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The mechanisms of interleaving in the equatorial baroclinic front

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Based upon a complete modeling in the traditional approximation of Coriolis force, numerical analysis of instability in the cases of more general shape of the equatorial front is studied. It is shown that there is analogy between double-diffusion and horizontal shear trapped-scale modes of instability: both can be generated but in limited zone and only if the asymmetry of the mean salinity/velocity field relative to the equator is considerable enough.

Using modeling results, an illustrative scheme of Equatorial Undercurrent regions where different types of instability can develop is presented, and subsequently applied to understand the mechanisms of the intrusions observed in a north-south hydrographic section located between the equator and 1^{o}N. Long coherent intrusions are situated within two isopycnal layers, aligned to 25 (upper layer) and 26.3 (lower layer)σ_T, where the vertical shear is low. It was shown from the model that intrusions in the upper layer being observed in the mid-layer of the Equatorial Undercurrent, where the mean horizontal gradient of salinity is approximately constant, are likely generated by a combined effect of double-diffusive instability and instability due to linear horizontal shear. The intrusions being observed in the lower part of Equatorial Undercurrent, where the mean salinity contours have a parabolic shape, arise likely due to linear horizontal shear only, while double-diffusion can be considered as an effect that increases the growth rate of unstable modes. Special attention is focused on two different parts of the Equatorial Undercurrent in the mixing of the thermocline. It is noted that the Equatorial Undercurrent only makes the mass transfer by long coherent intrusions in certain layers, where the vertical shear is small. Conversely, the Equatorial Undercurrent contributes to the growth rate of unstable modes, due to the horizontal linear shear.