

**Model Evaluation:**

- Correlation coefficient 
$$R = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \cdot \sum_{i=1}^n (y_i - \bar{y})^2}} \quad (1)$$

- Coefficient of determination 
$$R^2 = \frac{\sum_{i=1}^n (y_i - \bar{y})^2}{\sum_{i=1}^n (x_i - \bar{x})^2} \quad (2)$$

- Root mean square error 
$$RMSE = \sqrt{\frac{\sum_{i=1}^n (x_i - y_i)^2}{n}} \quad (3)$$

- Nash-sutcliffe efficiency 
$$NSE = 1 - \frac{\sum_{i=1}^n (x_i - y_i)^2}{\sum_{i=1}^n (x_i - \bar{x})^2} \quad (4)$$

- RMSE Observation standard deviation ratio 
$$RSR = \frac{RMSE}{STDEV_{obs}} = \frac{\sqrt{\sum_{i=1}^n (x_i - y_i)^2}}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2}} \quad (5)$$

Where x = observed value,  $\bar{x}$  = mean of observed values, y = simulated value,  $\bar{y}$  = mean of simulated values, n = number of values

Table S1. List of selected predictor variables for all climate variables and stations (partial correlation coefficient and significance level at annual scale).

Station	PRCP			Tmax			Tmin		
	Predictor	Partial r	P value	Predictor	Partial r	P value	Predictor	Partial r	P value
Crevoladossola	ncepmslpgl	-0.087	<0.0001	ncepp500gl	-0.161	<0.0001	ncepp5_vgl	-0.121	<0.0001
	ncepp5_vgl	0.255	<0.0001	ncepp850gl	0.238	<0.0001	ncepp500gl	-0.035	<0.0001
	ncepp5_zgl	0.086	<0.0001	nceps500gl	-0.125	<0.0001	nceps500gl	-0.101	<0.0001
	ncepp850gl	0.073	<0.0001	nceps850gl	-0.150	<0.0001	nceps850gl	-0.057	<0.0001
	nceptempgl	-0.067	0.0001	ncepshumgl	0.240	<0.0001	ncepshumgl	0.201	<0.0001
Devero	nceptempgl			nceptempgl	0.504	<0.0001	nceptempgl	0.464	<0.0001
	ncepp5_vgl	0.267	<0.0001	ncepp500gl	0.145	<0.0001	ncepp500gl	0.053	<0.0001
	ncepp8_zgl	0.107	<0.0001	ncepp850gl	0.053	<0.0001	nceps850gl	0.077	<0.0001
	nceps500gl	0.173	<0.0001	nceps850gl	-0.092	<0.0001	ncepshumgl	0.046	<0.0001
	ncepshuml	-0.092	<0.0001	ncepshumgl	0.128	<0.0001	nceptempgl	0.368	<0.0001
Domodossola Rosmini	nceptempgl			nceptempgl	0.367	<0.0001	nceptempgl		
	ncepp5_vgl	0.265	<0.0001	ncepp500gl	-0.178	<0.0001	ncepp500gl	-0.059	<0.0001
	ncepp8_zgl	0.128	<0.0001	ncepp850gl	0.284	<0.0001	ncepp850gl	0.076	<0.0001
	ncepp850gl	-0.108	<0.0001	nceps500gl	-0.159	<0.0001	nceps500gl	-0.105	<0.0001
	ncepprcpgl	-0.067	<0.0001	nceps850gl	-0.126	<0.0001	ncepshumgl	0.226	<0.0001
Formazza Ponte	nceps500gl	0.161	<0.0001	ncepshumgl	0.240	<0.0001	nceptempgl	0.519	<0.0001
	nceptempgl			nceptempgl	0.516	<0.0001	nceptempgl		
	ncepp5_vgl	0.237	<0.0001	ncepp500gl	0.453	<0.0001	ncepp500gl	0.282	<0.0001
	ncepp5_zgl	0.139	<0.0001	nceps850gl	-0.145	<0.0001	nceps850gl	0.019	0.0288
	nceps500gl	0.160	<0.0001	ncepshumgl	0.173	<0.0001	ncepshumgl	0.173	<0.0001
