

## **Understanding future changes in the Southern Annular Mode using perturbation experiments**

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Future anthropogenic climate change in the Southern Hemisphere is likely to be driven by two opposing effects, stratospheric ozone recovery and increasing greenhouse gases. Poleward shifts in the extratropical storm tracks and positive trends in the Southern Annular Mode (SAM) are projected in almost all climate models under increasing CO<sub>2</sub>, however there is a large range across the models in the magnitude of their SAM response. Ozone recovery, on the other hand, is expected to lead to a reversal in the SAM response in austral summer. The relative importance of each forcing to summer projections of the SAM varies across model experiments, with multimodel analyses suggesting close to equal contributions from both. We show that the intermodel spread in the SAM response to CO<sub>2</sub> is related to the climate sensitivity of the models. To what extent this range is due to processes in the tropics or the extratropics in the models is examined with perturbation experiments in those regions. We contrast the response of two models - the National Center for Atmospheric Research Community Atmospheric Model Version 4 (NCAR CAM4) and the Australian Community Climate and Earth System Science (ACCESS) model - to perturbations in sea surface temperatures and atmospheric heating. Understanding the mechanisms behind projected changes, and the sensitivity to changes in those mechanisms, is essential to increasing our confidences in predictions of future climate change.