The optimization of flow conditions in the spawning grounds of the Chinese sturgeon (Acipenser sinensis) through Gezhouba Dam units

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Abstract

The waters downstream from the Gezhouba Dam are the only spawning grounds of the Chinese sturgeon. To optimize the flow conditions in the spawning grounds by controlling the opening mode of the Gezhouba Dam generator units, a mathematical model of the three-dimensional hydrodynamics of the Chinese sturgeon spawning grounds was established in FLOW-3D. The model was verified with velocity measurements, and the results were in good agreement. Additionally, the model was used to invert the flow field of monitoring results from 2016-2019, and it was concluded that the preferred velocity range for the Chinese sturgeon was 0.6-1.5 m/s. The flow fields of different opening modes of the generator units were simulated with the same flow rate, and the results showed that the suitable velocity area was the largest when all units of the Dajiang Plant of the Gezhouba Dam were open and that conditions were especially favourable on the left side. Comparison of the suitable velocity area with different flow rates showed that when the flow rate was less than 12000 m^3/s, more than 90% of the area was suitable and that when the flow rate was greater than 12000 m^3/s, the suitable area decreased rapidly with increasing flow rate. Moreover, the suitable areas under different opening modes under high-flow conditions were compared, and the results showed that at flow rates of 12000 ~ 15000 m^3/s, opening 11~13 units on the left side was best. When the flow rate reached 15000 m^3/s, it was best to open all of the units. In this paper, the optimal opening scheme at different flow rates was analysed, and the results provide new ideas for Chinese sturgeon protection and ecosystem protection.

1. **Theoptimization of flow conditions in the spawning grounds of the Chinese sturgeon (*Acipenser sinensis*) through Gezhouba Dam units**
2. **Optimize flow conditions through units**

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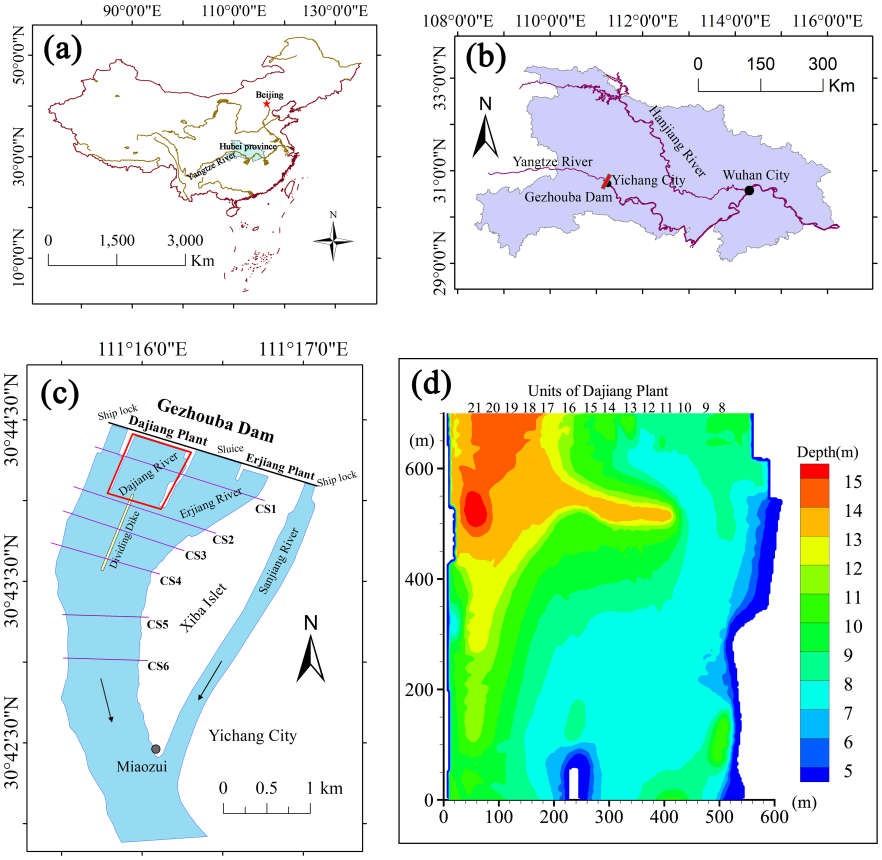

