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The effect of ozone depletion on the Southern Annular Mode and stratosphere-troposphere coupling

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The aim of this study is to investigate the influence of ozone depletion and recovery on the Southern Annular Mode (SAM) and stratosphere-troposphere coupling. Using the NIWA-UKCA chemistry-climate model, we compare reference runs with forcing due to greenhouse gases and ozone depleting substances to sensitivity simulations in which ozone depleting substances are fixed at their 1960 levels. We find that ozone depletion leads to an increased frequency of extreme anomalies and increased persistence of the SAM in the stratosphere as well as stronger, more persistent stratosphere-troposphere coupling. This change in the strength of the stratosphere-troposphere coupling has implications for extended range weather forecasting. Currently the stratosphere provides an appreciable amount of predictability to the troposphere on time scales of one or two months, however we find that this effect reduces over time as stratospheric ozone recovers to pre-ozone hole levels towards the latter part of this century.