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# Conservation laws in baroclinic inertial-symmetric instabilities

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Submesoscale oceanic density fronts are structures in geostrophic and hydrostatic balance, but are more prone to instabilities than mesoscale flows. As a consequence, they are believed to play a large role in air-sea exchanges, near-surface turbulence and dissipation of kinetic energy of geostrophically and hydrostatically balanced flows. We will present two-dimensional (x, z) Boussinesq numerical experiments of submesoscale baroclinic fronts on the f-plane. Instabilities of the mixed inertial and symmetric types (the actual name varies across the literature) develop, with the absence of along-front variations prohibiting geostrophic baroclinic instabilities. Two new salient facts emerge. First, contrary to pure inertial and/or pure symmetric instability, the potential energy budget is affected, the mixed instability extracting significant available potential energy from the front and dissipating it locally. Second, in the submesoscale regime, the growth rate of this mixed instability is sufficiently large that significant radiation of near-inertial internal waves occurs. Although energetically small compared to e.g. local dissipation within the front, this process might be a significant source of near-inertial energy in the ocean.