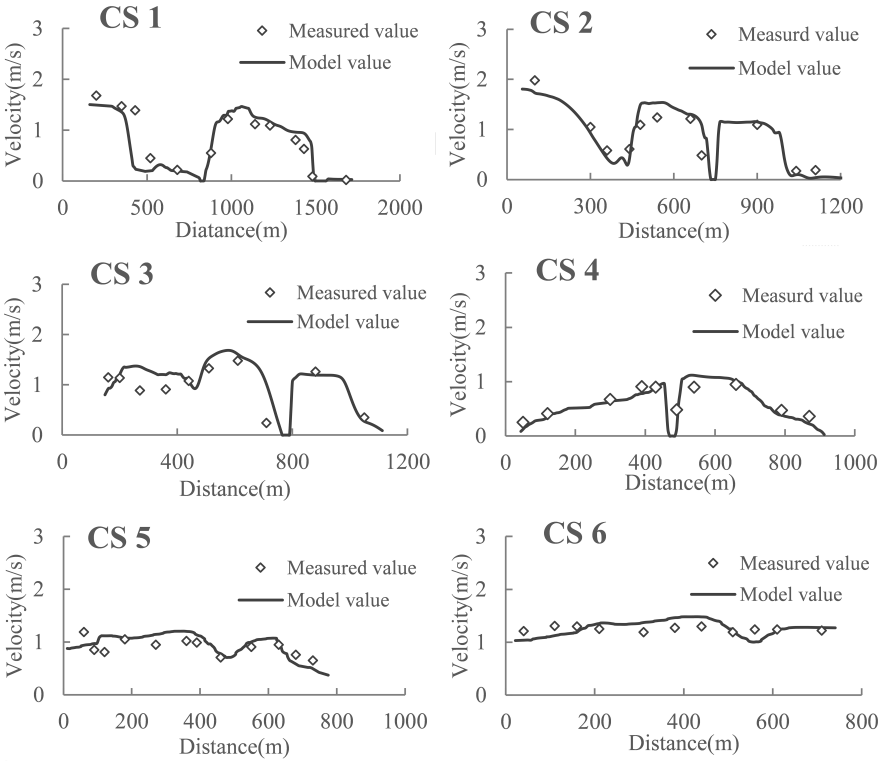

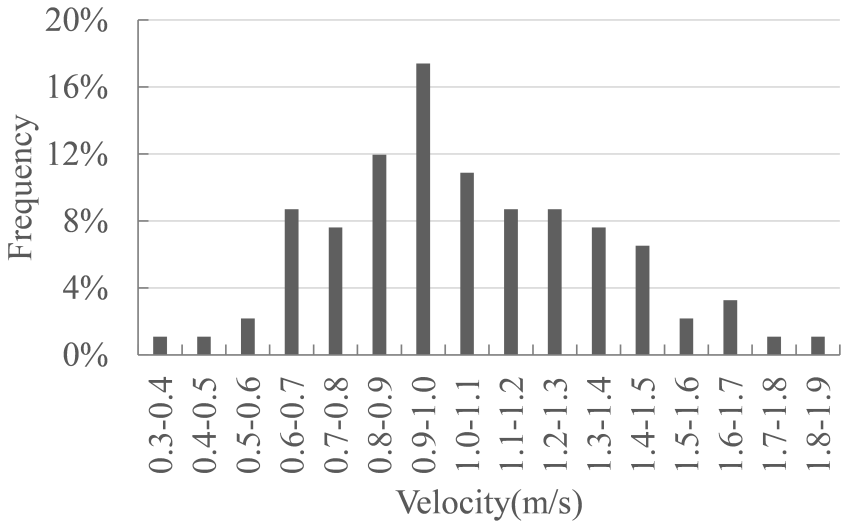

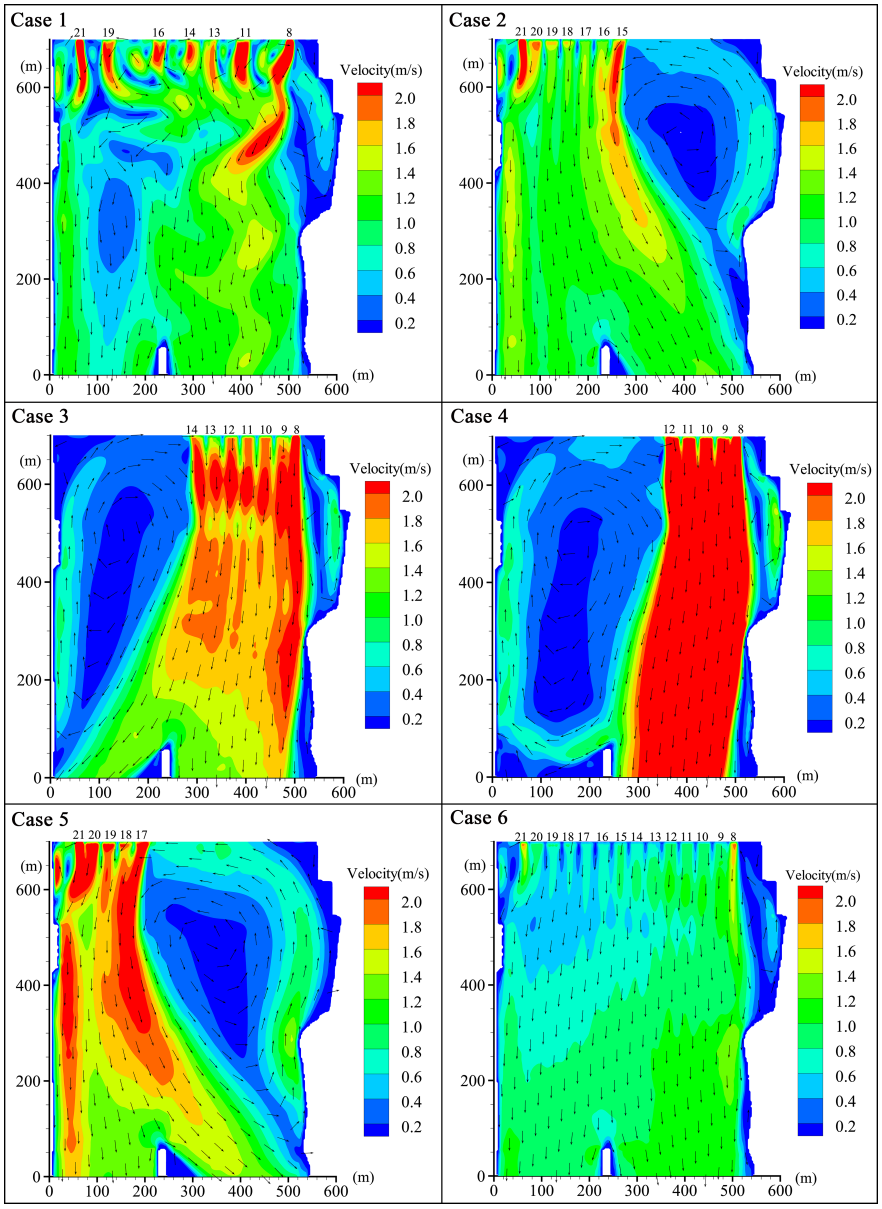

