

# Hydrodynamic Changes of Xiamen Bay (1938 – Present) and Management Implications

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As a key environmental factor, hydrodynamic condition determines the water exchange capacity of the Xiamen Bay. The changes in hydrodynamic conditions of the Bay greatly affect the level of coastal economic development in the area. The changes in hydrodynamic conditions in the Western and Eastern seas of Xiamen Bay is studied covering the period from 1938 to 2007 using numerical modeling. The accumulative effects of human activity in Xiamen Bay are analyzed. We also predict the improvement of hydrodynamic conditions through several environment restoration projects (under construction) in the Xiamen Bay.

The model is largely based on the Princeton Ocean Model (POM), but improved with the stable drying and wetting processes and two-way nested-grid technology which can reflect the



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topography and coastline with higher resolution (35 meter). The model also incorporates the Alternating Direction Implicit (ADI) method to make it more efficient.

The hydrodynamic condition of the Xiamen Bay has gradually weakened due to the coastal land reclamation activities since 1950. For the present discussion, we focus on the hydrodynamic changes using information in 1938, 1984 and 2007. The evaluation of the new environmental restoration projects is considered as the predicted situation. The simulation model shows that the impacts of tidal flows are considerably weakened from 1938 to 2007. In year 1938, the tidal areas were 120 km<sup>2</sup> and 101 km<sup>2</sup> at Eastern and Western seas, respectively. Because of the reclamation, the tidal areas decreased by 26% and 55% of that in 1938 at Eastern and Western seas, respectively in 2007. In proportion to the lost of tidal area, the average tidal velocity decreased by 20% and 40% at the mouth of Eastern and Western seas, respectively during the period from 1938 to 2007. The model also shows that after the restoration projects are completed, the tidal area at Western sea will increase to 58% of that in 1938 and almost reach the value in 1972. The average tidal velocity at the middle of Western sea would reach the value as recorded in 1938. The tidal prisms would increase to 72% and 85% of that in 1938 at Western sea and Eastern sea, respectively.

As predicted from the analysis, it can be concluded that the hydrodynamic condition at Xiamen Bay will be improved by the restoration projects and get back to the situation in 1972.