"Clouds First" Report

MCEN 5151-001 Flow Visualization, Fall 2025

Emma Wilder, 10/20/2025

Fig. 1: (A, left) the unedited image, and (B, right) the edited image.

Introduction

For the Cloud First assignment, I wanted to capture Cirrus clouds because I find the wispy form beautiful. I was lucky enough to capture an interesting cloud formation from an angle where both Cirrus and Cumulus clouds were both present in an interesting diagonal composition.

Image Circumstances

This image was taken on September 29, 2025 at 11:57 am in the SEEL parking lot on CU Boulder's East Campus (Boulder, CO, 40° 0'31.51"N, 105°14'31.88"W) facing southwest at an angle of about 10-20 degrees from horizontal.

Scientific Explanation

The clouds captured appear to be Cirrus on the upper left and be Stratocumulus clouds in the lower right. Looking at the Skew-T diagram (Fig. 2, University of Wyoming), which happened to be taken within minutes of the image, the CAPE (0.00) and slope of the temperature in relation to the adiabatic lapse rate indicates a stable atmosphere. However, there does appear to be evidence of clouds at around 600 mb (~4000 m altitude, kink in temperature profile), which may be the Cumulus clouds in the image. The night before the image was captured (Fig. 3), there was a low level of instability (CAPE = 52.85) which could have resulted in air parcels rising and thus the formation of clouds at around 600 mb and 300 mb (some potential slightly unstable air at 300 mb). These pressures may indicate that the Cumulus clouds at around 3000-4000 m elevation and Cirrus clouds at 9500 m, putting these clouds in the "Alto" and "Cirrus" levels, respectively. Therefore, the cloud formation in the lower right may be more precisely identified as Altocumulus. However, because of the relatively stable atmosphere, it is possible that these clouds were formed from atmospheric turbulence and/or orographic lift by the mountains (i.e., the Flatirons & Rocky Mountains) to the right side of the image, not shown.

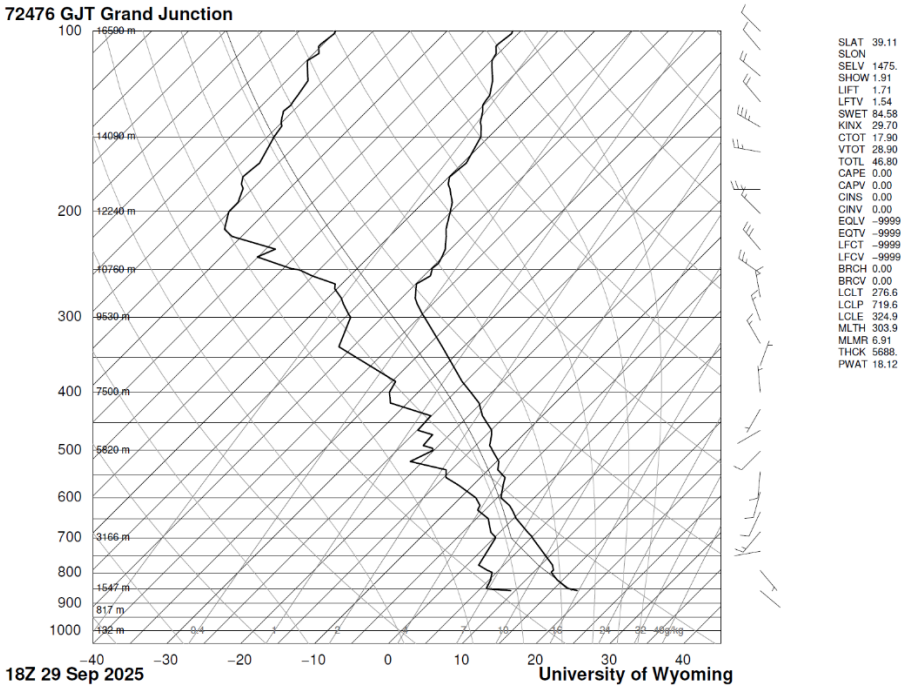

Fig. 2: Skew-T Diagram of Grand Junction near image capture time, 12 pm (18Z), on September 29, 2025

