Scientists identify asymmetry in the pressure anomalies of the mid–high latitudes of the Southern Hemisphere

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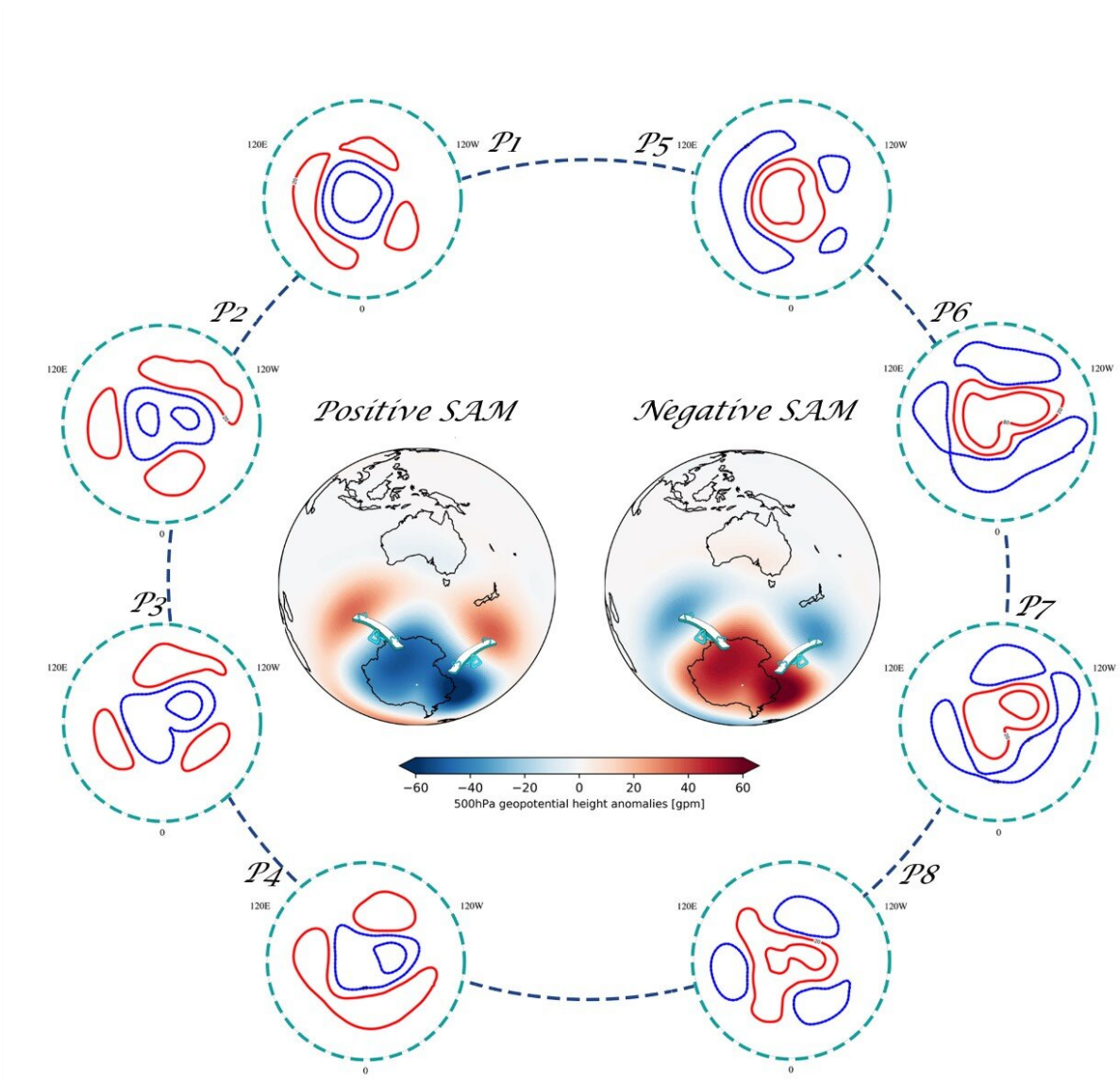

The SAM and its eight event patterns. Credit: Minglin Zheng

In the Southern Hemisphere, a zonally oriented high pressure belt extends around the globe in the subtropics and middle latitudes, while lower pressure covers the high latitudes. The pressure in these two regions fluctuates. The Southern Annular Mode (SAM) reflects such fluctuation, which shows a "seesaw" phenomenon of pressure variation in the mid–high latitudes of the Southern Hemisphere. It is called an "annular mode" because of the belt-shaped pressure anomaly in the middle latitudes, and its structure is zonally symmetric. However, some studies have shown some SAM events to be characterized by zonal asymmetries, the structure of which has been revealed in a recent study published in *Atmospheric and Oceanic Science Letters*.

To explore and characterize the zonal asymmetry, Associate Professor Xiuzhen Li and her research team from Sun Yat-sen University applied the self-organizing mapping network method to cluster the geopotential height anomalies at 500 hPa, and ultimately obtained eight patterns of SAM events (including four positive and negative phases)—namely, two symmetric patterns, two split-center patterns, three West Antarctica patterns, and one tripole pattern, accounting for 23.8%, 16.9%, 46.3% and 12.6% of all SAM events, respectively.

"The asymmetry of the pressure anomaly usually occurs near the Amundsen Sea and Bellingshausen Sea. When local asymmetry appears in the pressure anomaly, the westerly wind will also strengthen or weaken locally. Therefore, the westerly jet will move poleward or equatorward, and the entrance and exit of the jet will change accordingly. In some asymmetric structures, as the adjusted wind field is

characterized by a large meridional displacement, thus the Polar Front Jet might be weakened," says by Dr. Li.

The study reveals the characteristics of different patterns of SAM events, which may help to classify and discuss the formation causes and climate impacts of different patterns, and deepen our understanding of the zonal asymmetry of the SAM.

"However, we do not discuss much about the causes and seasonal tendencies of cluster patterns. The different asymmetries of SAM events might result from the different combinations of the SAM and other leading modes. SAM patterns also exhibit a certain seasonal change. Further research is needed to study the causes and seasonal variation in SAM patterns and their impacts on the Polar Front Jet and climate," adds Dr. Li.

More information: Minglin Zheng et al, Distinct patterns of monthly Southern Annular Mode events, *Atmospheric and Oceanic Science Letters* (2022). DOI: 10.1016/j.aosl.2022.100206

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