Remote Sensing of Hail Scar Producing Thunderstorms

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Objectives

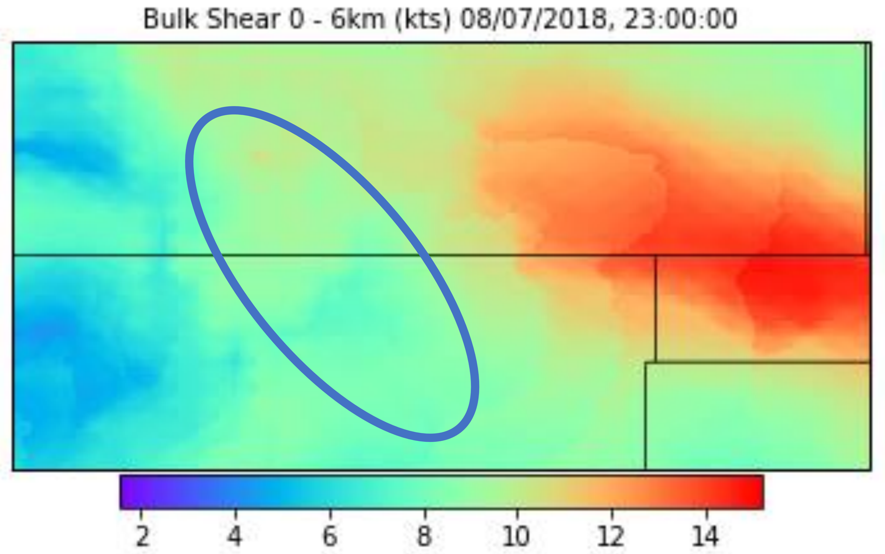
1.Conduct high resolution storm tracking using the **Warning Decision Support System-Integrated Information (WDSSII)** algorithms over the GOES-R domain for +/- 30 storms
2.Develop time series graphs for **Above Anvil Cirrus Plumes (AACP)**, **Overshooting Tops (OT)**, **Flash Extent Density (FED)**, and for near storm environment wind shear values
3.Derive an average duration and frequency for AACP in relation to hail scar producing thunderstorms
4.Derive **infrared window brightness temperatures (IRBT)** to calculate average temperature of **OT**
5.Determine average **FED** for hail scar producing thunderstorms
6.Develop a climatology of where the most hail scars exist within the domain area

