

The Impact of Warm Conveyor Belt Forecast Errors on Variability in the Downstream Waveguide

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Abstract:

Atmospheric waveguides denote the location of the jet stream and constrain the motion of Rossby waves. Perturbations of the waveguide, such as those associated with the warm conveyor belt (WCB) of midlatitude cyclones, can lead to the downstream radiation of Rossby waves, which can often spawn high-impact weather events. Previous studies have hypothesized that forecast errors associated with diabatic heating within WCBs may lead to variability in the downstream waveguide; however it is unclear to what extent this may be true.

This study evaluates the hypothesis that uncertainty associated with the WCB plays an outsized role in introducing downstream forecast errors along the midlatitude waveguide. The above hypothesis is evaluated by applying the ensemble-based sensitivity technique to ECMWF ensemble forecasts of select North Atlantic cyclones characterized by a significant waveguide perturbation. The role of waveguide perturbation uncertainty on downstream forecasts will be assessed by comparing the sensitivity of downstream forecasts to the divergent outflow to the sensitivity of the downstream forecasts to other nondivergent features, such as the position of upstream troughs or details of the waveguide itself. Finally, the role of thermodynamic uncertainty on waveguide perturbation structure will also be evaluated by computing the sensitivity of the waveguide perturbation to lower-tropospheric relative humidity and temperature within the WCB.