Morning Clouds from a CU Parking Garage

MCEN 5151 Flow Visualization - Clouds Second Report

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Statement of Meaning While viewed as a mundane object in the sky by many, clouds can actually be surprisingly complex when surrounding weather and atmospheric conditions are considered. The image in Figure 1 was taken on the top floor of a CU parking garage on October 31, 2025 to highlight the dramatic nature of clouds. Multiple types of clouds exist in this image and show a variety of light levels and shapes.

Location and Conditions The picture in Figure 1 was taken from the top floor of a parking garage on the CU Boulder campus on October 31, 2025 at 7:56 AM. I took these pictures while commuting to campus. My phone camera was angled upward at roughly a 30° angle from the horizon in the northwest direction when I took the photo.

Clouds and Weather In this image (Figure 1), altocumulus lenticularis and altocumulus opacus might be present, though the opacus clouds could be stratus.[2],[3] These clouds can be identified visually in this image, though the plot in Figure 2 corroborates some of these identifications.[1] Throughout the image, the clouds obscure the sky in a semi-smooth sheet, which is why I think the clouds could be stratus or altocumulus opacus. In the middle of the image, the clouds are darker and more defined than the rest, taking the shape of an altocumulus lenticularis cloud. Again, these clouds could also be misidentified, though the nearby mountains often create these clouds (orographic effects) at this time of year. The mountain range over which this cloud resided forced air upward where it cooled and condensed into this cloud shape. After I took this image, I recorded images of the sky in different directions. Some of these images showed blue sky with cirrocumulis clouds present at higher elevations, which is also corroborated with the skew-t diagram (Figure 2).

At the time the image in Figure 1 was taken, the atmosphere was stable. The plot in Figure 2 shows a CAPE value of 0.00, which supports this. When the atmosphere is unstable, a much larger CAPE value can be expected (in the hundreds or even thousands). The Skew T plot (Figure 2) has two thick, bold black lines as well as a gray line between them. The rightmost black line shows the temperature measured by a weather balloon as it ascended from Grand Junction, CO, while the leftmost black line shows the dewpoint. If these two bold lines touch, the actual temperature is the same as the dewpoint, meaning that water will condense and form clouds at that elevation. Rightward turns in the rightmost black line around 2250, 5000 and 7300 m support the idea that clouds were at these elevations: the temperature of air increases when water condenses and leaves it. Unfortunately, this plot was recorded almost 10 hours after the pictures of the clouds were taken, so the atmospheric conditions described in Figure 2 might differ from the actual conditions when the picture was taken.

Photographic Technique The clouds image was taken with the the Open Camera app[4] on a Pixel 6A using the default zoom (1x) and an infinite focus distance. The lens in the Pixel 6A phone has a fixed aperture of f/1.7, a focal length of 4.4 mm (35 mm equivalent), a minimum focus distance of 0.1 m, and a view angle of $65.6 \times 51.6°$. The 12.1 megapixel digital image sensor has an area of 23.9 mm and produces images at sizes up to 4032×3024 pixels, which was the size of the original image. The post-processed image retained these dimensions because I didn't crop the image. Exposure was automatically set by the Open Camera app with an ISO of 56 and a shutter speed of $\frac{1}{266}$s. Post processing of the photo in Darktable increased the contrast of the image using the exposure tool to improve the cloud visibility. The image was cropped to focus on the more interesting clouds.

Analysis and Reflection While this image shows a couple cloud types clearly, the scene could have been better captured with a different camera setup. The limited resolution of the cell phone camera (Google Pixel 6A) used to capture the scene could have prevented some of the smaller details in the image from being fully spatially resolved. Even though these details would not show up in this PDF well (due to size limitations), they could still have helped with cloud identification. Thankfully, these details weren't blurred out in this image because of poor time resolution. The shutter speed was $\frac{1}{266}$s, which was more than fast enough to capture the slow moving clouds in the image. It is possible that camera shake created blurring in the image. This could have been prevented if I had used a tripod. A video recording or timelapse video of the clouds could have provided a more detailed view of the clouds over time, helping with identification.

References

[1] "72476 GJT Grand Junction Sounding." (), [Online]. Available: https://weather.uwyo.edu/cgi-bin/sounding?region=naconf&TYPE=GIF%3ASKEWT&YEAR=2025&MONTH=10&FROM=3100&TO=3112&STNM=72476 (visited on 12/03/2025).

[2] WMO. "Altocumulus lenticularis (Ac len)," International Cloud Atlas. (), [Online]. Available: https://cloudatlas.wmo.int/species-altocumulus-lenticularis-ac-len.html (visited on 10/20/2025).