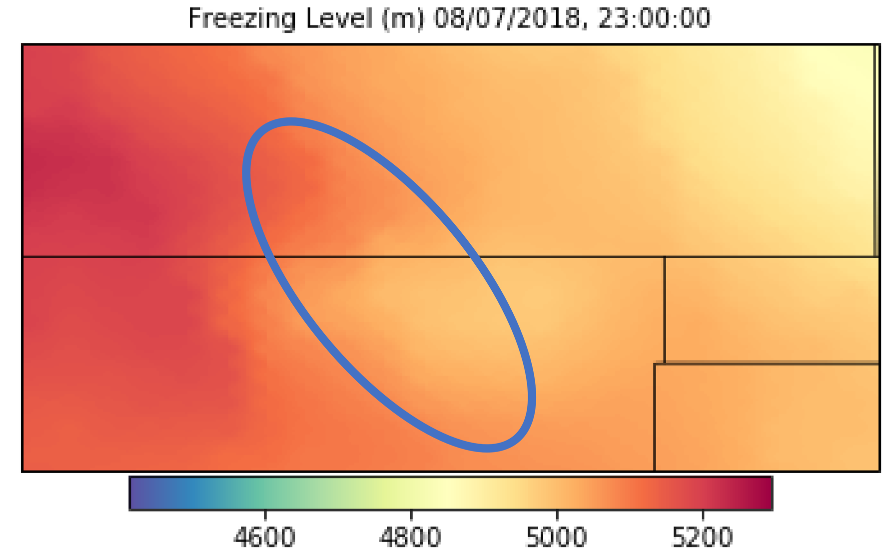
Methods

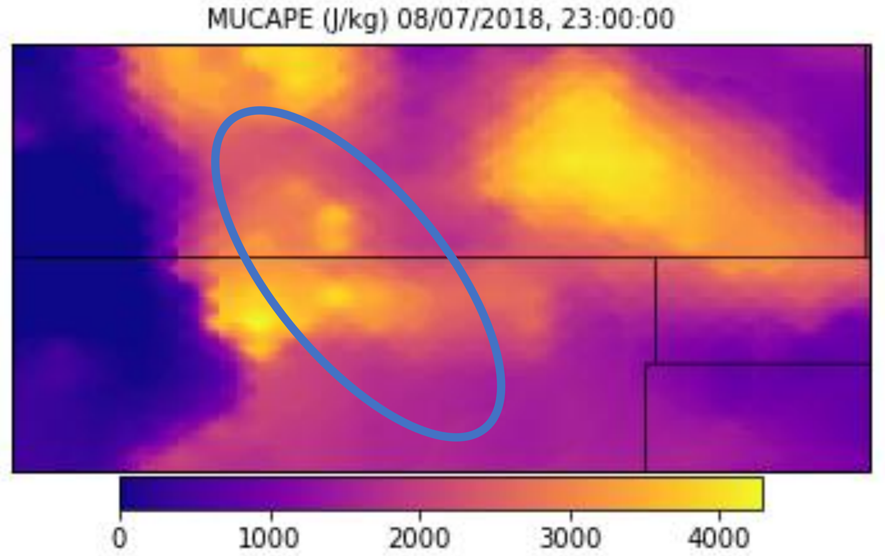
1.Find hailstorms via NOAA Storm Prediction Center's achieved storm reports.
2.Locate hail scar using NASA Worldview.
3.Use achieved NEXRAD radar data from National Centers for Environmental Information database.
4.Gather environmental data from the Rapid Refresh 13km resolution model.
5.Geostationary Lightning Mapper (GLM) data downloaded from GLM database.
6.Put radar, environment, and lightning data into the WDSSII algorithm.
7.Use WDSSII generated tracks to track storm features (MESH. Flash count)
8.Utilize Python to visualize NASA LaRC's Advanced Baseline Imager Convection Product for OT rating, Visible Imagery, IRBT.
9.Analyze storm features and compare with other storms.

