TIDE AND WIND INDUCED RESIDUAL CURRENT SYSTEM IN BOHAI SEA

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Recent news reports have reported that the so-called "red tides" occur more frequently in the whole basin of the Bohai Sea in China. Such eutrophication is conjectured to be excessive amounts of wastewater discharged from land into the bay. In order to reduce the occurrence of red tides and resulting damages of aquatic products in the Bohai Sea, it is necessary to control area-wide total pollutant loads discharged into the sea. There are, however, no ideas in promoting water quality conservation due to the lack of understanding of mechanism of tide and wind-induced flow and transport processes of seawater, and furthermore, ecosystem.

The Bohai Sea is a typical enclosed coastal sea surrounded by the Chinese mainland and Liaodong Peninsula and connected to the Yellow Sea with its narrow the Bohai Strait of approximately 100 km wide and the maximum depth of 70 m. The Bohai Sea is rather shallow with a mean depth of 18 m.

The present study focuses on the wind effects on the hydrodynamics in the Bohai Sea and especially, the water exchange through the Bohai Strait. A three-dimensional baroclinic flow model is applied to clarify the residual current system and density field and a Lagragian particle tracking method is applied to evaluate the wind effects on the water exchange between the Bohai Sea and the Yellow Sea.

Main results are as follows:

(1) The present model can predict well the co-tidal charts of major four tidal constituents given by Blain (1996) based on observation data.

(2) The tidal residual current is very weak less than 0.05 m/s in the whole Bohai Sea except in the Bohai Strait. Vertical and horizontal profiles of temperature, salinity and density show that weak stratification occurs in the central area in summer. In winter the stratification cannot be seen due to vertical mixing induced by strong wind.

(3) The south and north winds change the residual current system dynamically. For example, a clockwise circulation is induced by south wind in summer, while an anticlockwise circulation is done by north wind. The change of flow structure affects on the water exchange of the Bohai Sea. The result of our computation clearly shows that the wind greatly affects to the hydrodynamic of the Bohai Sea as well as to the water exchange between the Bohai Sea and Yellow Sea too.