Table S1. Classification standards of water quality levels in GB 3838-2002.

WQP (mg/L)	Water quality levels				
	I	II	III	IV	V
TN≤	0.2	0.5	1.0	1.5	2.0
AN≤	0.15	0.5	1.0	1.5	2.0
TP≤	0.02	0.1	0.2	0.3	0.4

Table S2. Statistical information of TN for all regions and seasons.

Type	Area	Slope	Intercept	R^2	p	N
Normal	All	0.00	0.82	0.00	0.98	
	A	0.00	-5.40	0.03	0.70	7
	B	0.00	-7.13	0.03	0.70	
	C	-0.01	14.60	0.07	0.56	
Wet	All	0.01	-24.17	0.52	0.10	
	A	0.01	-26.37	0.52	0.11	6
	B	0.02	-36.87	0.58	0.08	
	C	0.01	-11.91	0.20	0.38	

Table S3. Statistical information of AN for all regions and seasons.

Type	Area	Slope	Intercept	R^2	p	N
Normal	All	-0.02	48.73	0.81	<0.01**	
	A	-0.01	25.48	0.59	0.04*	7
	B	-0.03	58.08	0.31	0.19	
	C	-0.03	70.78	0.71	0.02*	
Wet	All	-0.05	99.99	0.76	0.02*	
	A	-0.04	71.95	0.69	0.04*	6
	B	-0.07	146.58	0.63	0.06	
	C	-0.05	99.04	0.77	0.02*	

Note, * p < 0.05, ** p < 0.01

Table S4. Statistical information of TP for all regions and seasons.

Type	Area	Slope	Intercept	R^2	p	N
Normal	All	-0.00	2.29	0.26	0.25	
	A	-0.00	4.55	0.75	0.01*	7
	B	-0.00	2.02	0.20	0.32	
	C	0.00	-0.37	0.01	0.88	
Wet	All	-0.00	4.69	0.36	0.21	
	A	-0.00	2.97	0.18	0.40	6
	B	-0.00	3.31	0.19	0.39	
	C	-0.00	7.95	0.55	0.09	

Note, * p < 0.05

Table S5. Statistical information of RFR for TN compare with previous regression equations in the testing dataset.

ID	Equations	Area	References	Slope	Intercept	R^2	p	RMSE (mg/L)	MAPE (%)
1	$TN=0.233*(B4-B1)^2+1.2714*(B4-B1)+1.3499$	Poyang lack, China	[1]	0.01	1.37	0.08	0.24	0.50	61.59

ID	Equations	Area	References	Slope	Intercept	R^2	p	RMSE (mg/L)	MAPE (%)
2	TN=0.5914*(B5+B2)+1.1997	Dongting lake, China		0.02	1.23	0.08	0.24	0.44	52.41
3	TN=-3.219*(B3-B7)+5.712	Taihu lake, China		-0.06	5.68	0.32	0.01*	4.54	534.00
4	TN=-0.1((B5-B7)/(-1335.5))²-0.66*((B5-B7)/(-1335.5))+1.45	Yangtze River, China	[2]	0.00	1.45	0.00	0.82	0.55	67.85
5	TN=2.89–20.054×B3+15.137×B4+8.257×B5	Nakdong River, Korea	[3]	-0.02	2.94	0.00	0.88	1.88	229.74
6	TN=2.492–1.134×B4+7.257×B5	Nakdong River, Korea		0.04	2.80	0.01	0.76	1.81	220.10

Note, * p < 0.05

Table S6. Statistical information of ANN for TP compare with previous regression equations in the testing dataset.

| ID	Equations	Area	References	Slope	Intercept	R^2	p	RMSE (mg/L)	MAPE (%)
1	TP=0.0038*((B4-B3)/B5)²+0.0146*(B4-B3)/B5+0.0772	Dongting lake, China	[1]	0.01	0.07	0.02	0.60	0.05	74.71
2	TP=0.0292*(B5/B1)²+0.0979*(B5/B1)+0.0332	Taihu lake, China		-14.99	2.55	0.11	0.19	2.56	4125.00
3	TP=0.0577*((B4+B6+B7)/3)²+0.707*((B4+B6+B7)/3)+0.0735	Yangtze River, China	[2]	0.16	0.09	0.25	0.04*	0.05	104.84
4	TP=0.063–0.022×B2+0.015×B3+0.005×B4–0.166×B5	Nakdong River, Korea	[3]	-0.03	0.06	0.05	0.39	0.05	54.92
5	TP=0.06+0.041×B3–0.209×B5+0.003×(B5/B3)	Nakdong River, Korea		-0.03	0.06	0.08	0.26	0.05	55.41
6	TP=0.043+0.152×B3–0.168×B5	Nakdong River, Korea		0.02	0.04	0.03	0.48	0.06	44.61

