Supplementary material

Model building process

The measured topographic data were used for the 2D hydrodynamic model of the Pengxi River. A boundary was drawn along the topographic points, enclosing a total area of 896.7 km^2. Due to the irregular shape of the boundary, the model was divided using unstructured grid processing. The main stream of the Pengxi River had a grid area of 3000 m^2 and its tributaries had a grid area of 2000 m^2, with a minimum allowable angle of 30°. A total of 55,073 grids and 30,606 nodes were generated.

Initial conditions: The initial flow velocity was set to 0.01 m/s and the initial state of the water level was considered to be the water level at the beginning of the simulation year; the initial water level was thus set to 173.05 m. The Pengxi River Basin has a large area and a slow flow velocity. Because the initial concentration influences the simulation results, the initial concentration field was constructed according to the measured water quality data.

Boundary conditions: According to the river water and land boundary conditions, six inflow boundary conditions were established using the measured daily discharge data as the inflow boundary conditions calculated by the model: the Dong River, the Toudao River, the Taoxi River, the Nan River, the Puli River, and the Wanxian Station section. The Fengjie Station section of the main stream of the Yangtze River was the outflow boundary, with the measured daily discharge data used as the outflow level. TP and TN were selected as the water quality indicators, and the measured water quality concentration process was adopted for the boundary of water quality.

Parameters: The simulation time was from January to December 2021 and the model time step was set to 10 seconds. When the water depth of the calculation area was less than 0.05 m, the calculation area was considered "dry" and was not included

in the calculation. When the water depth was greater than 0.2 m, the calculated water area was considered "wet" and was included in the calculation.

Wuyang regulating dam: The gate was regulated by the water level, and a portion of the gate was flooded. The weir crest elevation was 168.5 m, the total opening height was 7.8 m, and the gate opening and closing water level was set at 168.5 m.