Clouds and Atmospheric Phenomenon
Stratus, October 11, 2021, 6:00PM MDT, Denver, CO

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MCEN 4151 - 001
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Cloud 1 Assignment Report

1   Introduction

For the first cloud assignment in MCEN 4151: Flow Visualization, I wanted to capture clouds with interesting aesthetics and thought provoking atmospheric phenomenon behind them. We often take clouds for granted, but they are a result of fluid flow phenomenon that can be seen on a near daily basis. The intent behind this image was to capture multiple clouds types during, or close to, Golden Hour. I picked this particular time of day for the interesting lighting that is available as the sun hangs low on the horizon. This kind of lighting seemed a lot more dramatic than the simple blue sky with white clouds, although I captured plenty of those in preparation for this assignment. Capturing this photo was also a fun opportunity to take advantage of the optical capabilities of my new iPhone 13 Pro and try out a piece of software that allowed me to manually control exposure settings not exposed in the default camera application.

2   Discussion of Circumstances

My submission image for the first cloud assignment was captured in Highlands Ranch, CO which is about 12 miles south of Denver. I was positioned on a high point where you can see the foothills all the way north to Boulder and was facing southwest. I don't know the exact elevation angle above horizontal however, I did point the camera slightly higher into the sky to make the several different clouds types the main subject, and keep the street out of the un-cropped image. The image was captured at approximately 6:00 pm on October 11, 2021. Because it was within an hour of sunset, the sun created some beautiful orange and gold colors behind the lower altitude clouds.

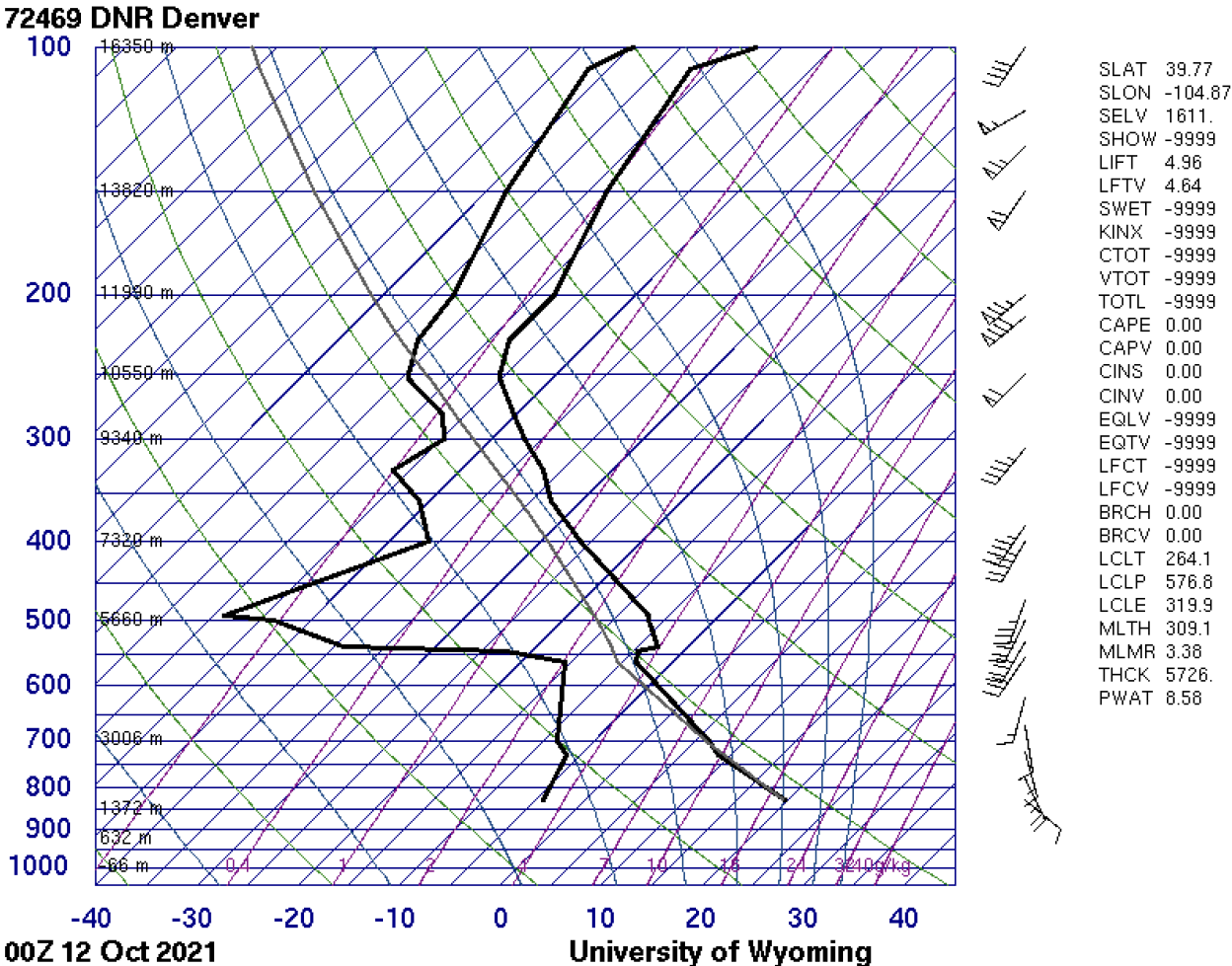# 3 Discussion of Clouds & Atmospheric Conditions