Lago Agaro	nceptempgl			nceptempgl	0.361	<0.0001	nceptempgl	0.354	<0.0001
	ncepp5_vgl	0.258	<0.0001	ncepp500gl	0.407	<0.0001	ncepp500gl	0.449	<0.0001
	nceps500gl	0.133	<0.0001	nceps850gl	-0.127	<0.0001	nceps850gl	0.038	<0.0001
	nceptempgl			ncepshumgl	0.147	<0.0001	ncepshumgl	0.086	<0.0001
	nceptempgl			nceptempgl	0.321	<0.0001	nceptempgl	0.335	<0.0001
Lago Alpe Cavalli	nceptempgl			nceptempgl	0.321	<0.0001	nceptempgl		
	ncepp5_vgl	0.205	<0.0001	ncepp500gl	0.404	<0.0001	ncepp500gl	0.364	<0.0001
	ncepp5_zgl	0.105	<0.0001	nceps850gl	-0.132	<0.0001	ncepshumgl	0.251	<0.0001
	ncepp850gl	-0.101	<0.0001	ncepshumgl	0.177	<0.0001	nceptempgl	0.384	<0.0001
	ncepprcpgl	-0.093	<0.0001	nceptempgl	0.362	<0.0001	nceptempgl		
Lago Campliccioli	nceps500gl	0.207	<0.0001	nceptempgl			nceptempgl		
	nceptempgl			nceptempgl			nceptempgl		
	ncepp5_vgl	0.210	<0.0001	ncepp500gl	0.092	<0.0001	ncepp500gl	0.377	<0.0001
	ncepp850gl	-0.124	<0.0001	ncepp850gl	0.107	<0.0001	ncepshumgl	0.241	<0.0001
	ncepprcpgl	-0.058	0.0002	nceps850gl	-0.110	<0.0001	nceptempgl	0.388	<0.0001
Lago Camposecco	nceps500gl	0.160	<0.0001	ncepshumgl	0.129	<0.0001	nceptempgl		
	nceptempgl			nceptempgl	0.359	<0.0001	nceptempgl		
	ncepmslpgl	-0.085	<0.0001	ncepp500gl	0.489	<0.0001	ncepp500gl	0.408	<0.0001
	ncepp5_vgl	0.179	<0.0001	nceps500gl	-0.130	<0.0001	ncepp850gl	-0.195	<0.0001
	ncepp5_zgl	0.100	<0.0001	ncepshumgl	0.150	<0.0001	nceptempgl	0.463	<0.0001
Lago Codelago	ncepprcpgl	-0.066	<0.0001	nceptempgl	0.230	<0.0001	nceptempgl		
	nceps500gl	0.191	<0.0001	nceptempgl			nceptempgl		
	ncepp5_vgl	0.232	<0.0001	ncepp500gl	0.542	<0.0001	ncepp500gl	0.340	<0.0001
	ncepp5_zgl	0.119	<0.0001	nceps500gl	-0.189	<0.0001	ncepshumgl	0.184	<0.0001
	ncepp850gl	-0.135	<0.0001	ncepshumgl	0.204	<0.0001	nceptempgl	0.380	<0.0001
Lago_Morasco	ncepprcpgl	-0.057	<0.0001	nceptempgl	0.378	<0.0001	nceptempgl		
	nceps500gl	0.181	<0.0001	nceptempgl			nceptempgl		
	ncepp5_vgl	0.225	<0.0001	ncepp500gl	0.519	<0.0001	ncepp500gl	0.475	<0.0001
	ncepp5_zgl	0.062	<0.0001	nceps500gl	-0.166	<0.0001	ncepshumgl	0.248	<0.0001
	ncepp850gl	-0.058	<0.0001	ncepshumgl	0.170	<0.0001	nceptempgl	0.350	<0.0001
Lago Sabbione	ncepprcpgl	0.070	<0.0001	nceptempgl	0.294	<0.0001	nceptempgl		
	nceptempgl			nceptempgl			nceptempgl		
	ncepp5_vgl	0.146	<0.0001	ncepp500gl	0.368	<0.0001	ncepp500gl	0.481	<0.0001
	ncepp850gl	-0.073	<0.0001	ncepp850gl	-0.167	<0.0001	nceps850gl	0.133	<0.0001
	nceps500gl	0.188	<0.0001	nceps500gl	-0.182	<0.0001	ncepshumgl	0.058	<0.0001
			ncepshumgl	0.137	<0.0001	nceptempgl	0.280	<0.0001	
			nceptempgl	0.250	<0.0001				

