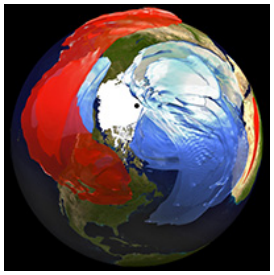

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ENSO modulation of MJO connection to the Stratospheric Polar Vortex

The Madden-Julian Oscillation (MJO), an organized eastward propagating source of enhanced convection, acts as a Rossby wave source and as a global tropical driver of predictability. The pathway from the MJO to the stratosphere is known to be primarily driven by poleward and vertical Rossby wave propagation and persists for over a month. It has been shown that after MJO phase 7, warm anomalies are established in the polar lower stratosphere and a weakened stratospheric polar vortex, while a strengthened polar vortex occurs after phase 3. The aim of this study is to investigate the dependence of the MJO–polar vortex connection on the interannual variations in the background state associated with the El Niño Southern Oscillation (ENSO), along with its consequent impact on the North Atlantic-European (NAE) weather regimes via stratosphere–troposphere coupling.

Here we show that the MJO–polar vortex connection is strongly active during La Niña years, particularly for the weakened vortex following MJO phases 7-8. Similarly, during La Niña years, there is a strengthened vortex for around 20-25 days following MJO phases 2-3. There are fewer coherent changes in the vortex strength during El Niño years. Looking at the stratosphere–troposphere coupling to the NAE weather regimes, we find the NAO– regime is most sensitive to this stratospheric state, occurring on 33% of days following weak vortex conditions but on only 5% of days following strong vortex conditions, while an opposite and slightly weaker sensitivity is found for NAO+ and Atlantic Ridge regimes. This stratospheric teleconnection pathway being active during La Niña years contributes to our dynamical understanding of why we find a robust dependence of the teleconnections from the MJO to NAE weather regimes on the phase of ENSO. This dependence has strong implications for subseasonal predictability, including interannual variations in subseasonal predictive skill.

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