VARIABILITY OF THE KUROSHIO IN THE EAST CHINA SEA

A THESIS SUBMITTED TO THE GRADUATE DIVISION OF THE
UNIVERSITY OF HAWAI'I IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

IN

OCEANOGRAPHY

MAY 2009

By
Ching-Hsi Nan

Thesis Committee:

Bo Qiu, Chairperson
Peter Müller,
Niklas Schneider

Abstract

The Kuroshio enters the Okinawa trough through the northeast corner of Taiwan and attaches the shelf break of the East China Sea (ECS) until turning right to enter the Tokara strait. Though the main stream of the Kuroshio stays in the Okinawa trough, this strong current and its variability greatly affects the ECS shelf and the neighbor area. Previous observations have indicated the propagating features of the fluctuation of the Kuroshio, called Frontal Eddies, in the trough. However, the observations from different studies suggest different time and length scales. The structures of the variability along the Okinawa trough have not yet been clarified. Since the in-situ data is difficult to cover a broad domain in space and time, the present study utilizes the high resolution data from OFES (OGCM for the Earth Simulator) model. The data output from OFES is 0.1x0.1° in horizontal resolution. Eight years (1990-1997) of daily output from the climatology run is used to study the variability structure of the Kuroshio. From the Eddy Kinematics Energy distribution (EKE), three regions of high EKE are located at east of Taiwan, east wall of the middle of the Okinawa trough within 25.5-27°N, and west edge of the Kuroshio mean path from 27°N to 30°N. Sections on the contours of mean surface elevation (η) are defined to represents these regions. Surface elevation and velocity field are the major variables to study the variability. From autocorrelation function, the time scales in the three regions are all different. East of Taiwan, time scale is 130 days; in the middle of the trough, it is 5 days; at the north end of the trough, it is 20 days. It is shown from spectra that the variance in different frequency bands change geographically. From the calculation of instability energy transfer rate, the middle of the trough is affected mainly by barotropic instability. The north end of the trough is likely to be affected by baroclinic instability and non-linear mechanisms. At east of Taiwan, the variability is reported to be dominated by meso-scale eddies from early studies.