0.139)	-164 (-328; 138)	**-232 (-374; -118)**	0.016 (-0.123; 0.168)	-91 (-241; 155)
CoSe 100	OpOc 100	-199 (-414; 218)	-0.088 (-0.281; 0.146)	-170 (-328; 103)	**-240 (-394; -122)**	-0.014 (-0.147; 0.136)	-99 (-328; 138)
CoSe 100	OpOc 300	-198 (-418; 205)	0.041 (-0.159; 0.289)	-143 (-328; 138)	**-238 (-381; -145)**	0.003 (-0.142; 0.159)	-42 (-155; 190)
CoSe 300	OpOc 1	-233 (-431; 236)	0.038 (-0.110; 0.226)	-167 (-310; 138)	**-299 (-378; -147)**	-0.097 (-0.221; 0.062)	-150 (-276; 34)
CoSe 300	OpOc 50	-251 (-438; 197)	0.015 (-0.131; 0.184)	-174 (-328; 121)	**-346 (-479; -168)**	0.122 (0.002; 0.278)	-91 (-241; 103)
CoSe 300	OpOc 100	-258 (-456; 202)	0.010 (-0.140; 0.182)	-179 (-328; 103)	**-353 (-495; -187)**	0.092 (-0.040; 0.251)	-99 (-328; 103)
CoSe 300	OpOc 300	-258 (-472; 192)	0.140 (-0.029; 0.312)	-153 (-328; 155)	**-351 (-450; -197)**	0.109 (-0.018; 0.271)	-42 (-172; 138)
OpOc 1	OpOc 50	-20 (-151; 127)	-0.023 (-0.122; 0.076)	-8 (-138; 104)	-47 (-156; 49)	**0.220 (0.124; 0.317)**	59 (-52; 155)
OpOc 1	OpOc 100	-25 (-178; 138)	-0.029 (-0.129; 0.067)	-13 (-138; 103)	-55 (-178; 41)	**0.190 (0.088; 0.293)**	50 (-121; 155)
OpOc 1	OpOc 300	-25 (-171; 130)	0.101 (-0.023; 0.210)	14 (-121; 155)	-53 (-132; 25)	**0.207 (0.102; 0.309)**	**108 (34; 172)**
OpOc 50	OpOc 100	-5 (-144; 131)	-0.006 (-0.092; 0.082)	-5 (-138; 121)	-8 (-154; 124)	-0.030 (-0.123; 0.067)	-8 (-190; 121)
OpOc 50	OpOc 300	-5 (-160; 138)	**0.124 (0.025; 0.226)**	21 (-138; 172)	-6 (-113; 110)	-0.013 (-0.119; 0.094)	49 (-34; 155)
OpOc 100	OpOc 300	-0 (-141; 141)	**0.130 (0.021; 0.233)**	27 (-138; 172)	2 (-113; 122)	0.017 (-0.096; 0.120)	57 (-34; 224)