



Supplement of

Synergistic identification of hydrogeological parameters and pollution source information for groundwater point and areal source contamination based on machine learning surrogate–artificial hummingbird algorithm

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Table S1 True values of the variables to be identified.

Variables to be identified	True value
K_1 (m/d)	60.37
K_2 (m/d)	42.84
K_3 (m/d)	50.17
H_1 (m)	19.09
H_2 (m)	16.11
S_1T_1 (g/d $\times$ 10)	34.25
S_1T_2 (g/d $\times$ 10)	57.07
S_1T_3 (g/d $\times$ 10)	57.99
S_1T_4 (g/d $\times$ 10)	31.76
S_1T_5 (g/d $\times$ 10)	18.14
S_2T_1 (g/d $\times$ 10)	82.07
S_2T_2 (g/d $\times$ 10)	22.18
S_2T_3 (g/d $\times$ 10)	74.35
S_2T_4 (g/d $\times$ 10)	49.24
S_2T_5 (g/d $\times$ 10)	15.84

Table S2 Ranges of values of pollution sources.

Pollution sources	Release intensity (g/d×10)					
	T1	T2	T3	T4	T5	T6-T10
S1	(0,86.4)	(0,69.12)	(0,60.48)	(0,51.84)	(0,43.2)	0
S2	(0,103.68)	(0,86.4)	(0,77.76)	(0,69.12)	(0,51.84)	0

Table S3 True values of the variables to be identified.

Variables to be identified	True value
K_1 (m/d)	45.93
K_2 (m/d)	46.54
K_3 (m/d)	32.11
K_4 (m/d)	44.23
S_1T_1 (g/d)	38.05
S_1T_2 (g/d)	32.24
S_1T_3 (g/d)	24.96
S_1T_4 (g/d)	5.17
S_1T_5 (g/d)	25.42
S_2T_1 (g/d)	31.15
S_2T_2 (g/d)	39.94
S_2T_3 (g/d)	51.5
S_2T_4 (g/d)	49.47
S_2T_5 (g/d)	31.53
S_3T_1 (g/d)	27.49
S_3T_2 (g/d)	26.93
S_3T_3 (g/d)	5.95
S_3T_4 (g/d)	30.5
S_3T_5 (g/d)	23.7

Table S4 Mean relative errors of the two case studies under different noise levels.

case	Different noise levels			
	0	0.5%	1%	2%
case1	1.58%	1.71%	2.03%	2.55%
case2	2.03%	2.30%	2.33%	3.52%