Table S1. Statistical characteristics for meteorological indexes for the observation period (*n* = 24).

Characteristics	MAT	ST_{5-8}	ST_{5-9}	SP	SP_{5-8}	SP_{5-9}	WI_{5-8}	WI_{5-9}	HTC_{6-8}
	°C			mm					
ClimNorm (1991-2020)	5.4	65	76	640	276	333	0.61	0.62	1.37
Mean	5.9	66	78	650	280	340	0.61	0.63	1.34
Median	6.0	65	77	665	266	314	0.63	0.61	1.46
Min	4.0	60	70	400	130	209	0.30	0.41	0.68
Max	7.6	81	92	929	444	599	0.85	0.87	2.23
Range (Max − Min)	3.6	21	22	529	313	390	0.55	0.46	1.54
STD	0.8	4.7	4.8	122	84	95	0.15	0.13	0.45
SE	0.2	0.97	0.99	25	17	19	0.03	0.03	0.09
CI	0.3	2.00	2.04	51	35	40	0.06	0.05	0.19
CV, %	14	7.1	6.2	19	30	28	25	20	34
Cos (Range/Mean)	0.61	0.32	0.28	0.81	1.12	1.15	0.90	0.74	1.15

MAT is a mean annual Tair (°C); SP Is an annual sum of precipitation, P (mm); ST_{5-8} and ST_{5-9} are the sum of mean monthly Tair from May to August and May to September, respectively; SP_{5-8} and SP_{5-9} are the sum of monthly P from May to August and May to September, respectively; wetness indexes WI_{5-8} and WI_{5-9} are the ratio $lgSP_{5-8}/ST_{5-8}$ and $lgSP_{5-9}/ST_{5-9;}$ HTC_{6-8} is the Selyaninov hydrothermal coefficient over the summer period (June–August); ClimNo – Climatological Norm is a mean value for each meteorological index over period between 1991 – 2020; Mean, Median, Min, Max are mean, median, minimal, and maximal values, respectively; Range is the difference between Max and Min; STD is standard deviation; SE is standard error; CI – is a confidence interval, CV is coefficient of variation; Cos is a ratio between Range and Mean (coefficient oscillation).

Table S2. Ranks of meteorological indexes for calculation of the Spearmen's correlation coefficient.

Index	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6
Entic Podzol, Mature mixed forest						
MAT, °C	< 5.5	5.6 - 6.0	6.1 - 6.5	> 6.6		
ST_{5-8}, °C	< 63	63.1 - 66.0	66.1 - 69.0	69.1 - 72.0	> 72.1	
ST_{5-9}, °C	< 72	72.1 - 76.0	76.1 - 80.0	80.1 - 84.0	> 84,1	
SP, mm	< 550	551 - 650	651 - 750	>751		
SP_{5-8}, mm	< 200	201 - 260	261 - 320	321 - 380	>381	
SP_{5-9}, mm	< 260	261 - 320	321 - 380	381 - 440	>441	
WI_{5-8}	< 0.4	0.41 - 0.50	0.51 - 0.60	0.61 - 0.70	0.71 - 0.80	> 0.81
WI_{5-9}	< 0.5	0.51 - 0.60	0.61 - 0.70	0.71 - 0.80	> 0.81	
HTC_{6-8}	< 0.80	0.81 - 1.20	1.21 - 1.60	1.61 - 2.00	> 2.00	
Haplic Luvisol, Secondary deciduous forest						
MAT, °C	< 5.5	5.6 - 6.0	6.1 - 6.5	> 6.6		
SP, mm	< 550	551 - 650	651 - 750	>751		
SP_{5-8}, mm	< 200	201 - 260	261 - 320	321 - 380	>381	
SP_{5-9}, mm	< 260	261 - 320	321 - 380	381 - 440	>441	
WI_{5-8}	< 0.5	0.51 - 0.60	0.61 - 0.70	0.71 - 0.80	> 0.81	
WI_{5-9}	< 0.5	0.51 - 0.60	0.61 - 0.70	0.71 - 0.80	> 0.81	
HTC_{6-8}	< 0.80	0.81 - 1.20	1.21 - 1.60	1.61 - 2.00	> 2.00	

MAT is a mean annual Tair (°C); *ST_{5-8} and ST_{5-9} are the sum of mean monthly Tair from May to August and May to September, respectively;* SP is an annual sum of precipitation; SP_{5-8} and SP_{5-9} are the sum of monthly P from May to August and May to September, respectively; WI_{5-8} and WI_{5-9} are the ratio $lgSP_{5-8}/ST_{5-8}$ and $lgSP_{5-9}/ST_{5-9}$; HTC_{6-8} is the Selyaninov hydrothermal coefficient.

Table S3. Statistical characteristics for Q_{10} and SR_{10} values for different temperature intervals (*n* = 24).

