Table S1. Groundwater classification based on the GQISWI values. Element concentrations are in mg/L, EC is in μS/cm, total depth and water level are in meters.

GW[1] Type	Class	Sample No.	Well type[2]	Total Depth	Water level	pH	TDS	EC	K	Na	Mg	Ca	Cl	SO_4	HCO_3	Water type
Fresh Groundwater	Highly Fresh	36	D	100	6.7	7.45	852	1205	10	45	45	95	90	60	360	Ca-Mg-HCO_3-Cl
		38	D	110	6	7.82	291.9	440	9	20	18	36	33	15	168	Ca-Mg-Na-HCO_3-Cl
		40	D	100	6.5	7.3	855.27	1310	12	64	38	115	100	49	426	Ca-Mg-Na-HCO_3-Cl
		57	D	110	4.6	7.8	298	389	9	21	15	36	30	18	160	Ca-Mg-Na-HCO_3-Cl
	Slightly Fresh	8	D	115	5.5	7.45	592	900	8.63	86.5	26.5	45	102	32	285	Na-Ca-Mg-HCO_3-Cl
		9	I	50	5.5	7.58	283	399	5.96	36.2	13.5	22.5	60	15	122	Na-Ca-Mg-HCO_3-Cl
		10	HD	25	6.5	7.69	588.6	888	8	92.3	24.8	42	100	30	253	Na-Ca-Mg-HCO_3-Cl
		14	I	50	6.5	7.4	341	530	15.6	16.2	20	61	86	53	113	Ca-Mg-Cl-HCO_3
		20	HD	35	4.2	7.42	645	1020	7	90	35	61	150	45	238	Na-Ca-Mg-Cl-HCO_3
		21	I	70	3.3	8.32	795	1210	8	92	20	41	55	28	310	Na-Ca-Mg-HCO_3-Cl
		23	I	50	5.7	8.61	313	482	7.5	16	13	42.5	80	17	113	Ca-Mg-Cl-HCO_3
		37	D	100	6.5	7.41	540.9	820	18	45	33	50	71	93	219	Mg-Ca-Na-HCO_3-Cl-SO_4
		52	I	50	5	7.33	313	572	8.4	23.5	20.3	30.9	80	22	118	Mg-Ca-Na-Cl-HCO_3
		59	D	120	6.5	7.35	592	793	35	65	28	40	105	60	250	Na-Mg-Ca-HCO_3-Cl
		60	D	110	6.7	7.82	336	498	9	42	13	18	30	18	150	Na-Mg-Ca-HCO_3-Cl

GW[1] Type	Class	Sample No.	Well type[2]	Total Depth	Water level	pH	TDS	EC	K	Na	Mg	Ca	Cl	SO_4	HCO_3	Water type
Mixed Groundwater	Slightly Mixed	7	I	50	3.3	7.68	542	832	5.51	97	20	40	100	30	233	Na-Ca-Mg-HCO_3-Cl
		11	HD	20	3.6	7.45	568	867	12.45	66.5	38	49	180	115	136	Mg-Na-Ca-Cl-SO_4-HCO_3
		15	HD	35	3.5	7.9	991	1510	11.5	83	46.5	95	281	120	200	Ca-Mg-Na-Cl-HCO_3
		24	I	50	4	7.9	476	730	16.9	66	18	52.6	113	33	178	Na-Ca-Mg-Cl-HCO_3
		53	I	60	4.75	8.9	1012	1686	28	120	80	70	250	132	289	Mg-Na-Ca-Cl-HCO_3
	Fairly Mixed	1	HD	30	4	7.33	2110	3161	18.3	250	130	222	950	350	140	Ca-Na-Mg-Cl-SO_4
		6	HD	30	3.5	7.34	1175	1703	9.8	213	45.3	113	388	200	190	Na-Ca-Mg-Cl-SO_4
		12	HD	20	3.4	7.56	1542	2310	10.5	258	64	122	510	250	285	Na-Ca-Mg-Cl-SO_4
		19	HD	20	4	7.82	1050	1600	8.15	192	35	85	320	180	202	Na-Ca-Cl-SO_4-HCO_3
		22	HD	20	5.5	7.3	1720	2600	12.3	286	110	132	586	200	366	Na-Mg-Ca-Cl-HCO_3
		25	I	50	5	7.4	882	1290	4.5	180	13	63.5	190	36	300	Na-Ca-Cl-HCO_3
		39	D	105	5	7.72	779.9	1200	15	165	25	65	263	29	233	Na-Ca-Cl-HCO_3
		51	HD	35	3.5	7.4	702	1100	17.9	73	50	63	270	120	110	Mg-Na-Ca-Cl-SO_4
		54	I	90	4.6	8.7	3120	5200	82	580	145	183	775	450	810	Na-Mg-Cl-HCO_3-SO_4
		55	I	70	2.3	7.45	2310	3610	14	340	27.5	85	312	215	402	Na-Ca-Cl-HCO_3-SO_4
		58	D	120	5.5	7.72	771	1310	25	156	20	52	190	22	290	Na-Ca-Cl-HCO_3

