International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2014): 5.611

Eddy Vertical Structure in Southern Java Indian Ocean: Identification using Automated Eddies Detection

Armyanda Tussadiah[1,3], Mega L. Syamsuddin[2], Widodo S. Pranowo[3], Noir P. Purba[2], Indah Riyantini[2]

[1]KOMITMEN Research Group, Dekanat Building, Padjadjaran University Jatinangor Km. 21 UBR 40600, West Java, Indonesia

[2]Departement of Marine Science, Padjadjaran University, Dekanat Building, FPIK-UNPAD Jatinangor Km. 21 UBR 40600, West Java, Indonesia

[3]Marine and Coastal Data Laboratory, R & D Center for Marine & Coastal Resources, Agency for Marine & Fisheries R & D, Ministry of Marine Affairs & Fisheries Republic of Indonesia
Pasir Putih II, East Ancol, Jakarta UBR 14430, Indonesia

Abstract: ***The eddy characteristic in Southern Java Indian Ocean has been investigated and discussed, but spesifically deals about the vertical structure of eddy is still not much. This research was conducted to determine the eddy vertical characteristic and to find out the biggest value of kinematic energy between the cyclonic and anticyclonic eddy. The data set was from NEMO model with parameter are current and temperature from 2014. By using an automated eddy detection the veertical eddies characteristic was set developed, it includes the statistical data of each eddy location, radius, kinematic energy, temperature, and SSH at four vertical levels. The results indicated that cyclonic eddy is mostly formed in Southern Java Indian Ocean in 2014. The temperature in eddy center mostly started changing at a depth of 109 m, which is at the cyclonic eddy has a lower value and at anticyclonic has a higher value.***

Keywords: Eddies, vertical structure, cyclonic eddy, anticyclonic eddy, kinematic energy.

1. Introduction

Indian Ocean waters has a unique and complex properties dynamics because the water system were affected by monsoon and trade wind system, unlike the Pacific Ocean and the Atlantic are only influenced by the trade wind system. In these waters there are several oceanography phenomena which have an important influence not only for oceanography but also for the atmosphere, such as Indian Ocean Dipole (IOD), upwelling, South Equatorial Current (SEC), South Java Current (SJC) and eddy [1].

An eddy is a loop of current that is cut off from the main current, or a small, spinning current. Ocean eddy can move at speeds of about 0.5 knots and may occasionally persist for many month [2]. Spatial distribution of eddy varies with the size. All eddy are categorized into two groups according to their size: a submesoscale eddy is about 10-100 km, and a mesoscale eddy can reach more then 50-200 km [3]. There are warm-core eddy and cold-core eddy. In southern hemisphere cold-core eddy rotate clockwise or known as a cyclonic eddy, while the warm-core eddy rotate counterclockwise or known as anticyclonic eddy. The cyclonic eddy can drive upwelling in their interior and increasing primary production [4].

Eddy are important because they have so much kinetic energy, and because they can transport momentum and trace water properties. They have deep „roots" that often reach 5 km or more downward, carrying energy and momentum to the seafloor. They are responsible for the irreversible mixing of waters with different properties. They may owe their existence to several sources other than meandering of strong currents: for example, direct generation by winds or cooling at the sea surface; flow over a rough seafloor or past islands and coastal promentories; or generation by mixing or waves of smaller scale [5].

Most of the former eddy studies in Southern Java Indian Ocean are focused on the surface and little is known about the vertical structures of eddies in the region. The first research about eddy in Southern Java was by Creswell and Golding in 1977 using drifter trajectories [2]. In this paper, we used a automated eddy detection developed by Nencioli et al. (2010) to analyze and identify the vertical eddy structures and characteristics.

2. Methodology

The study region extend from Southern Java Indian Ocean (0^o – 20^oS and 90^o - 120^oE). The data set was from NEMO Model from INDESO website (www.indeso.com). This model is forced at the surface using 3-hourly ECWMF atmospheric analysis and forecast fields and at the lateral open boundaries using Mercator Océan global operational analysis and forecast fields.

2.1 Ocean Model Data

The ocean model used by INDESO is a "regional" version of the OPA/NEMO global ocean circulation model. This regional model was developed by France (MERCATOR OCEAN) and is now used to simulate very accurately (at high resolution) ocean circulation around the world. The parameter that used to identify the eddy characteristic are vertical current (U and V component) and temperature with