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The role of the stratosphere in tropical-extratropical interactions arising from slow MJO episodes.

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The sporadic nature of the Madden-Julian Oscillation (MJO) can influence the extratropical circulation response. However, there are differences in the extratropical response depending on the propagation speed of the MJO in the tropics. Here, we define slow (fast) MJO events as events that take more (less) than 20 (10) days to propagate from the Indian Ocean (phase 3) to the Pacific Ocean (phase 6). The slowly propagating MJO episodes lead to a positive North Atlantic Oscillation (NAO) response at a lag of 10 days following phase 4 of the MJO, whereas fast MJO episodes lead to a development of a positive NAO response 10-15 days following phase 2-3. The slowly propagating MJO episodes can lead to a stronger positive (negative) NAO response after a lag of 10 days following phase 4 (7-8).

In addition to this tropospheric pathway, the MJO can also impact the stratospheric circulation, which in turn can impact the NAO via downward coupling. The stronger impact on the NAO during slow MJO episodes suggests that the stratosphere plays a role in the teleconnection of the MJO to the North Atlantic region. This is evident from the zonal wind response within the stratospheric polar vortex at 60°N and 10hPa and the geopotential height response at 500 hPa and 100 hPa. In this study, we discuss the stratospheric pathways during fast and slow MJO episodes using ERA-Interim reanalysis with respect to the strength of the Northern Hemisphere stratospheric polar vortex and for stratosphere-troposphere coupling.