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The impact of ozone recovery on Southern Hemisphere climate under different climate change scenarios

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Observations over the last few decades have shown a cooling trend in the Southern Hemisphere (SH) upper troposphere and lower stratosphere in conjunction with and acceleration of the SH westerly winds which directly affects tropospheric climate. General Circulation Models corroborate this result and reveal that both the increase in greenhouse gases and polar ozone depletion are responsible for this trend.

On the contrary, the increase in greenhouse gases and the expected ozone recovery have an opposite impact on future trends in the SH. Thus, the Chemistry Climate Models (CCMs) from the CCM Validation 2 activity (CCMVal-2 SPARC report) predict a deceleration of the polar jet on the poleward side during the SH summer, although at a weaker rate than the acceleration observed in the past decades. CCMVal2 models are fully chemistry-coupled models with their top well beyond the stratopause. However, they typically use observed surface temperatures as boundary conditions.

We make use of 95year AR5 simulations with the Whole Atmosphere Community Climate Model WACCM4 coupled to an ocean model to investigate the impact of ozone recovery on Southern Hemisphere climate under three different climate change scenarios. The results show that the effect of ozone recovery on temperature and wind trends is the weakest in the intermediate scenario in relation to the competing effects of ozone recovery and increase in GHGs.