Influence of the Durban cyclonic eddy on the east coast oceanography of South Africa

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Abstract

The Durban eddy is a lee-trapped, semi-permanent, cold core cyclonic eddy that occurs off the east coast of South Africa south of Durban (29.87°S, 31.03°E) (Fig. 1). It is driven by the Agulhas Current which moves offshore of a regressing shelf edge south of Durban. The eddy draws cold water upward, which is nutrient-rich compared to surrounding waters, facilitating biological production. The eddy is a mesoscale feature, extending approximately 60-90 km alongshore and 30-50 km offshore. Analysis of ADCP data together with satellite imagery shows that the eddy is present offshore of Durban approximately 55% of the time, with an average lifespan of 8.6 days, and ‘inter-eddy’ periods of 4.7 days. Eddy occurrence is sporadic and inshore currents (refer Fig. 2) are characterised by frequent current reversals associated with eddy spin-up followed by downstream propagation and dissipation of the eddy (refer Fig. 3). Roberts et al. (2010) has shown that short-term current reversals (2-3 days) observed in ADCP data measured off Port Edward (30.08°S, 30.22°E), some 150 km south of Durban (refer Fig. 3), corresponds with downstream propagation of the Durban breakaway eddy. The downstream influence of the southward propagating breakaway eddy on the Agulhas current system is investigated.

Example of eddy lifecycle

Diver tracks: Satellite-tracked drifters deployed into the Durban eddy indicate transport of surface waters both northward into the KZN Bight and southward into the Agulhas Current. Drifters took 2.5 to 3.5 days to do a complete rotation in the eddy. Drifters got taken up into the south-westward flowing Agulhas Current further offshore during the outer rotation, with north-east words sometimes playing a role in assisting them from the eddy into the current. The drifters then followed the main Agulhas Current, with some (e.g. No. 73 & 75) following Natal Pulses offshore of East London and Port Elizabeth, respectively, while one drifter (No. 74) ended up on the west coast.

Drifter tracks: Satellite-tracked drifters deployed into the Durban eddy indicate transport of surface waters both northward into the KZN Bight and southward into the Agulhas Current. Drifters took 2.5 to 3.5 days to do a complete rotation in the eddy. Drifters got taken up into the south-westward flowing Agulhas Current further offshore during the outer rotation, with north-east words sometimes playing a role in assisting them from the eddy into the current. The drifters then followed the main Agulhas Current, with some (e.g. No. 73 & 75) following Natal Pulses offshore of East London and Port Elizabeth, respectively, while one drifter (No. 74) ended up on the west coast.

Conclusion:

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Durban Eddy waters and associated biota are transported downstream into the Agulhas Current both by leakage from the outer rim of the eddy into the inshore boundary of the Agulhas Current (refer Fig. 4) and through downstream propagation of the eddy itself (refer Figs 3, 5 & 6). The Durban break-away eddy is a transient, southward propagating mechanism for the upwelling movement of cold water rich in nutrients, which may well be capable of stimulating primary production. Thus the Durban cyclonic Eddy is an important source of nutrients and associated biota to the Agulhas Current downstream of Durban and plays an important role in its ecosystem functioning, providing the nutrient source for primary production.

References:


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