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MCEN 5151
10/03/2022
Clouds 1
Stratocumulus
August 31, 2022 7:33 PM
Boulder, CO

Introduction

The objective of this image is to capture an interesting cloud phenomenon and analyze the atmospheric conditions that arose to produce it. This image was intended to showcase a beautiful sunset over Boulder, Colorado as well as some interesting cloud phenomena. The sunset here provided an infusion of color that I think provides much-needed contrast in the image.

Location Details

Location	Scenic overlook on US-36 overlooking Boulder, Colorado
Camera Direction	West
Elevation Angle	Zero degrees
Date and Time	August 31, 2022 7:33 PM

Cloud Physics

The clouds appearing in this image are stratocumulus. Stratocumulus clouds are characterized by distinct cloud elements (hence 'cumulus') in a flat layer (hence 'strato') [1]. This particular cloud does not typically produce precipitation [1]. Stratocumulus clouds have many different species and varieties, and the clouds in my image are most likely stratocumulus stratiformis.

Below is the corresponding skew-T diagram at the time and location closest to where and when the photo was taken. The skew-T diagram shows data from Grand Junction, Colorado at 6:00 PM. This is close enough for an initial estimate of the stability of the atmosphere, but there is some inherent error using data from a location so far from the location of the image.

According to the plot, the atmosphere was very slightly unstable, as evidenced by the CAPE value of 20.23. A value of zero denotes a fully stable atmosphere, while a value of a few hundred is weakly unstable. Therefore, it is safe to assume these clouds formed due to a stable atmosphere. Additionally, the plot shows that clouds are likely to form at an altitude of roughly 6750 meters. This is consistent with where stratocumulus clouds typically appear In the atmosphere, leading to the conclusion that this is the correct cloud identification.
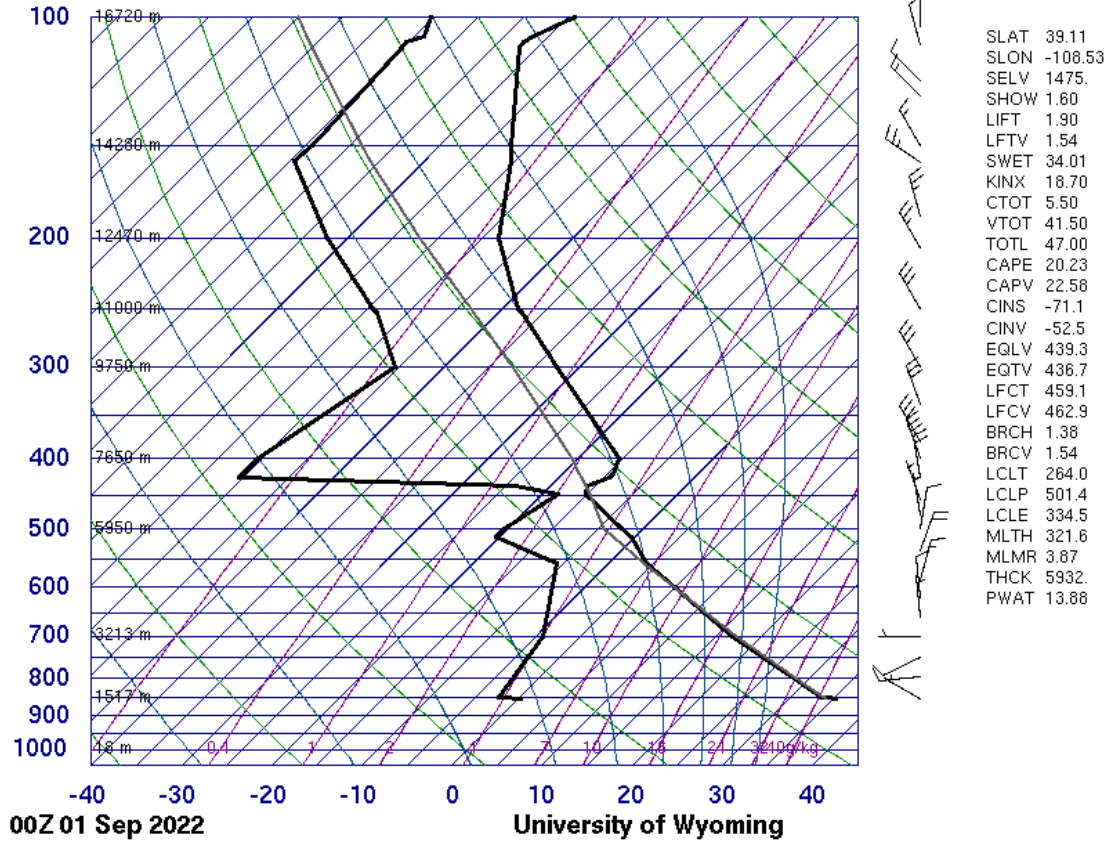
Figure 1: Skew-T diagram from the University of Wyoming [2]

Photographic Technique

This image was taken using an iPhone X with an 4mm (28mm equivalent) lens. The properties for my final image are tabulated below.

Image Property	Value
Shutter Speed	1/120 sec
Focal Length	4 mm
ISO	N/A
Aperture	f/1.8

Pixels	4032 x 3024

Table 1: Photograph Specifications

The field of view of the image according to camera specifications was 66 degrees horizontally and 46 degrees vertically. For this image, a couple edits were made. First, the RGB curve was adjusted to increase the contrast in the middle greys of the image. The other edit was a color correction. The shadows were color corrected to be purple, whereas the highlights were made to be slightly more blue. This was done to more easily visualize the details in the clouds.

Figure 2: Original Image

Figure 3: Final, edited image

Conclusion

This image shows a beautiful depiction of large-scale fluid flow in our atmosphere. I love the color in the picture, I think the color correction really brings out a lot of details, and I think it complements the natural oranges already present in the original image. One thing I struggled with that I would like to adjust is the color of the mountains in the edited photo. In the original, they are pitch black, but with the color correction they became more purple. I prefer the black of the original, but I couldn't figure out how to revert just the mountains back to black. Overall, however, I think the edits made enhance the image, and I'm very happy with the result.

References

[1] "Learn about Stratocumulus Clouds." What's This Cloud, https://whatsthiscloud.com/cloud-types/stratocumulus/.

[2] "Atmospheric Soundings." University of Wyoming, http://weather.uwyo.edu/upperair/sounding.html.

[3] "Clouds 3: Skew – T and Instability" Flow Visualization, https://www.flowvis.org/Flow%20Vis%20Guide/clouds-3-skew-t/