

Title: Simulation of Groundwater Dissolved Organic Carbon in Yufu River Basin during Artificial Recharge: Improving the SWAT-MODFLOW-RT3D Reaction Module

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Additional information on the parameters required for modeling

In this study, the Harmonized World Soil Database (HWSD) was used to establish the soil database for the SWAT model, and the soil parameters required for the SWAT model are shown in Table S1.

Table S1. List of Soil Parameters Required for SWAT Model

| Parameters | Source | Meaning |
|------------|--------------------------------------------------|-------------------------|
| SNAM | | Name of soil |
| NAYERS | | Number of soil horizons |
| SOL_ZMX | | Maximum rooting depth |
| SOL_Z | | Depth of soil |
| SOL_CBN | HWSD | organic carbon content |
| CLAY | | Percentage of clay |
| SILT | | Percentage of silt |
| SAND | | Percentage of sand |
| ROCK | | Percentage of rock |
| TEXTURE | | soil structure |
| ANION_EXCL | | Anion-exchange porosity |
| SOL_ALB | Default Value | surface reflectance |
| SOL_CRK | | Ultimate compression |
| SOL_EC | | conductivity |
| SOL_BD | | wet density |
| SOL_AWC | Calculated by SPAW | moisture content |
| SOL_K | | hydraulic conductivity |
| USLE_K | Calculated by Formula 1 | Soil Erosion factor |
| HYDGRP | calculate and group by formula 2、 3 and Table S3 | Hydrologic group |

$$K_{USLE} = f_{csand} \times f_{cl-si} \times f_{hisand} \times f_{orgc} \quad (1)$$

Where K_{USLE} is soil erosivity factor; f_{csand} is erosion factor for coarse sandy; f_{cl-si} is erosion factor for clayey; f_{hisand} is erosion factor for highly sandy soils; f_{orgc} is soil organic matter factor.

The soil infiltration coefficient was first calculated based on Equations 2 and 3, and then the hydrologic grouping of the soil was determined based on the SCS soil hydrologic grouping table (Table S2). The specific formulas are listed below:

$$X = 20Y^{1.8} \quad (2)$$

$$Y = 0.003Z + 0.002 \quad (3)$$

Where X is the infiltration coefficient of the soil, mm/h; Y is the average particle size of the soil particles, mm; Z is the sand content of the soil, %.

Table S2. SCS Soil Hydrology Grouping

| Soil classification | Minimum infiltration rate (mm/h) | Soil hydrological properties under complete wetting |
|---------------------|-------------------------------------|--------------------------------------------------------|
| A | >7.6 | High hydraulic conductivity |
| B | 3.8-7.6 | Medium drainage and hydraulic capacity |
| C | 1.3-3.8 | Low hydraulic conductivity |
| D | 0-1.3 | Very low hydraulic conductivity |