GW[1] Type	Class	Sample No.	Well type[2]	Total Depth	Water level	pH	TDS	EC	K	Na	Mg	Ca	Cl	SO_4	HCO_3	Water type
Mixed Groundwater	Highly Mixed	2	HD	20	4.5	7.75	785	1193	10.1	200	25.4	26	270	150	160	Na-Cl-SO_4-HCO_3
		3	I	45	4.5	7.56	1820	2736	13.5	344.5	55.5	136	590	370	300	Na-Ca-Cl-SO_4
		4	I	50	3.5	7.72	720	1110	7.46	146	26.3	45	254	130	101	Na-Cl-SO_4
		17	HD	30	3.5	7.62	1131	1720	8.15	272	32	41	300	200	271	Na-Cl-SO_4
		28	HD	25	2.3	7.53	1508	2199	12.06	293	52	94	530	300	172	Na-Ca-Cl-SO_4
		29	HD	20	2.5	7.4	2210	3350	25.3	410	85	140	900	360	160	Na-Mg-Ca-Cl-SO_4
		32	HD	18	5	7.55	698	1060	8.76	160.4	20.5	26	195	134	100	Na-Cl-SO_4
		50	HD	45	4	7.29	1162	1793	15.8	250	69	57	418	200	125	Na-Mg-Cl-SO_4
Mixed Groundwater	Extremely Mixed	5	HD	20	0.75	7.12	8352	12513	95	1670	350	460	3540	1540	500	Na-Mg-Cl-SO_4
		13	HD	25	3.7	7.58	4033	6100	29	1310	51	48	1260	890	441	Na-Cl-SO_4
		16	HD	30	3.2	7.23	5136	7700	20	1130	198	290	2120	990	356	Na-Cl-HCO_3-SO_4
		18	HD	30	3	7.65	1992	2900	10.1	493.6	43	65	690	330	300	Na-Cl-SO_4
		26	HD	20	2.4	7.84	2771	3990	22	705	85	152	890	545	330	Na-Cl-SO_4
		27	HD	20	1.4	7.78	3276	5010	38.97	613	100	136	990	700	175	Na-Cl-SO_4
		30	I	35	3.8	7.3	3394	5120	19.5	850	93	210	1082	750	281	Na-Cl-SO_4
		31	I	40	4	7.62	1075	1580	7.98	269.5	22	25	370	195	116	Na-Cl-SO_4
		44	HD	20	4.5	7.46	1220	1890	22.5	342	13	15	505	160	90	Na-Cl
		45	HD	20	5.5	7.16	1138	1710	26	250	32	26	450	150	75	Na-Cl
		46	HD	25	4.5	7.4	1986	2892	41.7	567	35	45	742	400	136	Na-Cl-SO_4
		56	I	70	5	8.3	2410	3890	17.5	660	55	90	581	518	450	Na-Cl-SO^4-HCO_3

GW[1] Type	Class	Sample No.	Well type[2]	Total Depth	Water level	pH	TDS	EC	K	Na	Mg	Ca	Cl	SO_4	HCO_3	Water type
Saline Groundwater	**Saline**	33	HD	25	1.5	7.31	19550	30030	146	4350	960	1230	10120	2520	200	Na-Mg-Cl
		34	HD	25	2.2	7.28	17064	26000	55	3850	650	990	8210	3120	180	Na-Cl-SO_4
		35	I	50	2.5	7.43	18036	27100	28.8	3370	850	1200	7350	4560	210	Na-Mg-Ca-Cl-SO_4
		41	I	50	1.75	6.9	15520	23230	30	3120	720	1554	9620	250	210	Na-Ca-Mg-Cl
		42	HD	35	2.75	7.1	10590	16020	30	2620	350	500	4720	2200	154	Na-Cl-SO_4
		43	HD	35	2.3	7.15	17290	25900	110	3140	895	1130	7150	4520	95	Na-Mg-Cl-SO_4
		47	HD	20	3.5	7.29	13167	19590	58.9	3000	490	755	5410	3000	72	Na-Cl-SO_4
		48	HD	40	3.8	7.1	15050	22510	52	3330	610	820	6310	3780	90	Na-Mg-Cl-SO_4
		49	HD	35	3.5	7.2	15211	22760	34.3	2458	550	1100	5100	3250	119.5	Na-Ca-Mg-Cl-SO_4
Seawater							37900		357	11760	1515	426	20979	2930	169	

[1] GW: Groundwater; [2] D: Drinking, I: Irrigation, HD: Hand Dug

Table S2. The results of calculated ionic deviations (mi, react) in the groundwater samples based on the conservative mixing. fsea and saturation indices of selected minerals were also given.

