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Vertical coupling and dynamical source for the intraseasonal variability in the deep Kuroshio Extension

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In the power spectrum, the upper and deep parts of the Kuroshio Extension have distinctly different peaks. The former peaks around 200 days, while the latter is mainly at the intraseasonal band. How the upper meandering jet links the deep intraseasonal eddy current then makes an issue. In this study, it is investigated using the outputs from a 1/10° ocean general circulation model. The theoretical framework is the theory of canonical transfer that gives a faithful representation of the energy transfers among distinct scales in the light of energy conservation, and a space-time-dependent energetics formalism with three-scale windows, namely, a slowly varying background flow window, an intraseasonal eddy window, and a high-frequency synoptic eddy window. The vertical pressure work is found to be the primary driver of the deep intraseasonal variability; it transports intraseasonal kinetic energy (IKE) to the deep layer (below 3000 m) from the interior layer (~ 200–3000 m) where the intraseasonal variability is generated through baroclinic instabilities. Besides the downward IKE fluxes, significant upward fluxes also exist in the surface mixed layer of the upstream Kuroshio Extension (above ~ 200 m, west of 146°E) as a comparable IKE source as baroclinic instability. The accumulated upstream IKE is advected eastward, forming the primary KE source of the intraseasonal variability in the surface layer of the downstream Kuroshio Extension (east of 146°E). Regarding the IKE sinks, the deep layer IKE is damped by bottom drag, while in the surface (interior) layer, IKE is damped by the wind stress and may also be given back to the background flow (the up/downward IKE fluxes via pressure work).

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