High-resolution observations of generating cells in Colorado snowstorms Daniel Hueholt¹, Sandra Yuter¹, Matthew Miller¹, Levi Lovell¹, Patrick Kennedy² ¹Department of Marine, Earth, and Atmospheric Sciences, North Carolina State University, Raleigh, NC ²CHILL National Weather Radar Facility, Colorado State University, Fort Collins, CO

Introduction

Generating cells are small (2 km or less horizontal and vertical) overturning air circulations which locally increase the size and mass of ice crystals in winter storms. The crystals can continue to grow as they fall, leading to increased surface precipitation.





Generating cell diagram adapted from Houze, R. A. (1993). Cloud Dynamics. Cambridge, MA: Academic Press.

Example reflectivity images with some cells and groups of cells annotated. From top: 21 Dec 2017 1217 UTC, 21 Dec 2017 1220 UTC, 01 Feb 2018 1252 UTC

We present evidence that generating cells are associated with velocity waves in some cases. We also observe generating cells that are tilted, and find no consistent evidence of crystal shape changes in cells.

Methods

The resolution of most Doppler weather radars is too low to observe features as small as generating cells. In collaboration with the Colorado State University CHILL National Weather Radar facility, we made high-resolution radar observations through four storms in Greeley, Colorado during winter 2017-2018. Our target storms were not associated with strong surface fronts. They began at night and continued through sunrise, and had snow as the only precipitation type. Generating cells were observed in all cases.

Radar observation types

Reflectivity (Z): a measure of precipitation intensity Radial velocity (V): wind velocity along the radar beam Spectral width (SW): range of velocities, related to turbulence **Differential reflectivity (Zdr):** depends on particle shape



Generating cells can be associated with velocity waves In these images from 10 Feb 2018, velocity waves are clearly visible. Generating cells are present at peaks in the waves.



01 Feb 2018 1150 UTC Distance from radar (km)

Conclusions

1. Generating cells are at times associated with velocity waves; these waves may act to trigger cell development 2. Wind shear near the storm top is usually present, and tilts generating cells 3. Dramatic changes in crystal shape are not a standard feature of generating cells



