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Length scales in dry and moist baroclinic instability

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The length scales associated with baroclinic eddies are important not only for determining the character of midlatitude storms, but also for understanding the general circulation of the atmosphere, since eddy length scales in part determine the efficiency of the poleward transport of heat and moisture in the atmosphere. In this study, the most unstable wavenumbers in baroclinic life cycle experiments are determined in both dry and moist simulations, in which latent heating effects are included. The work is motivated by recent results by Frierson, Held, and Zurita-Gotor (2006, hereafter FHZ). FHZ found that the static stability is controlled by moist convection in the midlatitudes, leading to a large increase in both buoyancy frequency and tropopause height as the moisture content is increased. However, the eddy length scales in these simulations remain remarkably similar despite the changes in static stability and tropopause height, leading FHZ to conclude that the dry Rossby radius may not not be the relevant scale that determines the most energetic eddies. Various definitions of the Rossby radius are examined in life cycle experiments, with a focus on the importance of the static stability, tropopause height, jet latitude, and moisture content in determining the most unstable wavenumber.