Snow characteristics, storm structures, and velocity waves in coastal Northeast U.S. winter storms

The spatial pattern and magnitude of snowfall accumulation is difficult to forecast accurately. Many disparate microphysical, thermodynamic, and kinematic factors can influence the snow that reaches the ground. The residence times of individual precipitation-sized ice particles are usually an hour or more. Hence, the observed microphysics at any one time represents the slower time-integrated result of the faster responding kinematics.

We have examined over 100 coastal northeast U.S. snow storms from Delaware to Maine using a combination of operational WSR-88D scanning radar data, soundings, vertically pointing radar (MicroRainradar), and reanalysis. Locally intense snowfall within mesoscale snow bands can have large impacts on snow accumulation. Previous work has shown that > 200 km long and > 20 km wide single bands are associated with mid-level frontogenesis and relatively weak stability. Smaller snow bands < 200 km long and 10-20 km wide that occur in parallel sets, termed multi-bands, are neither consistently associated with frontogenesis nor clear, sustained convergence signatures which would be required for sustained updrafts at the scale of individual multi-bands. We identified moving bands of velocity change within winter storms using the temporal difference between Doppler radar velocity fields. These velocity waves are consistent across adjacent radar domains and appear to originate outside of the precipitation echo. The waves often move radially outward from the vicinity of the low but typically several m/s faster than the motion of radially moving multi-bands in the same storm. Seventy percent of winter storm cases with multi-bands (with or without coexisting single bands) are associated with waves.

A Multi-angle Snowflake Camera (MASC) has collected images of snowflakes in freefall since January 2015 at Stony Brook, NY on the north shore of central Long Island. At this coastal location, aggregates are a common if not predominant mode of snowfall. In contrast to idealized clusters of dendrites, the observed aggregates show a wide diversity of components including different habits and different degrees of riming in the same aggregate particle.

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Wednesday, February 21, 2018 at 3:15pm
Room 110 INSCC
Refreshments and Meet the Speaker at 3:00pm

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