

Numerical Experiments of Upwelling, relating to “Aoshio”, in Tokyo Bay

Masaji Matsuyama, Toru Suzuki

Tokyo University of Fisheries, JAPAN

Masanobu Hamatani, Takashi Yanuma

PASCO Environmental Science Institute, JAPAN

Numerical experiments were made to clarify the mechanism of the generation and propagation of “Aoshio” in Tokyo Bay. “Aoshio” is an upwelling phenomenon of an anoxic blue-green water. Tokyo Bay has 60km length, 20km width and 15m depth in average, and the direction of the axis of the bay is northeastward. The anoxic water is formed due to the consumption of oxygen by nutrients in sea bed near the bay head during the period from summer to early fall, and discolors to blue-green with the upwelling in the surface layer. “Aoshio” occurs occasionally under the stratification and appears in the region from the bay head to the east side of the bay. The field observations also show that “Aoshio” is connected with the upwelling of the anoxic water mass from the lower layer for the northeast wind.

We developed a multi-level (16 level) model, and numerical experiments were carried out under the density stratification in summer. The results of the experiment for the northeast wind (blowing from the head to the mouth of the bay) show that the coastal upwelling is generated near the head of the bay at first, and then the upwelling region spreads along the east side of the bay. The upwelling region is caused by the vertical water circulation with the surface water flowing from the bay head to the bay mouth, and the bottom water flowing from the bay mouth to the bay head. Horizontal density distribution shows that higher density water exists in the east side of the bay, while lower density water exists in the west side of the bay. Calculated upwelling region, flow pattern and density structure nearly coincide with the result of the field observation when the north wind blows. The result of the experiment shows that after the wind turning off, the upwelling region cyclonically moves along the coast, which suggests the propagating of internal Kelvin wave.

Under the condition of the north wind, the upwelling is generated at the northside of the head of the bay and the upwelling region is more confined than that of the case of the northeast wind.