Fine-Scale Orographic Precipitation Variability and Gap-Filling Radar Potential in Little Cottonwood Canyon, Utah
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MOTIVATION & INTRODUCTION

- The prefrontal environment featured very dry air below cloud level in the Salt Lake Valley and a veering wind profile, with southerly winds in the valley and westerly flow aloft.
- Persistent quasi-stationary features included:
  - A barrier-scale precipitation maximum over the crest of the Wasatch Mountains and east of the high windward peaks
  - A cross-valley band of precipitation extending across the Salt Lake Valley and into the central Wasatch Mountains

- During the event described here, a progressive upper-level shortwave trough moved across northern Utah, with an accompanying surface cold front passing KSLC at 1940 UTC 12 November and entering LCC at 2030 UTC 12 November.

FRONTAL STAGE

- The frontal stage featured the passage of a surface cold front through the Salt Lake Valley and Little Cottonwood Canyon.
- The relatively low elevation (below crest level) of the frontal inversion and the shallow, northwesterly post-frontal flow produced the strongest radar reflectivities over lower Little Cottonwood Canyon and the north-to-northwest-facing canyon wall.

HYDROMETEOR TYPING (PREFRONTAL)

- A hydrometeor typing algorithm specific for X-band wavelengths was applied to the time-mean reflectivity RHI (following Dolan and Rutledge [2009]). This was compared to photos of actual snow crystals taken at Alta in Little Cottonwood Canyon.
- When the wave-like radar-reflectivity feature predominated (as shown above), heavily, rimed crystals were observed in upper Little Cottonwood Canyon.
- When the wave-like radar-reflectivity feature ebbed (c. & d.), aggregated crystals were observed.

ACKNOWLEDGEMENTS

The Center for Severe Weather Research provided the use of the DOW6 without which this research would not be possible. University of Utah students operated the DOW during the Fall of 2011. Thanks to Tim Garrett for providing HYSPLIT images, as well as Alta Ski Area and Howie Hemsley for providing surface observations. This work is supported by the National Science Foundation under Grant No. AGS-0939161. Any opinions, findings, and conclusions or recommendations expressed here are those of the authors and do not necessarily reflect the views of the National Science Foundation.

CONCLUSIONS

- Significant spatiotemporal variations in storm structure occurred during the prefrontal and frontal storm stages.
- The shallow, localized reflectivity maxima observed in the lower reaches of the canyons during the frontal stage appeared to be the result of the frontal dynamics, the low elevation of the frontal capping inversion (below crest level), and the shallow, postfrontal, northwesterly upslope flow over the north-to-northwest-facing canyon walls.
- The wave-like structure of the cross-valley band of precipitation, which persisted during much of the prefrontal stage, is most likely a product of the interactions of a veering wind profile with the surrounding topography.