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Secondary instability of forced baroclinic critical layers CHEN WANG[1], NEIL BALMFORTH, University of British Columbia — Baroclinic critical levels arise as a singularities in the inviscid linear theory of waves propagating through stratified fluid with horizontally sheared flow. For a steady wave forcing, disturbances grow secularly over the criticial layers surrounding these levels, generating a jet-like defect in the mean flow. We use a matched asymptotic expansion to furnish a reduced model of the nonlinear dynamics of such defects. By solving the linear initial-value problem for small perturbations to the defect, we establish that secondary instabilities appear at later times. Although a conventional normal-mode analysis does not strictly apply to the evolving defect, it does successfully predict the occurrence of the secondary instability, but with quantitatively inaccurate results. Notably, the model becomes ill-posed at late times, with the mode with shortest wavelength growing most vigorously, unless dissipation is included. Numerical computations with the reduced nonlinear model demonstrate that the secondary instability prompts the roll up of the defect's vorticity into vortices.

[1]The first author is leaving for the University of Exeter, which will be his affiliation at the time of the conference.

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