Impact of upstream errors on the medium-range predictability of convection-permitting forecasts

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Accurate depiction of the synoptic-scale forcing and environment conducive to storm development is a necessary condition for predicting severe weather outbreak potential. Recent studies have identified persistent weather regimes associated with severe weather outbreaks over the contiguous United States (CONUS) (e.g., Gensini et al. 2019, Miller et al. 2020) that can help extend the practical predictability of these events. Here, we examine the medium-range (up to seven days) predictability of one such severe convection event associated with multiple tornado outbreaks in May 2019 over the CONUS. Using the global variable-resolution Model for Prediction Across Scales-Atmosphere (MPAS-A), the CONUS mesh spacing is refined to a convection-permitting resolution, which explicitly simulates some of the convective processes and improves their representation in simulations. We focus on the medium-range prediction skill of these convection-permitting forecasts and identify the potential sources of errors in the large-scale environment associated with the identified weather regime with the goal to understand and improve the predictability of severe weather outbreak potential in the U.S. Results suggest that the growth of forecast errors over the CONUS in the medium-range is partly associated with the propagation of upstream errors across the North Pacific. Synoptic-scale errors upstream tend to grow more rapidly during periods of active convection across the Pacific leading up to the severe weather outbreak event. These results indicate that improved representation of moist convection upstream can potentially improve the medium-range predictability of severe weather outbreak potential over the CONUS, such as for the event in May 2019.