Stratosphere-resolving CMIP5 models simulate different changes in the Southern Hemisphere

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This work documents long-term changes in the Southern Hemisphere circulation in the austral spring–summer season in the Coupled Intercomparison Project Phase 5 models, showing that those changes are larger in magnitude and closer to ERA-Interim and other reanalyses if models include a dynamical representation of the stratosphere. Specifically, models with a high-top and included dynamical and - in some cases - chemical feedbacks within the stratosphere better simulate the lower stratospheric cooling observed over 1979–2001 and strongly driven by ozone depletion, when compared to the other models. This occurs because high-top models can fully capture the stratospheric large-scale circulation response to the ozone-induced cooling. Interestingly, this difference is also found at the surface for the Southern Annular Mode (SAM) changes, even though all model categories tend to underestimate SAM trends over those decades. In this analysis, models including a proper dynamical stratosphere are more sensitive to lower stratospheric cooling in their tropospheric circulation response. After a brief discussion of two RCP scenarios, our study confirms that at least for large changes in the extratropical regions, stratospheric changes induced by external forcing have to be properly simulated, as they are important drivers of tropospheric climate variations.

Key words: Southern Hemisphere Change · CMIP5 Models

References

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