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Clouds Second
MCEN 4151
12/16/23

Clouds Second Report:
Stratocumulus and Altocumulus Clouds

December 4th, 2023 at 4:48 PM
University of Colorado Boulder Campus

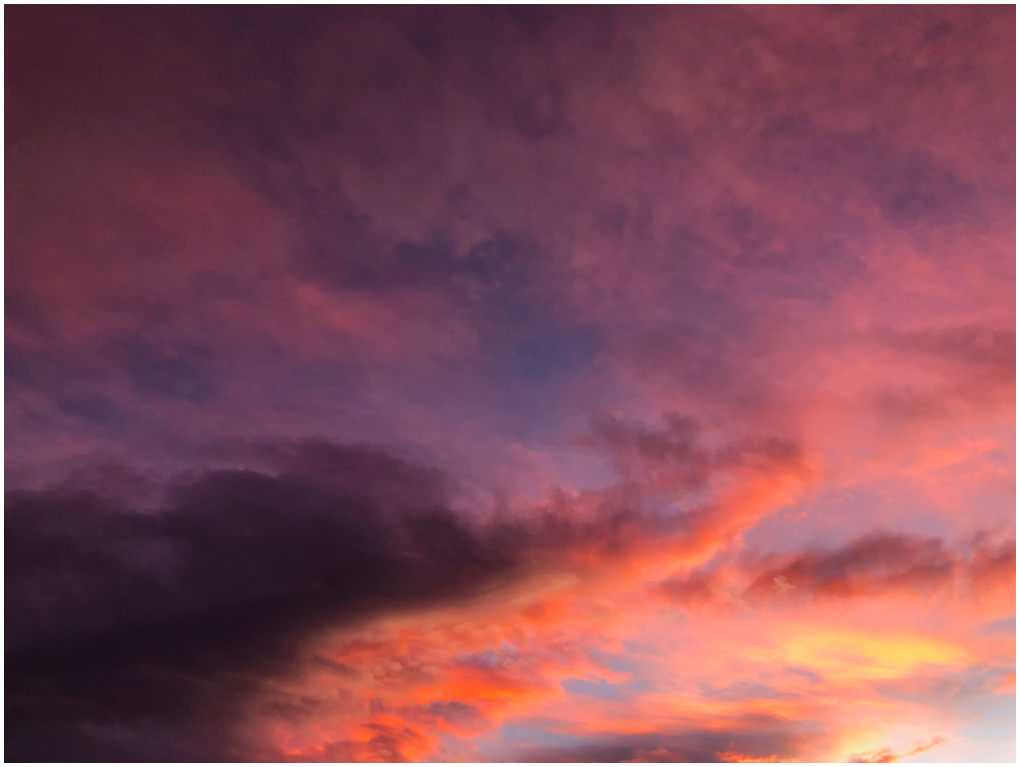

Figure 1: Stratocumulus and Altocumulus Clouds Overhead

This photograph was taken for an assignment in the course *Flow Visualization* at the University of Colorado Boulder during the 2023 fall semester. The goal of the assignment was to capture a cloud formation that was interesting to the student and submit a picture with a description of why the cloud formed as it did in regards to the atmospheric physics and weather record. The clouds stuck out in particular to the author for several reasons (figure 1). First of all, the sunset lighting enhanced the clouds. Secondly, it was interesting to see the clear distinction between the two types of clouds in the sky. The cloud type in the foreground is a stratocumulus, while the type in the background is an altocumulus. When the image was taken, the specific type of cloud formations that are shown were unknown by the author and more details were desired.

The author shot the image on the University of Colorado Boulder campus on December 4th, 2023 at 4:48 PM. The author's elevation was approximately 5,430 feet (1628 meters). The camera was located outside of the stairs of the Norlin Library on the Norlin Quad and it was pointed in the southwest direction.

These clouds can be generally classified as stratocumulus and altocumulus. A brief description of cloud physics, the weather report on December 4th and the Skew-T diagram can help support this fact. One reason clouds form is because the air can only contain so much water vapor, which is in a gaseous state. This is called the saturation point. After this point, the water molecules emerge as visible liquid water molecules in the form of clouds. The saturation point is dependent on the amount of water vapor or temperature and pressure of the atmosphere. That being said, cloud formation can happen in two different ways. These two ways are an increase in humidity or a decrease in temperature (1). When there is an increase in water vapor above the saturation point, evaporation occurs, and the moisture may rise due to atmospheric lift (1,2). When the temperature decreases, condensation occurs and the moisture is released as liquid water droplets, forming a cloud (1). The weather conditions on December 4th were part of a warm front that occurred between December 3rd to December 5th. On December 3rd, the average temperature was 34.5℉, with a maximum of 38℉. On December 5th, the average temperature was 41.5℉, with a maximum of 59℉ (3). Other atmospheric conditions during this time include an average dew point of 25.65℉ and constant pressure throughout the day. The clouds were most likely formed from a 12 hour increase in humidity from 11:56 am at 30% to 11:56 pm at 88% (3). At the time this image was captured there was wind blowing in the northwest direction at the elevation in which these clouds sat. The atmosphere was stable with a CAPE score of 0 (figure 2) (2). There was no precipitation on this day.

