

The future of latent heat release in extratropical cyclones

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The meridional temperature gradient in the Northern Hemisphere is expected to decrease near the surface and increase aloft with global warming. At the same time, specific humidity should increase with temperature following the Clausius-Clapeyron relation. The net influence of these competing changes on mid-latitude cyclones and their aggregate behavior in the climatological stormtracks remains uncertain. Some uncertainty results from current climate model resolutions being inadequate for representing mesoscale features associated with strong latent heating. Previous studies have shown that this latent heating plays an important role in extratropical cyclogenesis. Here we evaluate potential changes in the North Atlantic stormtrack using the Weather Research and Forecast (WRF) model. We simulate ten JFM seasons (2001-2011) using current boundary conditions and with projected 2090-2100 temperature anomalies imposed. Our simulations are run at relatively coarse (120 km) and fine (20 km) resolution to more accurately assess the role of latent heat release in future cyclones. We use PV inversions to determine systematic changes in diabatic processes within extratropical cyclones in regions along the stormtrack. Changes in the frequency and distribution of high-impact cyclones are examined, and diabatic feedbacks contributing to these changes are discussed.