EDDY DYNAMICS AND ENERGY CONVERSION IN THE SUBTROPICAL GYRE

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Low-frequency motions in the subtropical ocean are characterized by multiple quasi-zonal jet-like features, hereafter called striations, which slowly, at a speed of about 0.3-0.5 km/day, propagate toward the equator. Using satellite altimetry data and the OFES hindcast simulation, we demonstrate that (1) the meridional distribution of the striations' meridional length scales is quantitatively similar to that of the eddy length scales, and (2) the striations' amplitudes correlate well with the averaged eddy amplitudes. The similarity in properties between the striations and eddies suggest that eddies are not completely random in their paths but tend to align along the striations, implying that the dynamics of the striations and eddies are coupled. To test this hypothesis we conduct a cases study of the propagating striations in the eastern part of the subtropical North Pacific. The results indicate that that the striations' energy cycle is dominated by two dynamically distinct components. The first one is attributable to baroclinic instability of the large-scale meridional flow in the eastern limb of the subtropical gyre. Potential energy stored in the large-scale flow is accessible for conversion directly to the zonal striations. The second component arises from the nonlinear interactions between the zonal striations and eddies and can be put into the context of the geostrophic turbulence theory. The space-time distribution of eddies is generally striation-oriented such that the distribution of cyclonic and anticyclonic eddies alternates between "troughs" of enhanced concentration of cyclonic eddies (negative sea level anomaly) and "ridges" of enhanced concentration of anticyclonic eddies (positive sea level anomaly). Such anisotropic localization of eddy pathways may have a profound effect on the horizontal transport and mixing of tracers.

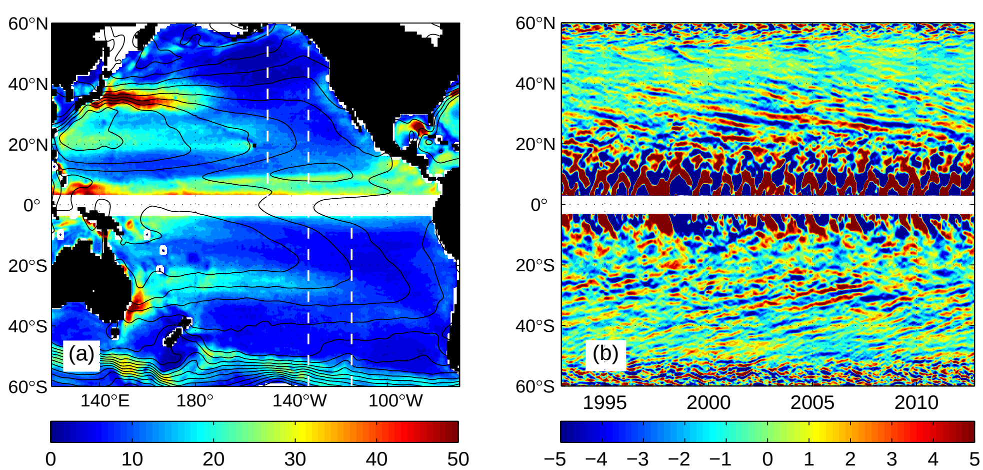

Figure. (a) Root-mean-square surface geostrophic velocity variability (cm/s) based on satellite altimetry data from November 1992 to October 2012. Shown on top are contours of the mean dynamic topography. (b) Time-latitude diagram of the zonally averaged zonal geostrophic velocity anomaly. Boundaries of the zonal bands, over which the zonal averaging is applied, are shown in (a) by the white dashed lines.