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Impact of Mesoscale Eddies on Chlorophyll Variability off the Coast of Chile

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The mesoscale eddies off the coast of Chile significantly impact the distribution of local chlorophyll and the development of marine ecosystem. Multiple processes, including eddy trapping, pumping, advection, Ekman-pumping, and submesoscale dynamics, exert their impacts simultaneously on transport of water masses at different distances with respect to the eddy center. The cyclonic (anticyclonic) eddies are generally characterized by upwelling (downwelling) within the eddy, which elevates (depresses) chlorophyll inside the eddy. Outside the eddy periphery, multiple processes are involved simultaneously, but their corresponding influences on chlorophyll are not well identified. In this study, the amplitudes of cyclonic and anticyclonic eddies are distinguished as positive and negative values, respectively. A linear regression method is applied to seek the connection between eddy's amplitude and chlorophyll distribution at different locations w.r.t. the eddy center. The regression slope between eddy amplitude and chlorophyll anomaly is found to be negative in the eddy interior and along the periphery, which gradually changes to positive away from the periphery. The location where the response of chlorophyll to an eddy switches its sign is defined as the transition zone. The location of the transition zone varies with offshore distance and is impacted by topography, such as the presence of islands, which can change the dynamics of eddies. Thus, the distance from eddy center and offshore distance from coast should be taken into consideration when investigating their influences on nutrient transport and chlorophyll distribution.