The Influence of Microphysics Parameterizations on Forecasts of Downstream Waviness

by

Jessica R. Taheri and Jonathan E. Martin

Department of Atmospheric and Oceanic Sciences
University of Wisconsin-Madison
1225 W. Dayton St.
Madison, WI 53706

The release of latent heat in the cloud and precipitation structures characterizing mid-latitude weather systems can exert a substantial impact on the downstream Rossby wave pattern. Previous studies have demonstrated that the nature of these impacts is strongly dependent upon the manner in which cloud and precipitation processes are represented in numerical forecast models. Models approximate the processing of water substance within such disturbances using cloud microphysical parameterizations of varying complexity.

Much prior work has considered the impact of latent heat release in organized cloud systems in terms of its contribution to forecast errors in the phase and/or amplitude of individual synoptic waves. Such consideration overlooks a related but perhaps more fundamental question – namely, what is the impact of such latent heat release on the aggregate waviness of the evolving, larger-scale flow? We conduct experiments aimed at gaining insight into this question.

First, we run a daily triad of low resolution, 120-h WRF-ARW simulations in which only the model’s cloud microphysical package is different between the runs. We then employ sinuosity as a measure of the aggregate 200 hPa waviness over the Northern Hemisphere and consider the waviness differences in the light of the varying microphysical representations in the model. Two different synoptic environments characterized by 1) a particularly intense cyclogenesis event, and 2) a robust atmospheric river are examined as case studies of the influence of different synoptic settings on variations in the downstream waviness.