# Intraseasonal variability of large-scale meteorological patterns and tornado activity

Large-scale meteorological patterns (LSMPs) are known to be associated with local extreme weather events. For example, the LSMPs favorable for tornado activity in the central U.S., including the presence of a mid- and upper-tropospheric trough, low static stability, high surface water vapor mixing ratios, and the positioning of features such as low-level jets, fronts, and the dry line, have been well known for decades. These LSMPs act to control the down-scale, local conditions necessary for tornado formation, such as the levels of convective available potential energy, bulk shear, and storm-relative helicity. However, the nature of this interaction between the large scale and the local scale remains unclear, particularly when the result of that interaction is extreme weather. Further complicating the picture, teleconnections from planetary-scale circulation themselves project onto both the synoptic-scale LSMPs and local-scale extreme events. One such teleconnection comes from the Madden-Julian Oscillation (MJO), which is a leading driver of intraseasonal weather variability.

The objective of this study is to examine how the MJO projects onto the LSMPs favorable for U.S. extreme weather, including tornado activity and heavy precipitation. Daily composites of observational and reanalysis data will be examined to determine statistical links between the planetary-scale MJO, synoptic-scale LSMPs, and local-scale rainfall and tornadoes. Co-variability between tornado activity and heavy precipitation events will be explored, with specific attention given to how LSMPs vary by phase of the MJO. Results will be used to establish protocols for incorporating this variability into both observational-based and model-based analyses.