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Stratospheric Influence on the Mechanisms and Potential Predictability of the MJO-NAM Teleconnections in the S2S Models

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There is increasing evidence that the Madden Julian Oscillation (MJO), the leading mode of intraseasonal variability in the tropics, may be a source of predictability for the extratropical Northern Hemisphere (NH) atmospheric circulation during the boreal winter. This study examines the mechanisms through which NH stratospheric variability influences the relationship between the MJO and the leading mode of extratropical NH atmospheric variability, the Northern Annular Mode (NAM). Consistent with previous studies, observational analysis demonstrates a link between the positive phase of the NAM and the MJO phases characterized by convection in the eastern hemisphere (MJO phases 3-4). The negative phase of the NAM tends to be linked to MJO convection in the western hemisphere (MJO phases 7-8). These teleconnections are based on the surface signature of the NAM. Preliminary results suggest that while the MJO remains strongly linked to the positive NAM signature in the stratosphere, the link to the negative phase of the stratospheric NAM is weaker.

We then evaluate the extent to which the boreal winter MJO-NAM teleconnections can be captured in a suite of models from the Sub-seasonal to Seasonal Prediction Project (S2S). In particular, the analysis focuses on how much the MJO-NAM teleconnections rely on the model's ability to capture the extratropical stratosphere-troposphere coupling. The analysis utilizes a subset of S2S models with varying model tops and number of vertical levels to provide models with a range of stratospheric resolutions. In doing so, we will be able to determine if the models' inability/ability to reproduce these MJO-NAM teleconnections is related to the stratospheric resolution of the models. Understanding the role of the stratosphere on the MJO-NAM teleconnections has the potential to provide important information for forecasting extreme winter weather.