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The role of transient eddies in shaping Storm Tracks using an idealized GCM

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The Northern Hemisphere climate differs greatly from its Southern Hemisphere counterpart due to the presence of continents that break the zonal symmetry. The continent- ocean contrast produces sharp temperature gradients and results with strong localized jets and enhanced eddy activity, such as the observed Atlantic and Pacific storm tracks. The resulting eddy fluxes play a significant role in the existence, as well as the termination, of the storm tracks, as they redistribute heat and momentum in a way that can either maintain or destroy the mean gradients. Though much work has been done with regard to storm track dynamics, many aspects are not yet fully understood. For example, Storm tracks are characterized by a downstream poleward deflection that is of major importance for the global climate, however a complete understanding of this phenomenon is still absent. In this work, we investigate the eddy mean flow interaction within these localized baroclinic jets and the role of eddies in shaping the storm tracks. For this purpose, we use an idealized aquaplanet General Circulation Model (GCM) with a localized zonal asymmetry in the form of surface heating. Through systematic experiments with varying parameters such as the strength and location of the localized heating, the idealized GCM allows developing a mechanistic understanding of the processes controlling the dynamics. Our results show that the localized surface heating produces a storm track that resembles very well the observed features, including the poleward tilt, which increases as we increase the heating strength or lower its latitudinal location. These findings are consistent with the recently suggested 'beta drift' mechanism, which explains the poleward tendency of cyclones on a beta plane due to nonlinearities. We also analyze experiments with increased planetary rotation rate, for which a larger separation between the subtropical and eddy-driven jets exists. This allows studying the different responses for the heating as it interacts with the existing jets, and provides a link to the observed differences between the Atlantic and Pacific storm tracks.