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## Why is there a Zonal Wave 3 pattern in the Southern Hemisphere extratropical circulation?

Rishav Goyal<sup>1,2</sup>, Martin Jucker<sup>1,2</sup>, Alex Sen Gupta<sup>1,2</sup>, and Matthew England<sup>1,2</sup>

<sup>1</sup>Climate Change Research Center, University of New South Wales, Sydney, Australia (rishav.goyal@student.unsw.edu.au)

<sup>2</sup>ARC Center of Excellence for Climate Extremes, University of New South Wales, Sydney, Australia

Studies of the Southern Hemisphere (SH) extratropical circulation are dominated by investigations of the zonally symmetric component of the Southern Annular Modular (SAM). However, there are significant asymmetries embedded in the zonal flow. In particular, a zonal wave 3 (ZW3) pattern is one of the dominant features of the SH circulation on daily, seasonal and interannual timescales. While the ZW3 circulation has had significant impacts on meridional heat transport and Antarctic sea ice extent in recent years, the physical mechanisms responsible for its presence still remain elusive. In this study, we use the Community Earth System Model (CESM) to understand the mechanisms that give rise to and modulate the ZW3 pattern in the SH extratropics. We examine, among other things, the popular belief that the ZW3 pattern is present due to the existence of three separate land-masses in the SH, namely Australia, Africa and South America, and whether it is modulated by both the land-ocean contrast and tropical forcing.