The Photography of Clouds

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Introduction

For my first clouds assignment, I decided to take my photo on October 10th, 2019 during a cold afternoon. The weather in the morning was chilly and snowing while the afternoon calmed and these beautiful clouds formed over Boulder. Cumulus and stratocumulus clouds rolled through the sky and glowed in the afternoon sunset.

Description of the Cloud

This image of the cloud was taken at 6:32 pm on October 10th facing north-west near Scott Carpenter Park in Boulder, CO. A skew-t diagram in figure 1 is given to understand the weather of the day leading to the clouds seen. The atmosphere is likely a stable atmosphere as the CAPE value in figure 1 is 0.00.

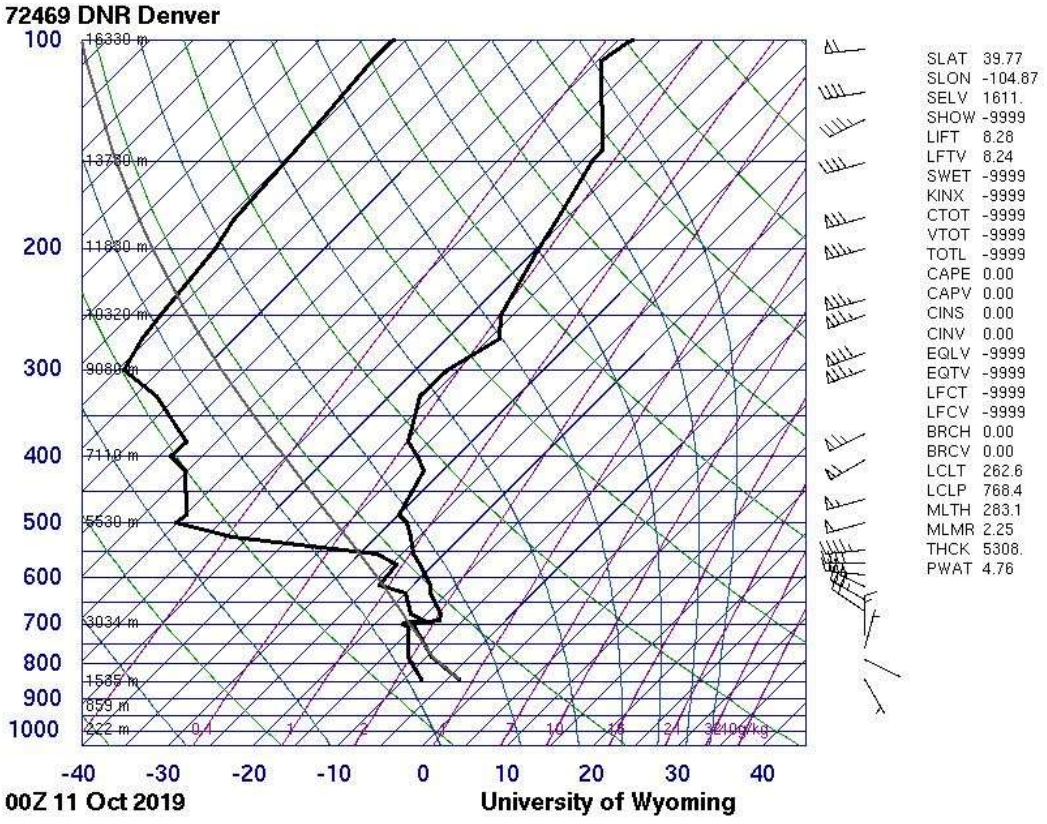

Figure 1: Skew-t diagram from October 11 00Z 2019 of Denver's sounding.

As the dew point temperature and temperature lines approach each other between 1000-3000 m, I believe the clouds photographed are around that elevation. The wind was recorded around 3 m/s around this time. The cloud was assumed to be 200 m in length with a density of 1.0 kg/m^3, and a viscosity of 1.7*10^-5 Ns/m^2. The Reynolds number is calculated to be which describes turbulent air flow:

$$Re = \frac{\rho V D}{\mu}$$

$$Re = 3.5 * 10^7.$$

From figure 2, a ceilometer reflectivity sensor indicates there is cloud activity above Boulder roughly at 2000 m. This Ceilometer sends a laser beam into the atmosphere which reflects off the cloud's water particles. This machine can accurately calculate the distance a cloud is above the ground via geometry and the time it takes for the reflected laser beam to return to the Ceilometer device.

