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From Balanced Barotropic and Baroclinic Shear to Turbulence in Rotating and Stratified Flow ERIC AROBONE, SUTANU SARKAR, University of California, San Diego — In the oceanic submesoscale regime, rotation is important but does not control dynamics. Instabilities and nonlinear cascades are possible even for stably stratified flows. Previous work by the authors explored the rotating stratified barotropic shear layer. Here, the vertical wavenumber band associated with linear barotropic instability greatly increased when centerline absolute vorticity was approximately zero. Correspondingly, nonlinear simulations showed a marked transition event during the changing in sign of centerline absolute vorticity. Our study will include direct numerical simulations exploring the effect of a weak isolated front in combination with the previously explored barotropic shear layer. The primary aim of this study is to explore how the instabilities of the barotropic simulations are modified by weak baroclinicity. We will explore coherent structure evolution to qualitatively assess the importance of the numerous possible instability mechanisms, especially the zero absolute vorticity mechanism. Additionally, energy and enstrophy budgets will be analyzed comparing the various pathways from large-scale kinetic and potential energies to turbulence.

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