Figure

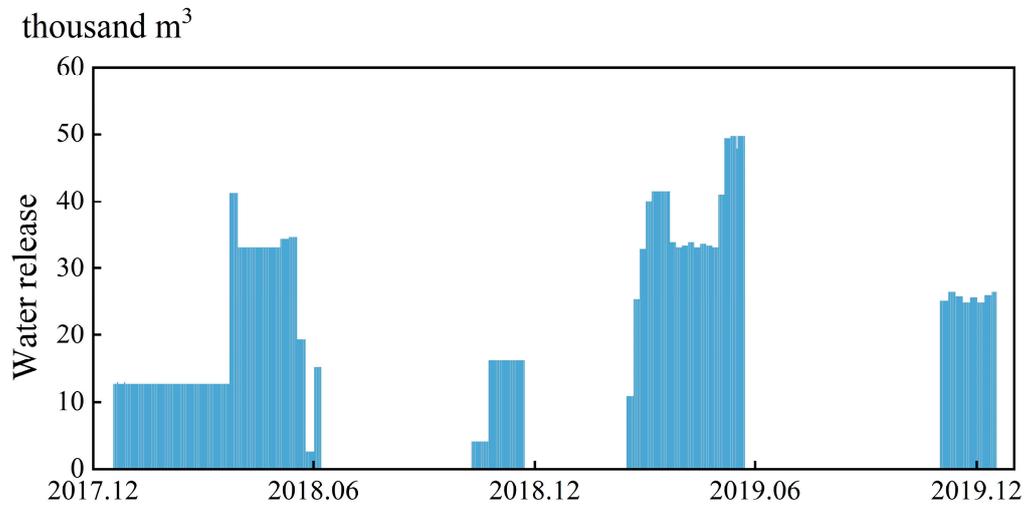


Figure S1. Artificial recharge volume of Wohushan Reservoir during the simulation period.

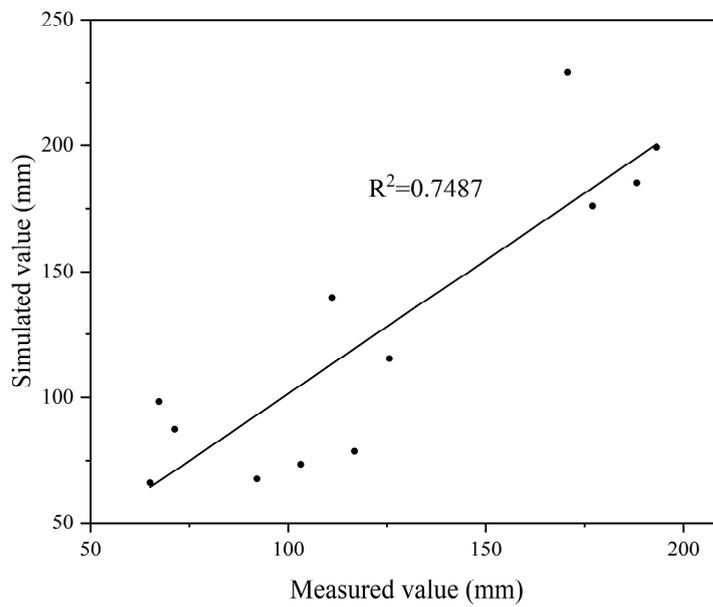


Figure S2. Correlation analysis between measured and simulated values of evaporation.

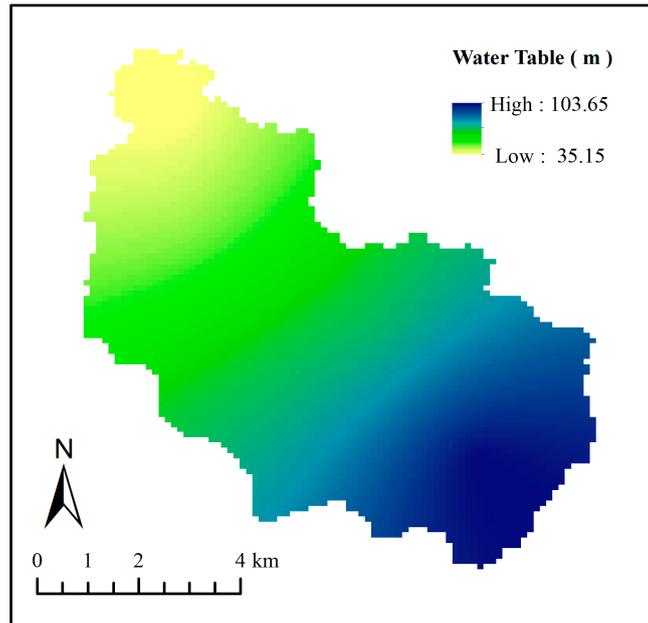


Figure S3. Initial groundwater flow field in the study area.