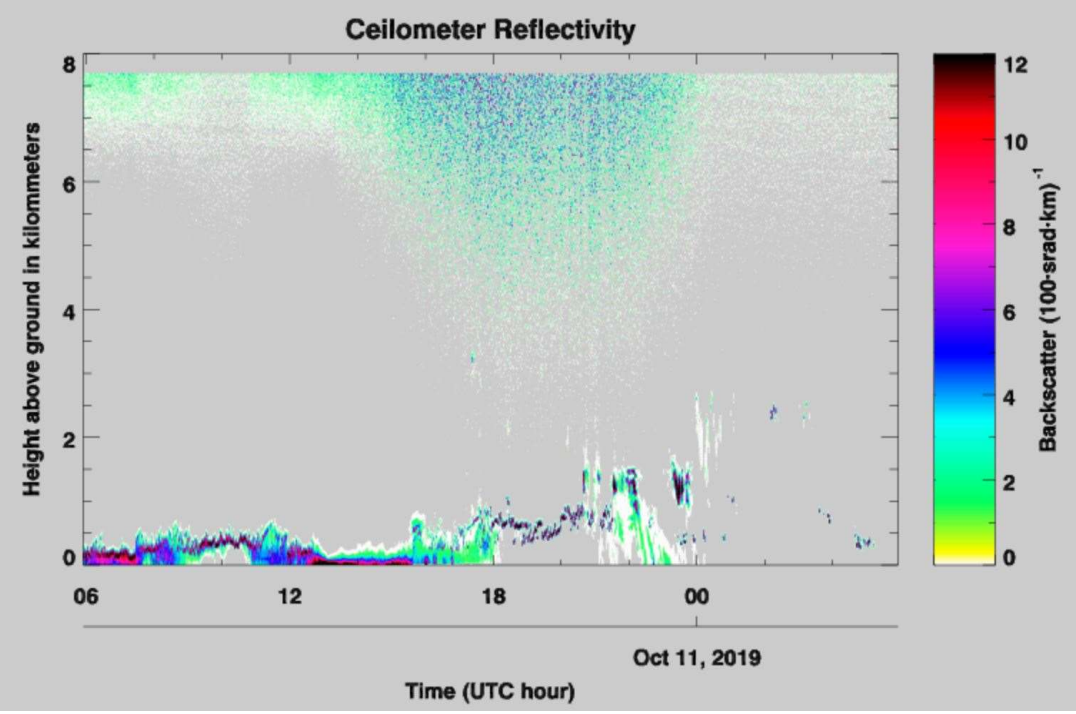

Figure 2: Ceilometer reflectivity measurement readings

This cloud formation is believed to be a Cumulus cloud with Stratocumulus clouds behind it. Cumulus are often described as "fluffy" in appearance. The name Cumulus derivates from the Latin cumulo-, eluding to "heap" or "pile". These massive particles of water in the atmosphere are generally found at low elevations roughly around 2000 m or less. Stratocumulus clouds are extremely common and form after a cold front around 2000 m or less in elevation. They are characterized by being lumped together and generally large than Cumulus clouds.

Photo Editing

This image was taken on a Google Pixel 3 camera with settings f/1.8, ISO 38, with a shutter speed of 1/197 on a 4.44 mm lens. With relatively stagnant clouds, the photographed cloud traveled less than a couple feet during the exposure period. The original image was 4020 x 3020 pixels. The image was taken during sunset which added a glow to the belly of the cloud. Figure 3 gives context to the surroundings of the cloud within the original photo. For editing the image, I used Gimp to crop, rotate, and resize the image. No color changes were made as to capture the natural look of the cloud.

Figure 3: Original image

Conclusion

The overall ambience was captured in this image to produce an accurate photo of a cumulus cloud. I am pleased with the way the image turned out and I believe I was able to accurately choose the cloud type from measurement sensors.

References

1) "Atmospheric Soundings." *Atmospheric Soundings*, weather.uwyo.edu/upperair/sounding.html.
2) "Cumulus Clouds." *Wikipedia*, en.wikipedia.org/wiki/Cumulus_cloud.
3) "Skywatch Observatory." *Skywatch Observatory*, skywatch.colorado.edu/.