	Mixed mature forest, Entic Podzol				
Characteristics	Q^*_{10}	Q_{10}	SR^*_{10}	SR_{10}	SR_{10}-obs
Mean	2.65	2.20	1.77	1.83	2.65
Median	2.56	2.25	1.70	1.70	2.56
Min	1.58	1.42	1.15	1.23	1.58
Max	5.04	3.15	2.86	2.93	5.04
Range (Max − Min)	3.46	1.73	1.71	1.70	3.46
STD	0.88	0.50	0.41	0.44	0.88
SE	0.18	0.10	0.08	0.09	0.18
CI	0.37	0.21	0.17	0.19	0.37
CV, %	33.0	22.8	23.3	24.2	33.0
Cos (Range/Mean)	1.31	0.78	0.97	0.93	1.31
	Secondary deciduous forest, Haplic Luvisol				
Mean	2.37	1.91	1.77	1.87	2.07
Median	2.19	1.90	1.72	1.87	2.05
Min	1.48	1.33	1.10	1.17	1.26
Max	6.29	2.74	2.65	2.65	3.28
Range (Max − Min)	4.81	1.40	1.55	1.49	2.01
STD	0.97	0.34	0.39	0.39	0.51
SE	0.20	0.07	0.08	0.08	0.10
CI	0.41	0.14	0.17	0.16	0.22
CV, %	40.7	17.8	22.3	20.8	24.7
Cos (Range/Mean)	2.03	0.73	0.88	0.79	0.97

Q^*_{10} and Q_{10} are the temperature coefficient for soil respiration at all range of soil temperature, Ts and for Ts > 1°C, respectively; SR^*_{10} and SR_{10} are the rate of soil respiration at 10°C (g C/m²/hour) calculated with using Q_{10} values; SR_{10}-obs is the observed rate of soil respiration at 10oC (g C/m²/day). Mean, Median, Min, Max are mean, median, minimal, and maximal values, respectively; Range is the difference between Max and Min; STD is standard deviation; SE is standard error; CI is a confidence interval, CV is coefficient of variation; Cos is a ratio between Range and Mean (coefficient oscillation).

