

Stratosphere-troposphere coupling: The role of stratospheric vortex breakdown in Southern Hemisphere climate trends

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Observations indicate that the final breakdown of the stratospheric polar vortex, the stratospheric final warming (SFW), in the Southern Hemisphere is increasingly delayed in the late 20th century, presumably a consequence of anthropogenic ozone depletion. Using the trend in the timing of the SFW, we present a new way to characterize the downward influence of stratospheric ozone depletion on tropospheric climate trends. It is found, in both the reanalysis and climate model output, that the trend in stratospheric zonal winds is primarily associated with a delay in the vortex breakdown in late spring, and that much of the downward influence of ozone depletion is associated with the slower zonal wind transition from spring to summer. A model with interactive ozone chemistry is better able to depict the observed trend in the spring-to-summer transition than a model with prescribed ozone concentrations, showing the importance of stratospheric dynamics-chemistry interactions for Southern Hemisphere climate trends.