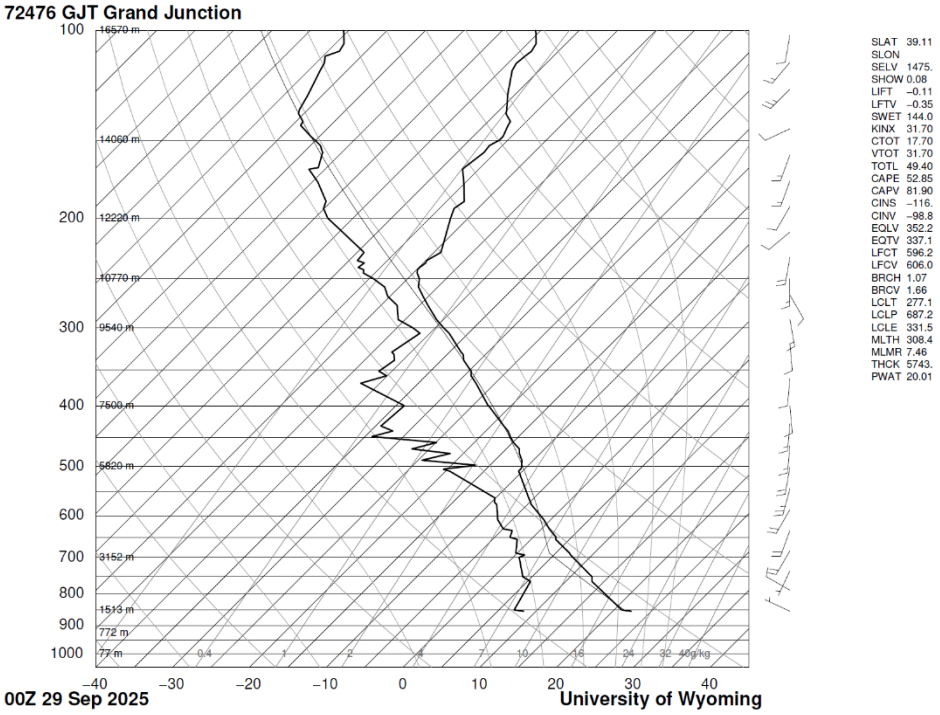

Fig. 3: Skew-T Diagram of Grand Junction the night before image capture, 8 pm, on September 28, 2025 (00Z 9/29)

The Skew-T diagram could imply multiple levels of clouds, which agrees with observations. However, the evidence of multiple cloud levels from the Skew-T diagram is not very strong, which implies that instability isn't the main mechanism of the formation of these clouds. Since just below and to the right of the image, mountains are present, and since there appears to be some wind shear from 600-300 mb (albeit not very strong), turbulence is more likely a formation mechanism of these clouds.

Photographic Technique

An ISO of 100 was used to keep exposure down in the bright sun while minimizing noise, with an aperture of f/10 to further reduce exposure and to approach ideal sharpness and minimize aberrations and refraction. A 1/250 s shutter speed was also used to reduce exposure while preventing blurriness from handheld camera movement. A Canon EOS Rebel T7 (digital DSLR) was used with an EF-S 18-55mm IS II Kit lens. An 18 mm focal length was used to capture a wide enough angle to capture both types of clouds. Slight cropping was used to remove the branches of a tree I did not see when capturing the image (original photo: 6020 x 4015 pixels, cropped to 5695 x 3264 pixels). Edits for higher contrast (s-curve) and saturation for a bluer sky were made in darktable (Fig. 1a-b).

Conclusion

The image shows multiple cloud types at different elevations. I like the diagonal composition of this photo, the contrast from the shadows in the clouds, and the contrast of the different cloud types. If I could, I would try to capture this image with the mountains to include some context and get a sense of scale, while also trying to exclude distracting telephone poles and light poles that were around the scene.

References:

University of Wyoming, College of Engineering, Department of Atmospheric Science. *Atmospheric Soundings*. https://weather.uwyo.edu/upperair/sounding_legacy.html