

Stationary and transient striations as a hint for an organized mesoscale eddy field in the eastern South Pacific

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Abstract:

In recent years, persistent quasi-zonal jets or striations have been ubiquitously detected in the world ocean using satellite and in situ data as well as numerical models. These alternating bands of eastward/westward flow have a meridional scale of 300–500 km, are vertically coherent over several hundred meters, and extend zonally for 1000's of km across all major ocean basins. There is an ongoing debate on the nature and origin of these striations. They are not universally accepted as real jets, and they have been proposed to be artifacts of time-averaging westward-propagating mesoscale eddies. These may be either random eddies averaged over the relatively short observational record, or organized eddies following preferred pathways. This study aims at determining the role of mesoscale eddies in the generation and persistence of striations in the eastern South Pacific Ocean off Chile. A 50-year long climatological integration of an eddy-resolving numerical ocean model is used to assess the long-term persistence of striations. Automated eddy tracking algorithms are applied to the model outputs and altimetry data. Bands of alternated eddy polarity are compared to eddy generation sites along the coast and offshore. Source terms for eddy kinetic energy allow estimating the eddy-striation nonlinear interaction. Results reveal the existence of two types of striations: stationary and transient. Stationary striations coincide with both polarized eddy tracks and the offshore formation of new eddies in the subtropical front and coastal transition zones. Shear instability of striations is proposed to feedback onto the eddy field, acting to maintain the subtropical front striations/eddy streets. Transient striations are well correlated with transient polarized eddy tracks in the subtropical front region and exhibit a slow equatorward drift. New eddies may form along transient striations, but it is not as clear as for stationary striations. No evidence was found that either mean or transient striations/polarized eddy tracks originate from the coast.