Class	Sample no.	m K react	m Na react	m Mg react	m Ca react	m Cl react	m SO_4 react	m HCO_3 react	f_{sea}	SI_{cal}	SI_{dol}	SI_{gyps}	SI_{hal}	SMI
FGH	36	0.00	-0.42	1.06	1.44	0.00	0.35	3.28	0.29%	0.45	0.84	-1.77	-6.99	0.09
	38	0.00	-0.12	0.11	0.00	0.00	-0.04	0.13	0.01%	0.16	0.29	-2.6	-7.75	0.03
	40	0.05	0.16	0.74	1.94	0.00	0.22	4.36	0.33%	0.45	0.68	-1.8	-6.8	0.10
	57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%	0.12	0.13	-2.52	-7.76	0.03
FGS	8	-0.04	1.09	0.26	0.19	0.00	0.04	2.05	0.34%	0.06	0.16	-2.27	-6.64	0.10
	9	-0.09	-0.07	-0.15	-0.35	0.00	-0.07	-0.62	0.14%	-0.41	-0.77	-2.77	-7.22	0.05
	10	-0.06	1.40	0.20	0.12	0.00	0.02	1.52	0.33%	0.22	0.49	-2.32	-6.62	0.11
	14	0.14	-1.57	0.04	0.60	0.00	0.28	-0.77	0.27%	-0.23	-0.68	-1.89	-7.43	0.06
	20	-0.10	0.08	0.47	0.57	0.00	0.11	1.28	0.57%	0.07	0.17	-2.04	-6.46	0.13
	21	-0.04	2.48	0.13	0.11	0.00	0.07	2.46	0.12%	0.91	1.78	-2.36	-6.88	0.08
	23	-0.06	-1.44	-0.23	0.14	0.00	-0.08	-0.77	0.24%	0.81	1.37	-2.48	-7.46	0.05
	37	0.21	0.04	0.62	0.33	0.00	0.72	0.97	0.20%	-0.06	-0.03	-1.79	-7.08	0.08
	52	-0.04	-1.11	0.07	-0.15	0.00	-0.03	-0.69	0.24%	-0.55	-1.01	-2.51	-7.29	0.06
	59	0.63	0.09	0.31	0.06	0.00	0.33	1.47	0.36%	-0.15	-0.19	-2.06	-6.75	0.10
	60	0.00	0.91	-0.08	-0.45	0.00	0.00	-0.16	0.00%	-0.18	-0.22	-2.78	-7.46	0.04

Class	Sample no.	m K react	m Na react	m Mg react	m Ca react	m Cl react	m SO_4 react	m HCO_3 react	f_{sea}	SI_{cal}	SI_{dol}	SI_{gyps}	SI_{hal}	SMI
MGS	7	-0.12	1.60	0.00	0.07	0.00	0.02	1.20	0.33%	0.16	0.3	-2.33	-6.6	0.11
	11	0.02	-1.68	0.50	0.25	0.00	0.79	-0.39	0.72%	-0.25	-0.34	-1.73	-6.52	0.15
	15	-0.04	-3.42	0.56	1.36	0.00	0.70	0.65	1.20%	0.61	1.18	-1.51	-6.24	0.21
	24	0.17	-0.07	-0.12	0.38	0.00	0.04	0.29	0.40%	0.38	0.57	-2.17	-6.71	0.10
	53	0.39	-1.06	2.03	0.75	0.00	0.87	2.11	1.05%	1.48	3.31	-1.66	-6.14	0.22
MGF	1	-0.15	-12.46	2.02	4.21	0.00	2.12	-0.33	4.39%	0.12	0.29	-0.94	-5.29	0.66
	6	-0.13	-0.37	0.19	1.76	0.00	1.38	0.49	1.71%	0.06	0.01	-1.28	-5.71	0.33
	12	-0.17	-1.39	0.60	1.92	0.00	1.72	2.05	2.29%	0.46	0.91	-1.21	-5.52	0.43
	19	-0.14	0.37	-0.03	1.09	0.00	1.27	0.69	1.38%	0.46	0.81	-1.4	-5.83	0.28
	22	-0.15	-2.03	2.27	2.14	0.00	1.09	3.37	2.65%	0.33	0.85	-1.32	-5.42	0.48
	25	-0.18	3.02	-0.55	0.61	0.00	-0.04	2.29	0.76%	0.16	-0.1	-2.11	-6.06	0.19
	39	0.05	0.58	-0.28	0.62	0.00	-0.22	1.19	1.11%	0.37	0.6	-2.22	-5.96	0.22
	51	0.13	-3.59	0.73	0.56	0.00	0.71	-0.82	1.15%	-0.31	-0.44	-1.65	-6.31	0.20
	54	1.55	6.16	3.15	3.32	0.00	3.42	10.65	3.56%	1.98	4.16	-1	-5.03	0.77
	55	0.01	7.00	-0.32	1.09	0.00	1.64	3.96	1.35%	0.36	0.51	-1.37	-5.6	0.36
	58	0.34	1.97	-0.27	0.32	0.00	-0.19	2.13	0.76%	0.38	0.62	-2.41	-6.12	0.18

