Anticipating Snow to Liquid Ratio Gradients Associated with Mesoscale Banding in Large-Scale, Eastern U.S. Snowstorms

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Given the relatively high population density and interwoven transportation network across the Northeastern and Mid-Atlantic states, large-scale winter storms can have a particularly high public impact. As such, accurate forecasts of their timing and intensity are critical to those involved in preparedness and mitigation efforts (i.e. state, county, and local Department of Transportation workers, school administrators, and other public safety officials).

Within many synoptic-scale snowstorms, specific snowfall maxima and often sharp snowfall gradients are tied to intense, relatively narrow mesoscale bands. Atmospheric processes that lead to development, maintenance, and intensification of these mesoscale snow bands have been well referenced in the scientific literature over the last 10-20 years. These include, but are not limited to enhanced areas of frontogenesis, in the presence of reduced stability, adequate saturation, and sufficient larger-scale forcing. However, the effects that mesoscale bands and their supporting ingredients have on crystal density/snow to liquid ratios have not been as frequently studied, and thus are not as well understood.

In this work, a number of high-impact winter storms that featured mesoscale banding were investigated. Within and just outside of these intense snow bands, synoptic and frontal-scale atmospheric parameters, microphysical ingredients, and source regions were all closely interrogated. The main goal is to identify which factors, if any, play the most significant role in producing particularly high or low snow to liquid ratios (those which have the greatest deviation from climatology). Improved understanding of these factors will help produce better forecasts of specific snowfall amounts, as well as better anticipation of potential water loading problems in heavy, wet snow scenarios.