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Ozone Depletion, Increasing Greenhouse Gases, and Southern Hemisphere Climate Change

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Analyses of integrations with IPPC/AR4 ocean-atmosphere coupled models, and with stratosphere-resolving chemistry-coupled models from the SPARC/CCMVal inter comparison project, suggest that ozone depletion is capable of producing a considerable impact on the tropospheric circulation of the entire Southern Hemisphere, notably on the poleward shift of the midlatitude jet and the widening of the Hadley cell during austral summer. However, integrations without ozone depletion show that increasing greenhouse gases are also responsible for the such shifts. Hence the relative roles of ozone depletion and greenhouse gas increase remain unclear. Part of the difficulty in assesing the relative importance of these two forcings is the large interannual variability, which is comparable in magnitude to the response to ozone and greenhouse forcings in the recent past. To address this limitation, we have performed a new set of long, time-slice integrations with NCAR's atmospheric model (CAM) in which ozone depletion and increased green house gases are specified independently. Analysis of this new set of integrations reveals that, for the Southern Hemisphere summer in the second half of the 20th century, only ozone depletion is able to produce statistically significant climate shifts in the model. This suggests that ozone depletion may in fact have been the dominant driver of climate change in the Southern Hemisphere in the last half century.