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## Impacts of stratospheric ozone and greenhouse gas changes on the Southern Hemisphere circulation in the CCMI models

**Bo-Reum Han**<sup>1,2</sup>, Jung Choi<sup>1</sup>, and Seok-Woo Son<sup>1,2</sup>

<sup>1</sup>Computational Science and Technology, Seoul National University, Seoul, Korea (hbreum11@snu.ac.kr)

<sup>2</sup>School of Earth and Environmental Sciences, Seoul National University, Seoul, Korea (hbreum11@snu.ac.kr)

The impacts of stratospheric ozone and greenhouse gas changes on the Southern Hemisphere (SH) climate are re-visited by examining the single forcing experiments from the Chemistry-Climate Model Initiative (CCMI) project. In particular, the fixed ozone-depleting substance (ODS) runs and the fixed greenhouse gas (GHG) concentration runs are directly compared with the reference runs for both the past and future. Consistent with the previous studies, the SH-summer general circulation changes, such as changes in the jet location, Hadley cell edge, and Southern Annular Mode (SAM), show the opposite trends from the past to the future in response to the Antarctic ozone depletion and recovery. The GHG-induced circulation changes largely enhance the ozone-induced circulation changes in the past, but partly cancel them in the future. The ozone recovery-related tropospheric circulation return dates are also estimated in this study. We will further discuss the inter-model diversity among the CCMI models.