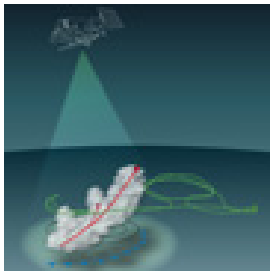

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The Impact of Warm Conveyor Belt Forecast Uncertainty on Variability in the Downstream Waveguide

Tuesday, 10 March 2020 14:45 (25 minutes)

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 extreme 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 mesoscale 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 Model for Prediction Across Scales (MPAS) ensemble forecasts of five North Atlantic cyclones characterized by a significant waveguide perturbation. This hypothesis is assessed by comparing the sensitivity of downstream forecasts to the divergent outflow as well as other features, such as the position of upstream troughs or details of the waveguide itself. In addition, the ensemble's evolution of the downstream state is evaluated by computing a robust potential vorticity (PV) budget, which quantifies the unique contributions to downstream PV from diabatic heating and from advection of PV by the divergent and non-divergent flow. Finally, the sensitivity and PV budget analyses are confirmed using several perturbation experiments, which involve modifying the MPAS initial conditions within the sensitive regions associated with the WCB and upstream waveguide.

Primary authors: BERMAN, Jeremy (University at Albany, SUNY); TORN, Ryan (University at Albany, SUNY)

Presenter: BERMAN, Jeremy (University at Albany, SUNY)

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