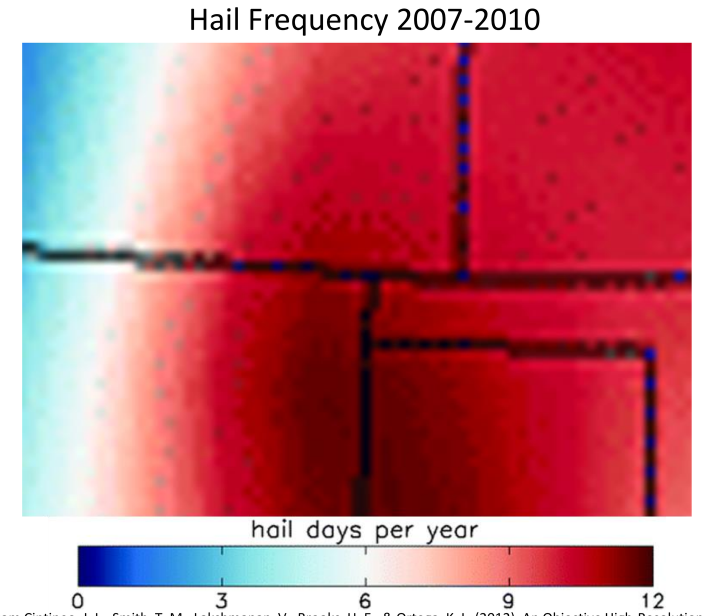
New Mexico Hail Scar August 7, 2018

Environmental Set Up



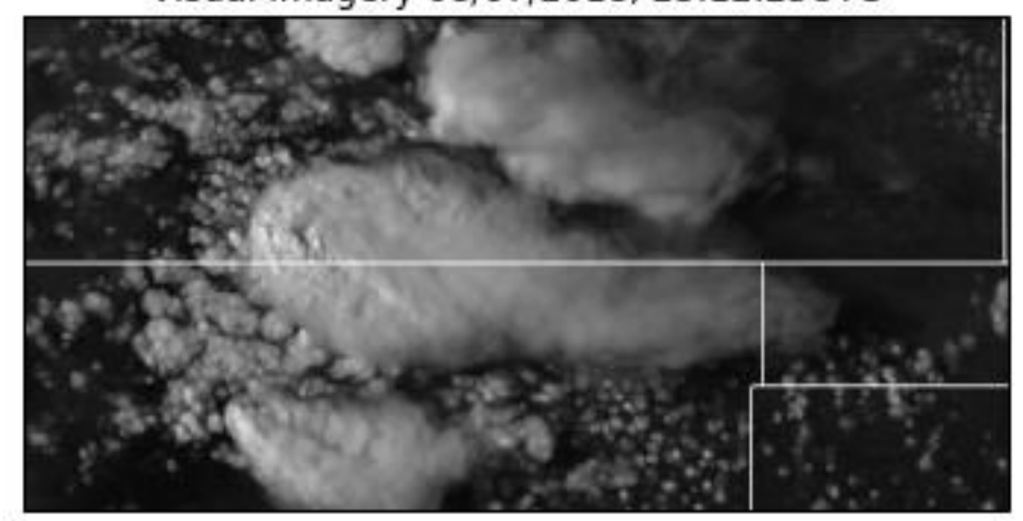


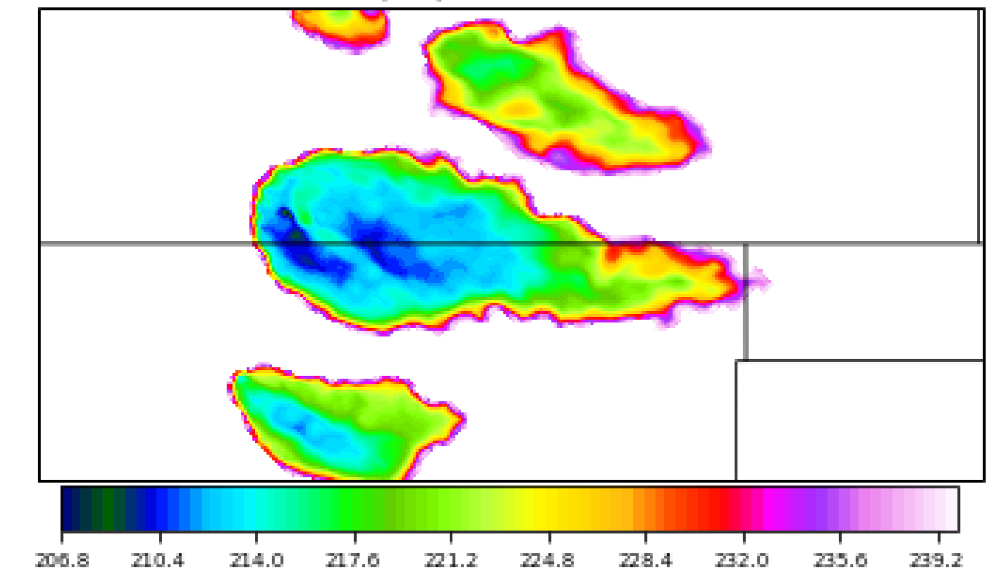


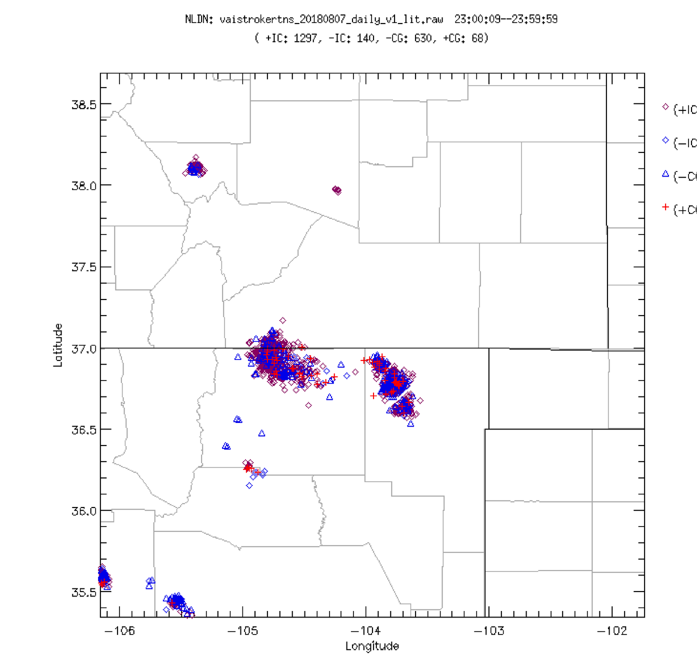


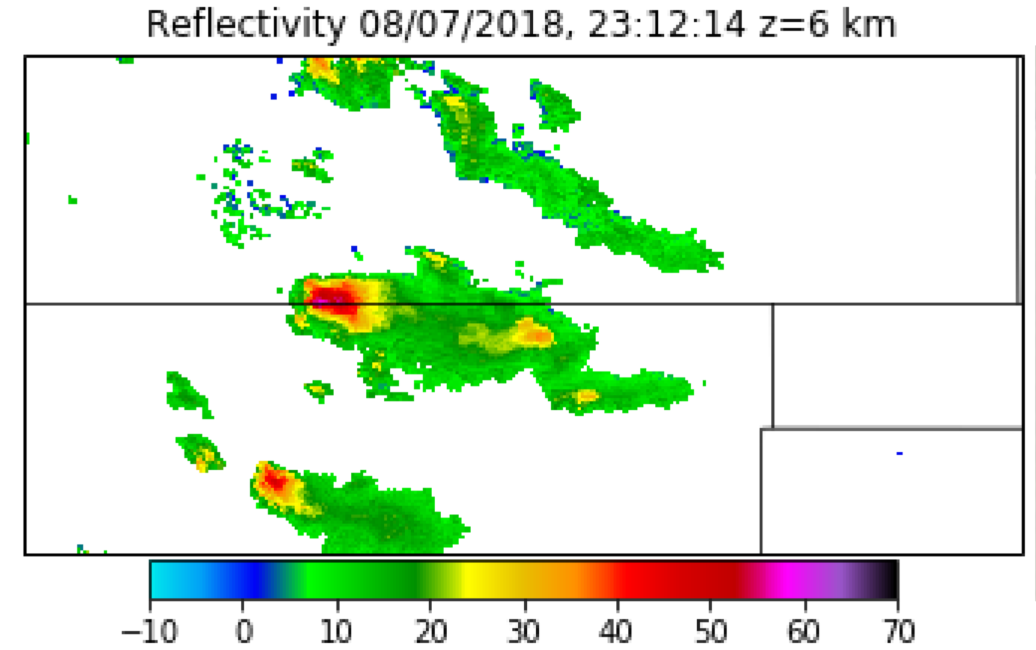
Acquired from Cintineo, J. L., Smith, T. M., Lakshmanan, V., Brooks, H. E., & Ortega, K. L. (2012). An Objective High-Resolution Hail Climatology of the Contiguous United States. *Weather and Forecasting, 27*(5), 1235–1248. doi: 10.1175/waf-d-11-00151.1

