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Observations of mesoscale eddies in the North Pacific

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Nineteen years of absolute dynamical topography (ADT) maps constructed from the merged multi-satellite altimeter datasets are analyzed to investigate mesoscale eddies in the North Pacific. To track mesoscale eddies, this study developed an integration filtering algorithm based on connected component labeling and the Okubo-Weiss parameter which can separate the flow field into deformation-dominated and vorticity-dominated regions. The area, relative vorticities, nonlinearity parameter, central velocities, lifetimes, propagation pathways and kinetic energy of all identified eddies over the North Pacific, were all determined by the integration filtering algorithm. In this study, we consider the terms that mesoscale eddies have longer life span than 12 weeks. The seasonal and annual variations of cold and warm eddies will all be analyzed. According to the analyses of ADT data from October 1992 to July 2011, the results indicate there are quantities of mesoscale eddies with tens to hundreds of kilometers in spatial scales, and tens to hundreds of days in temporal scales. The 83% of eddies are generated between 15ºN and 40ºN and average translation speed is 4.5$\pm$1.9km/day. The average life span is 20$\pm$11weeks, but warm eddies have longer life span than cold eddies. There are about 300 eddies generated in this ocean per year, but numbers of eddy keeps gaining more and more with a trend of 1.7$\pm$0.4numbers per year. More interesting thing is that cold eddies with a trend of 1.1$\pm$0.5numbers per year are growing more than warm eddies with a trend of 0.6$\pm$0.4numbers per year. Referring to the pathway, most eddies propagate westward with slightly equatorward and poleward deflection of cold and warm eddies, respectively. This result indicates that theories for nonlinear eddies propagation may be influenced by β effect, but this divergence of the eddy pathway in Northwestern Pacific is not clearer than Northeastern Pacific. Nevertheless, background conditions in Northwestern Pacific are more complex than Northeastern Pacific. Moreover, this study will present some special cases that warm and cold eddies propagate in opposite direction of the theories, and different background conditions will be compared.