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Stratosphere-troposphere coupling: Connection between Antarctic Ozone Depletion and tropospheric Rossby wave breaking

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The connection between the formation of the Antarctic ozone hole and upper tropospheric Rossby Wave Breaking (RWB) is examined using meteorological reanalyses and integrations with both realistic and idealized atmospheric general circulation models. The reanalyses show an increase in the occurrence of RWB in middle latitudes during southern summer over the last thirty years, which is connected to the movement of the tropospheric jet (and southern annular mode). Consistent changes in RWB are found in time-slice simulations whose stratospheric ozone distributions differ between 1960 and 2000, but not in simulations that differ only in their greenhouse gas concentrations and sea surface temperatures. This supports the hypothesis that the observed increases in RWB are due to the formation of the stratospheric ozone hole. Changes in RWB are also found in idealized model simulations which differ only in the strength of the polar vortex, and provide insights into the mechanisms involved in the connections between the ozone hole, the southern annular mode, and tropospheric RWB.