Supplementary material

The Risk of Water Quality Deterioration Accompanied by Urban Flood Control-A Case in Wuxi

2.2 Sample Collection and Laboratory Analysis

Table S1 Surface Water Environment Quality Standard (GB 3838-2002) (unit:mg/L)

Class	TN	TP	COD_{Mn}	NH_3-N
I	0.2	0.02	2	0.15
II	0.5	0.1	4	0.5
III	1.0	0.2	6	1.0
IV	1.5	0.3	10	1.5
V	2.0	0.4	15	2.0

3.2 Pollution level and degree

Table S2 CCME WQI Water Quality Classification

Score threshold	Grade	Features
95-100	Excellent	Very close to the natural water body, and the water environment is not damaged
80-94	Good	It rarely deviates from the natural water body, and the water environment is only slightly damaged
65-79	Fair	Occasionally offset the natural water body, and the water environment is damaged to a certain extent
45-64	Marginal	It often deviates from the natural water body, causing great damage to the water environment
0-44	Poor	It usually deviates from the natural water body, and the water environment is greatly damaged

3.3 Development of pollutants

Table S3 Mann-kendall trend types and features

β (Slope Estimate)	Z (Statistic)	Tend type	Trend features
β > 0	2.58 < Z	4	Extremely significant increase
	1.96 < Z ≤ 2.58	3	Significant increase
	1.65 < Z ≤ 1.96	2	Slightly significant increase
	Z ≤ 1.65	1	Not significantly increased
β = 0	Z	0	No change
β < 0	Z ≤ 1.65	-1	Not significantly decreased
	1.65 < Z ≤ 1.96	-2	Slightly significant decrease
	1.96 < Z ≤ 2.58	-3	Significant decrease
	2.58 < Z	-4	Extremely significant decrease

Formula

2.3.3 Water Quality Index

$$F_1 = \left(\frac{1}{M}\sum_{i=1}^{M} \max_{j=1,2,\cdots,N} \{S_{ij}\}\right) \times 100$$

$$F_2 = \left(\frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N} S_{ij}\right) \times 100 \qquad \text{(S1)}$$

$$F_3 = \frac{\sum_{i=1}^{M}\sum_{j=1}^{N} e_{ij}}{\sum_{i=1}^{M}\sum_{j=1}^{N} e_{ij} + MN} \times 100$$

In the formula, F_1 is the percentage of index exceeding the standard; F_2 is the percentage of data exceeding the standard; F_3 is the percentage of amplitude exceeding the standard; M is the index number, N is the number of measuring points, S_{ij} is the scale value, e_{ij} is the percentage exceeding the standard.

The allowable limit of a single index in this region is c_i, the measured value of I at section j is x_{ij}.

The higher the indicator, the better: $x_{ij} \geq c_i$ is up to standard otherwise it is over standard, $e_{ij} = (c_i - x_{ij})/x_{ij}$.

The lower the indicator, the better: $x_{ij} \leq c_i$ is up to standard otherwise it is over standard, $e_{ij} = (x_{ij} - c_i)/c_i$.

When reaching the standard: $S_{ij} = 0$. When exceeding the standard: $S_{ij} = 1$.

Then CCME WQI model constructs the three factors F1, F2 and F3 as water quality index, and obtains the score:

$$WQI = 100 - \sqrt[3]{F_1^2 + F_2^2 + F_3^2} / 1.732 \qquad \text{(S2)}$$

2.3.4 Mann-Kendall Trend

$$\beta = Median\left(\frac{x_j - x_i}{j - i}\right) \forall j > i \tag{S3}$$

$$\mathrm{sgn}(x_j - x_i) = \begin{cases} +1 & x_j - x_i > 0 \\ 0 & x_j - x_i = 0 \\ -1 & x_j - x_i < 0 \end{cases}$$

$$Var(S) = \frac{n(n-1)(2n+5)}{18}$$

$$S = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} \mathrm{sgn}(x_j - x_i)$$

$$Z = \begin{cases} \dfrac{S}{\sqrt{Var(S)}} & (S > 0) \\ 0 & (S = 0) \\ \dfrac{S+1}{\sqrt{Var(S)}} & (S < 0) \end{cases} \tag{S4}$$

In the formula: β is the slope estimate;
x_i and x_j are the are dual values.
Var(s) is the variance;
n is the number of data in the sequence;
S is the statistics that follow a normal distribution;
Z is the statistic.