Drifter and Satellite Observations on the Variation of Dongsha Cyclonic Eddy in Northern South China Sea

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Abstract

A Lagrangian observation under an international project upon the nonlinear internal waves (NLIW) experiment in northern South China Sea (NSCS) was carried out in 2005. Twenty-eight ARGOS drifters were tracked during May to August to provide data for displaying the spaghetti diagram as shown in Figure 1. Intuitively, there seemed to be some eddies around.

At the south or southwest of Dongsha in the NSCS, there is a cold-core cyclonic eddy existing throughout year and it has been identified as "Dongsha Cyclonic Eddy" [He, 1996; Chu, 1998] and abbreviated to "DCE" in this study. By analyzing the drifter data from the NLIW experiment and other historical kriged data provided by AOML (Atlantic Oceanographic and Meteorological Laboratory), the eddy seemed to increase its tangential speeds while it migrated westward from Dongsha to around 114°E and then gradually diminished. The mean tangential speeds in summer were around 10~19 cm/s, while in winter the speeds were faster of around 16~36 cm/s. The Lagrangian autocorrelation function indicates the time scales of the eddy were mostly longer in summer than in winter.

From the sea level anomaly (SLA) data during 2000~2005 provided by AVISO (Archiving Validation and Interpretation of Satellite data in Oceanography), ten DCEs with lifetime longer than a month could be identified and their variations could be carefully observed. After initiating around Dongsha, they propagated southwestward mostly with a moving speed of 5~10 km/day along the continental slope of 1000~2000 m depth. These mesoscale eddies usually diminished after passing 114°E and entering an "underwater bay" which could be delineated by 1000 m and 2000 m contours with its mouth opened oppositely toward the moving orientation of the DCE. DCE generally appeared one to three times per year. They were mostly born in winter and spring. However, one exception was that born in summer of 2000 as shown in Figure 2.

The DCE in Figure 2 was actually the largest one with a horizontal size reaching $3.6x10^4$ km^2 with the longest lifetime of over 4 months and the highest difference (DIF) of 24 cm. The DIF is defined as the sea level from its boundary to center of the eddy. The AVHRR and ocean color images of the same period disclose the core of this largest eddy a low temperature of 26 °C and high chlorophyll-*a* concentration of 1 mg/m^3 respectively. These two values differ from the surrounding area of about 3 °C and 0.8 mg/m^3 implying the waters upwelled by the DCE.

The DCE has a long lifetime and journey to substantially affect the environment of the NSCS waters, such as currents, heat transportation, primary production etc. Further studies, such as its dynamic and mechanism, should be of certain importance.

References

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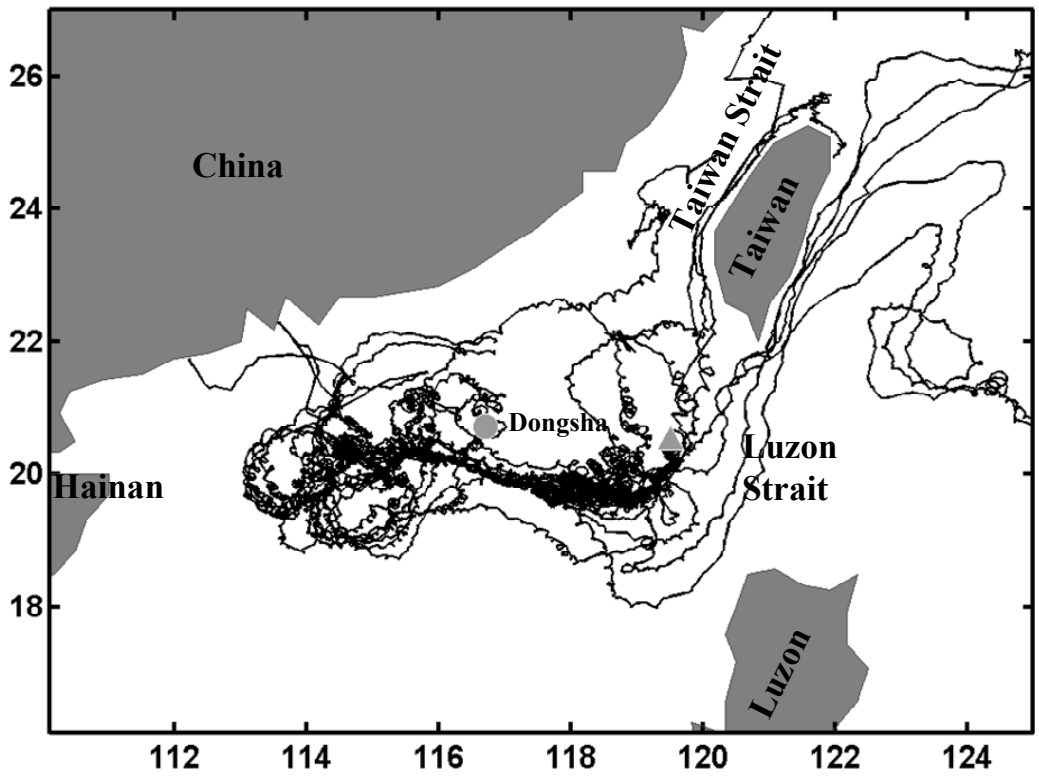

Figure 1. The spaghetti diagram of twenty-eight ARGOS drifters deployed at the spot marked by ▲. The mark ● is the location of Dongsha.