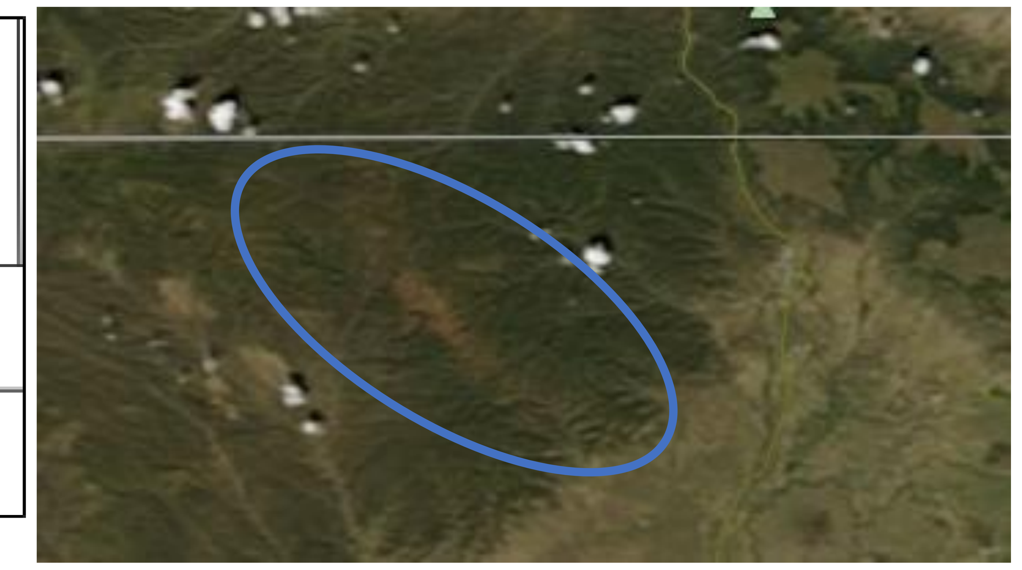
Remotely Sensed Attributes







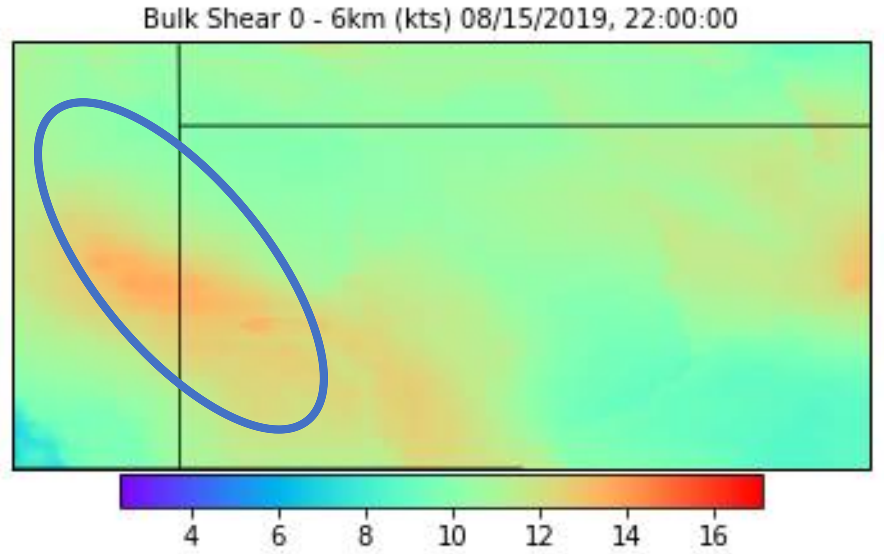


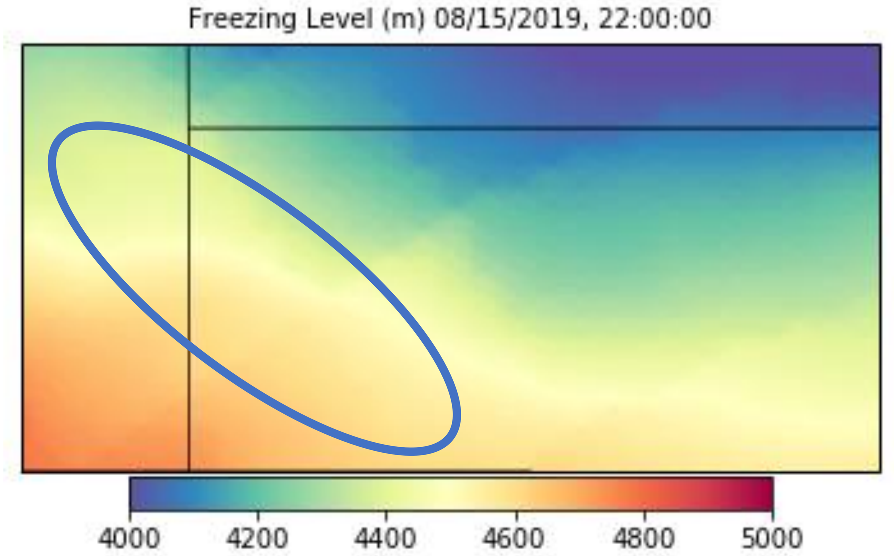


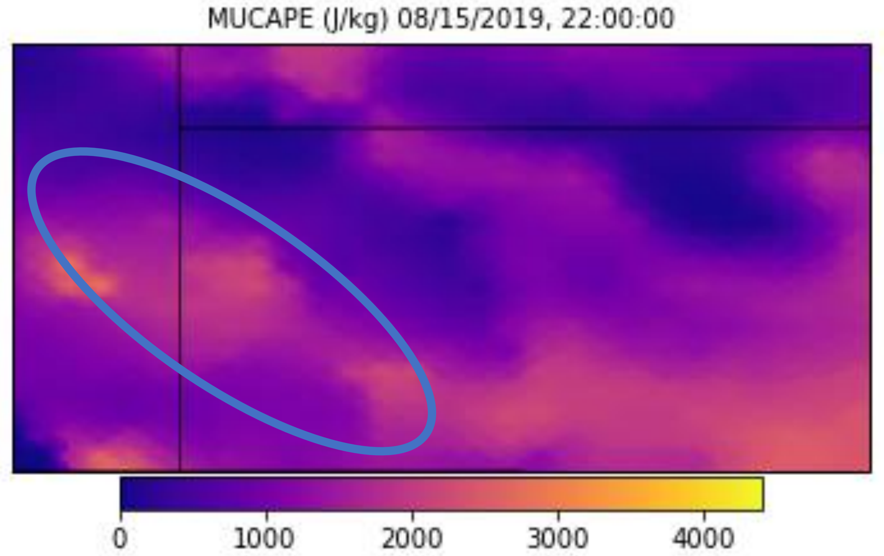
- Hail reported approx. 2359UTC
- Plume visible in Visible and IR imagery for approx. 2 hours before and during hail damage
- Lightning increased approx. 30 minutes before hail was reported