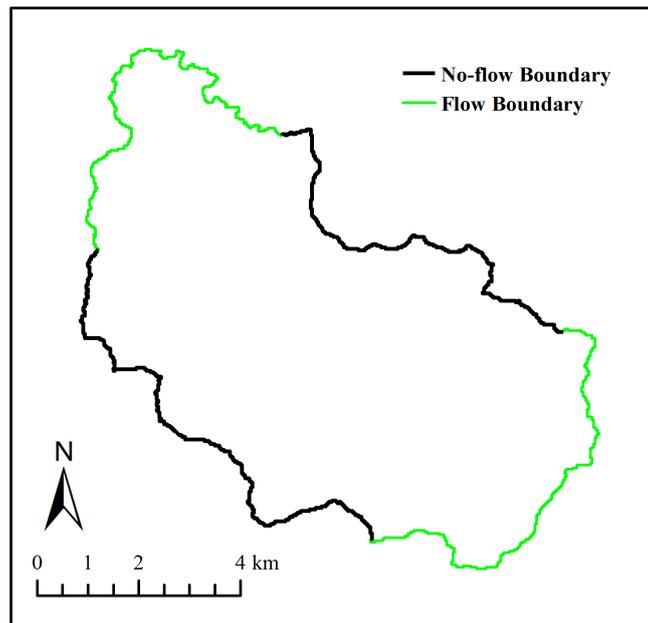


Figure S4. Generalization of aquifer boundary conditions.

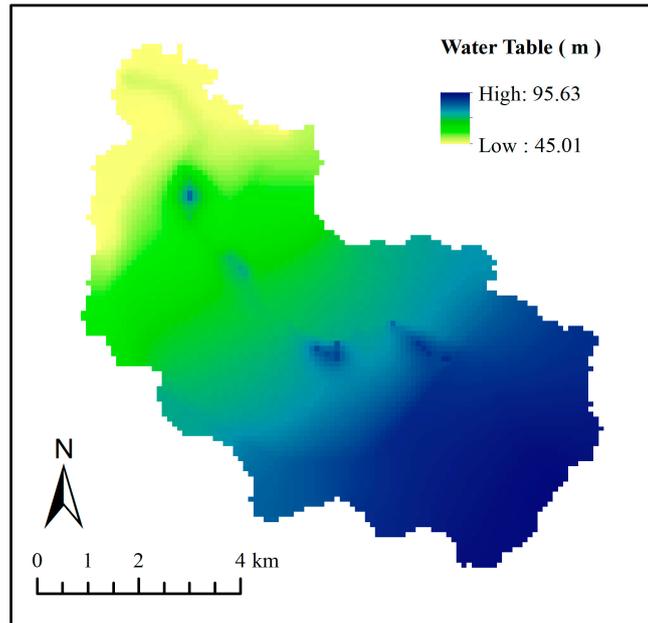


Figure S5. The simulated flow field in January 2020.

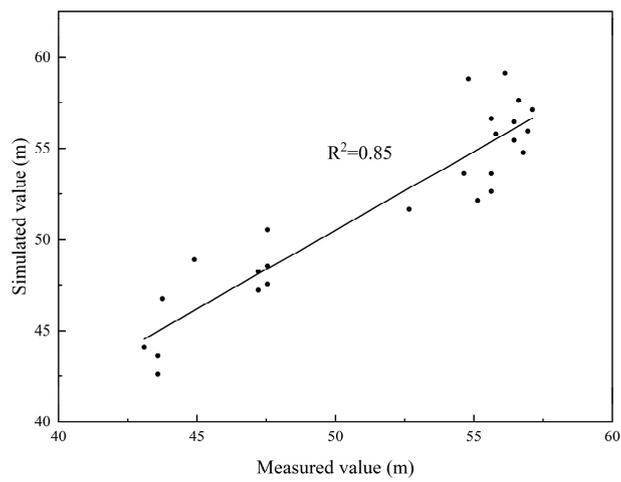


Figure S6. Correlation analysis between measured values and simulated values of groundwater level.

