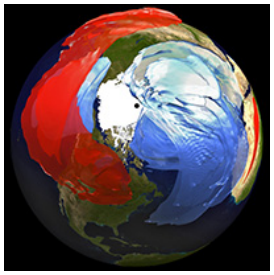

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The Combined Influence of the MJO and the Stratospheric Polar Vortex on Subseasonal Northern Hemisphere Winter Weather Patterns

Subseasonal forecasts of Northern Hemisphere (NH) extratropical winter weather patterns remain a large challenge for the forecasting community. Previous studies have looked to the individual influence of two key modes of climate variability –the Madden-Julian Oscillation (MJO) and the strength / orientation of stratospheric polar vortex (SPV) –on changing the NH polar jet stream and associated weather regimes. Our work instead quantifies the joint influence of the SPV and the MJO on NH subseasonal winter weather patterns. Composites from ERA-Interim exhibit that the MJO primarily influences tropospheric circulation patterns across the North Pacific and western North America 2 weeks later, while SPV variability mainly influences tropospheric circulation patterns over the North Atlantic and Europe for the same lags. Over much of North America and parts of the Arctic, however, constructive and destructive interference between the two teleconnection patterns yield unique jet stream and temperature patterns than those seen in either single-mode composite. As such, S2S forecasts of temperature and jet stream patterns across North America in particular benefit the most by considering both the SPV and the MJO. We also find that MJO/stratospheric circulation interactions differ depending on the phase of the MJO, which also influences exactly how the tropospheric circulation evolves. For example, while MJO Phases 2+3 teleconnections mature primarily by a tropospheric pathway, MJO Phases 7+8 tropospheric teleconnections manifest from both tropospheric and stratospheric pathways. Evaluating similar composites in the S2S Prediction Project reveals strong disagreements in the MJO/SPV relationships with those derived from reanalysis. These disagreements are linked to biases in stratosphere-troposphere coupling dynamics and model stratospheric resolution. Overall, this study proposes another benchmark by which to test S2S dynamical prediction systems and emphasizes the importance for accurately modeling stratosphere-troposphere coupling dynamics in operational subseasonal prediction systems.

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