Radar Observations of Storms for Education

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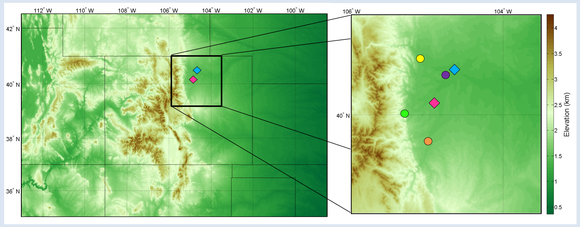
Introduction

The Radar Observations of Storms for Education (ROSE) Project focuses on the Colorado Front Range to study the complete life-cycle of a thunderstorm.

How thunderstorms are presented and discussed in university classrooms needs to be updated by building realistic 3-D depictions of thunderstorm structure.

The month long project spanned from May 20, 2014 to June 20, 2014 during which two weather radars were remotely operated. Precipitation and wind data was collected to create a more informative 3-D representation of thunderstorm life-cycles.

The two weather radars, SPol and CHILL, are located along the Front Range of the Rocky Mountains in Colorado. May/June is the peak thunderstorm season for this region.



Colorado domain of interest.

Forecasts

To determine when to operate the radars, daily forecasts were made for the weather along the Front Range. Three ingredients are necessary to decide if thunderstorms are probable including:

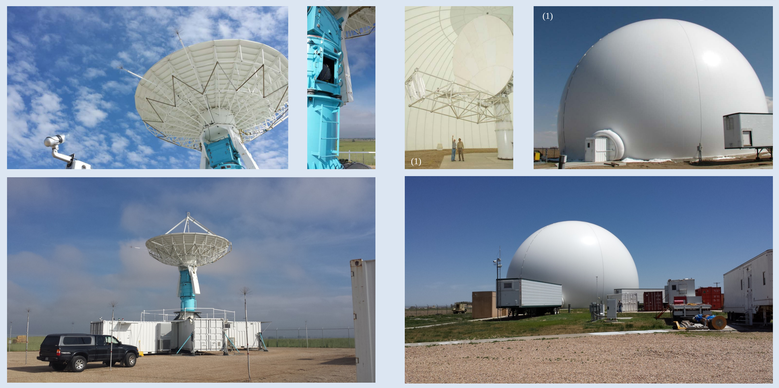
- Moisture content of the atmosphere
- Atmospheric instability
- Triggers for tall cloud development

Surface weather stations recorded moisture content around the domain. Atmospheric instability was assessed by weather balloons and model output. The Rocky Mountains were the greatest trigger for tall cloud development. All forecasts were compared against the Denver National Weather Service forecasts for consistency.

Thunderstorms primarily formed in the late afternoon hours with instability peaking around 6 pm MDT. Typically, storms quickly dissipated after sundown.

The Radars

SPol CHILL



Two radars were remotely controlled from Dr. Yuter's laboratory at North Carolina State University. SPol, located in Firestone, CO, is owned by the National Center for Atmospheric Research (NCAR). It sits atop storage containers which can be packed up and shipped all over the world. CHILL, located in Greeley, CO, is owned by Colorado State University and is housed in an air-supported dome to protect it from the elements.

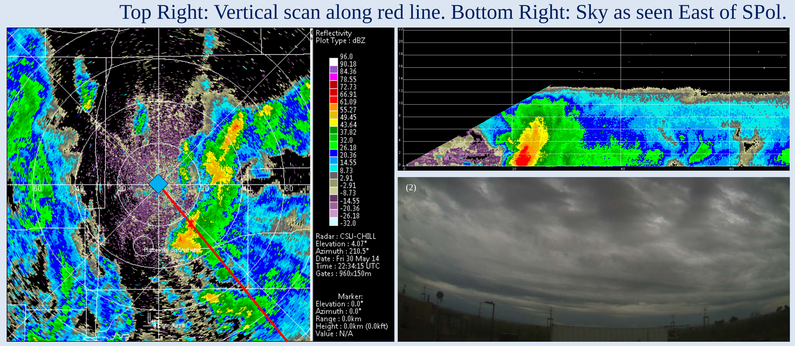
Various horizontal cross-sections were taken every 3 minutes and vertical cross-sections every 6 minutes of storms. Scans could be viewed remotely using various computer programs in real time.

Case 1: Severe Thunderstorm (05/30)

Below is a horizontal scan and a vertical scan of a severe thunderstorm that occurred on May 30, 2014 at 4 PM MDT.

The challenge with this case is multiple storm cells were present simultaneously. Therefore, both radar operators has to decide which cells were most important to take a vertical cross-section through. This was determined by the strength of the precipitation center and proximity to one of the radars.

Left: Horizontal scan as seen from CHILL.
Top Right: Vertical scan along red line. Bottom Right: Sky as seen East of SPol.

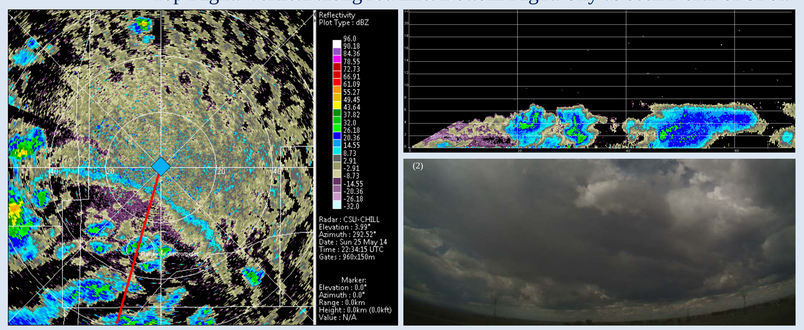


Case 2: Gust Boundary (05/25)

Another type of meteorological phenomenon encountered was a gust boundary which is a pool of cool air sinking down and out from a thunderstorm. This can be seen on the radar by bugs and dust being lofted into the air. This case occurred on May 25, 2014 at 4 PM MDT.

The vertical scans were positioned perpendicular to the boundary's direction of propagation. The challenge with this case was only a small portion of the entire boundary could be scanned, so a decision had to be made to discern the angle that would scan a section to give the best representation of the entire boundary.

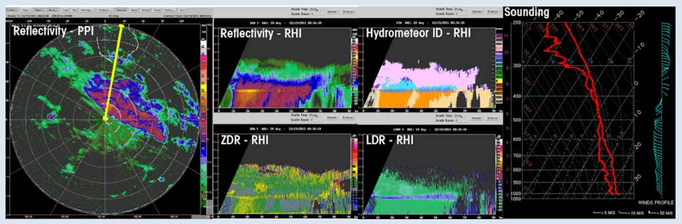
Left: Horizontal scan as seen from CHILL.
Top Right: Vertical along red line. Bottom Right: Sky as seen North of SPol.



Future Work

The next step is to compile the data into organized databases, quality control the data, and combine radar images into a useful format.

Also modules will be created that will provide users with representations of the various weather phenomena encountered during this project. These modules will be posted online for public use.



References

(1) CSU-CHILL National Radar Facility: http://www.chill.colostate.edu/w/Facilities
(2) NCAR EOL Media Resources

Acknowledgements

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