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A midwinter minimum in storm track activity in an idealized GCM with a seasonal cycle

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Seasonal variations of the Pacific storm track show a distinct minimum in transient eddy activity during midwinter despite the strong background baroclinicity and enhanced jet during this period, relative to fall and spring. This intriguing seasonal decrease in eddy activity has been attributed to various factors, including diabatic effects, upper-level trapping and inefficiency of barotropic energy conversion due to the Tibetan Plateau, yet the governing mechanism to this phenomenon remains unclear. In this study, we explore the seasonal cycle of storm tracks in an idealized moist atmospheric general circulation model (GCM), where we implement an idealized seasonal cycle by varying the radiative parameters. We show that the midwinter minimum can be simulated in a zonally-symmetric model, without topography or land-sea contrasts. We find that the minimum becomes more pronounced as the ratio between the eddy time-scale and the seasonal time-scale is increased, which in the idealized GCM we explore by increasing the planetary orbital period. By analyzing the eddy energy balance, we investigate the relationship between the strength of the subtropical jet (and the Hadley circulation) and midlatitude eddies. We find that in simulations with stronger subtropical jet, the decrease in eddy activity in winter becomes more pronounced. Furthermore, using 30-yr reanalysis data from NCEP/NCAR, the climatological characteristics of the Pacific and the Atlantic storm tracks are explored. Over the Pacific, in periods of negative correlation between the intensity of the zonal winds and eddy activity the jet has stronger vertical shear, and is located closer to the equator relative to fall or spring.