National Aeronautics and Space Administration
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Extratropical Cyclones Sensitivity to Environmental Change

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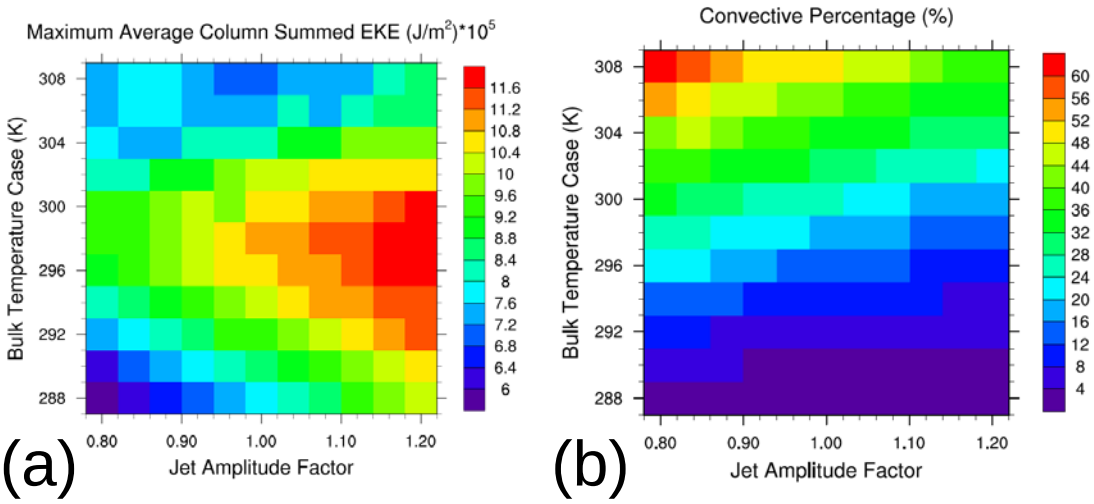

(a) Maximum value of the average column-summed EKE (in (J/m2)*10^5) during the lifetime of each ETC in the bivariate sensitivity test (color shading). (b) Percentage of the precipitation that comes from convection in each ETC in the bivariate sensitivity test (color shading). In each figure, the x-axis represents increases in baroclinicity, via amplification of the maximum jet stream speed. The y-axis represents increases in the bulk environmental temperature, as represented by the temperature at the southernmost point in the model domain.

Tierney, G., D. J. Posselt, and J. F. Booth (2018). An Examination of Extratropical Cyclone Response to Changes in Baroclinicity and Temperature in an Idealized Environment. Cli. Dyn., 50, doi: https://doi.org/10.1007/s00382-018-4115-5.

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Science Question: How sensitive are extratropical cyclones (ETCs) to changes in their environment? What does this tell us about how storms may change in future climates?

Results: We ran an ensemble of simulations of ETCs for varying environmental temperature and baroclinicity (south-north temperature contrast). Storm strength increases uniformly with baroclinicity, but decreases with warming after a threshold temperature is reached. The influence of convection is key in determining the response of storms to changes in their environment.

Significance: ETCs do not uniformly strengthen with increasing temperature. With warming, convection becomes more prevalent, and eventually causes a storm maximum intensity to be lower than at lower temperatures.