Lago Toggia	ncepp5_vgl ncepp5_zgl ncepp850gl ncepprcpgl	0.160 0.070 -0.065 0.092	<0.0001 <0.0001 <0.0001 <0.0001	ncepp500gl nceps500gl ncepshumgl nceptempgl	0.455 -0.135 0.205 0.301	<0.0001 <0.0001 <0.0001 <0.0001	ncepp500gl nceps850gl ncepshumgl nceptempgl	0.423 0.124 0.081 0.305	<0.0001 <0.0001 <0.0001 <0.0001
Lago Vannino	ncepp5_vgl ncepp5_zgl ncepp850gl nceps500gl	0.188 0.161 -0.081 0.218	<0.0001 <0.0001 <0.0001 <0.0001	ncepp500gl nceps500gl ncepshumgl nceptempgl	0.461 -0.186 0.120 0.382	<0.0001 <0.0001 <0.0001 <0.0001	ncepp500gl nceps850gl ncepshumgl nceptempgl	0.395 0.128 0.064 0.333	<0.0001 <0.0001 <0.0001 <0.0001
Pallanza	ncepp5_vgl ncepp8_vgl ncepprcpgl nceps500gl	0.195 0.164 0.064 0.188	<0.0001 <0.0001 0.0001 <0.0001	ncepp500gl ncepp8_vgl ncepp850gl nceps850gl ncepshumgl nceptempgl	-0.081 -0.649 0.097 -0.252 0.244 0.609	<0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001	ncepp500gl ncepp850gl nceps500gl ncepshumgl nceptempgl	-0.160 0.203 -0.152 0.343 0.574	<0.0001 <0.0001 <0.0001 <0.0001 <0.0001
Varese	ncepp5_vgl ncepp8_vgl ncepprcpgl nceps500gl	0.144 0.220 0.217 0.172	<0.0001 <0.0001 <0.0001 <0.0001	ncepp500gl ncepp850gl nceps500gl nceps850gl ncepshumgl nceptempgl	-0.167 0.250 -0.275 -0.254 0.308 0.548	<0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001	ncepp500gl nceps500gl ncepshumgl nceptempgl	0.038 -0.228 0.310 0.583	0.0002 <0.0001 <0.0001 <0.0001
Camedeo Paese	ncepmslpgl ncepp5_fgl ncepp5_vgl ncepp8_ugl ncepp8_vgl nceps500gl	-0.135 0.127 0.155 -0.222 0.177 0.265	<0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001						
Cimetta	ncepp5_fgl ncepp5_vgl ncepp8_vgl nceps500gl Nceptempl	0.061 0.172 0.137 0.159 0.104	0.0055 <0.0001 <0.0001 <0.0001 <0.0001	ncepp500gl ncepp850gl nceps500gl ncepshumgl nceptempgl	0.241 0.063 -0.120 0.163 0.350	<0.0001 <0.0001 <0.0001 <0.0001 <0.0001	ncepp500gl ncepp850gl nceps500gl nceps850gl ncepshumgl nceptempgl	0.395 -0.083 -0.135 0.091 0.052 0.365	<0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001
Comprovasco	ncepp1_vgl ncepp5_fgl ncepp5_vgl ncepp8_vgl nceps500gl nceptempgl	-0.144 0.230 0.117 0.225 0.128 0.069	<0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001	ncepp500gl ncepp850gl nceps500gl nceps850gl ncepshumgl nceptempgl	-0.146 0.293 -0.178 -0.050 0.157 0.527	<0.0001 <0.0001 <0.0001 0.0002 <0.0001 <0.0001	ncepp850gl nceps500gl ncepshumgl nceptempgl	0.208 -0.080 0.278 0.556	<0.0001 <0.0001 <0.0001 <0.0001
Frasco	ncepp1_ugl ncepp5_fgl ncepp5_ugl ncepp5_vgl ncepp850gl nceps500gl	-0.100 0.192 -0.088 0.284 -0.087 0.278	<0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001						
Fusio Paese	ncepmslpgl ncepp5_fgl ncepp5_vgl ncepp8_ugl ncepp8_vgl nceps500gl	-0.178 0.235 0.164 -0.214 0.078 0.248	<0.0001 <0.0001 <0.0001 <0.0001 0.0001 <0.0001						
Gnosca	ncepmslpgl ncepp1_ugl ncepp5_fgl ncepp8_vgl ncepprcpgl nceps500gl	-0.098 -0.164 0.197 0.146 0.174 0.243	<0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001						
Isonne	ncepmslpgl ncepp1_ugl ncepp5_fgl	-0.134 -0.189 0.088	<0.0001 <0.0001 <0.0001						

