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## **The interannual variability of eddy activities in the Kuroshio region south of Japan and its relationship to Kuroshio latitudinal position over the Izu Ridge**

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This study investigates the variability of eddy activities in the Kuroshio region south of Japan using both satellite sea surface height observation and high-resolution ocean reanalysis data. It is found that the eddy kinetic energy (EKE) measuring eddy activities has a significant interannual variability. On the meanwhile, the EKE variability is negatively leading correlated with the change in the Kuroshio latitudinal position over the Izu Ridge. We further find that the baroclinic instability and advection processes are responsible for the EKE interannual variability and its relationship to the Kuroshio latitudinal position over the Izu Ridge. Specifically, before the high EKE level occurs, a cyclonic eddy generates east of Kii Peninsula. The rapid development of this eddy and its eastward movement to the Kuroshio region induce the isopycnal inclinations there and the associated horizontal density gradient, which leads to the strong baroclinic instability and promotes the evolution of eddy field. The developed strong eddies move downstream to the Izu Ridge. This pushes the Kuroshio off the shore and causes the southerly Kuroshio latitudinal position. Contrarily, when the cyclonic eddies do not appear in the Kuroshio region, the isopycnals are relatively flat, which is not conducive to the generation of baroclinic instability. Consequently, the EKE level is low and only weak eddies are advected to Izu Ridge, which does not substantially shift the Kuroshio southward and thus results in the northerly Kuroshio position. This contributes to the understanding and prediction of the Kuroshio dynamics.