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Representation of the Antarctic circumpolar vortex mixing barrier in a Global Climate Model

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Dynamical processes that occur in the stratosphere between 15 and 50 km above Earth's surface can affect circulation in the troposphere and have an impact on weather and climate. The Antarctic Circumpolar Vortex (ACV) forms each winter and spring as a zone of strong stratospheric westerly winds surrounding Antarctica. The ACV presents a barrier to transport of air masses between middle and high-latitudes, and contributes to stratospheric temperatures above the polar region dropping sufficiently low in spring to allow for ozone loss. The processes controlling the permeability of the ACV, and how they are likely to respond to a changing climate and a recovering ozone hole, have not been well studied, and as a result are not well simulated in Global Climate Models, particularly in terms of sub-grid scale turbulent diffusion which is parameterized in the models. The UK Met Office Unified Model (UM) is used to examine vortex permeability using both the "New Dynamics" and the upgraded "ENDGame" dynamical cores. Results are compared against reanalysis representations of vortex permeability using the MERRA-2 and ERA-Interim reanalyses data sets, which have been shown to have superior performance in the Southern Hemisphere stratosphere when compared against NCEP-CFSR, and MERRA reanalyses. Results are expected to lead to improved representation of ACV transport process in Global Climate Models and subsequent improvements in climate modelling.