



## **The Northern Monsoons and the Southern Subtropical Anticyclones**

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The reasons for the different seasonal evolution of subtropical highs in the southern and northern hemisphere differs are demonstrated. In the northern hemisphere, the subtropical anticyclones are stronger and better defined in the boreal summer than in winter. By contrast, in the southern hemisphere the subtropical anticyclones are notably stronger in the austral winter than in summer, particularly over the Atlantic and Indian Oceans. It is shown that this seasonal asymmetry of the climate system is due to the seasonal asymmetry in the interhemispheric effects of the summer monsoons. The intensification of the northern anticyclones in the boreal summer is consistent with the “monsoon heating” paradigm, according to which heating over continents generates a Rossby wave response and adiabatic descent over the oceanic regions to the west. The summer heating over northern continents also produces subsidence over the tropical southern hemisphere via an interhemispheric meridional overturning circulation. Suppressed convection and diabatic cooling over these regions of subsidence generate stationary barotropic Rossby waves that propagate beyond the tropics enhancing the subtropical highs. The interhemispheric effects of summer southern monsoons are much weaker.

Our methodology for research is based on performing AGCM runs in which a control simulation is compared to an idealized experiment with artificially weakened summer monsoons in the northern hemisphere. This weakening is achieved by synchronizing the seasonal cycles in the model’s external and boundary conditions across hemispheres, i.e. by shifting in the northern hemisphere only both the insolation at the top of the atmosphere and the sea surface temperatures and sea ice cover by one-half the seasonal cycle (6 months). We use the US National Center for Atmospheric Research (NCAR) Community Atmospheric Model version 4 (CAM4). According to the results, the interhemispheric response to the northern summer monsoons is most dramatic in the South Pacific, where the subtropical anticyclone nearly disappears in the austral winter without the influence from the northern summer hemisphere.