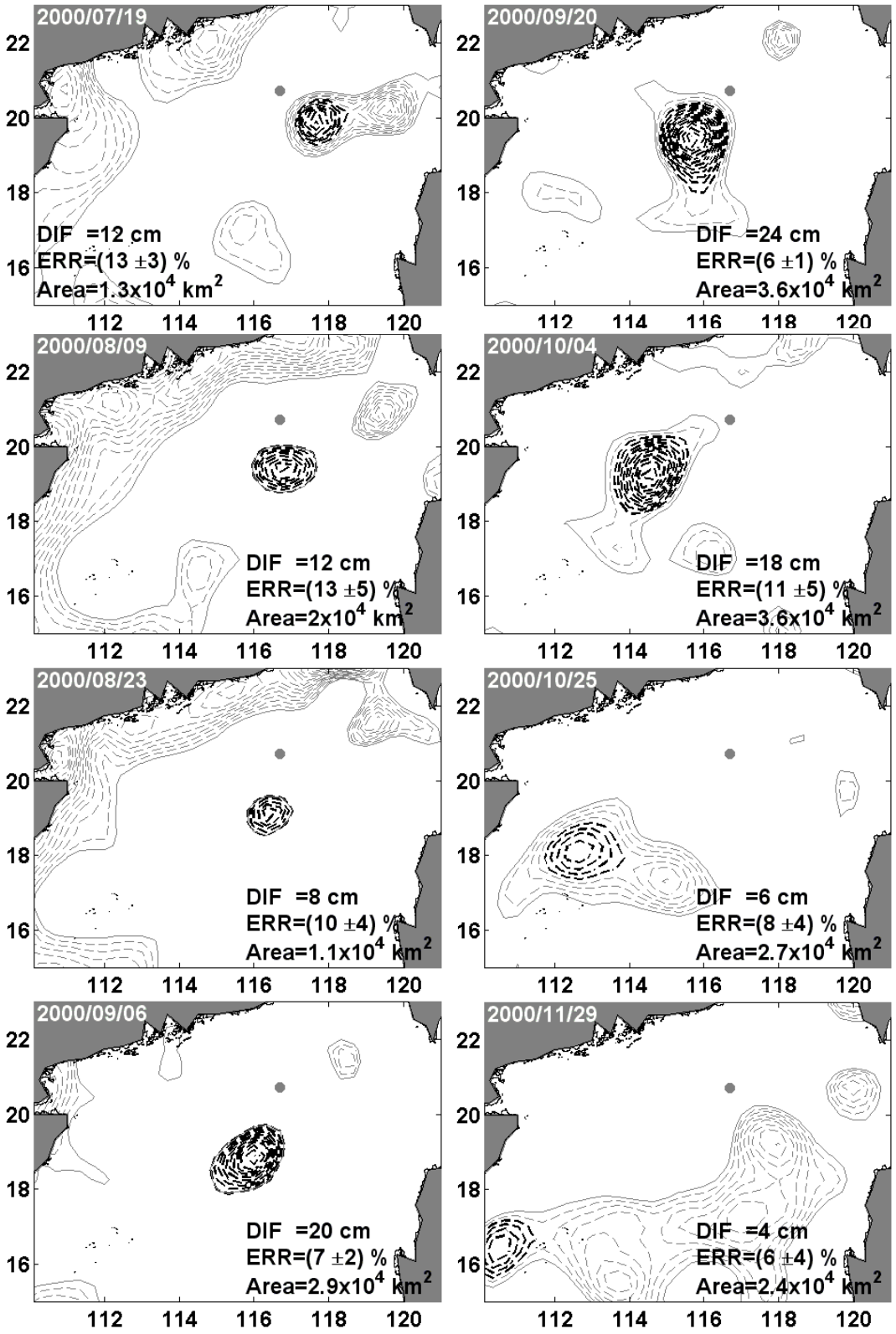

Figure 2. Eight time series of weekly SLA maps in 2000. C.I.=2 cm. Solid gray curves are zero contours, gray dashed curves are negative (note that all positive contours are not shown), black dashed curves are of the Dongsha Cyclonic Eddy.