University of Colorado Boulder

MCEN 4151: Flow Visualization

2021 Fall Clouds First Report

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1. Introduction

The intent of this image was to capture a collection of clouds and explain both the theory behind how the clouds were formed and the photographic effect of the clouds. This is my first cloud assignment for MCEN 5151 Flow Visualization. This image shown in Fig.1 was taken on October 2, 2021 at 6:34 AM on the peak of Mount Falcon in Morrison, Colorado. The exact coordinates are: 39°38'43.6"N 105°12'35.6"W. The original inspiration for this image was the low clouds/ fog that I had never experienced before. On this particular day the fog was extreme. In the parking lot before the hike I could barely see 25 meter in front of me. I immediately thought of this class, pulled out my camera and started snapping pictures.

Figure 1: 2021 Fall clouds First captured image

The purpose of this picture was to understand the forces of fluids better particularly of clouds while exploring the concept of flow visualization and how to best represent a phenomenon through a lens. This report will thoroughly go though classification and understanding of the cloud patter. After learning about cloud types and psychometrics a further analysis was done on the image and clouds, those results can be found in this report.

2. Cloud Science and Psychometrics

On October 2nd it was a chilly Saturday morning, we woke up at 5:00 AM to get ready for the hike. As we entered Morison, Colorado we entered this mysterious bowl of low clouds/fog that was like nothing I had ever experienced before. Immediately I was wide a wake and taking pictures and experimenting by making loud noises and waving our hands to see if there was any difference in the environment. Using a SKEW-T diagram from the University of Wyoming's College of Engineering's website[1], I was able to report some finds about this image and the clouds and atmosphere captured in the image. As seen in Fig. 2, the CAPE exactly at zero shows a very stable atmosphere.