Class	Sample no.	m K react	m Na react	m Mg react	m Ca react	m Cl react	m SO_4 react	m HCO_3 react	f_{sea}	SI_{cal}	SI_{dol}	SI_{gyps}	SI_{hal}	SMI
MGH	2	-0.07	1.94	-0.28	-0.36	0.00	1.03	0.00	1.15%	-0.19	-0.12	-1.91	-5.87	0.26
	3	-0.12	0.42	0.02	2.24	0.00	2.85	2.29	2.67%	0.49	0.87	-1.03	-5.34	0.52
	4	-0.13	-0.02	-0.20	0.12	0.00	0.84	-0.97	1.07%	-0.17	-0.29	-1.72	-6.03	0.22
	17	-0.14	4.34	-0.10	0.00	0.00	1.50	1.82	1.29%	0.07	0.3	-1.66	-5.71	0.32
	28	-0.13	-0.36	0.05	1.22	0.00	2.21	0.19	2.39%	0.09	0.21	-1.22	-5.45	0.46
	29	0.05	-4.28	0.32	2.19	0.00	2.30	-0.01	4.15%	0.06	0.18	-1.07	-5.09	0.71
	32	-0.08	2.04	-0.26	-0.33	0.00	0.97	-0.98	0.79%	-0.57	-0.96	-1.92	-6.1	0.20
	50	0.01	0.50	1.08	0.34	0.00	1.33	-0.58	1.85%	-0.46	-0.56	-1.57	-5.61	0.37
MGE	5	0.71	-13.83	3.44	8.95	0.00	10.77	5.55	16.75%	0.55	1.28	-0.37	-3.98	2.85
	13	-0.01	26.09	-2.14	-0.27	0.00	7.30	4.60	5.87%	0.09	0.49	-1.29	-4.48	1.41
	16	-0.61	-2.70	1.37	5.37	0.00	7.09	3.20	9.98%	0.4	0.91	-0.6	-4.34	1.78
	18	-0.25	4.47	-0.79	0.42	0.00	2.29	2.29	3.15%	0.26	0.63	-1.37	-5.12	0.64
	26	-0.03	8.79	0.35	2.50	0.00	4.24	2.78	4.11%	0.79	1.6	-0.93	-4.88	0.88
	27	0.36	2.35	0.67	2.05	0.00	5.71	0.24	4.58%	0.39	0.93	-0.88	-4.89	0.91
	30	-0.18	10.42	0.11	3.85	0.00	6.10	1.98	5.02%	0.29	0.51	-0.72	-4.73	1.08
	31	-0.17	2.52	-0.71	-0.43	0.00	1.35	-0.72	1.62%	-0.5	-0.78	-1.85	-5.61	0.35
	44	0.14	2.39	-1.48	-0.74	0.00	0.79	-1.15	2.27%	-0.99	-1.76	-2.15	-5.38	0.44
	45	0.26	-0.28	-0.54	-0.44	0.00	0.77	-1.40	2.00%	-1.12	-1.87	-1.95	-5.56	0.37
	46	0.53	6.40	-1.27	-0.11	0.00	2.95	-0.40	3.40%	-0.49	-0.82	-1.45	-5.03	0.71
	56	-0.02	14.36	0.02	1.09	0.00	4.41	4.75	2.63%	1.15	2.36	-1.13	-5.08	0.70