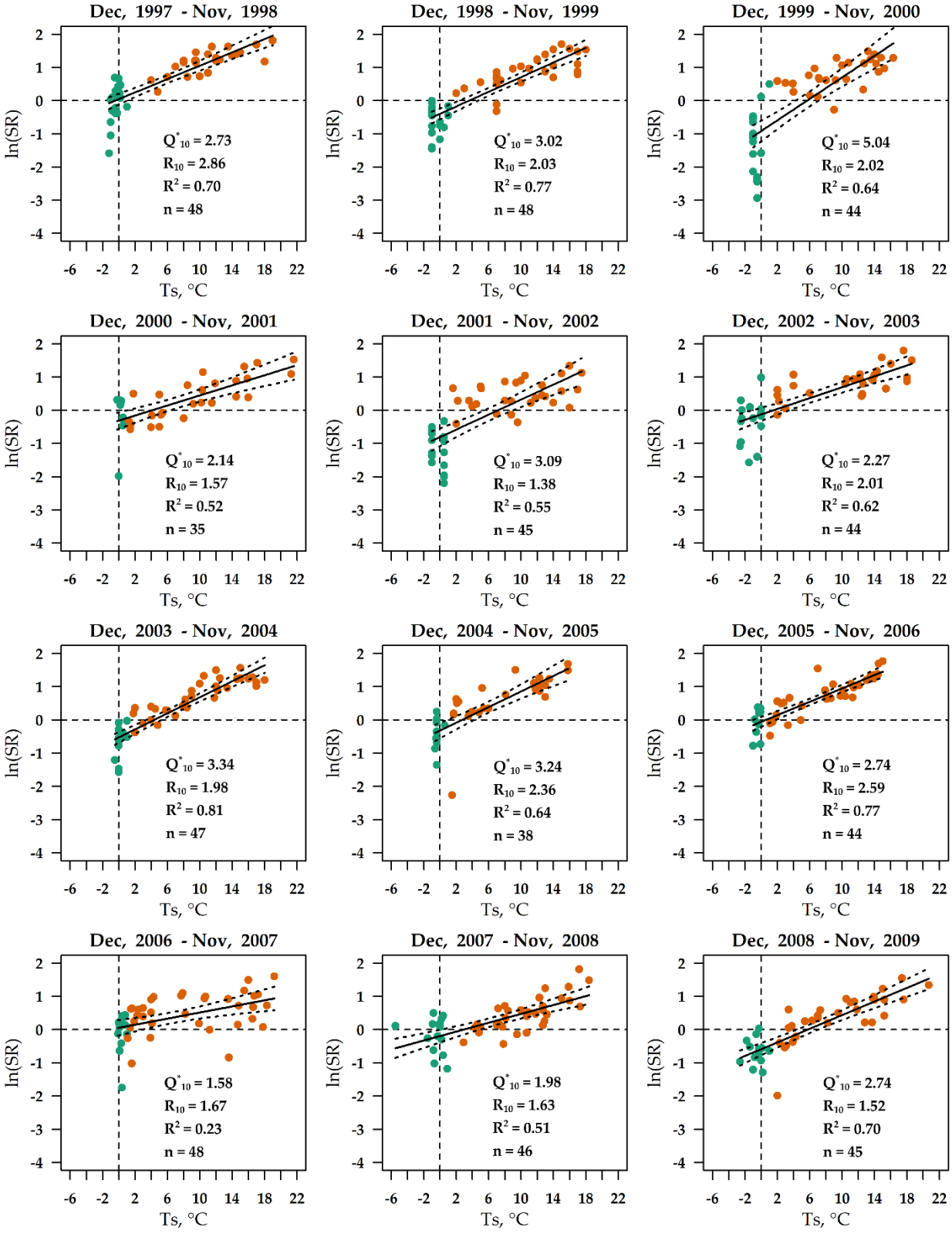

Figure S1. Correlation between logarithmic function of soil respiration rate (Ln(SR)) and soil temperatures at 5 cm (Ts) at the full range of Ts in sandy Entic Podzol in 1998–2009.The solid lines present the Q^*_{10} fit of the selected dataset; the dotted lines correspond to the standard error. All regressions are statistically significant at $P<0.001$. In each plot, the Q^*_{10}, R^*_{10}, the number of measurements (n), and R^2 of the regression are given. Green circles correspond to the measurements at Ts < 1°C, red circles correspond to the measurements at Ts ≥ 1°C.

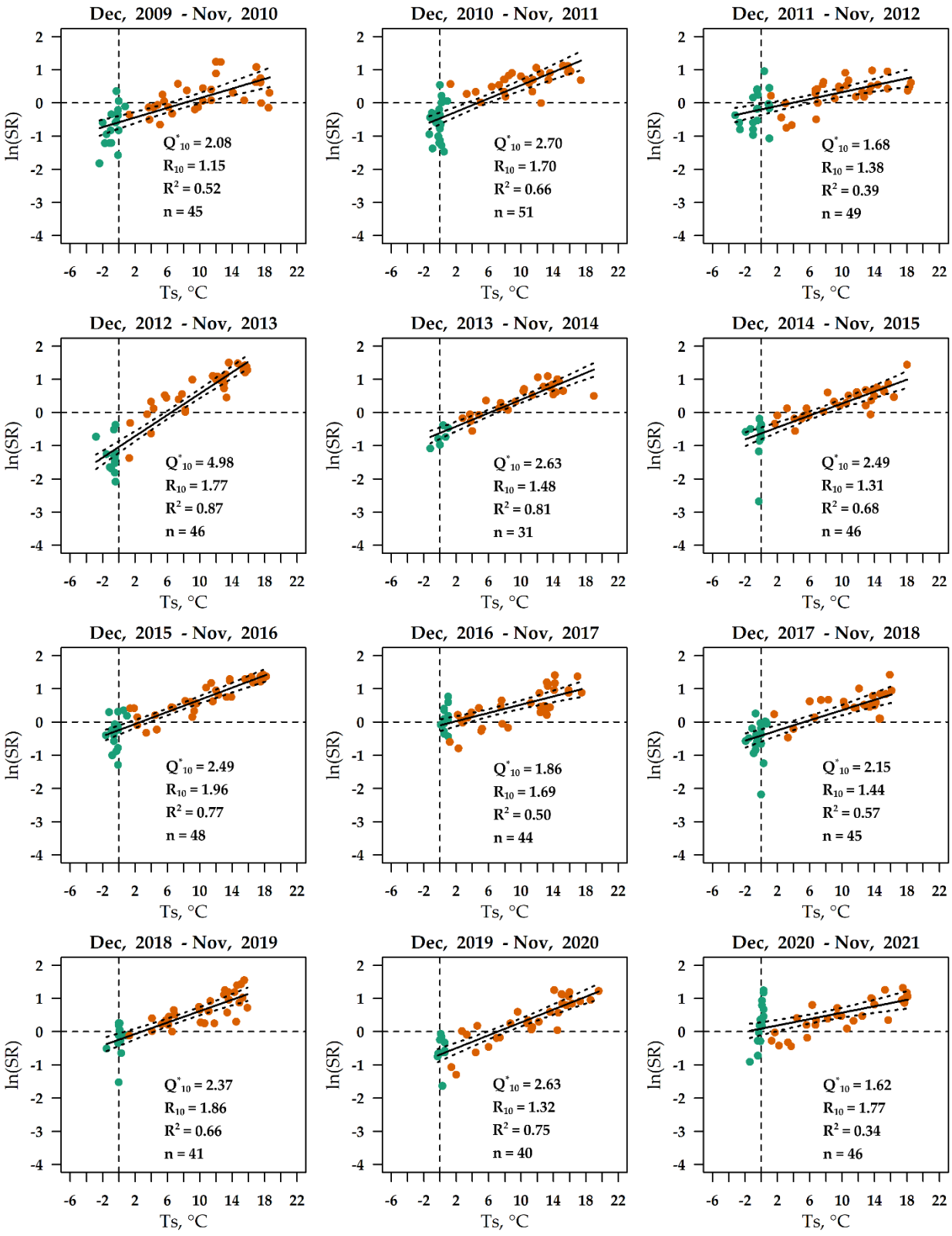

Figure S2. Correlation between logarithmic function of soil respiration rate (Ln(SR)) and soil temperatures at 5 cm (Ts) at the full range of Ts in sandy Entic Podzol in 2010–2021.The solid lines present the Q^*_{10} fit of the selected dataset; the dotted lines correspond to the standard error. All regressions are statistically significant at $P<0.001$. In each plot, the Q^*_{10}, R^*_{10}, the number of measurements (n), and R^2 of the regression are given. Green circles correspond to the measurements at Ts < 1°C, red circles correspond to the measurements at Ts ≥ 1°C.