	ncepp5_vgl	0.266	<0.0001						
	ncepprcpgl	0.113	<0.0001						
	nceps500gl	0.195	<0.0001						
Locarno Monti	ncepp5_vgl	0.190	<0.0001	ncepp500gl	-0.189	<0.0001	ncepp500gl	0.305	<0.0001
	ncepp8_vgl	0.156	<0.0001	ncepp850gl	0.311	<0.0001	nceps500gl	-0.205	<0.0001
	nceps500gl	0.239	<0.0001	nceps500gl	-0.183	<0.0001	ncepshumgl	0.266	<0.0001
				nceps850gl	-0.061	<0.0001	nceptempgl	0.489	<0.0001
				ncepshumgl	0.223	<0.0001			
	nceptempgl	0.465	<0.0001						
Lodrino	ncepmslpgl	-0.105	<0.0001						
	ncepp1_vgl	-0.150	<0.0001						
	ncepp5_fgl	0.189	<0.0001						
	ncepp5_vgl	0.251	<0.0001						
	ncepprcpgl	0.080	<0.0001						
	nceps500gl	0.255	<0.0001						
Magadino	ncepp5_vgl	0.205	<0.0001	ncepp500gl	-0.221	<0.0001	ncepp5_vgl	0.040	<0.0001
	ncepp8_vgl	0.271	<0.0001	ncepp850gl	0.320	<0.0001	ncepp500gl	-0.066	<0.0001
	nceps500gl	0.221	<0.0001	nceps500gl	-0.175	<0.0001	ncepp850gl	0.074	<0.0001
				nceps850gl	-0.071	<0.0001	nceps500gl	-0.074	<0.0001
				ncepshumgl	0.218	<0.0001	ncepshumgl	0.256	<0.0001
	nceptempgl	0.500	<0.0001	nceptempgl	0.446	<0.0001			
Mendisio	ncepp1_vgl	0.245	<0.0001						
	ncepp1zhgl	-0.092	0.0001						
	ncepp5_vgl	0.199	<0.0001						
	ncepp500gl	0.151	<0.0001						
	ncepp8_vgl	-0.190	<0.0001						
	ncepprcpgl	0.136	<0.0001						
Olivone	ncepmslpgl	-0.141	<0.0001						
	ncepp5_fgl	0.256	<0.0001						
	ncepp5_vgl	0.163	<0.0001						
	ncepp8_vgl	-0.216	<0.0001						
	ncepp8_vgl	0.114	<0.0001						
	ncepprcpgl	0.074	0.0005						
nceps500gl	0.221	<0.0001							
Piotta	ncepmslpgl	-0.173	<0.0001	ncepp500gl	0.409	<0.0001	ncepp500gl	0.179	<0.0001
	ncepp5_fgl	0.267	<0.0001	nceps500gl	-0.244	<0.0001	nceps500gl	-0.109	<0.0001
	ncepp5_vgl	0.088	<0.0001	nceps850gl	-0.057	<0.0001	nceps850gl	0.101	<0.0001
	ncepp8_vgl	-0.226	<0.0001	ncepshumgl	0.114	<0.0001	ncepshumgl	0.065	<0.0001
	ncepp8_vgl	0.136	<0.0001	nceptempgl	0.503	<0.0001	nceptempgl	0.536	<0.0001
	nceps500gl	0.126	<0.0001						
	nceptempgl	0.083	<0.0001						
S. Bernardino	ncepp5_fgl	0.224	<0.0001	ncepp500gl	0.675	<0.0001	ncepp500gl	0.387	<0.0001
	ncepp5_vgl	0.203	<0.0001	ncepshumgl	0.088	<0.0001	nceps850gl	0.230	<0.0001
	ncepp8_vgl	0.165	<0.0001	nceptempgl	0.377	<0.0001	nceptempgl	0.461	<0.0001
	nceps500gl	0.272	<0.0001						



