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Dr. Atsuhiko Isobe is an oceanographer working in ocean dynamics of continental-shelf circulation, with a focus on theoretical, observational and numerical studies on the shelves of marginal seas such as the East China Sea and Yellow Sea. In addition, his research interest extends to interdisciplinary studies on marine environment especially the coastal waters of Seto-Inland Sea, Japan. His work has been published as 50 original scientific articles in *Journal of Oceanography*, *Journal of Physical Oceanography*, *Journal of Geophysical Research*, *Continental Shelf Research*, etc. He was an editor of *Journal Oceanography* until 2007. He started his professional experience in 1990 at the National Fisheries University, and thereafter moved to Kyushu University in 1994 as an Associate Professor. He was a guest investigator at Physical Oceanography Department, Woods Hole Oceanographic Institution in 2005. He became a Professor in CMES in 2008, and presently working as the principal investigator of a research project “East China Sea marine-litter prediction experiment conducted by citizens and researchers” supported by the Global Environment Research Fund of the Ministry of the Environment, Japan.

Numerical Model Approach to Ocean Circulation and Material Transports in Coastal and Shelf Waters

Residual currents (i.e., continuous ocean circulation) are much more important than short-term fluctuations such as tidal currents for transporting nutrients and/or marine pollutants. However, in general, it is a difficult task for oceanographers to understand the present ocean circulation, and to predict its possible future changes, especially in coastal and shelf waters, because the ocean circulation in these areas is a complicated system driven by adjacent ocean currents (such as the Kuroshio in East Asian marginal seas), by spatiotemporally variable winds over the sea, and by seawater density gradient due to freshwater and heat inputs.

Numerical model approaches well validated by reliable observation data provide us with a powerful tool to depict present and future ocean-circulation views. Our research group has conducted numerous field observations in the East China Sea to elucidate the ocean circulation, using acoustic Doppler current profiles, satellite-track drifters and so forth. Using a numerical ocean-circulation model validated with these observed data set, we have elucidated various physical processes over the Yellow Sea and East China Sea shelves: for instance, about 70 % of Changjiang-derived fresh water is carried into the Japan Sea by ocean currents over the East China Sea shelf. In addition, Kuroshio frontal waves at the shelf break lead to about $0.85 \times 10^6 \text{ m}^3/\text{s}$ of seawater exchange between the Kuroshio and East China Sea shelf. Recently, using this numerical ocean-circulation model, we are

trying to forecast and/or hindcast behavior of marine litter and giant jelly fish drifting in East China Sea.

In addition to the above ocean-circulation model, material-transport models with various biochemical processes in the study areas are required for hindcasting and forecasting the fates of non-conservative chemicals such as nutrients and marine pollutants.

Furthermore, the ocean-circulation model can be improved in various ways. For instance, it should be reasonable if our regional model is nested into the general ocean circulation models over the Pacific to investigate how the global climate change affects regional and coastal waters. In addition, using finite volume ocean models with unstructured triangle cell grids, the ocean circulation is likely to be reproduced much more accurately in coastal and shelf waters having a complicated topography. Our goal is to establish a reliable numerical model for hindcasting and/or forecasting the ocean circulation and its related material transports in shallow coastal and shelf waters such as the Seto-Inland Sea and the East China Sea.

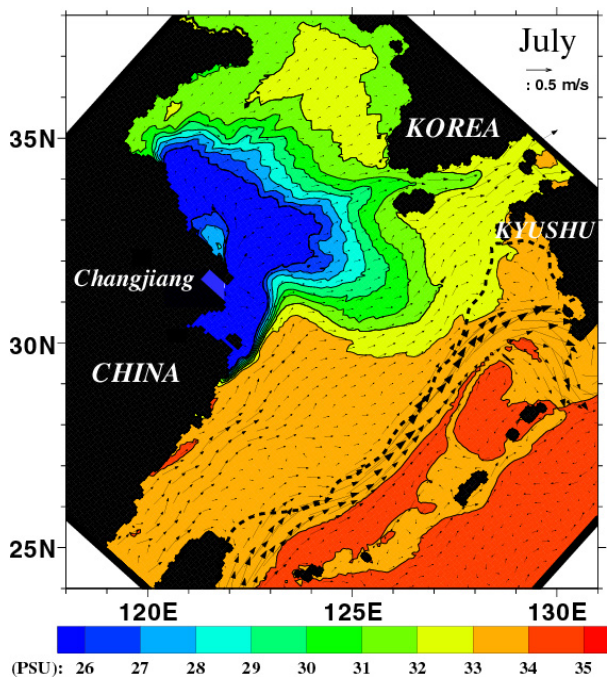


Figure caption

Horizontal distribution of monthly averaged sea surface current vectors and sea surface salinity in July computed using a numerical model. Also shown by broken lines are the isobaths of 200 and 500 meters.