Class	Sample no.	m K react	m Na react	m Mg react	m Ca react	m Cl react	m SO_4 react	m HCO_3 react	f_{sea}	SI_{cal}	SI_{dol}	SI_{gyps}	SI_{hal}	SMI
SG	33	-0.78	-57.63	9.15	25.11	0.00	11.45	0.58	48.16%	0.63	1.46	-0.04	-3.18	7.66
	34	-2.30	-32.83	2.03	20.01	0.00	20.46	0.27	39.05%	0.47	1.07	0.02	-3.31	6.48
	35	-2.60	-32.74	12.79	25.64	0.00	36.69	0.77	34.94%	0.73	1.61	0.22	-3.42	6.07
	41	-3.53	-98.95	0.75	33.42	0.00	-11.46	0.75	45.78%	0.41	0.79	-0.87	-3.33	6.41
	42	-1.45	-1.26	-0.04	9.40	0.00	15.93	-0.13	22.39%	0.01	0.17	-0.25	-3.68	3.99
	43	-0.44	-37.87	15.23	23.99	0.00	36.56	-1.12	33.99%	0.09	0.38	0.19	-3.46	5.87
	47	-1.01	-1.55	3.69	15.44	0.00	23.26	-1.48	25.68%	0	0.11	-0.03	-3.58	4.65
	48	-1.57	-9.14	5.98	16.65	0.00	30.08	-1.19	29.98%	-0.09	0	0.05	-3.48	5.39
	49	-1.51	-17.57	7.07	24.19	0.00	26.31	-0.70	24.20%	0.28	0.56	0.14	-3.7	4.28

Table S3. Pearson correlation matrix of some variables of the groundwater samples from the study area.

		Total Depth	Water level	pH	EC	Distance	BEX	SAR	Cl	m K-react	m Na-react	m Mg-react	m Ca-react	m SO_4-react	m HCO_3-react	SI_{Hal}	SI_{Cal}	SI_{Dol}	SI_{Gyps}
Total Depth	PC[1]	1																	
	Sig. (2-tailed)																		
Water level	PC	**.565****	1																
	Sig. (2-tailed)	0.000																	
pH	PC	.259*	0.224	1															
	Sig. (2-tailed)	0.045	0.085																
EC	PC	-0.254	**-.557****	-.409**	1														
	Sig. (2-tailed)	0.050	**0.000**	0.001															
Distance	PC	**.601****	**.855****	0.209	**-.574****	1													
	Sig. (2-tailed)	0.000	**0.000**	0.109	0.000														
BEX	PC	0.070	**.315***	.347**	-.485**	0.233	1												
	Sig. (2-tailed)	0.594	**0.014**	0.007	0.000	0.073													
SAR	PC	-.413**	**-.569****	-.349**	**.776****	**-.695****	-0.180	1											
	Sig. (2-tailed)	0.001	0.000	0.006	0.000	0.000	0.169												
Cl	PC	-0.251	**-.558****	-.433**	**.981****	**-.558****	**-.626****	**.746****	1										
	Sig. (2-tailed)	0.053	0.000	0.001	0.000	0.000	0.000	0.000											
m K-react	PC	0.210	.385**	.449**	**-.744****	.361**	**.667****	**-.533****	**-.784****	1									
	Sig. (2-tailed)	0.107	0.002	0.000	0.000	0.005	0.000	0.000	0.000										
m Na-react	PC	0.104	.409**	.380**	**-.717****	.341**	**.927****	-.317*	**-.813****	**.715****	1								
	Sig. (2-tailed)	0.430	0.001	0.003	0.000	0.008	0.000	0.014	0.000	0.000									
m Mg-react	PC	-0.104	-.347**	-0.219	**.779****	-.348**	-0.195	.392**	**.711****	-.403**	**-.547****	1							
	Sig. (2-tailed)	0.427	0.007	0.093	0.000	0.006	0.136	0.002	0.000	0.001	0.000								
m Ca-react	PC	-0.192	**-.512****	-.419**	**.960****	**-.511****	**-.648****	**.645****	**.967****	**-.804****	**-.846****	**.763****	1						
	Sig. (2-tailed)	0.142	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000							
m SO_4-react	PC	-0.237	-.384**	-.288*	**.794****	-.437**	0.079	**.646****	**.677****	-.462**	-0.246	**.817****	**.672****	1					
	Sig. (2-tailed)	0.068	0.002	0.026	0.000	0.000	0.550	0.000	0.000	0.000	0.058	0.000	0.000						
m HCO_3-react	PC	.264*	0.001	.329*	-0.109	-0.016	0.218	0.040	-0.141	.319*	0.204	-0.069	-0.126	-0.150	1				
	Sig. (2-tailed)	0.041	0.992	0.010	0.405	0.903	0.094	0.759	0.282	0.013	0.117	0.602	0.337	0.252					
SI_{Hal}	PC	**-.507****	**-.710****	-.406**	**.837****	**-.822****	-.306*	**.887****	**.810****	**-.572****	-.483**	**.554****	**.763****	**.675****	0.061	1			
	Sig. (2-tailed)	0.000	0.000	0.001	0.000	0.000	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.644				
SI_{Cal}	PC	0.203	-0.187	**.586****	0.179	-0.129	-0.007	0.050	0.149	0.000	-0.100	0.238	0.199	0.094	**.692****	0.168	1		
	Sig. (2-tailed)	0.119	0.153	0.000	0.171	0.327	0.957	0.702	0.256	0.998	0.447	0.067	0.128	0.477	0.000	0.198			
SI_{Dol}	PC	0.155	-0.222	**.587****	0.220	-0.191	0.001	0.111	0.187	0.001	-0.110	.279*	0.223	0.137	**.694****	0.230	**.988****	1	
	Sig. (2-tailed)	0.235	0.088	0.000	0.091	0.144	0.994	0.400	0.152	0.996	0.402	0.031	0.087	0.296	0.000	0.077	0.000		
SI_{Gyps}	PC	-.460**	**-.665****	-.384**	**.831****	**-.734****	-0.203	**.757****	**.774****	**-.524****	-.435**	**.664****	**.760****	**.768****	0.069	**.919****	.270*	.320*	1
	Sig. (2-tailed)	0.000	0.000	0.002	0.000	0.000	0.119	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.600	0.000	0.037	0.013	

****Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed); [1]PC is Pearson Correlation.**

Table S4. Percentages and facies of the hydrochemical substages of freshening and intrusion stages.

Stage	Substage	Description	Anion facies	Ion percentage	No. of samples in each substage	% of samples in each substage	Value	Range in heatmap	Color
Freshening	Freshwater	Distal- Proximal- Endmember	-HCO3	$\%HCO_3>50\%$, %Ca>66.6%	2	3.4	1	≤2.5	
	f4		-HCO3	%HCO3>50%	6	10.2	2		
	f3		-MixHCO3	$50\%\geq\%HCO_3>33.3\%$	2	3.4	3	2.6-3.5	
	f2		-MixCl	33.3%<%Cl≤50%	5	8.5	4	3.6-4.5	
	f1		-Cl	50%<%Cl<66.6%	9	13.6	5	4.6-5.4	
			Freshwater- saltwater dynamic boundary					5.5	.....
Intrusion	i1	Endmember- Proximal- Distal	-MixHCO3	$50\%\geq\%HCO_3>33.3\%$	1	1.7	6	5.6-6.5	
	i2		-MixCl	33.3%<%Cl≤50%	5	8.5	7	6.6-7.5	
	i3		-Cl	50%<%Cl<66.6%	13	23.7	8	7.6-8.5	
	i4		-Cl	%Cl>66.6%	1	1.7	9	>8.5	
	Saltwater		-Cl	%Cl>66.6%, %Na>50%	15	25.4	10		

