Can Extratropical Cyclones Increase Baroclinicity?  
A Pathway to Cyclone Clustering

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The positioning and maintenance of mid- and high-latitude baroclinicity and associated storm tracks is still not fully understood. A seminal paper pointed to the self-maintenance of storm tracks via diabatic heating of the storms themselves, which would imply that the storms not only live off the baroclinicity, feeding from its available potential energy, but would actually also act to resupply baroclinicity for subsequent development. This raises the question if baroclinicity can actually be conserved for an individual cyclone. The observation of so-called cyclone clustering already hints at that baroclinicity is not conserved but rather undergoes episodic cycles. Using a recently introduced diagnostic analysing the slope of isentropic surfaces and its tendency, the relative roles of diabatic and adiabatic effects associated with extra-tropical cyclones in maintaining baroclinicity in the lower and upper troposphere can be assessed.

We first present a few cases proving the concept and value of our diagnostic in interpreting baroclinic development. First, we will show that a particular sequence of storms culminating in a severe cyclone is due to the fact that the previous storms act to maintain or increase the background baroclinicity along which the succeeding storms evolve. We separately quantify the diabatic and adiabatic effects and thereby assess their relative importance and discuss the build-up of the baroclinicity as well as the relative contributions to its tendency. In addition, the life cycle of these storms is discussed in terms of how the storm changes and uses its environment to attain its intensity. We will also compare composites of clustered and non-clustered days to quantify how consistent the clustering-mechanism is.