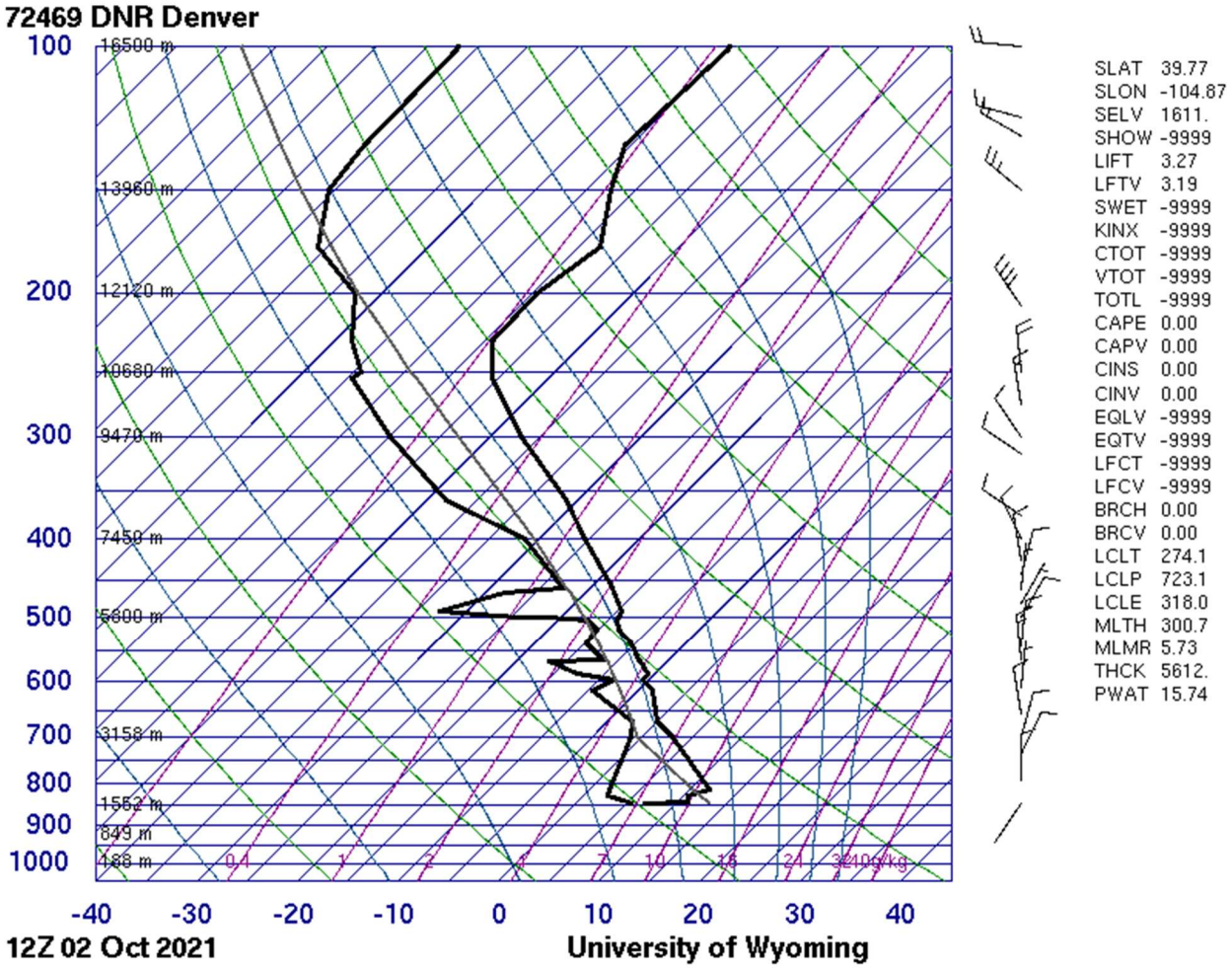

Figure 2: SKEW-T diagram for 6:00 PM October 2, 2021 MST

Additionally, we can also gather from Fig.1 the temperature and dew point temperature lines are very close together between 1552 meters and 5800 meters suggesting that the air is saturated or very close to be saturated. Dew point temperature is never greater than air temperature but can be close. When air temperature and dew point temperature are close, the air has a high relative humidity[2]. With all of these details I classify the lower clouds as fog and the higher clouds as stratocumulus due to the low nature of them and since the CAPE was zero. The fog could have been caused by many different reasons. Mount

Falcon is located in a bowl and there could have been a cloud moving west and got blocked by the clouds and dropped. During my presentation of this image to the class we discussed how the fog is probably not represented well on the SKEW-T diagram because it is below the threshold that the sensors start recording data. I think it was caused by dense cold air that was trapped in the area and became higher pressure and denser. I believe fog forms when water vapor condenses.

3. Photographic Technique

As stated earlier I was located on top of Mount Falcon to take this image, when the picture was taken I attempted focus on the small mountain/ hill emerging from the fog. I used a Canon EOS Rebel T5 with a Canon 24-105mm lens and this image was taken as the maximum focal length of 105mm. The other metadata can be seen below in Table 1.

Camera Setting and Metadata

Camera	Canon EOS Rebel T5 DSLR
Lens	Canon EF 24-105mm f/4L IS II USM
Aperture	f/14 24 mm
Exposure	1/400 sec.
Focal Length	105mm
ISO	100

Table 1: Camera Settings and Metadata

The unedited(raw) image can be seen in Fig. 3 in a reduced quality, the original size of the image was 3088 by 2056. As you can see there is a very small difference between the unedited and the edited. I really liked the raw photo so I made very little adjustments by just lightening it up a big and adjusting the contrast slightly. No cropping was don't as I liked the original frame.

Figure 3: 2021 Fall clouds First captured image Unedited

4. Conclusion

Being my first cloud image it was really cool to learn more about how clouds are formed and the classification behind them. This assignment gives us a look at low forming clouds in Morison, Colorado on a fall morning. It was interesting to see how the fog affected our vision so much. I was mesmerized by the fog for a couple days after this hike. Sadly, the SKEW-T diagram probably doesn't have data for the fog, it would have been cool to see what the data would have looked like. I imagine the dew point temperature and temperature lines are very close. I plan to continue to practice identifying cloud types and reading SKEW-T diagrams Overall really enjoyed taking time to enjoy the things that I often don't think about. Additional photos from the hike can be seen at the end of the report in Figures 4,5,6, and 7.

Figure 4: Additional Image from October 2, 2021

Figure 5: Additional Image from October 2, 2021

Figure 6: Additional Image from October 2, 2021

Figure 7: Additional Image from October 2, 2021

6. References

[1] Department of Atmospheric Science. (2020, September 20). Retrieved October 22, 2020, from http://weather.uwyo.edu/upperair/sounding.html

[2] *Observed Dew Point Temperature: Indicates the Amount of Moisture in the Air*, Department of Atmospheric Sciences (DAS) at the University of Illinois at Urbana-Champaign http://ww2010.atmos.uiuc.edu/(Gh)/guides/maps/sfcobs/dwp.rxml#:~:text=When%20the%20dew%20point%20temperature,GREATER%20than%20the%20air%20temperature.&text=Relative%20Humidity%20can%20be%20inferred,has%20a%20high%20relative%20humidity.