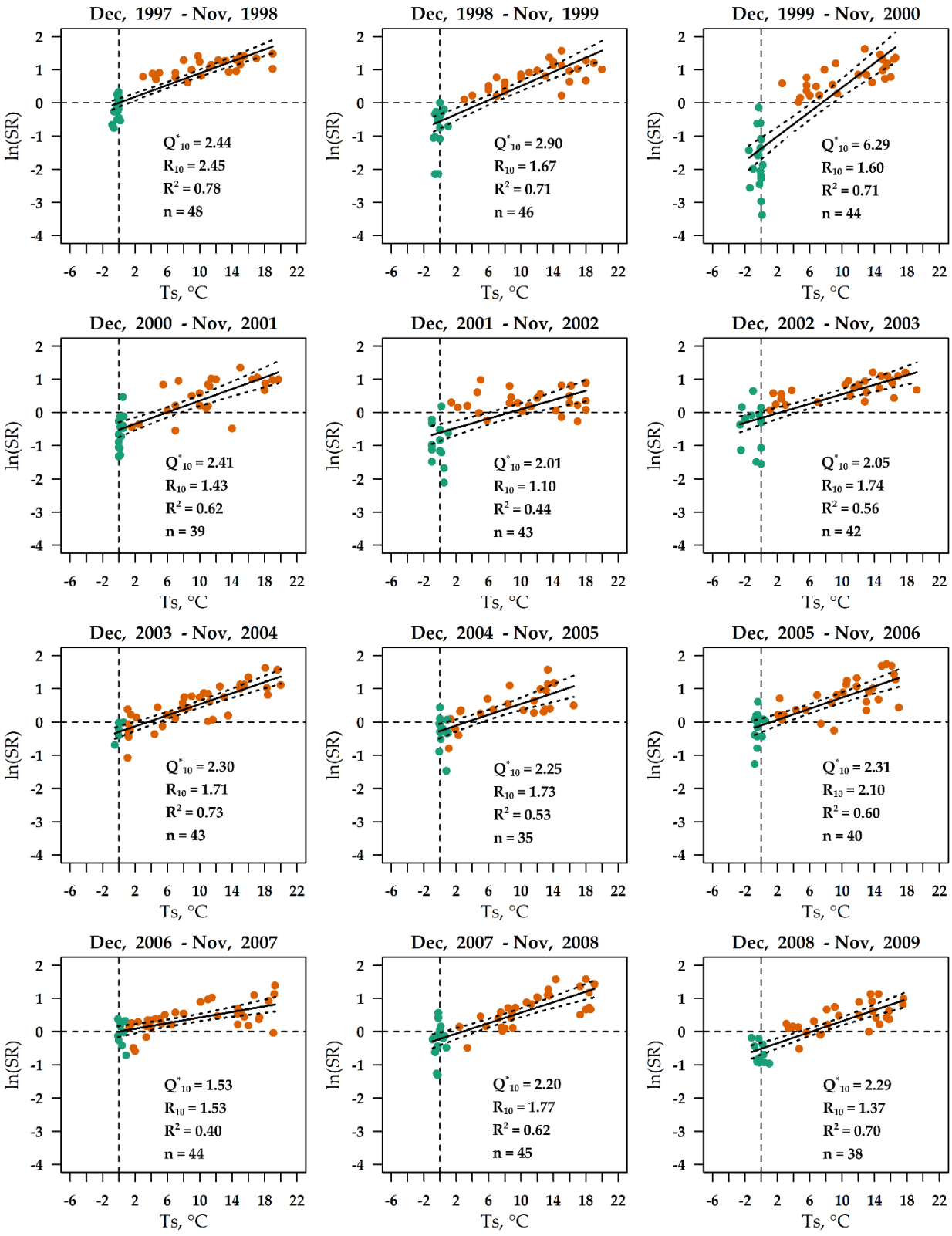

Figure S3. Correlation between logarithmic function of soil respiration rate (Ln(SR)) and soil temperatures at 5 cm (Ts) at the full range of Ts in clay Haplic Luvisol in 1998–2009.The solid lines present the Q^*_{10} fit of the selected dataset; the dotted lines correspond to the standard error. All regressions are statistically significant at $P<0.001$. In each plot, the Q^*_{10}, R^*_{10}, the number of measurements (n), and R^2 of the regression are given. Green circles correspond to the measurements at Ts < 1°C, red circles correspond to the measurements at Ts ≥ 1°C.

