Suppression of Baroclinic Eddies by Strong Jets

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The midlatitude storm tracks are one of the most prominent features of extratropical climate. Despite the theoretical expectation, based on baroclinic instability theory that baroclinic eddy strength correlates with jet intensity, there is a decrease in storm-track activity during midwinter over the Pacific compared to the shoulder seasons. Recent studies suggest this phenomenon is a result of the general circulation effect on the storm-track through interaction with the jet-stream. To isolate the effect of jet strength, we conduct a series of GCM experiments with a systematically varied jet intensity. The simulations are analyzed using Lagrangian tracking to understand the response from a single eddy perspective. The results of the Lagrangian analysis show that while the response of upper-level eddies is dominated by a reduction in the amount of tracked features, the lower-level eddies' response is also affected by a reduction in their lifetime. Analyzing the effect of the jet strength on the pairing between the upper- and lower-level eddies, we show how the jet intensification break the baroclinic wave structure and limits its growth. Furthermore, we show that these results can be settled with linear baroclinic instability models if the eddies' spatial scale is considered. The intensification of the jet and increase in the deformation radius shift the preferred scale for growth from the synoptic-scale toward the planetary-scale, consistent with the reduction in storm activity. This mechanism potentially explains the midwinter suppression of storm activity over the Pacific and the difference from the response over the Atlantic.