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Future changes in extratropical storm tracks and baroclinicity under climate change

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Abstract

The weather in Eurasia, Australia, and North and South America is largely controlled by the strength and position of extratropical storm tracks. Future climate change will likely affect these storm tracks and the associated transport of energy, momentum, and water vapour. Many recent studies have analyzed how storm tracks will change under climate change, and how these changes are related to atmospheric dynamics. However, there are still discrepancies between different studies on how storm tracks will change under future climate scenarios. Here, we show that under global warming the CMIP5 ensemble of coupled climate models projects only little relative changes in vertically averaged mid-latitude mean storm track activity during the northern winter, but agree in projecting a substantial decrease during summer. Seasonal changes in the Southern Hemisphere show the opposite behaviour, with an intensification in winter and no change during summer. These distinct seasonal changes in northern summer and southern winter storm tracks lead to an amplified seasonal cycle in a future climate. Similar changes are seen in the mid-latitude mean Eady growth rate maximum, a measure that combines changes in vertical shear and static stability based on baroclinic instability theory. Regression analysis between changes in the storm tracks and changes in the maximum Eady growth rate reveal that most models agree in a positive association between the two quantities over mid-latitude regions.

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Keywords

baroclinicity, climate change, storm tracks