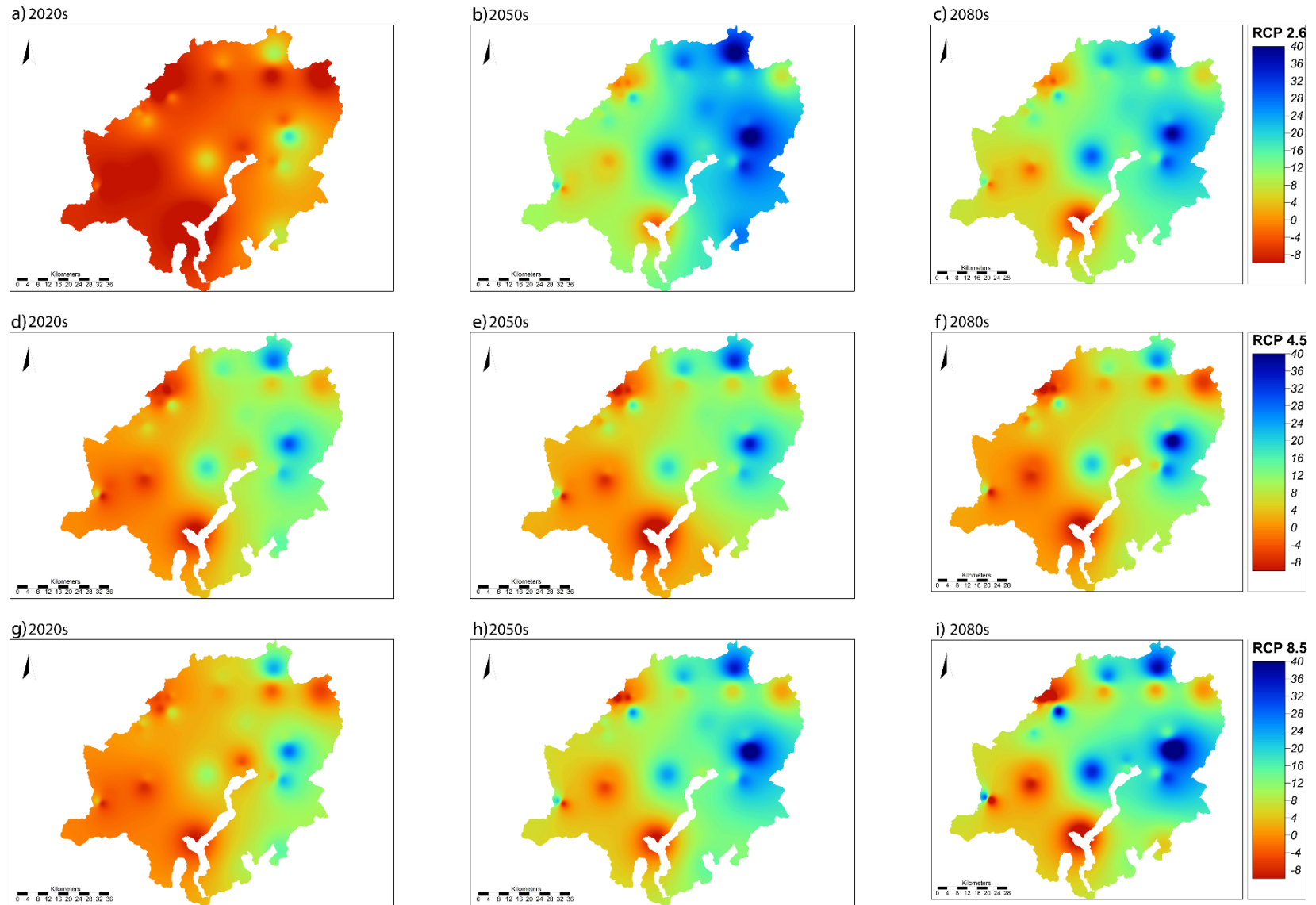


Fig. S2. Projected future change of spring PRCP (2020s 2050s and 2080s) under RCP 2.6, RCP 4.5 and RCP 8.5

