Southern Hemisphere Atmospheric General Circulation Changes in CCMI models

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The effects of ozone-depleting substances (ODS) and greenhouse gases (GHG) on tropospheric circulation in the Southern Hemisphere (SH) are re-visited by analyzing the state-of-the-art models within the Chemistry-Climate Model Initiative (CCMI) project. Stratospheric ozone depletion and recovery effectively control the stratospheric temperature trends in SH spring. The related tropospheric circulation changes in SH summer, such as changes in the Hadley cell edge and jet location, are investigated for the past (1960-2000) and future (2001-2099) periods. In the past, both the ODS- and GHG-forced simulations show a poleward expansion of the Hadley cell and a poleward shift of the westerly jet, but the contribution of ODS forcing is greater than that of GHG one. In the future, the ODS forcing induces an equatorward shift of circulation changes, while the circulation shifting poleward is evident in the GHG-forced simulations. The magnitudes of circulation changes in ODS and GHG runs are comparable to each other in the future. These results suggest that both stratospheric ozone and greenhouse gas are the major factors influencing the SH circulation in the future climate, confirming the previous studies.

Key words: stratospheric ozone, greenhouse gas, Southern Hemisphere, jet location, Hadley cell expansion