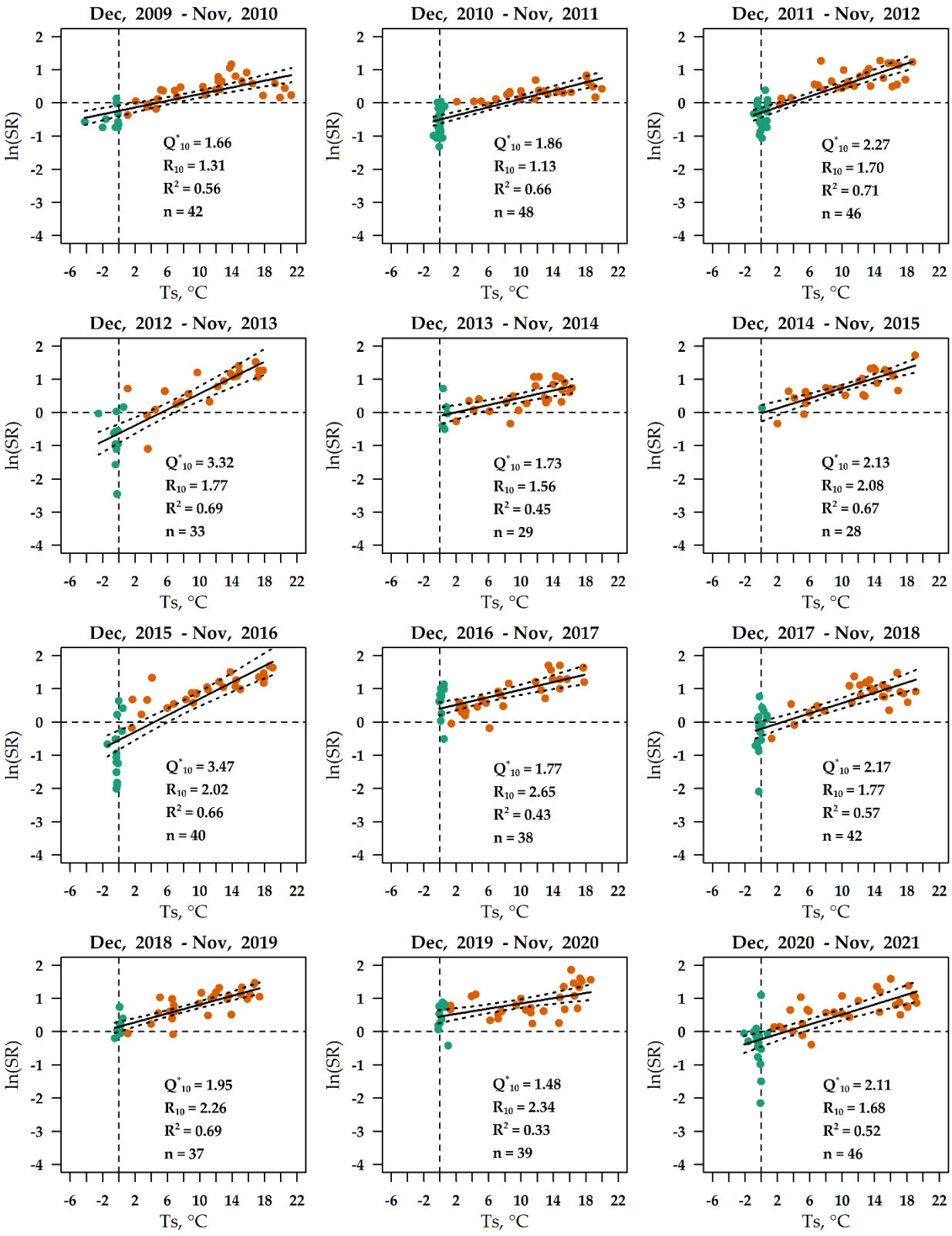

Figure S4. Correlation between logarithmic function of soil respiration rate (Ln(SR)) and soil temperatures at 5 cm (Ts) at the full range of Ts in clay Haplic Luvisol in 2010–2021.The solid lines present the Q^*_{10} fit of the selected dataset; the dotted lines correspond to the standard error. All regressions are statistically significant at $P<0.001$. In each plot, the Q^*_{10}, R^*_{10}, the number of measurements (n), and R^2 of the regression are given. Green circles correspond to the measurements at Ts < 1°C, red circles correspond to the measurements at Ts ≥ 1°C.