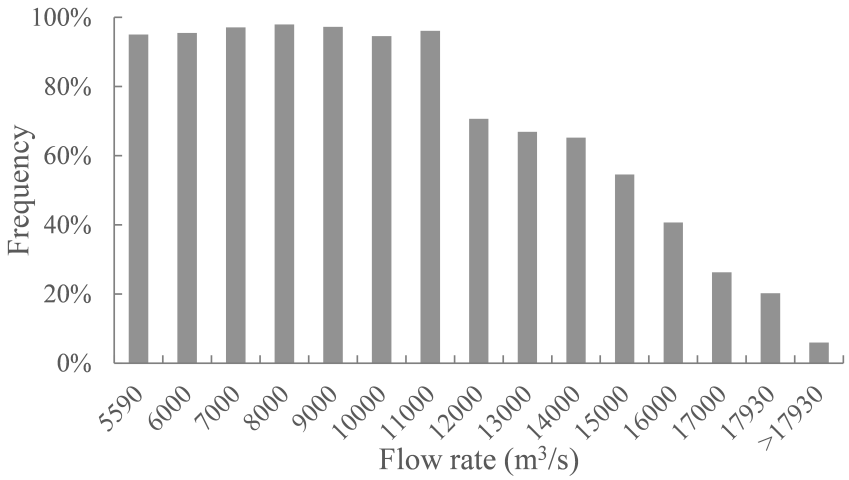

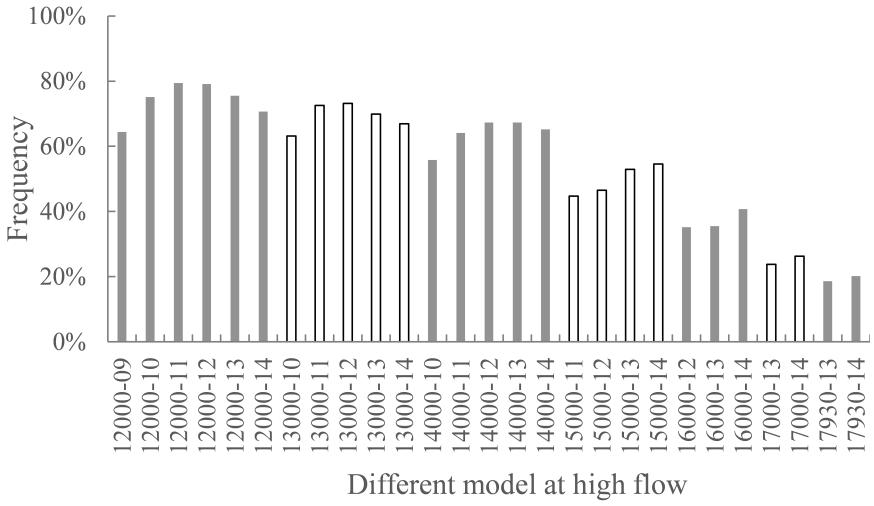

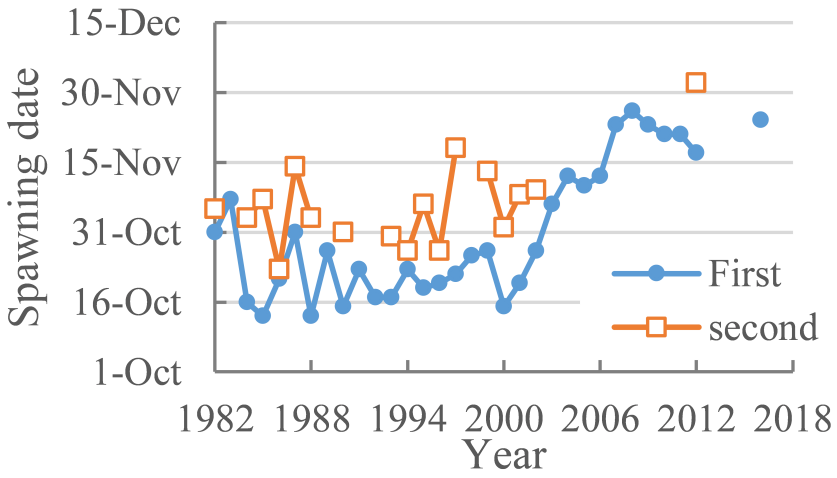

