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Diagnosing the effect of circulation trends on atmospheric temperature

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In studying recent climate, changes to atmospheric circulation are often understood as a response to temperature changes. This work instead quantifies the contribution to temperature trends from the atmospheric dynamics, by analysing trends in the ERA5 zonal-mean temperature budget over the satellite era. The results are consistent with several previously highlighted trends in the circulation. In the winter hemisphere, the region of subtropical descent and heating associated with the Hadley cell strengthens on its poleward side, and the deep diabatic heating in the ITCZ intensifies and shifts northward in the northern hemisphere (NH) winter. In keeping with other studies, we find a weakening of the transient eddy heating associated with the NH summer storm tracks. At high northern latitudes, the climatological eddy heating is weakened at low levels; this signal is strongest in NH winter, consistent with the reduced baroclinicity associated with arctic warming. Our work also points towards emerging trends in the transition seasons, SON and MAM, and underlines the importance of circulation changes in understanding trends in atmospheric temperature.