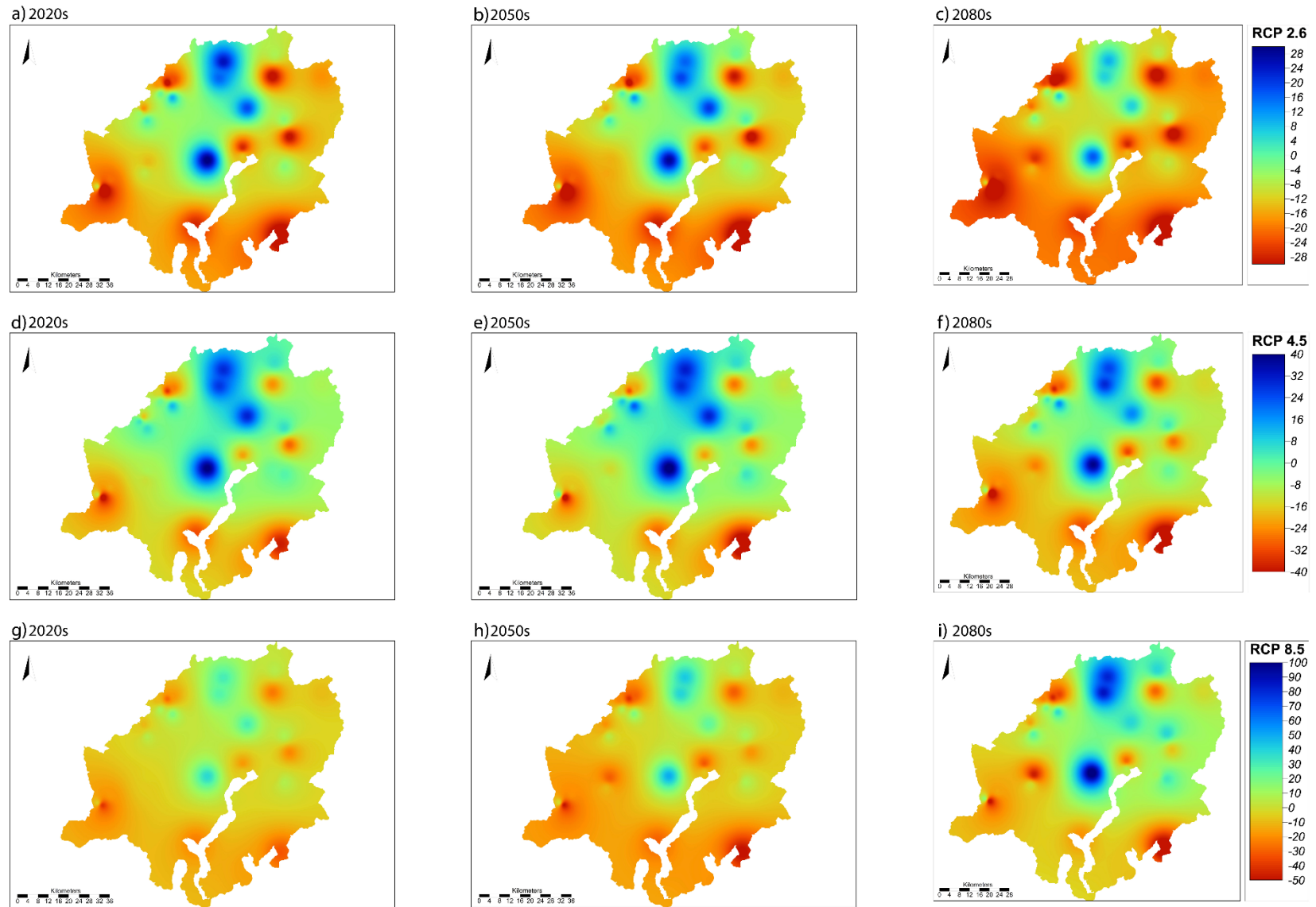


Fig. S3. Projected future change of summer PRCP (2020s 2050s and 2080s) under RCP 2.6, RCP 4.5 and RCP 8.5