Note, * p < 0.05
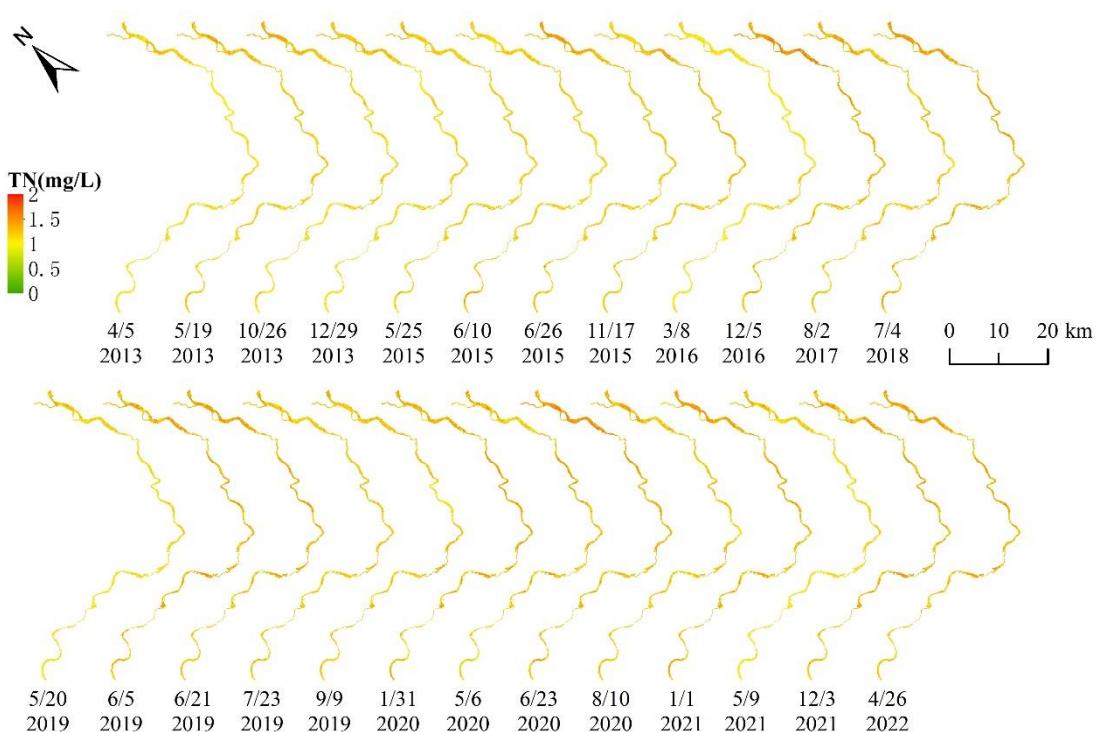
**Figure S1.** The spatial distribution of TN in NRD.
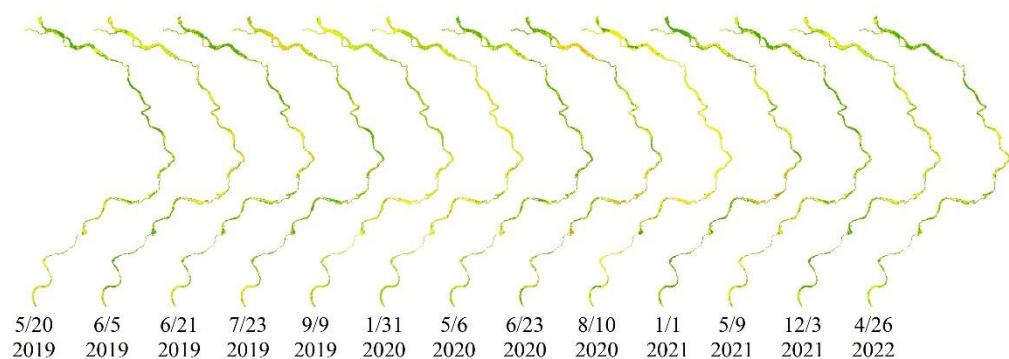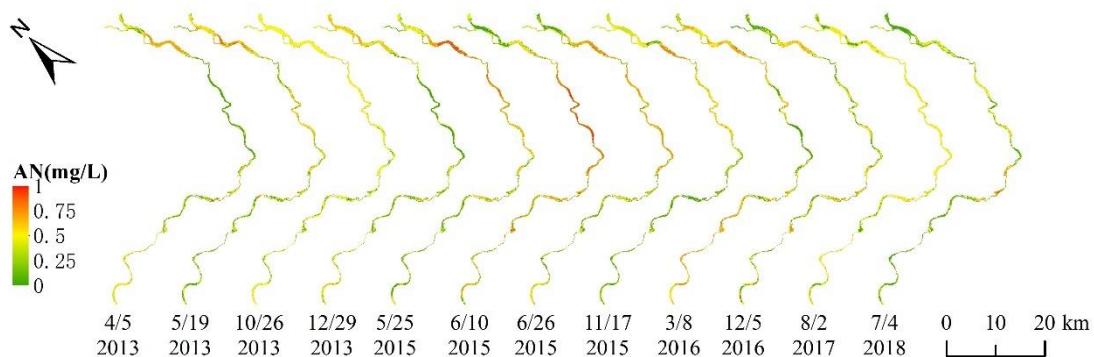
**Figure S2.** The spatial distribution of AN in NRD.
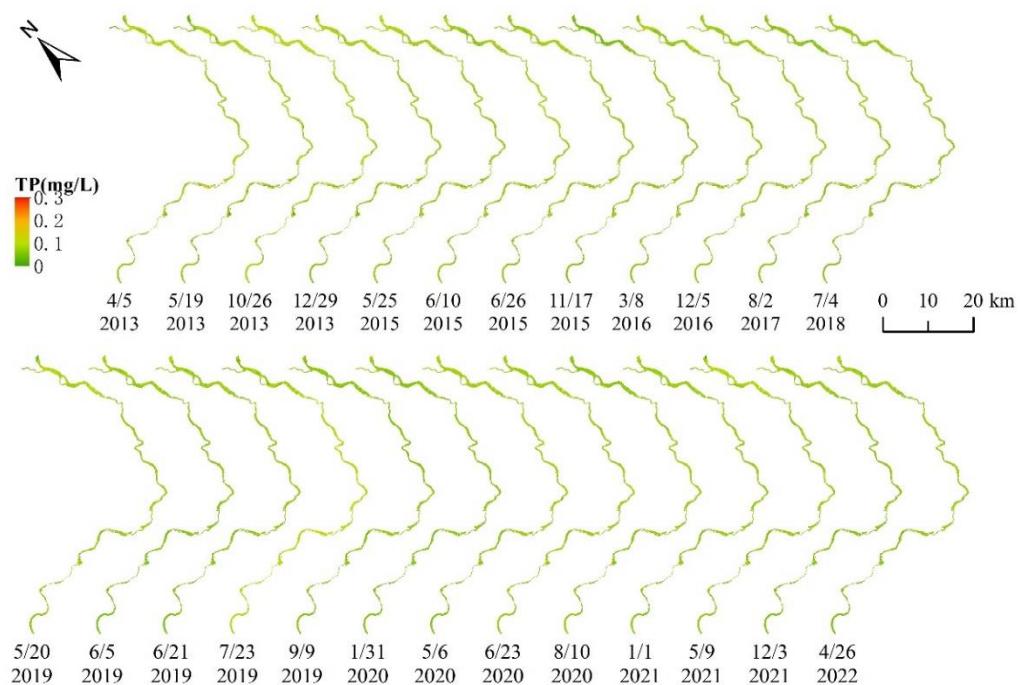
Figure S3. The spatial distribution of TP in NRD.

References

1.   Shang W, Jin S, He Y, Zhang Y, Li J. Spatial–Temporal Variations of Total Nitrogen and Phosphorus in Poyang, Dongting and Taihu Lakes from Landsat-8 Data. *Water*, **2021**, *13*, 10.3390/w13121704.
2.   He Y, Jin S, Shang W. Water Quality Variability and Related Factors along the Yangtze River Using Landsat-8. *Remote Sensing*, **2021**, *13*, 10.3390/rs13122241.
3.   Lim J, Choi M. Assessment of water quality based on Landsat 8 operational land imager associated with human activities in Korea. *Environ Monit Assess*, **2015**, *187*, 384. 10.1007/s10661-015-4616-1.