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Wave-mean flow interaction throughout a baroclinic wave life cycle

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Baroclinic instability theory describes how waves can grow on a zonally symmetric background state. As the waves attain finite amplitude, the wave fluxes modify the background on which they grow. Changes to the background have a profound influence on the structure of the waves and their fluxes. The two-way interaction between the wave and background is difficult to diagnose because the results depend on the manner in which the background is partitioned from the full flow. The traditional approach is to associate the background state with the Eulerian zonal average. However, then the background and wave both vary rapidly through adiabatic processes. Here we consider defining the background in terms of the modified Lagrangian mean. In this framework the background can only evolve through non-conservative processes and there is a wave activity conservation law valid at large amplitude.