Clouds Second - Fall 2025

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Purpose and Context

The artistic intent behind this image was to capture a beautiful sunrise, present with different cloud phenomena appearing in the sky. The scientific intent was to analyze the stability of the clouds within the image, and determine what could have caused the phenomenon at hand. The image that I ended up capturing was the early morning sunrise over Boulder (on Highway 36), and provided a great amount of depth that can be seen with the different cloud types and multiple colors in the sky.

Location Details

Location	Boulder, Colorado (Highway 36)
Camera Direction	East
Elevation Angle	Zero degrees
Date and Time	November 26, 2025 6:28 AM

Cloud Physics

The main cloud formations appearing in this photo are stratocumulus (developing inward, toward the main orange colors of the sunrise) and altostratus clouds (toward the upper left-hand side, observed in the darker blue parts of the image). Stratocumulus clouds are characterized by their low-level appearance and often "appear as a lumpy cloud layer" [1]. On the other hand, nimbostratus clouds form on the precipice of a major storm or climate event, where they often "appear as gray or bluish sheets or layers, ranging from several hundreds to thousands of meters thick, often covering the entire sky" [3]. The image captured displays these two cloud structures in one image, something that is often found in early mornings when the atmosphere is not as stable. However, having these two cloud types together does not always indicate severe weather at hand, as is such in this case. Instead, these two clouds just happened to form together in the early morning with no indication of instability (seen in the Skew-T diagram below).
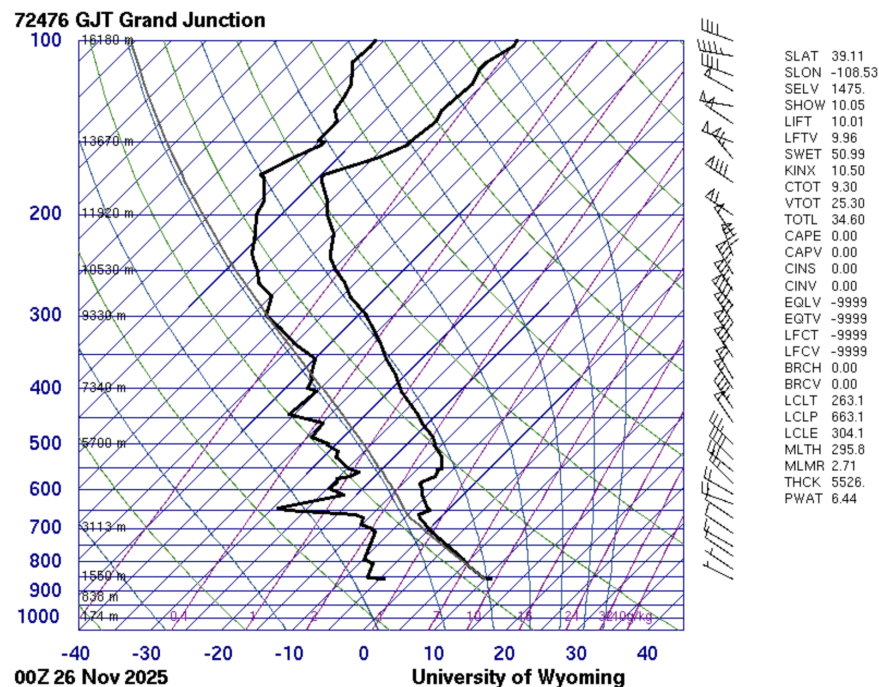

Figure 1: Skew-T Diagram

The Skew-T diagram (above) was generated for 6:00 AM on November 26th near Grand Junction, Colorado. This location was the closest atmospheric data center to when and where the photo was taken. This leads to some discrepancy with the actual cloud phenomenon and the associated data, but similar patterns are observed, proving that the data does capture the relative weather patterns even though the location is fairly far away.

The plot shown above shows that there is a very stable atmosphere, as indicated by the CAPE (Convective Available Convective Energy) value of 0.00. According to NOAA, "A higher value of CAPE means the atmosphere is more unstable and would therefore produce a stronger updraft" [4]. Given this association, it can be concluded that these clouds were formed in a mildly-unstable atmosphere, supported by the darker shades seen in the clouds in the upper left hand corner of the image. Taking another look at the plot, it can be seen that clouds are likely to form around an altitude of 3000 and 12000 meters. In general, stratocumulus clouds tend to form anywhere between the surface and 2000 meters, suggesting that these might be a bit high for them to be stratocumulus. Altostratus clouds often form anywhere between 2000 and 7000 meters, suggesting that these clouds might not be altostratus, yet it is hard to decipher since this data is taken from relatively far away.

Visualization Techniques

The final image was captured on an iPhone 16 Plus with a 24mm equivalent lens. The following table presents the exact properties of the final image.

Camera Settings	Value of Settings
Focal length	26 mm
Aperture	f/1.6
Shutter Speed	1/60 s
ISO	400
Size	5712×4284 pixels

Figure 2: Image Properties

The field of view for this image, with the associated camera specs, is 143.36 degrees horizontally and 127.126 degrees vertically. A few edits were made for this image, specifically related to the cropping techniques and RGB enhancement. The image was cropped from its original size (shown below) to maintain focus on the cloud formation at hand while providing a bit of context for the clouds themselves (leaving some black foreground in the image), and to remove the

reflection of the speedometer. I also adjusted the RGB curve to maintain more of an "S-shape" to increase the deep shadows from the increased moisture in the clouds and the highlights were slightly increased to emphasize the drama within the photo.

Original Image	Final Image
5712×4284 pixels	1300×691 pixels

Figure 3: Original and Edited images

Conclusion

The final image, as shown above, captures the awe-worthy beauty of the beginning of a new day. I find the most appealing aspect of the image to be depth that is solely captured by the color contrast within the cloud formations. I am very satisfied with the color adjustments and cropping choices I made with this image, especially with the amount of context that I left in the image. I would have liked to try to take an image with my Canon Rebel XS, though I didn't have access to a more advanced camera at the time the photo was taken. Overall, I really enjoy the final edits I decided to make and the atmospheric conditions that were captured.

References

[1] Matheou, Georgios, et al. "Large-eddy simulation of a stratocumulus cloud." *Physical Review Fluids*, vol. 2, no. 9, 29 Sept. 2017, https://doi.org/10.1103/physrevfluids.2.090509.

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[3] *The Interaction of Cognitive and Physiological Determinants of Emotional State - Sciencedirect*,
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