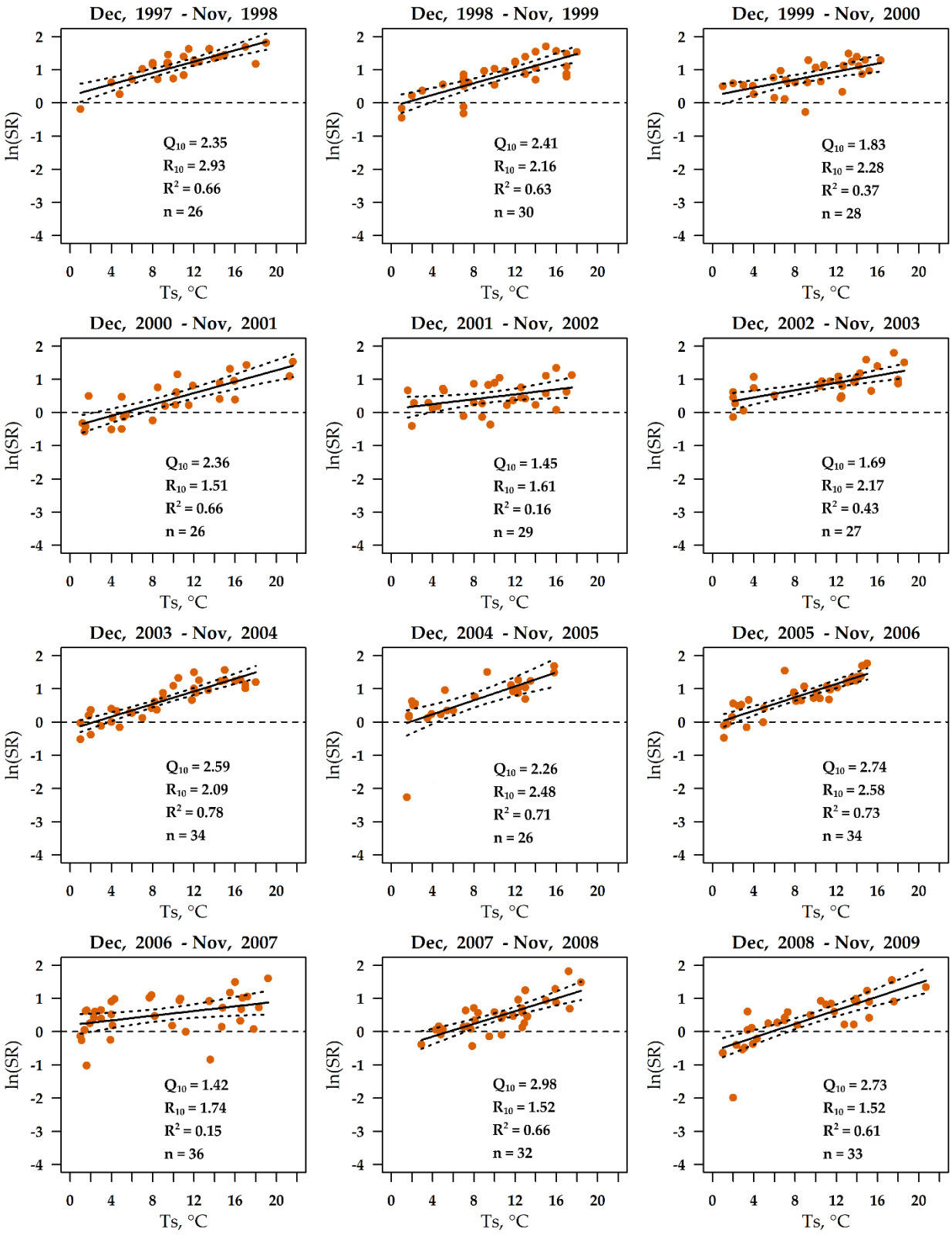

Figure S 5. Correlation between logarithmic function of soil respiration rate (Ln(SR)) and soil temperatures at 5 cm (Ts) at Ts ≥ 1°C in sandy Entic Podzol in 1998–2009.The solid lines present the Q^*_{10} fit of the selected dataset; the dotted lines correspond to the standard error. All regressions are statistically significant at $P<0.02$. In each plot, the Q^*_{10}, R^*_{10}, the number of measurements (n), and R^2 of the regression are given.

