

# **Clouds Second Report**

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*Cirrus and Stratocumulus Clouds on 10/17/2023 at 6:59 PM in Broomfield, CO*

**MCEN 5151: Flow Visualization**

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## Context and Purpose



*Figure 1: Sunset with a background of cirrus clouds and a foreground of stratocumulus clouds on November 3rd, 2023 at 6:08PM. Taken at the Broadlands Golf Course in Broomfield, Colorado*

Capturing a visually unique cloud photo is difficult in that many aspects such as lighting, atmospheric conditions, and cloud type must align. I was particularly excited to see the above cloud formation as it occurred at the intersection of these aspects, taken during a windy day at sunset. These conditions were perfect for demonstrating flow, as the purpose of this photograph was to demonstrate flow within clouds for the “Cloud First” assignment of MCEN 5151, Flow Visualization.

### **Circumstances**

This image was captured at the Broadlands Golf Course in Broomfield, Colorado. It was taken while facing Northeast at an angle of  $40^\circ$  from the ground, with the clouds coming from the South and lighting from the West via the setting sun. The specific point at which the photo was taken is located at an elevation of 5335 feet above sea level. The photo was captured at 6:08 PM on November 3rd, 2023, right at the peak of sunset.

### **Statements & Data**

The cloud formation in Figure 1 is most likely a combination of a cirrus and stratocumulus formation. Qualitatively, there are a number of visual aspects the clouds have that indicate they are stratocumulus. The most prominent of these is the shape. The formation in the foreground has several large layers of continuous sheets with a slightly lumpy appearance. These lumps indicate the basic formation of cumulus. We can further visually categorize the formation using the color, thickness, and size of the clouds. As seen in Figure 1, the clouds are mostly gray and white. In addition, we can observe that clouds are moderately thick, however not as thick as nimbostratus, meaning that they must fall between the cumulus and nimbostratus categories in terms of thickness. Finally, we can see the individual clouds are fairly large with defined edges, but slightly smaller than altocumulus clouds. All these factors imply that we are seeing stratocumulus clouds. In the background, we can see that the formation is likely cirrus as they are short, detached, and at a higher altitude than the formation in the foreground.

There is also quantitative data to support this assumption. We can examine atmospheric conditions via Figures 2 and 3 to help categorize the cloud.

