Hydrodynamic and water quality modeling of coastal water based on Delft3D model

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Coastal rivers and estuarine systems currently face increasing pressure due to population growth and rapid economic development, which threaten the deterioration of their water quality and water ecological environment. This study takes the example of the Yongjiang River Estuary, which is located on the eastern coast of China and the south of Hangzhou Bay, to investigate the relationship between hydrodynamics and water quality response in the coastal water. Based on the hydrodynamics, pollutant transport, and water quality variation characteristics of the 26-kilometer long river network, a hybrid model was established using the open-source Delft3D model. We used the bathymetry data at 1:10,000 scale from China Navy Hydrographic maps published by China Navigation Publications Press, water elevation data from Ningbo gauging stations, and water quality data (COD, BOD, turbidity, T-N, T-P, NH4+, etc.) in 2020. The proposed model has three major components including three-dimensional (3D) hydrodynamics modeling, water quality simulation, and future predictions. It reconstructs the 3D temporal-spatial variations of key water quality indices in the river reach and coastal waters. By using 75% of the dataset for training, the results showed that the model is reliable with good performance. Although the approach is used for the Yongjiang River Estuary in eastern China, the methodology is also applicable to other coastal areas that are affected by shipping activities in the port. Whilst the corresponding water environment capacity is calculated, this study provides a scientific basis for research of the coastal rivers and estuarine systems. It gives support to the water environment management and sustainable development of the coastal water environment.