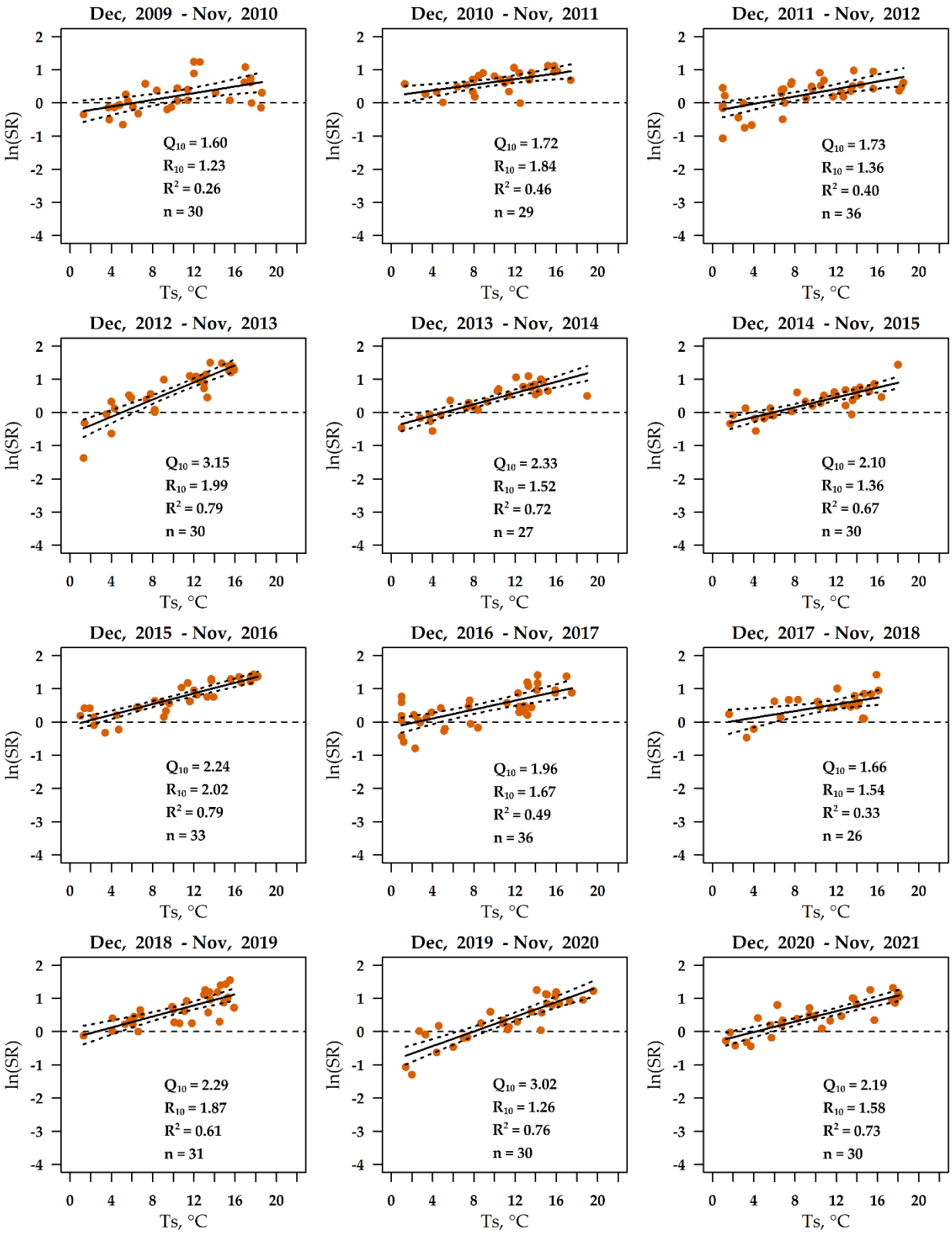

Figure S6. Correlation between logarithmic function of soil respiration rate (Ln(SR)) and soil temperatures at 5 cm (Ts) at Ts ≥ 1°C in sandy Entic Podzol in 2010–2021.The solid lines present the Q^*_{10} fit of the selected dataset; the dotted lines correspond to the standard error. All regressions are statistically significant at $P<0.005$. In each plot, the Q^*_{10}, R^*_{10}, the number of measurements (n), and R^2 of the regression are given.

