Cloud First report: Cumulonimbus Clouds after a Thunderstorm

(This photo was taken at 6:15 p.m. on Aug 28,2025, in parking lot 436 on the east side of the Engineering Center, facing east.)

Haiying Peng

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1 Introduction

The purpose of this report is to describe and discuss the cloud image on the cover. High-resolution versions of the image are available on flowvis.org, along with many other inspiring flow images. This image was created for the Cloud First assignment in the MCEN 5151 Flow Visualization course in Fall 2025.

The purpose of this image was to observe and document cloud formations related to a summer thunderstorm's dissipation stage. The photo captures a combination of cumulonimbus remnants and mammatus clouds, which are characteristic of turbulent air motions near the anvil base of a weakening convective system. This moment was chosen to show how instability, vertical motion, and moisture gradients produce distinct cloud textures and layers as the storm transitions from active convection to stabilization.

2 Methodology

2.1 Setup

This photo was taken near the Engineering Center on the main campus, in parking lot 436 on the east side of the building. The camera was facing east at a low elevation angle (approximately 15–20° above the horizon). The photo was taken at 6:15 p.m. on August 28, 2025, at an elevation of about 5,400 feet (1,646 m) above sea level. The CU Boulder campus is located at the foot of the Rocky Mountains, where local convective storms frequently develop in the afternoon due to upslope flow and differential heating. On this day, a thunderstorm had passed through earlier, and the rain had just ended when the image was taken, leaving a rainbow visible against the remaining storm clouds.

2.2 Cloud Identification and Atmospheric Discussion

The image shows several types of clouds. The lower-left portion of the image contains Cumulonimbus clouds, indicated by their shape and the presence of rain that created the rainbow. The upper region shows Mammatus clouds, identified by pouch-like formations under the anvil of a decaying cumulonimbus. In the upper-right and middle portions, smoother Stratus or Altostratus layers can be seen, representing the spreading anvil and residual stratiform clouds following the convective core's dissipation.

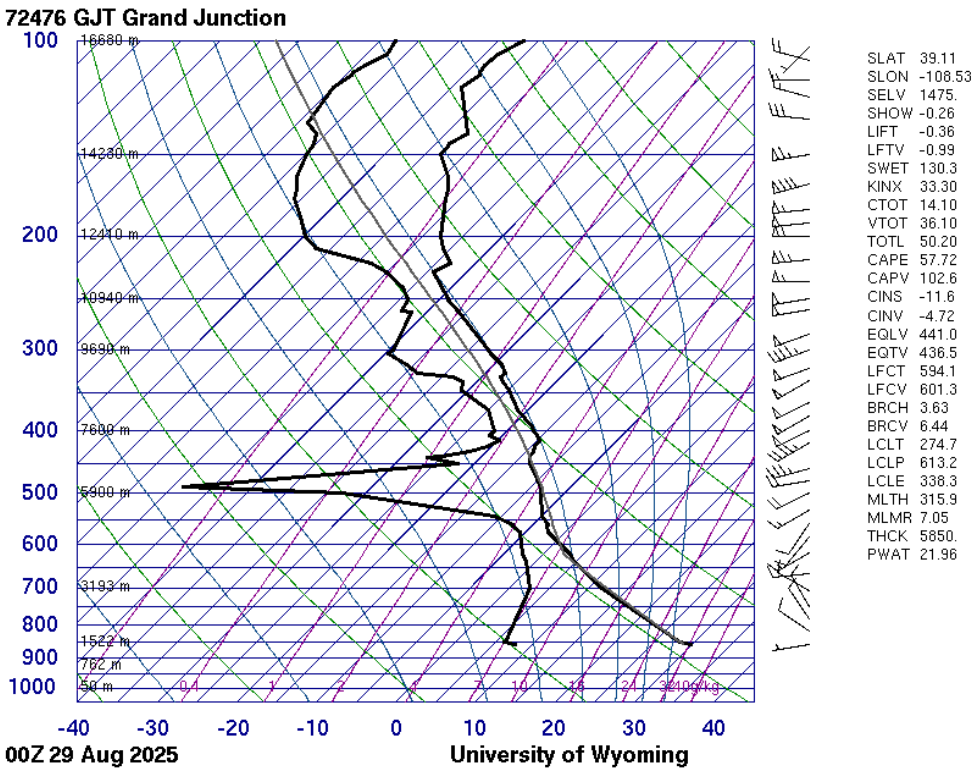

Figure 1 Skew-T diagram from Grand Junction (00Z 29 Aug 2025)

As shown in Figure 1, the atmosphere was weakly unstable. The air was moist near the surface, while the middle levels were relatively dry. The temperature decreased rapidly with height, supporting convective instability. The CAPE (~57 J/kg) and Lifted Index (~–0.36) show limited but non-negligible buoyant energy, sufficient for weak thunderstorms. The K Index (33) and PWAT (21.96 mm) suggest moderate moisture, consistent with brief convective showers that can create rainbows.

The Skew-T profile shows winds veering from southeast near the surface to westerly above, suggesting a favorable environment for convective cloud formation: warm, humid air inflow at low levels and drier air above. Cumulonimbus development and the observed vertical extent of the clouds are consistent with cloud bases (LCL approximately 610 m AGL) and tops close to 7 km AGL.

Earlier in the day, thunderstorms occurred, and the atmosphere stabilized afterward. In the dissipating stage of a thunderstorm, the mammatus formations are consistent with sinking air and ice-laden anvils. Although there was no impending major cold front, the weather that was observed was caused by local convective instability that was driven by surface heating and the mountainous terrain near Boulder, Colorado produced the observed weather.

In conclusion, the image captures a scene following a thunderstorm that includes cumulonimbus remnants, mammatus clouds and a rainbow. The atmospheric profile shown by

the Skew-T diagram, which shows a weakly unstable, moderately moist atmosphere moving toward stability following convective activity, is in good agreement with the observed cloud types and features.

4 Photographic techniques

A Samsung phone camera (model SM-S901U) equipped with a 5–7 mm f/1.8–2.4 lens was used to capture the image. The lens was set to a focal length of 5 mm with an aperture of f/1.8. The exposure time was 1/750 s, and the ISO was 20.

The camera was positioned horizontally at approximately 15° above the horizon, facing east from parking lot 436 on the east side of the Engineering Center on CU boulder main campus, around (40, -105.26).

The image was edited using Darktable. The original photo (Figure 3) had a resolution of 4000 × 3000 pixels. After cropping, the final processed image size was 3999 × 2825 pixels, representing a reduction of about 0.03% in width and 5.8% in height. The tone curve was adjusted to enhance contrast between the bright mammatus lobes and the darker surrounding clouds. Local contrast was also fine-tuned, with the “detail” parameter increased from 125 to 150, “highlight” decreased from 50 to 5, and “shadows” adjusted to 50%, to better emphasize the three-dimensional texture of the mammatus formations.

Figure 2 Original image

5 Conclusion

The image reveals the complex and dynamic nature of the sky after a thunderstorm. The rainbow adds both aesthetic appeal and meteorological meaning, indicating that sunlight was refracting through lingering raindrops as the storm cleared. It also helps illustrate the transition from active convection to post-storm stabilization. If possible, I would use a larger aperture in future shots to capture a brighter image, which would make the cloud layers and structures more visible and detailed. Overall, the photo successfully shows the beauty and physics of a dissipating thunderstorm, combining artistic and scientific value.