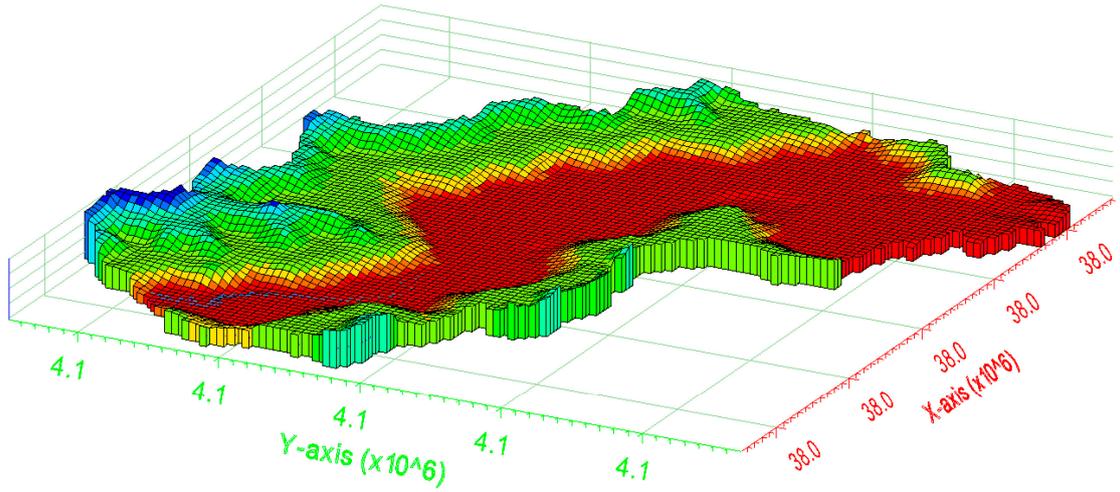


Figure S7. Schematic diagram of the conceptual model of the study area.

Table**Table S3. Water recharge and DOC input under multiple scenarios**

| Data (year) | Precipitation (mm) | Recharged by Yellow River water(mm) | DOC Input (kg/ha) | Recharged by Yangtze River water(mm) | DOC Input (kg/ha) | Recharged by multi- source water | DOC Input (kg/ha) |
|----------------|-----------------------|----------------------------------------|----------------------|-----------------------------------------|----------------------|-------------------------------------|----------------------|
| 2021 | 779.8 | 55.89 | 6.14 | 33.68 | 5.23 | 65.22 | 9.58 |
| 2022 | 796.6 | 56.28 | 6.18 | 33.94 | 5.55 | 65.64 | 9.66 |
| 2023 | 813.4 | 56.34 | 6.22 | 34.05 | 5.53 | 65.72 | 10.13 |
| 2024 | 831 | 56.68 | 6.55 | 34.25 | 5.75 | 66.05 | 10.27 |
| 2025 | 847.4 | 56.48 | 6.86 | 34.27 | 6.50 | 65.64 | 10.35 |
| 2026 | 864.6 | 56.09 | 6.24 | 34.31 | 6.14 | 64.93 | 10.39 |
| 2027 | 881.5 | 55.33 | 6.40 | 34.37 | 6.13 | 63.96 | 10.39 |
| 2028 | 898.5 | 54.39 | 7.18 | 34.15 | 5.88 | 62.78 | 10.36 |
| 2029 | 915.4 | 52.97 | 6.35 | 33.46 | 5.23 | 61.28 | 10.12 |
| 2030 | 932.7 | 52.07 | 6.47 | 32.69 | 5.01 | 60.54 | 9.95 |

Table S4. Results of sensitivity analysis

| Parameter | ΔX_i | | | |
|-----------|--------------|------|------|------|
| | -20% | -10% | 10% | 20% |
| K | 0.12 | 0.12 | 0.04 | 0.11 |
| X_{AR} | 0.20 | 0.10 | 0.10 | 0.10 |
| φ | 0.63 | 0.67 | 0.67 | 0.65 |