Seasonal variation of current in Bohai Sea simulated by a 1/18-degree resolution ocean model

Xinyu GUO[1,2] and Tetsuo YANAGI[3]

[1] Center for Marine Environmental Studies, Ehime University, Matsuyama 790-8577, Japan

[2] Institute for Global Change Research, Yokohama 236-0001, Japan

[3] Research Institute for Applied Mechanics, Kyushu University, Fukuoka 816-8580, Japan

Based on Princeton Ocean Model (POM), we developed a triple-nested system for the Kuroshio simulation (Guo et al., 2003). The three models nested in this system are called NEST1, NEST2 and NEST3 in order of increasing horizontal resolution. NEST1, the coarsest grid, has a 1/2-degree resolution and covers almost the whole Pacific Ocean (40° S- 70° N, 100° E- 70° W). The NEST3, the finest grid, has a 1/18-degree resolution and covers the eastern Asian marginal seas (24°N-44°N, 118°E-150°E). Located between them, NEST2 has a 1/6-degree resolution and covers the northeast Pacific Ocean (0-63°N, 115°E-175°E).

The lateral boundary of NEST1 is treated as land for simplicity. Since its southern boundary is located at 40° S far from the Kuroshio region, this simplicity is acceptable. For the NEST2 and NEST3, the water elevation, velocity, water temperature and salinity along the open boundary are firstly guessed by bilinear interpolation of the results of NEST1 and NEST2, respectively. Since the bilinear interpolation does not conserve a volume transport through the interface between the fine and coarse grid model, the first guess of a vertically averaged normal velocity component is adjusted so that the conservation of volume transport is satisfied between two models (Guo et al., 2003).

These models are driven by the wind stresses, heat and salt fluxes through the sea surface. At the spin-up state, the monthly wind stresses (Hellerman and Rosenstein, 1983) and heat fluxes (Da Silva et al., 1994) are used while the salinity fluxes are set to zero. The monthly sea surface temperature and salinity in WOA94 (Levitus et al., 1994) are used in the correction terms of Haney type (Barnier, 1998).

The NEST1 and NEST2 started from a rest state with the annual mean temperature and salinity as in WOA94 (Levitus et al., 1994) and were integrated for 20 and 15 years, respectively. The NEST3 starts from the initial conditions interpolated from the results of NEST2 and its spin-up time is shortened to 3 years. After the three models have finished spinning up, a hindcast experiment from 1991.9 to 2000.12 was conducted. In place of monthly mean wind stresses and SST, the weekly satellite winds from the ERS-1 and ERS-2 (CERSAT, http://www.ifremer.fr/cersat) and the weekly SST blended from ship, buoy and bias-corrected satellite data (Reynolds and Smith 1994) are used in the hindcast experiment.

As a new feature of this system, the tidal forcing is included in the last two years of integration of NEST3. We will present the seasonal variation of current system in the Bohai Sea simulated by the NEST3 and also show the influence of tidal forcing on this current system.

All references listed here may be addressed in paper of Guo, X., H. Hukuda, Y. Miyazawa, and T. Yamagata (2003): A triply nested ocean model for simulating the Kuroshio -Roles of horizontal resolution on JEBAR-. Journal of Physical Oceanography, Vol.33, No.1, 146-169.