

Clouds First Report



Figure 1: My final cloud image, showing a cirrus radiatus cloud obscured slightly by a cumulus humilis. Photo taken October 5th, 2026 at approximately 5:27PM, about 1450ft. West of the Cherryvale & South Boulder Rd. intersection in Boulder, CO, facing west.

The photograph above was taken as part of my Flow Visualization class's "Clouds First" assignment, in which the general goal was to capture and classify a cloud. For this image, my main intent was to capture the cirrus radiatus cloud spanning most of the image, as I found the fractal-like details in it incredibly interesting, along with the dynamic shape the cloud took overall. The dark cumulus humilis cloud in the foreground was not something I originally wanted in the shot, but I didn't get many good photos that didn't include it, and came to like the way the cirrus's brightness made the silhouette so crisp, regardless. This image was taken by me with the help of no others.

As mentioned in the caption for Figure 1, this image was taken around 1450 feet west of the intersection between Cherryvale and South Boulder Road in Boulder, Colorado. Specifically, it was shot within a couple feet of the coordinates (39° 59' 10.6" N, 105° 12' 28.6" W), with the camera's center pointed approximately 232.3° clockwise from a north heading at a pitch around 25° from the ground. Taken at 5:27PM MDT, this was just over an hour before that day's sunset.

I primarily suspect the large cloud in Figure 1 to be a cirrus radiatus, given the sheer size of it, and the distinct tendrils that seem to radiate from a common area. It is worth noting that with such clouds, the radial appearance is most often a result of perspective, where cloud bands roughly parallel in space to appear to visually converge (similar to crepuscular rays). The day this cloud was photographed was mostly clear with no precipitation, and a high of 83°F coming from a low of 42°F in Boulder (NCEI, 2026). The day before had had very similar conditions, though with a high of 73°F.

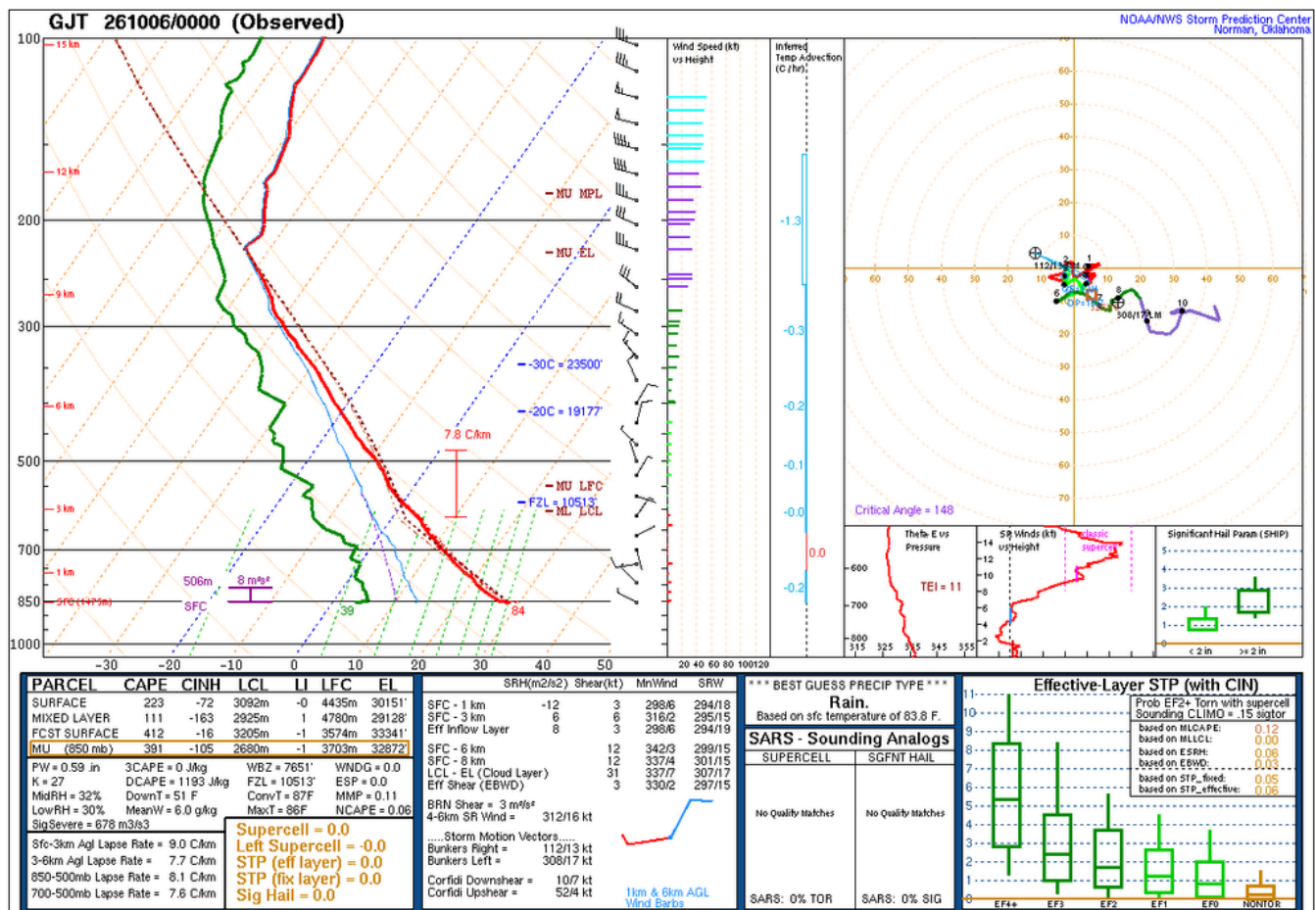


Figure 2: Sounding data for UTC 00:00 (MST 6:00 PM) taken by the National Weather Service's Grand Junction office.