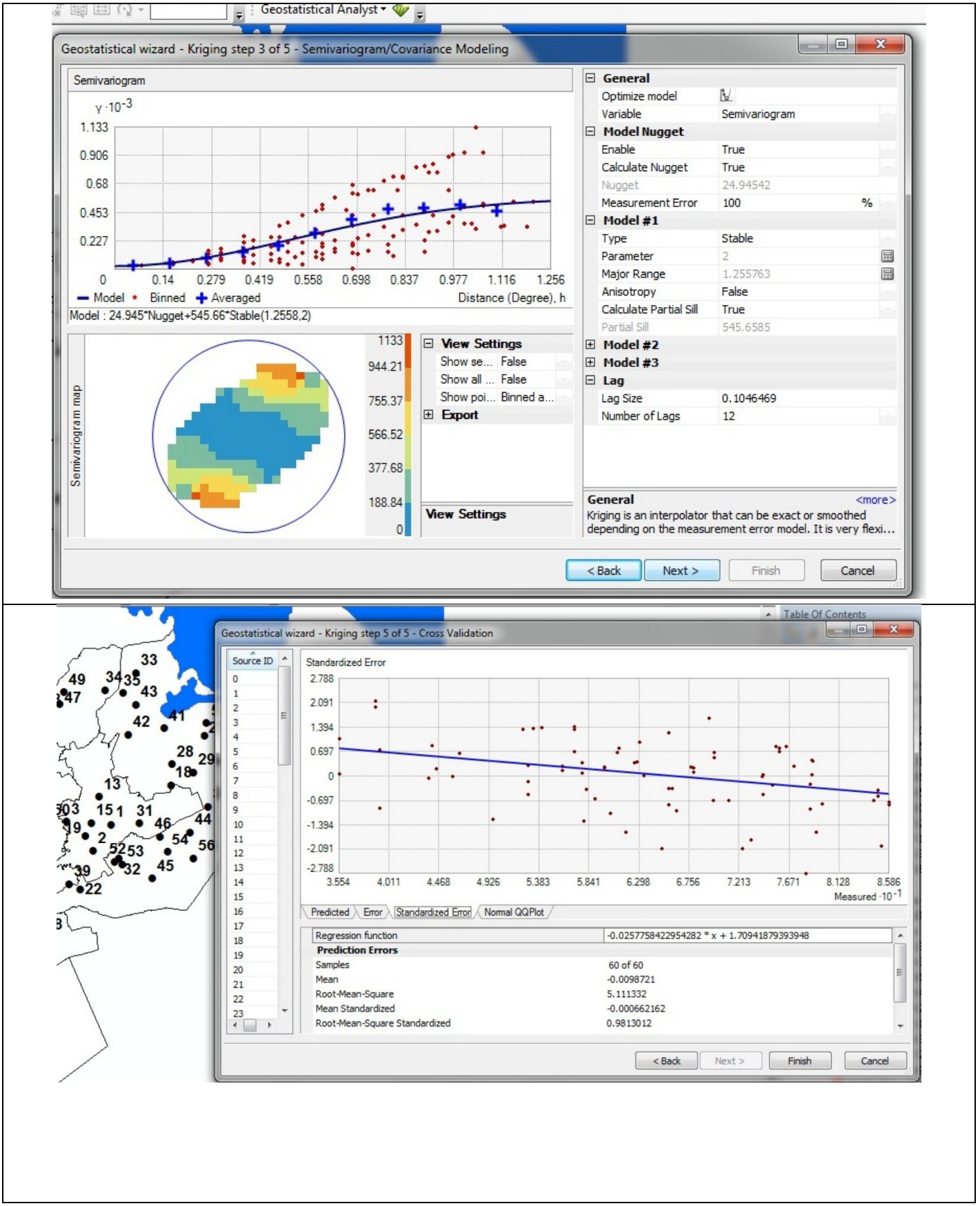


Figure S1. An example for Semivariogram and Cross validation of the used kriging interpolation method .