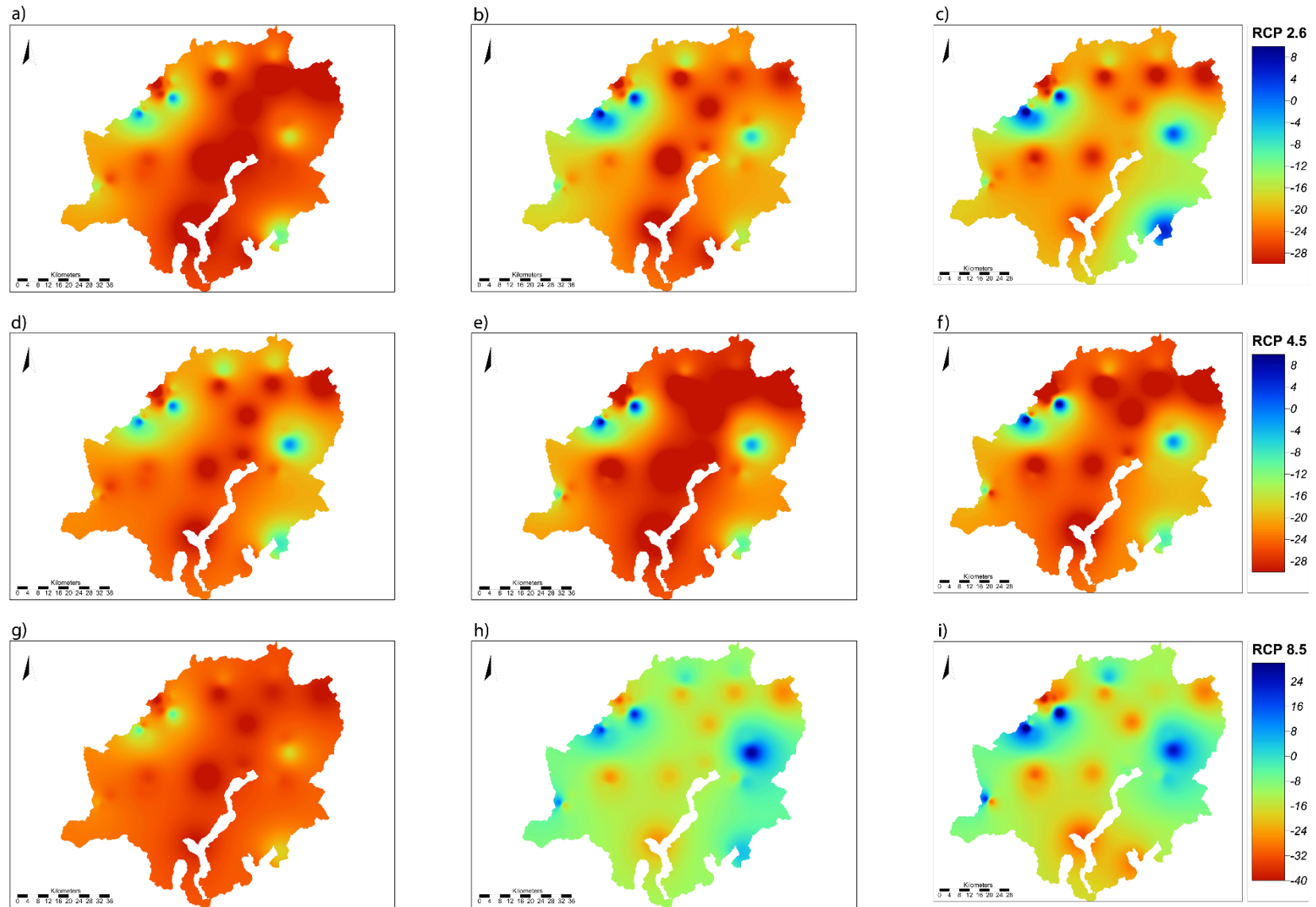


Fig. S4. Projected future change of autumn PRCP (2020s, 2050s, and 2080s) under RCP 2.6, RCP 4.5, and RCP 8.5