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MCEN 5151 | Flow Visualization

Photograph Date and Time: 10/05/2026, 5:23 P.M.

Cloud Type: Cirrus Radiatus and Cumulus^[2]

Clouds First Report

For this assignment, I wanted to capture an image that clearly displayed interesting atmospheric phenomena while also producing an aesthetically pleasing photograph. I was particularly interested in finding clouds with complex structures, where the motion of the atmosphere could be visualized through the shape and development of the clouds themselves. I ended up capturing an image of thin, streaky clouds spreading/radiating across a large portion of the sky. These were accompanied by smaller, fluffier clouds at lower elevations. I liked the contrast between these formations, with the thin clouds stretching outward and the smaller clouds having a more compact shape. The goal here is to investigate the atmospheric conditions responsible for these formations and explain the physics that can be observed in the photograph.



Figure 1. The Cloud

The image in Figure 1 was taken from a parking lot in Louisville, CO, about 8 miles east of the University of Colorado Boulder. This photograph was taken on 10/05/2026 at approximately 5:23 P.M., facing west at an estimated elevation angle of 20 degrees above the horizon. The sun is behind the clouds. The landscape is included to provide a sense of scale when determining position and size of the cloud.

Looking at Figure 1, two types of clouds can be identified: cirrus radiatus and cumulus. The cirrus clouds are characterized by thin, streaky structures that appear to radiate outward from a central location. The smaller, fluffier clouds are cumulus, which typically form at lower elevations as rising air cools through adiabatic expansion until saturation occurs. I find the contrast between these two formations interesting, visually demonstrating the difference in atmospheric conditions at varying altitudes.

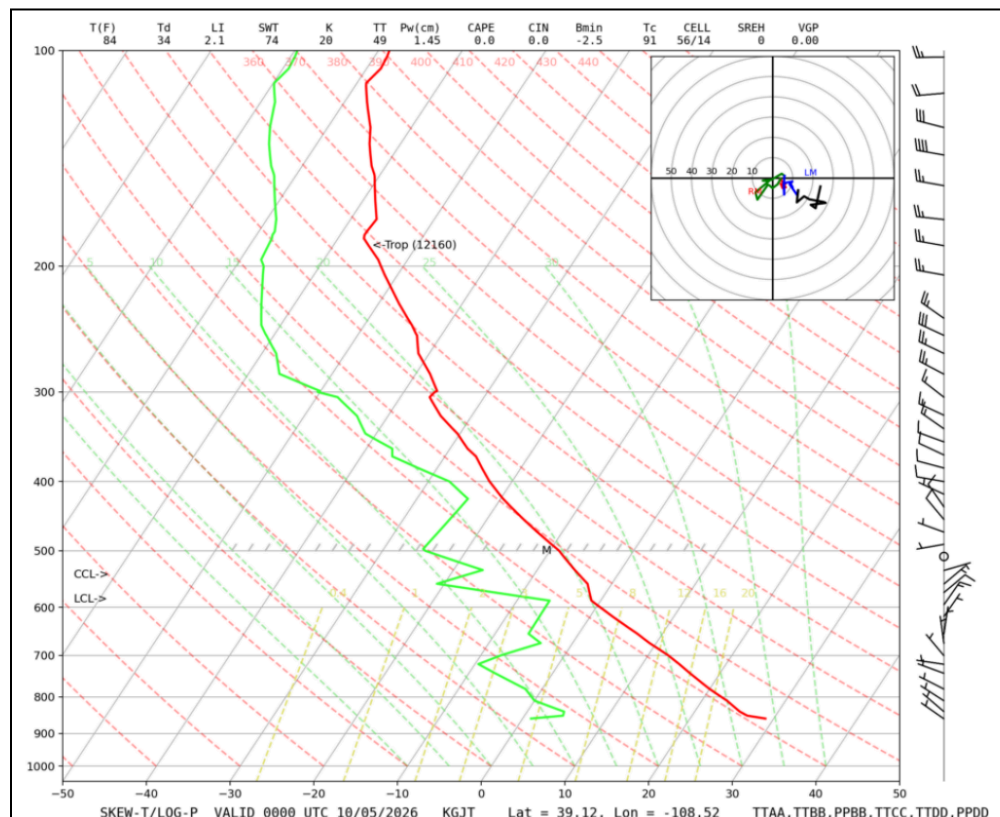


Figure 2. Representative Skew-T

The atmospheric conditions can be further investigated using the Skew-T diagram shown in Figure 2. The red line represents the environmental temperature, while the green line represents the dew point temperature. When these lines approach one another, the relative humidity increases, creating conditions for cloud formation. The sounding reports a Convective Available Potential Energy (CAPE) of 0 J/kg, suggesting that the atmosphere is stable. This is consistent with Figure 1, where the cumulus clouds remain compact rather than developing into towering formations.

The Lifted Condensation Level (LCL) represents the elevation where a parcel of air cools enough to reach saturation, allowing water vapor to condense into liquid droplets and form clouds^[1]. Using the surface temperature of 84°F and dew point of 34°F from Figure 2, the LCL is estimated to be 3.47 kilometers up from Boulder, CO^[1]. This provides an estimate for the elevation of the darker cumulus clouds seen in Figure 1. The cirrus radiatus cloud forms higher up. Looking at the Skew T, at higher elevations (lower pressures) the saturation point for the cirrus radiatus cloud corresponds to an altitude of about 9 kilometers. This is expected, as the lower temperatures at higher altitudes allow for ice crystals to form, creating the streak-like formation seen in Figure 1. Wind shear is an additional cause of the wispy effect of the cirrus radiatus cloud. The wind differences at different altitudes, depicted by the changing barb directions in Figure 2, will cause the cloud to stretch and deform.

The rest of the sky was clear, and it was a relatively warm day for October. The weather in Boulder was calm with little-to-no wind at the ground level. The days before and after were also unexpectedly warm. A cold front with precipitation came in a week later on October 12th.

The photograph was taken using an iPhone 17 on 1x zoom, with an original resolution of 5712x4284 pixels. To remove distracting elements, I cropped the final photo in post-processing to be 4264x3285. I chose a landscape orientation to capture the entire cirrus formation. The iPhone 17 camera has a focal length of 26 mm and an aperture of f/1.6, with a shutter speed of 1/6993 s and ISO of 50^[3]. The lower cumulus clouds were located an estimated 11 kilometers from the camera, making distance to the center of the higher cirrus clouds about 16 kilometers.

My favorite part of this image is the contrast between the thin, feather-like cirrus clouds and the darker, more defined cumulus clouds. The photograph does a great job of demonstrating how fluid motion can produce complex structures on a big scale. One limitation is that the image captures only a single moment in time, making it difficult to determine how the clouds are moving. It might be interesting to capture a time-lapse to better visualize the influence of wind shear on cloud development. Overall, I am happy with the result, as the photograph captures both the artistic beauty of the atmosphere and the fluid physics responsible for the cloud formations.

References:

[1] "ATSC 113 Weather for Sailing, Flying & Snow Sports." *UBC ATSC 113 - LCL Computation*, www.eoas.ubc.ca/courses/atsc113/flying/met_concepts/01-met_concepts/01d-ceilings/zlcl.html. Accessed 19 Oct. 2026.

[2] "Clouds Archive." *Cloud Appreciation Society*, cloudappreciationsociety.org/cloud-library/. Accessed 19 Oct. 2026.

[3] "iPhone 17 - Technical Specifications." *Apple*, www.apple.com/iphone-17/specs/. Accessed 19 Oct. 2026.