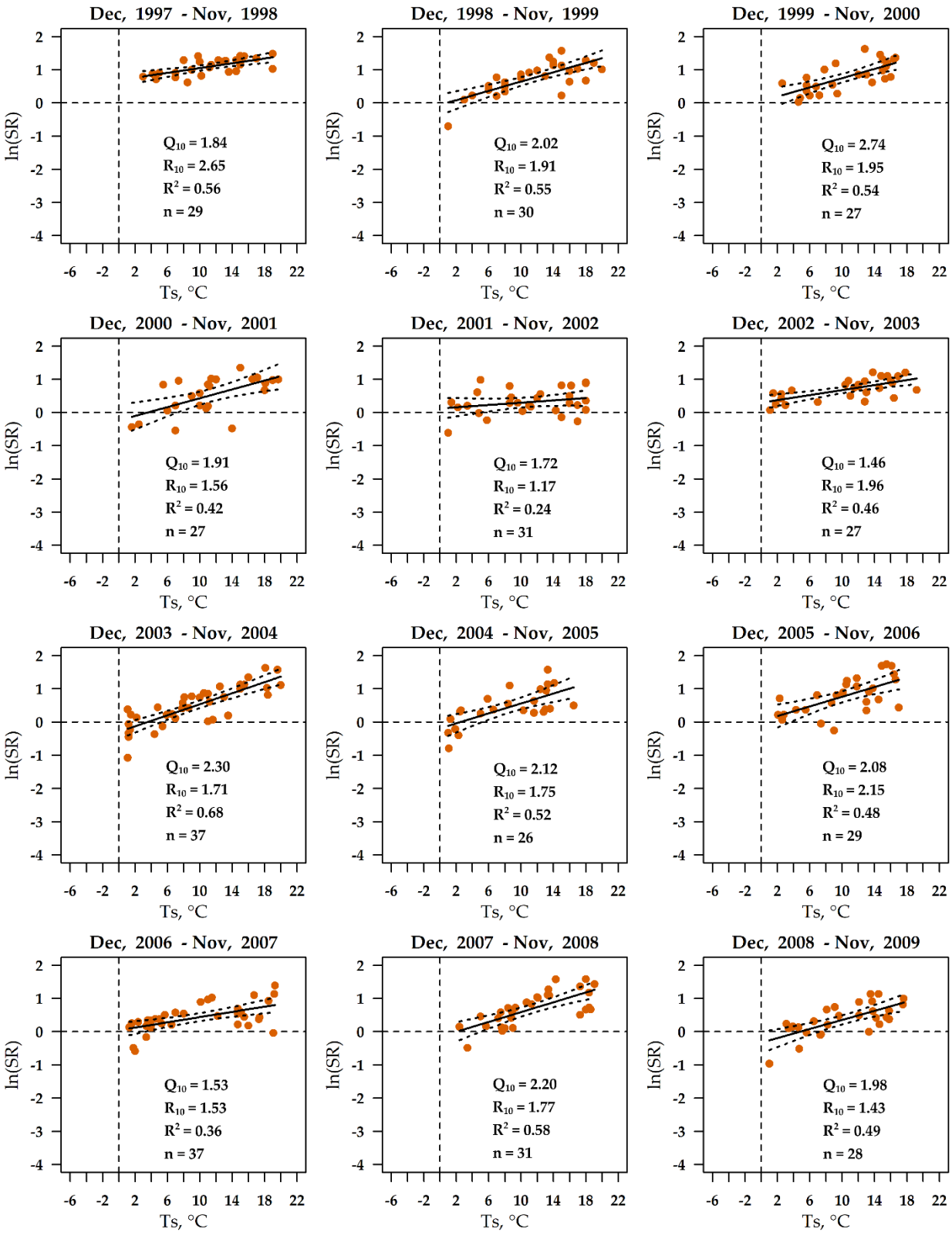

Figure S7. Correlation between logarithmic function of soil respiration rate (Ln(SR)) and soil temperatures at 5 cm (Ts) at Ts ≥ 1°C in clay Haplic Luvisol in 1998–2009.The solid lines present the Q^*_{10} fit of the selected dataset; the dotted lines correspond to the standard error. All regressions are statistically significant at P<0.005. In each plot, the Q^*_{10}, R^*_{10}, the number of measurements (n), and R^2 of the regression are given.

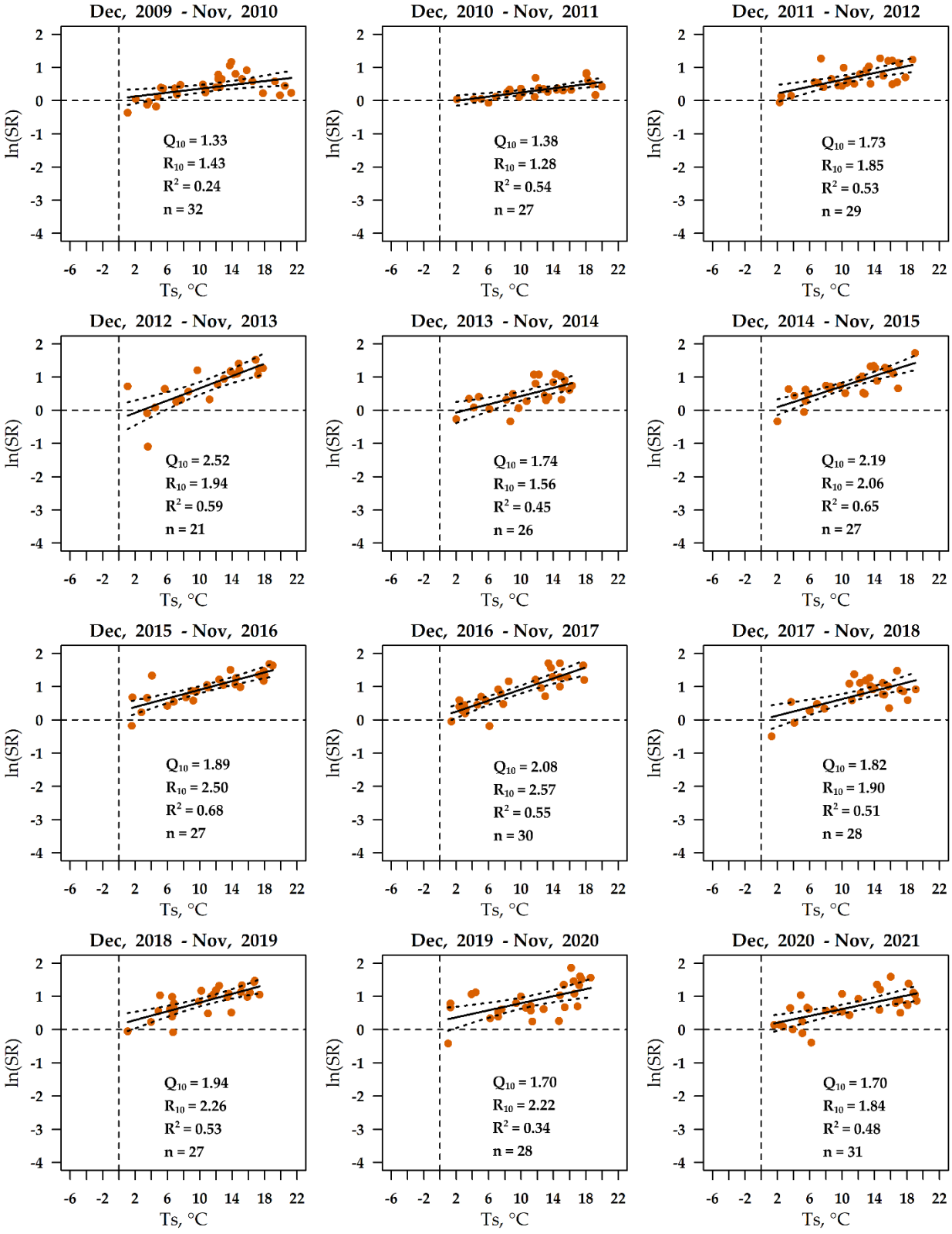

Figure S8. Correlation between logarithmic function of soil respiration rate (Ln(SR)) and soil temperatures at 5 cm (Ts) at Ts ≥ 1°C in clay Haplic Luvisol in 2010–2021.The solid lines present the Q^*_{10} fit of the selected dataset; the dotted lines correspond to the standard error. All regressions are statistically significant at P<0.005. In each plot, the Q^*_{10}, R^*_{10}, the number of measurements (n), and R^2 of the regression are given.