Based on the skew-T diagram shown in Figure 2 (above), I would estimate this cirrus cloud to have been at an altitude somewhere above 29,000–32,900 feet, given the Skew-T's saturated parcel ascent line diverges left of the temperature line at around 9.5km (31,000ft) and the EL ranges in the table. However, it's hard to estimate where the upper bounds for this height might be, as this particular diagram shows no clear zone in the stable region (where the cirrus clouds would be expected) where the dewpoint line gets particularly close to the temperature line. Generally, though, cirrus clouds in Colorado have an upper height bound of around 45,000 feet (WMO, 2017). Regardless, this sounding data may not be ideal for identifying the clouds I saw: though the weather balloon capturing this data was likely in the air at the time I took my picture, it was also nearly 180 miles west of the photographed cloud.

Regarding the cloud in the foreground I identified earlier to be a cumulus humilis, I have very little data. Because I did not take the shot intending to capture that cloud, no effort was taken to judge its size relative to, for example, a finger's width at arm's length. All I can say with respect to the height is that it did seem to be at a relatively low elevation when observed in-person. Going off of visuals alone, I initially narrowed it down to be either a humilis or fractus variety. In the end, I decided it was most likely humilis because many of the clouds surrounding it (some visible in Figure 1) appeared somewhat flat, and because subsequent photos taken minutes later showed this cloud did not change very quickly (eliminating fractus as a likely possibility).

Figure 1 was taken using a Sony a6000 camera with a 16mm f/11 lens, set to an ISO of 100 to minimize sensor noise, and a shutter speed of 1/200 sec. The sensor size of this camera is 23.5mm×15.6mm, which with this 16mm lens corresponds to a horizontal field of view of:

$$2\tan^{-1}\left(\frac{23.5\text{mm}}{2(16\text{mm})}\right) \approx 72.6^\circ$$

And a vertical field of view of:

$$2\tan^{-1}\left(\frac{15.6\text{mm}}{2(16\text{mm})}\right) \approx 52.0^\circ.$$

With the cloud spanning the full image and a little more, and assuming it's around 32,000 feet from the camera, its width can be estimated using the FoV to be

around $2(32000ft)\tan(\frac{72.6^\circ}{2}) \approx 47000ft$. However, height is hard to accurately judge given the perspective effects.

The original image size was 6000×3376 pixels, which was the maximum resolution the camera supported at the 16:9 aspect ratio used. No cropping was done to obtain the final image, and so Figure 1 is also 6000×3376 pixels. The only edits made to create Figure 1 were done in Windows Photos. The highlights and shadows were both turned down to reduce the brightness of the nearly overexposed area, while increasing the contrast between the clouds and the sky. Exposure and contrast were turned up to brighten up the overall image once those previous edits were made, and to make some of the smaller features more prominent. Saturation was turned down slightly, as the sky's blue had increased in saturation after the contrast and shadows edits, and finally, some sharpening was done to accentuate the high-frequency details.

Ultimately, I am quite satisfied with the shot I managed to get, though I'll admit I had other candidate cloud pictures which I had a hard time picking this one from. In this photo, I'm particularly glad to have captured the fractal-like patterns seen within the individual wisps of the cloud, which were the part I found most interesting:



Figure 3: A close-up of Figure 1, showing the finer details in the cirrus cloud's edges.

I'm not sure exactly what causes these structures, and am hesitant to make a guess based on these limited visuals, but to me they strongly resemble some patterns I've seen resulting from diffusion-limited aggregation.

Given I couldn't control which clouds I saw, nor the lighting conditions under which I saw them, the only thing I might have changed in taking this image would have been to use a lens with a greater focal length in order to get more resolution on details such as those in Figure 3. However, I do like that my current image has the full context of the cloud type, and some sense of scale thanks to the presence of the mountains. This cloud did end up persisting for well over an hour, and went through a lot of interesting shapes in that time. I didn't expect it to last so long originally, but if I had known it would, I'd have definitely considered getting a timelapse of it. Doing that might have given some insight into why those fractal shapes formed.

References:

National Centers for Environmental Information. (2026). Record of Climatological Observations: Boulder, CO, October 6th 2026.

<https://www.ncei.noaa.gov/access/past-weather/Boulder%2C%20Colorado>

World Meteorological Organization. (2017). *Cirrus*. International Cloud Atlas.

<https://cloudatlas.wmo.int/en/observation-of-clouds-from-aircraft-descriptions-cirrus.html>