The clouds in the foreground are labeled as stratocumulus because they are a collected group of fluffy and thick clouds with some darkness. They are relatively low to the ground, seeming to be a low altitude cloud formation (figure 1). Examining the Skew-T diagram in figure 2, cloud formation is most likely to occur at about 3141 meters (roughly 10,305 ft) above sea level. Given the fact that Boulder is at an elevation around 1655 meters (5,430 feet) above sea level, the stratocumulus cloud would be roughly 1500 meters (4921 feet) above ground level and would be in the less than 2000 meter range that would classify it as a low level cloud. The clouds in the background can be justified as being altocumulus for several reasons. First of all based on physical appearance, the clouds look like a thin clumped sheet of clouds. They are also relatively low to the ground, but still higher than the stratocumulus clouds previously mentioned, seeming to be a low to middle altitude cloud formation (figure 1). Once again examining the Skew-T diagram in figure 2, this cloud formation in particular is most likely to occur at about 7400 meters (roughly 24272 ft) above sea level. The altocumulus cloud would be roughly 5745 meters (18848 feet) above ground level and would be in the 2000 meter (roughly 6,500 feet) to 6000 meter (roughly 20,000 feet) range that would classify it as a mid level cloud.

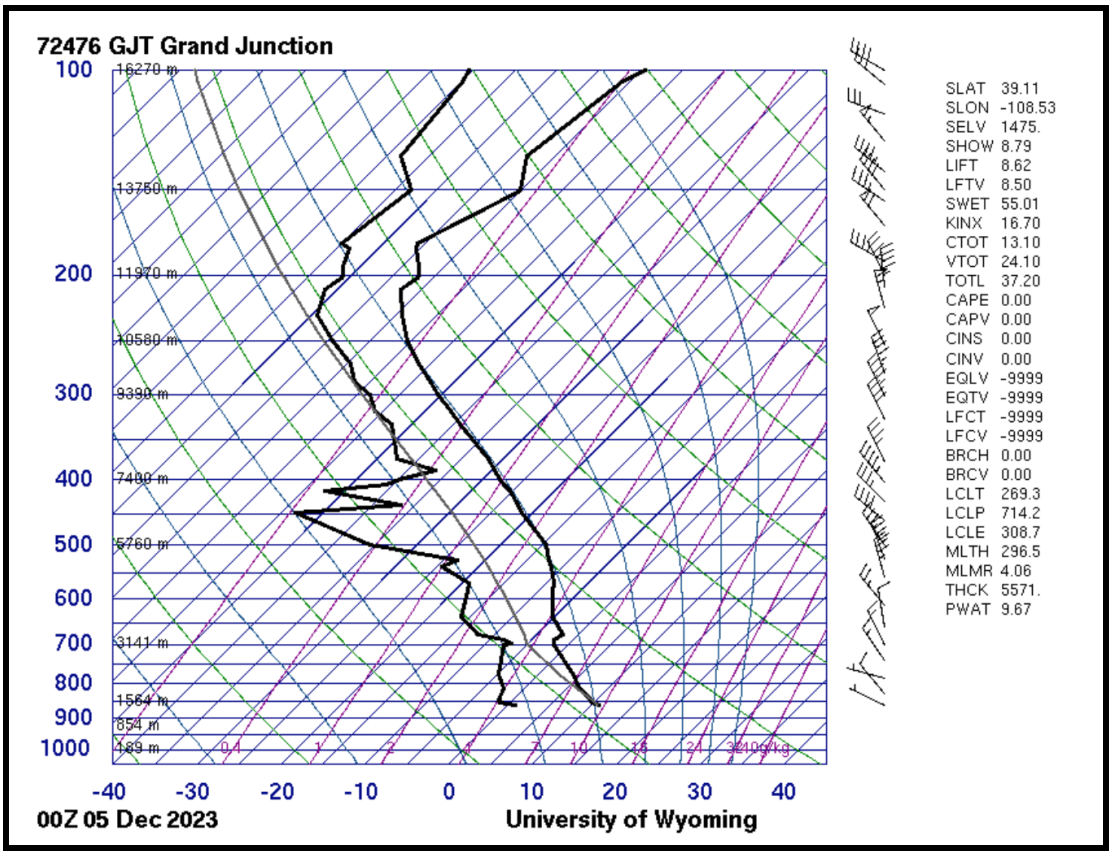

Figure 2: Skew-T Diagram

This image was taken with an apple iPhone 8. The automatic settings of the phone were used. After focusing on the sky the settings used were an ISO of 64, shutter speed of 1/120 second, f-stop of 1.8, and a focal length of 28 mm. The image was manipulated through the program *Darktable*. The following adjustments were made:

Local Contrast

- Detail: 106%
- Highlights 87%
- Shadows: 72%
- Midtone range: 0.331

Linear Chroma Grading

- Global chroma: +17.43%
- Shadows: +19.27%
- Mid-tones: +17.35%
- Highlights: +4.43%

Perceptual Saturation Grading

- Global Saturation: +4.59%

Perceptual Brilliance Grading

- Global Brilliance: -3.67%
- Shadows: -4.59%
- Mid-tones: +4.59%

The effects these adjustments made to the original image can be compared to figure 3.

Figure 3: Unedited Image

This image reflects altocumulus cloud formation on an autumn day with a stable atmosphere and light wind. I enjoy this image because it shows two different groups of clouds illuminated differently by the sunlight. Through this project I have learned more about identifying different types of clouds.

References

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