

On the Coupling between Baroclinic and Barotropic Annular Modes

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Baroclinic and barotropic processes are the key components of midlatitude tropospheric dynamics. Baroclinic processes are involved in the growth of extratropical storms, whereas barotropic processes are involved in the decay of storms, suggesting the two processes are closely linked. However, recent observational studies have suggested a decoupling of the baroclinic and barotropic components of atmospheric variability. We study this counterintuitive result using annular modes of variability: baroclinic (based on eddy kinetic energy, a proxy for eddy activity and an indicator of storm-track intensity) and barotropic (based on zonal mean zonal wind, representing the north-south shifts of the jet stream). Through the analysis of an idealised model and reanalysis data, we identify three different mechanisms for the coupling between the two modes of variability, and show that the decoupling of the two processes can indeed occur, but is frequency-dependent.

Key words: baroclinic, barotropic, annular modes, climate variability, atmospheric dynamics