ASLO Aquatic Sciences Meeting 2012, Otsu, Japan.

Transient thermal plume dispersal in the Hudson River estuary

Uchiyama, Y. Ishii, S., Tuy, P.N.M., Wells, J.C., Kirkey, W.D., Islam, M.S. and Bonner, J.S.

Abstract:

A three-dimensional, transient thermal plume dispersal in the Hudson River estuary is examined with Regional Oceanic Modeling System (ROMS) with an empirical near-field buoyant source submodel for approximately two spring-neap cycles. We focus on the area of 13.4 km x 67.7 km between the USGS monitoring stations at Poughkeepsie and Piermont, resolved by 160 x 800 longitudinally-stretched curvilinear horizontal grids with 20 vertical sigma layers. The Indian Point Power Plant, located about 65 km upstream from the mouth, continuously discharges thermal effluent at 109.8 m^3/s heated by +9.6 deg. C from the intake. The model output is compared with the USGS gauges and HADCP data at West Point to show a reasonable agreement. With a modest mean river discharge, the thermal plume from the plant tends to be restricted near the source location, generally traveling back and forth. However, the topographically-generated eddies and vorticity significantly enhance the mechanical and buoyant mixing. Tidally-driven longitudinal flows are highly skewed in the lateral direction near the bend, leading to substantial secondary circulations.

ASLO Aquatic Sciences Meeting 2012, Otsu, Japan.

Interaction between the Kuroshio intrusion and intrinsic variabilityin Seto Inland Sea, Japan

Kuriyama, T., Uchiyama, Y. and Miyazawa, Y.

Abstract:

The estuarine circulation in Seto Inland Sea, Japan, has been reported to be largely affected by the intrusion of the Kuroshio water through its two narrow channels, the Bungo Channel to the west and the Kii Channel to the east. In addition, freshwater inputs and the complicated coastline, topography and over 3,000 islands could skew the Kuroshio influxes through nonlinear processes, and substantially enhance intrinsic variability in the estuary. In the present study, a doubly-nested oceanic modeling framework based on ROMS (Regional Oceanic Modeling System) downscaled from the JCOPE2 (Japan Coastal Ocean Predictability Experiment) dataset is developed to examine the interaction between estuarine and Kuroshio waters at a horizontal resolution up to 600 m. To accurately account for the mass, momentum and buoyancy fluxes from Kuroshio to the estuary, a careful diagnosis on the reproducibility of Kuroshio paths, thermocline slope and density structure is conducted by comparing to data. Tidal and subtidal variabilities of the mass exchange at the two channels and several cross-sections along the longitudinal axis of the estuary and their impacts on the circulation are discussed.

ASLO Aquatic Sciences Meeting 2012, Otsu, Japan.

A downscaling experiment on reproducibility of the Kuroshio off Japan

Ishii, S., Uchiyama, Y. and Miyazawa, Y.

Abstract:

Whereas the Kuroshio flowing up off the eastern side of Japan is known to be controlled by the mesoscale dynamics, effects of the submesoscale dynamics on the mean structure, eddies, frontal processes, stratification, etc. has not been fully understood. In prior to designing a submesoscale Kurhoshio modeling, a detailed numerical downscaling experiment is performed with ROMS at a horizontal resolution of 3 km, forced by the assimilative JCOPE2 at 1/10 deg. as the boundary condition. Three nesting configurations are prototyped for an assessment of surface kinetic energy: 1) a free run without any controls 2) with a homogeneous constant horizontal eddy viscosity of 100 m2/s, and 3) a three-dimensional T-S nudging towards the JCOPE2 at a nudging time scale of 20 days. Among the others, the T-S nudging is found to best reproduce the Koroshio including its paths, surface KE and EKE, thermocline slopes and stratification. In turn, the free run substantially overestimates the KE and EKE because of the lack of subgrid-scale energy dissipation associated with the submesoscale turbulence leading to overly meandered paths and more isolated warm/cold-core rings.