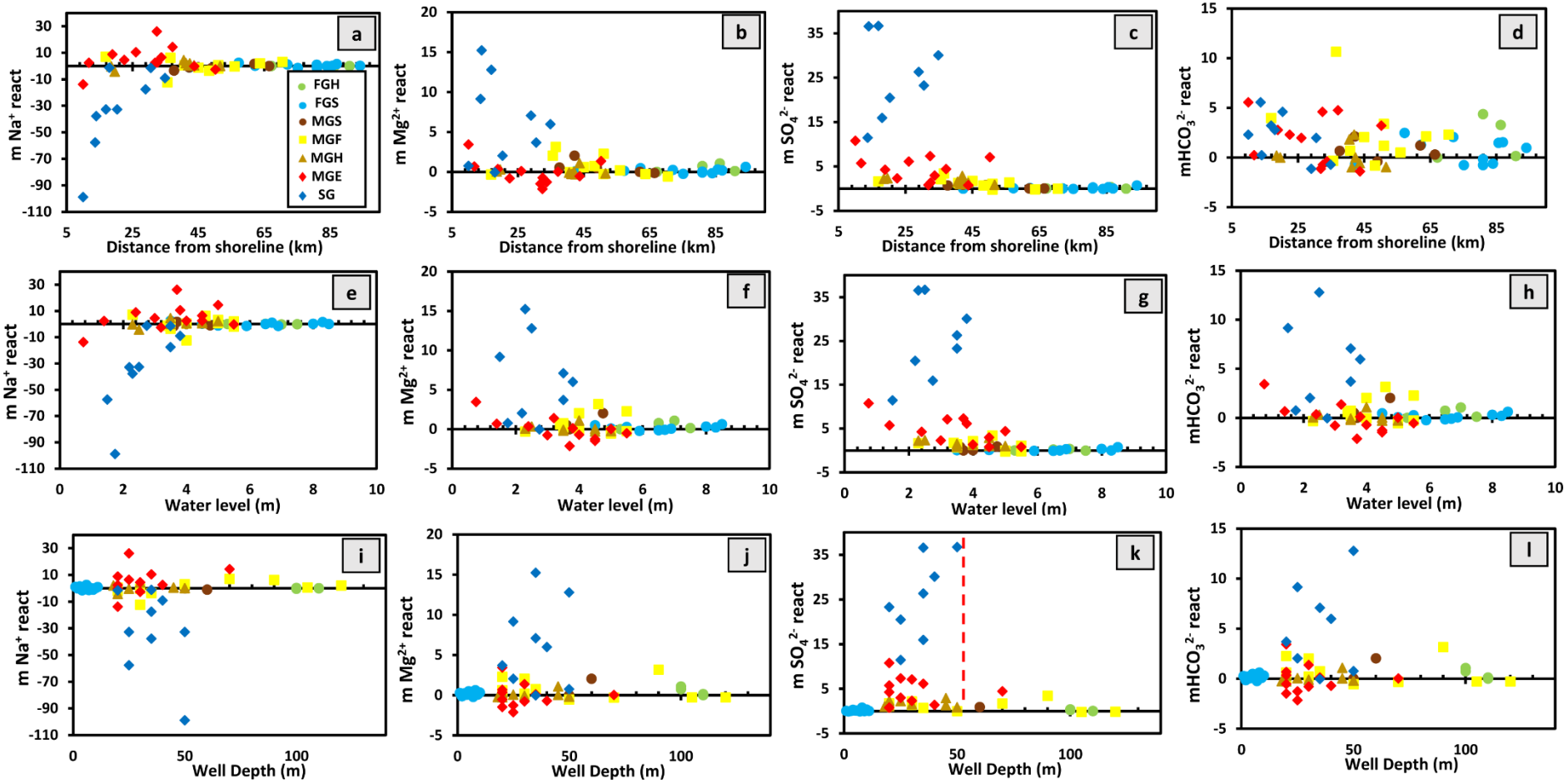
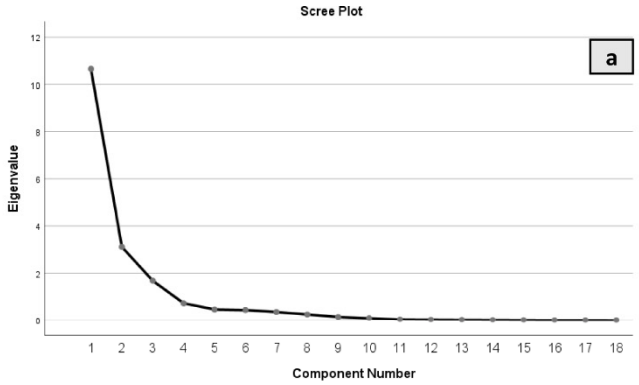
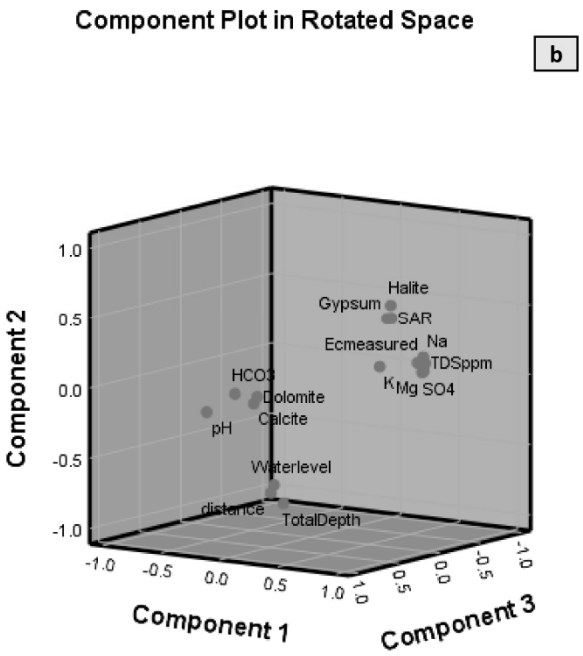


Figure S2. Relationship of ionic deviations of selected major ions with distance from the shoreline, water level, and well depth.





c

Component Transformation Matrix

Component	1	2	3
1	.901	.434	.024
2	.014	-.083	.996
3	.434	-.897	-.080

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Figure S3. a) Scree plot, b) PCA, and c) component transformation matrix of the applied factor analysis for the studied variables.