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New method to describe the zonal symmetries and asymmetries of the Southern Annular Mode

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Abstract Text:

The Southern Annular Mode (SAM) is the main mode of the circulation anomalies in the Southern Hemisphere and it has influence over local anomalies of several atmospheric variables such as surface temperature and precipitation. While mostly zonally symmetric, it has symmetric and asymmetric characteristics, each with its potentially different causal mechanism and downstream effects. Since indices used in the literature respond to both aspects, they can lead to difficult interpretations. Here, we propose a straightforward method of creating two indices representing, respectively, the Symmetric and Asymmetric SAM components of variability .

To construct the two indices, we first separate at each level the geopotential pattern associated with SAM into its zonally symmetric and asymmetric components. After that, observed monthly geopotential anomalies are projected onto each of the componentes to construct the respective Symmetric and Asymmetric SAM monthly index. Regression patterns of geopotential height based on the Symmetric SAM index removing the effect of the Asymmetric SAM index are almost totally zonally symmetric and vice versa. The Asymmetric SAM structure in the troposphere is associated with equivalent barotropic planetary waves 3, 2, and 1 to a lesser extent, while in the stratosphere it is almost completely dominated by planetary wave 1. The tropospheric asymmetric signal is not correlated with the stratospheric asymmetric signal, while the respective symmetric signals show larger troposphere-stratosphere connection. The tropospheric Asymmetric SAM is associated with negative temperature anomalies over South America, Australia and Southern Africa in boreal Spring and Summer, none of which are evident when using the tradicional SAM index. We show that the temperature anomalies over the central Pacific associated with the tradicional SAM index is explained by the Asymmetric SAM. In addition, the observed trend towards more positive SAM in the troposphere is completely explained by the Symmetric component, which provides further insight about the processes explaining it.

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A104. The Dynamics of the Large-Scale Atmospheric Circulation in Past, Present, and Future Climate: Jet Streams, Storm Tracks, Stationary Waves, and Monsoons

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