CU-Boulder Weather Observations: 11/03/23 11:55p

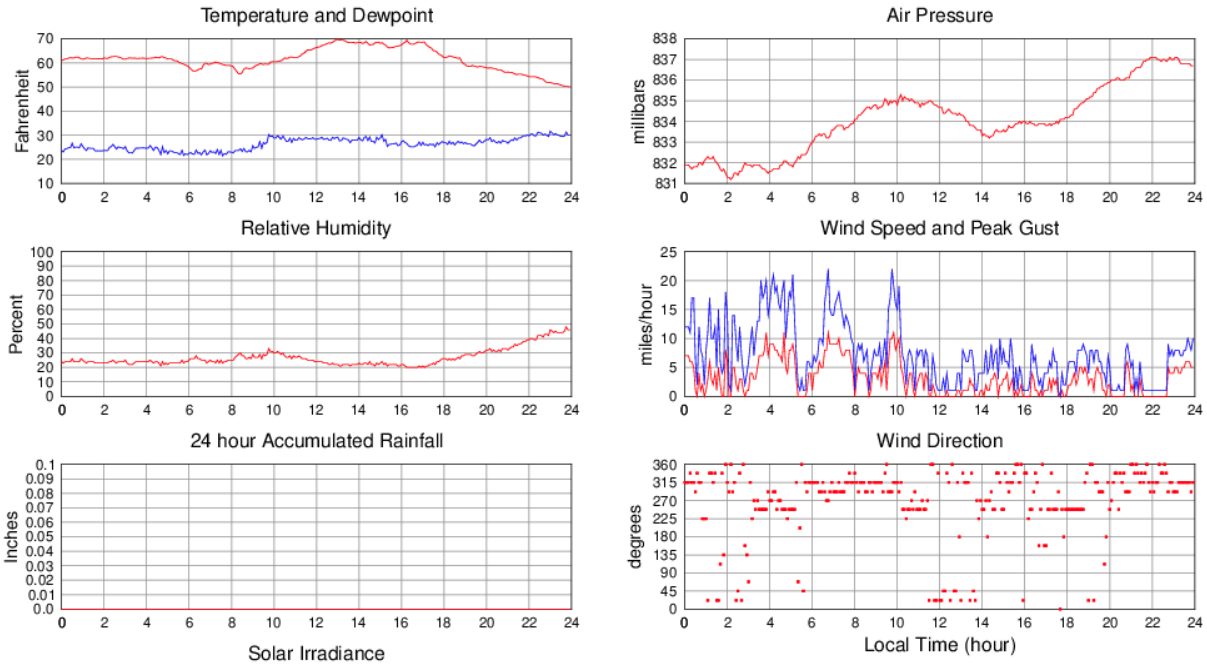


Figure 2: Weather data via ATOC for Boulder, CO, on 11/3/2023

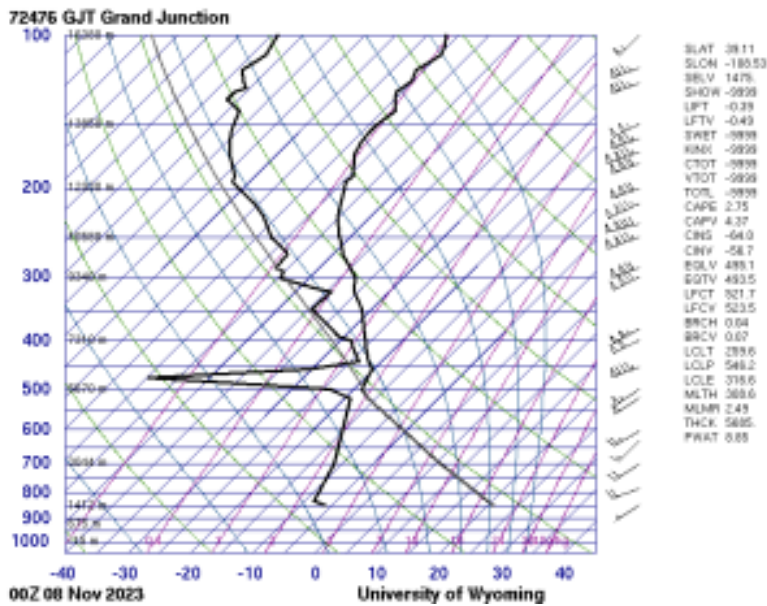


Figure 3: Skew-T diagram from Grand Junction, CO, on 11/3/2023

We can gather information regarding weather conditions from Figure 2. The most significant information is temperature, precipitation, humidity, and wind speed. Stratocumulus clouds form in a temperature range of 5-20°C, a range that is relatively cool yet not cold enough

to cause ice crystal formation. We can read from the graph that the temperature was about 10°C. We can also see that there was a 0% chance of precipitation and 46% humidity at the time the photo was captured. The cool temperature, low humidity, negligible precipitation, and mild wind speed are all conditions that cause stratocumulus cloud formation. Cirrus clouds arise in similar conditions, which Figure 2 supports.

There is also important data provided by the Skew-T diagram in Figure 3. It must be noted that the diagram was generated in Grand Junction, Colorado. This location is at a significantly lower elevation, and over 265 miles East of Broomfield, Colorado, meaning that this data may not be an accurate representation of the conditions in Boulder. However, it can still provide relevant information regarding altitude and wind. The Skew-T diagram indicates that the region that contains the most cloud development is between 3,000 to 6,000 meters. This is interesting in that stratocumulus clouds typically form around 2,000 meters. This discrepancy can be attributed to the data being gathered at a significantly different geographic location from Boulder.

## Photographic Techniques

Mild edits were made to create the final image. The color grading was adjusted to highlight the edges of the clouds. The white balance was adjusted to compensate for the dim lighting conditions from the sunset lighting. Finally, the image was cropped to cut out power lines and trees.



*Figure 4: Original Image*

Camera information is listed below:

- Camera: iPhone 13 Pro (Editing via Lightroom)
- ISO: 40
- Focal Length: 43mm
- Exposure: f1.5
- Object-to-Lens Distance: ~1000m
- Image Dimensions: 4032px x 3024px (4:3)



### **Comments on Image**

Overall, I thought that the image was quite interesting, as it was able to effectively capture a combined cirrus and stratocumulus cloud formation. The dynamic range did a good job highlighting the physical characteristics of the cloud. Most importantly, I enjoyed how well this photo captured the flow occurring within the clouds. There are a few aspects of the image that I dislike, however. Some of these are the contrails in the image, as I feel that they could potentially distract from the cloud formations I was trying to emphasize. I would remedy this in a future photo by using more involved editing software such as photoshop to remove the contrails.



## References

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