Figure 1: Skew-T plot on October 11, 2021

The Skew-T plot on October 11, 2021 reveals two different altitudes where the temperature and dew point are very close, which stood out to me as the two altitudes where the clouds in my photo are present. The low altitude clouds are at approximately 5000m and the high altitude clouds are at approximately 9500m. These altitudes agree with the photo itself. The other elements of this plot that stood out were the CAPE value of 0.00 which would indicate a stable atmosphere, and the wind markings which indicate winds aloft in excess of 50 knots. The indication of a stable atmosphere is in line with the type of clouds pictured, which seem to be stratus at the lower altitudes. The higher cloud layer seems to be a mix of altostratus and altocumulus. Additionally there had been no precipitation on this day.

4   Visualization Technique & Equipment

(a) Before post-processing   (b) After post-processing

Figure 2: Before and after post-processing

Although this photo was captured with a humble smartphone camera, there was still quite a bit of thought that went into exposure settings , framing choices, and lens choices. The smartphones of today have come a long way and now offer amateur photographers professional level tools including a choice of several different lenses ranging from ultrawide, to telephoto. The iPhone 13 Pro used to capture this photo has three different lenses to choose from. For this picture, I felt that the telephoto lens, which is a 77mm equivalent, was the best choice. It allowed me to just barely include the dark silhouette of the foothills and truly make the clouds and colors the centerpiece of the photo. It also allowed me to keep other man-made distractions such as houses, cars, streetlights, and powerlines out of the photo.

For this image, I utilized an $f/2.8$ aperture, a setting of ISO 32, and $\frac{1}{1064}s$ shutter speed. The original image had a resolution of 4032x3024 pixels, and was cropped to a resolution of 2786x1622 pixels. For the post processing, I increased brilliance to 0.33, shadows to 0.09, brightness to 0.06, contrast to 0.07, and black point to 0.06. For color settings, I increased saturation to 0.13, and vibrance to 0.03.

5 Conclusions

My image reveals the way atmospheric phenomenon can vary over different terrain and at different altitudes. I was pleased with the way I was able to capture clouds at different altitudes. But even more importantly I was pleased with the way these different clouds layers had different colors and aesthetics due to the position of the sun behind them and vantage point at which I could view from. The way the colors have an ombre effect was my favorite part. My post processing could always use improvement to allow me to utilize the colors in the photo to full effect. The blue color higher in the sky blends nicely into gold/orange seen just over the dark silhouette of the mountains. I could develop this idea further by choosing other times of day that provide interesting lighting, such as early morning where the bottoms of the clouds can appear red. Another idea for development could be to choose some different camera angles which might require a hike or a flight to achieve a better vantage point. All things considered, this image reveals some great fluid physics and underscores how good digital sensors and computational photography have become.