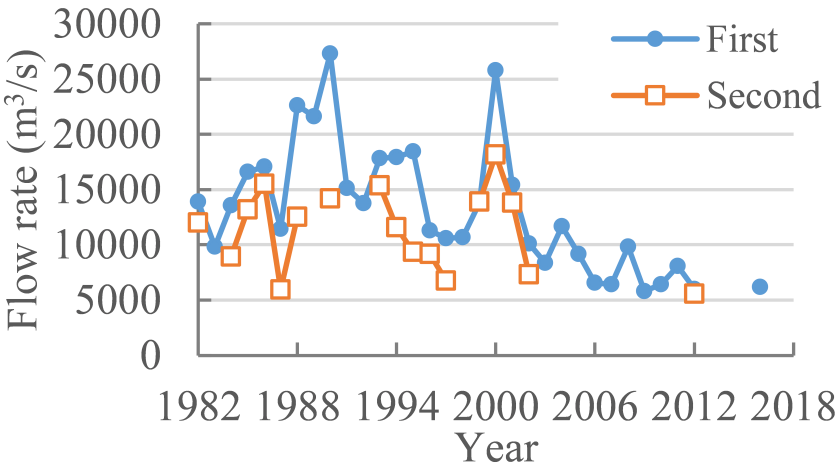

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