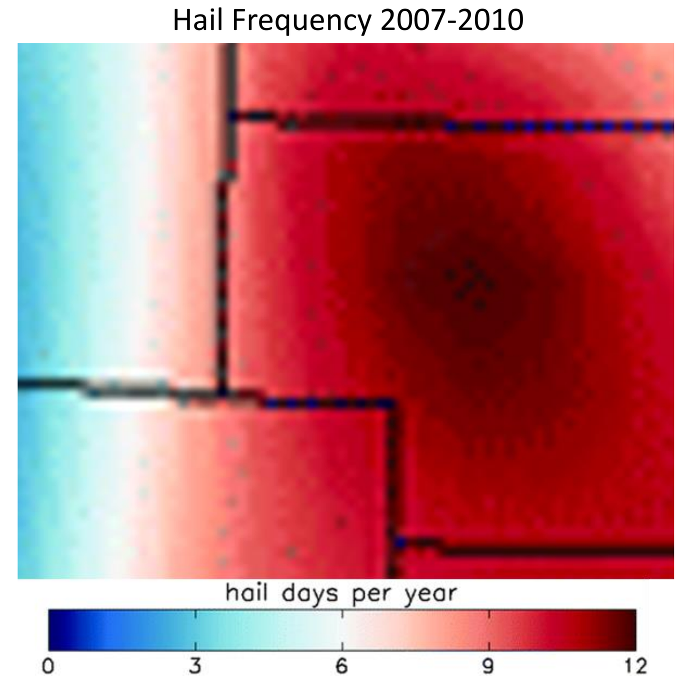
Nebraska Hail Scar August 15, 2019

Environmental Set Up









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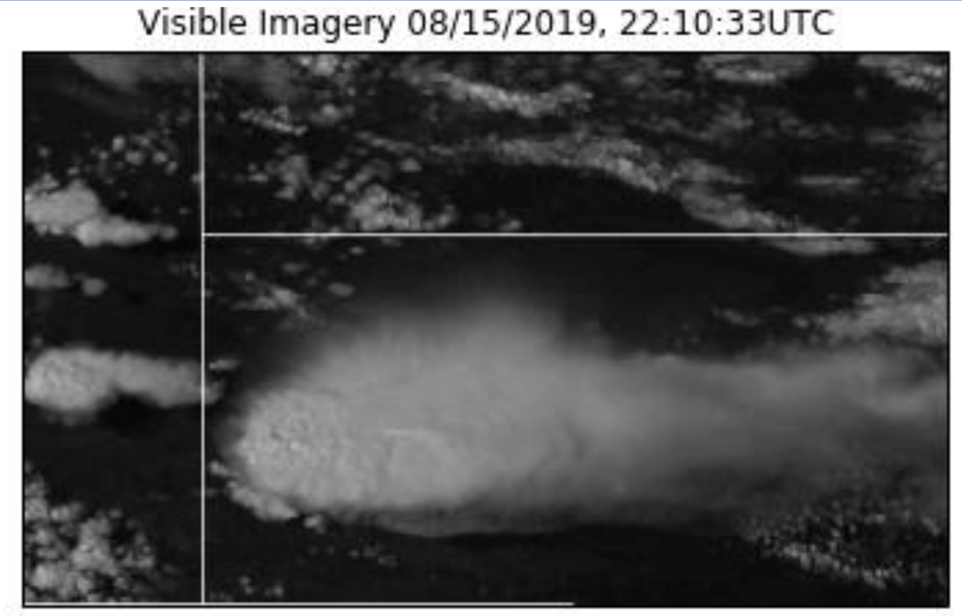

