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The response of extreme extratropical cyclone wind fields to climate change

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How extratropical cyclones will respond to changes in future climate forcing is often uncertain. Changes in the overall number of cyclones and precipitation rates is well understood, however, there is less consensus on how the frequency of extreme cyclones and the near-surface winds will respond to a warmer climate. Using an ensemble of models from CMIP6 across a range of climate scenarios we aim to reduce the previous uncertainty and have investigated how extreme cyclones will change using a composite analysis method across a variety of intensity metrics.

We find an increase in the frequency of extreme cyclones in the Northern Hemisphere winter, with the reverse being found in the summer. For the cyclone winds in the lower troposphere we examine both the maximum wind speed and the area of wind speeds above a high intensity threshold. Results show that despite there being little change in the maximum wind speed by the end of the century, the portion of the cyclone with wind speeds above a high intensity threshold may be at least 15% higher in the NH winter. This increase is partly driven by changes in the cyclone propagation speed, although dynamical changes within the cyclones leads to further increases in wind speeds for extreme cyclones compared to those of average intensity. These results have significant implications for risk modellers and the loss potential of high impact wind storms.