[3] WMO. "Altocumulus opacus (Ac op)," International Cloud Atlas. (), [Online]. Available: https://cloudatlas.wmo.int/varieties-altocumulus-opacus-ac-op.html (visited on 12/03/2025).

[4] "Open Camera," SourceForge. (Aug. 27, 2025), [Online]. Available: https://sourceforge.net/projects/opencamera/ (visited on 09/24/2025).

(A) Compressed Unedited Photo

(B) Compressed Edited Photo

Figure 1: Clouds captured at 7:56 AM MDT on October 31, 2025 from a parking garage on the CU Boulder main campus.

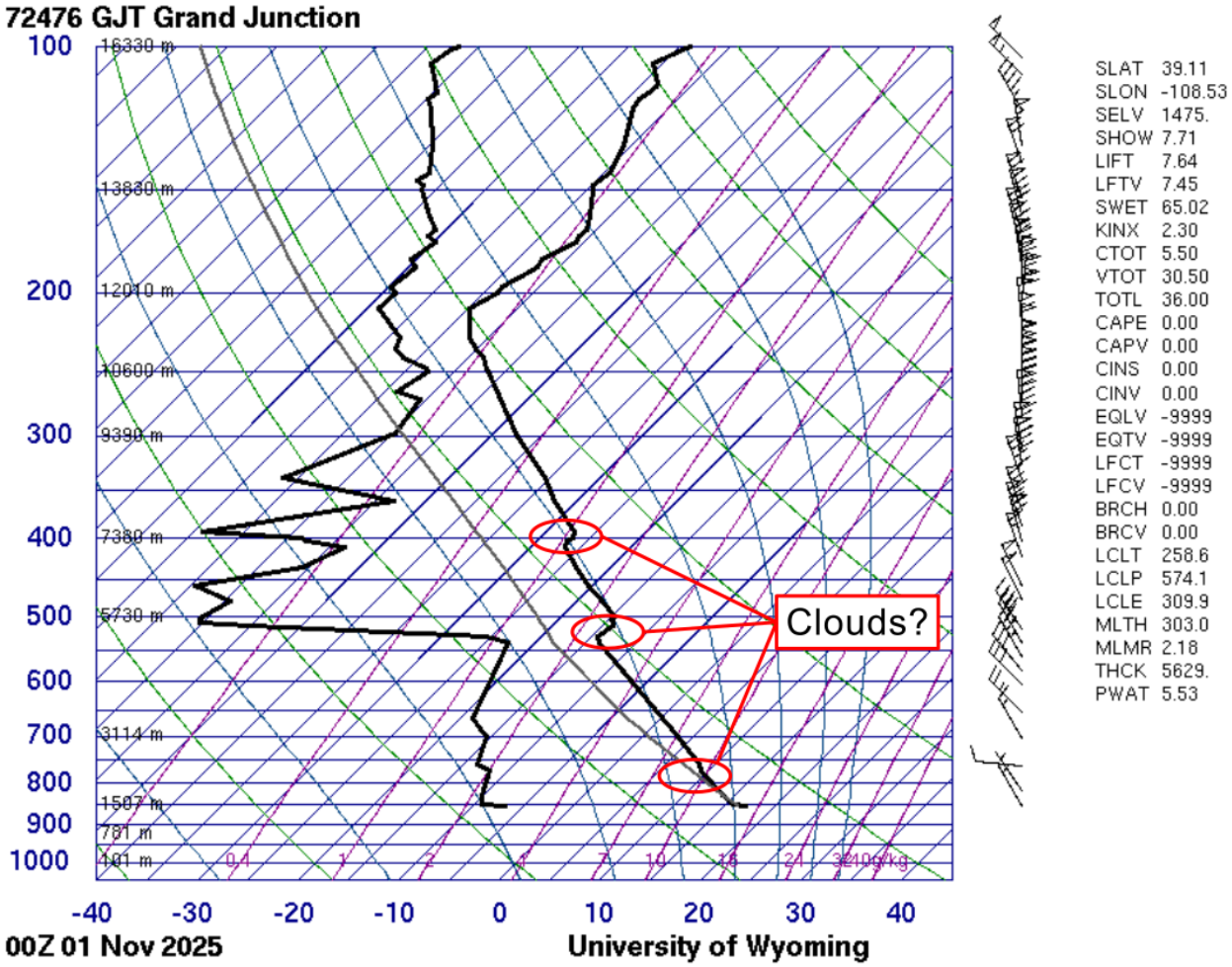

Figure 2: Skew-T plot from Grand Junction, CO at 6:00 PM mountain time.[1]