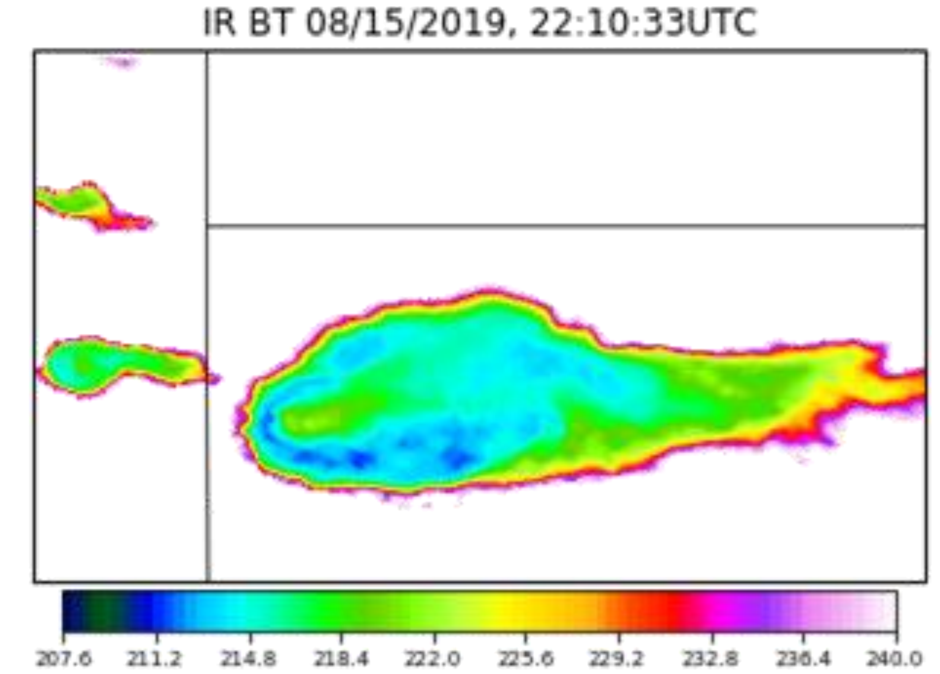

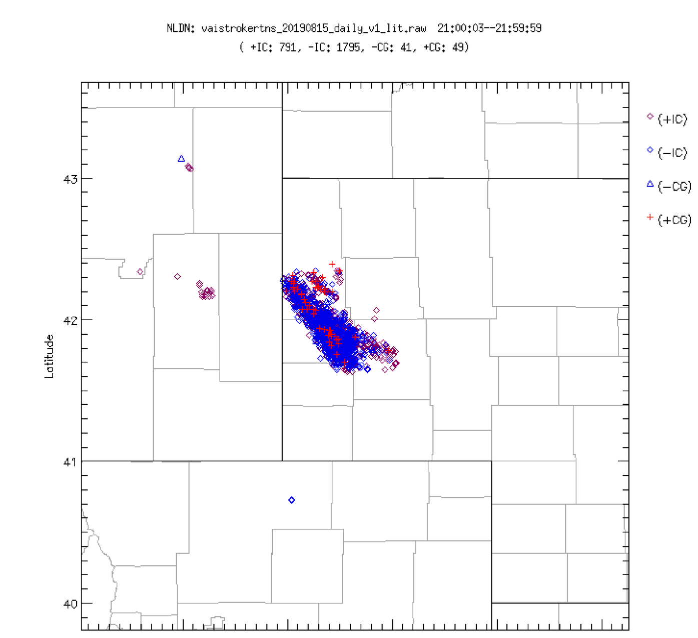

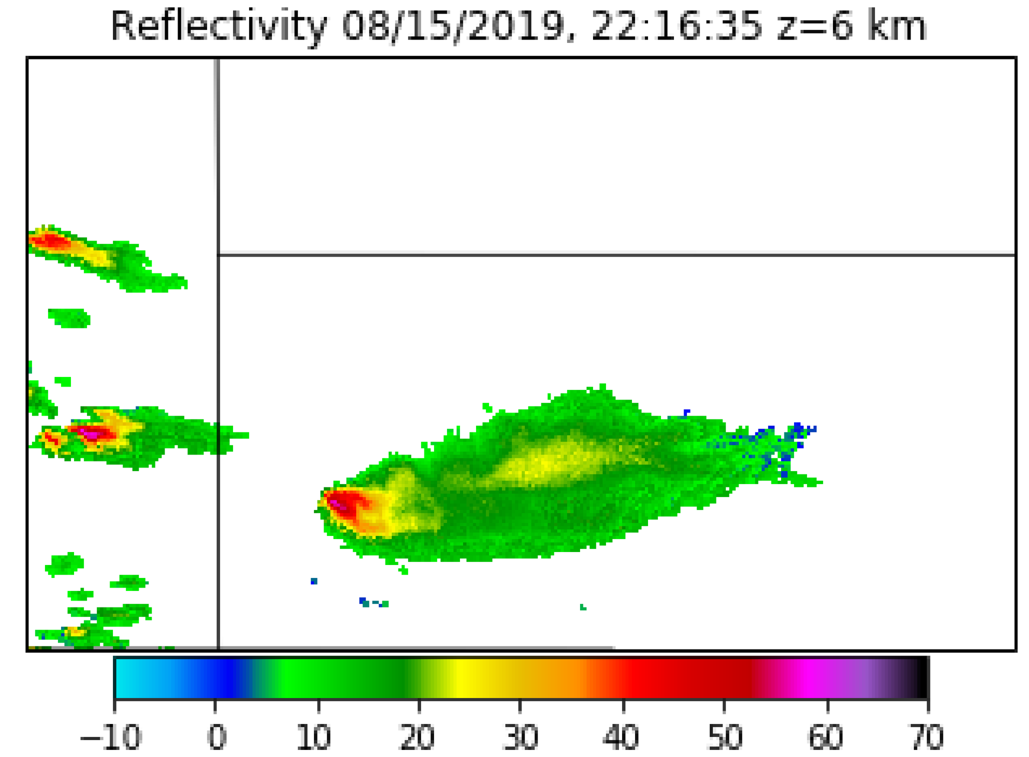

- Hail reported near Scottsbluff, NE approx. 2126UTC
- Plume visible in Visible and IR imagery for approx. 3 hours before and during hail damage
- Lightning increased approx. 30 minutes after hail was reported

Conclusions

A long-lived AACP was detected in both hail scar producing thunderstorms. A lightning jump was during the storms' lifetime of producing severe hail. Remotely sensed features can help improve severe thunderstorm detection and improve lead time.

Future Work

This is the beginning of a study aimed to characterize hail scar producing thunderstorms. In the future, more storms will be analyzed from across the country. Eventually, high resolution imagery will be used to capture unique land features where hail scars formed.