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Nonlinear evolution of a baroclinic wave and imbalanced dissipation BALU NADIGA, Los Alamos Natl Lab — The question of how ocean circulation equilibrates in the presence of continuous large-scale forcing and a tendency of geostrophic turbulence to confine energy to large and intermediate scales is considered. By considering the nonlinear evolution of an unstable baroclinic wave at small Rossby and Froude numbers (small aspect ratio domain) at high resolutions, it is shown that submesoscale instabilities provide an *interior* pathway between the energetic oceanic mesoscales and smaller unbalanced scales. An estimate of the magnitude of this pathway is presented. Phenomenology-wise, mesoscale shear and strain resulting from the primary baroclinic instability drive frontogenesis; fronts in turn support ageostrophic secondary circulation and instabilities. These two processes together lead to a quick rise in dissipation rate which then reaches a peak and begins to fall as frontogenesis slows down; eventually balanced and imbalanced modes decouple. Dissipation of balanced energy by imbalanced processes is shown to scale exponentially with Rossby number of the base flow. Further, a break is seen in the total energy (TE) spectrum at small scales with a transition from k^{-3} to $k^{-5/3}$ reminiscent of the atmospheric spectra of Nastrom & Gage. For details see JFM 756, 965-1006.

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