Cumulus and Cumulus Fractus Clouds

3/26/18, 1:09pm, Copper Mountain Colorado

Clouds Second: Lara Buri

MCEN 4151-001

Figure 1: Final Image

INTRODUCTION

This image was taken for the Clouds Second assignment for the Flow Visualization class. While skiing at Copper Mountain, I noticed how beautiful the sky looked with scattered clouds beginning to build up in the northwest. The clouds complimented to white mountain tops very beautifully and I felt it would be a great opportunity to not only show the beauty of the clouds, but the landscape as well. I knew that a cold front and snow storm were coming in that afternoon and I feel like the clouds in the image capture the "calm before the storm."

CLOUD ANALYSIS

Image Circumstances

The final image, shown in Figure 1, was taken at Copper Mountain, Colorado facing west at 1:09pm on March 26th, 2018. The camera was tilted about 10˚ from the horizontal. At the time the photo was taken, the temperature was about 28˚ Fahrenheit with a maximum wind speed of about 27 mph from the west[1].

Cloud Identification and Physics

The clouds shown in Figure 1 are cumulus clouds and cumulus fractus clouds formed in a stable atmosphere. The clouds in this image have a fairly uniform flat bottom, most likely a result of the flat lifting condensation level. The lifting condensation level is the height at which an air parcel would saturate if lifted adiabatically, meaning no heat transfer occurs[4]. An air parcel is simply a volume of air that acts independently of the surrounding air, assuming that no heat transfers into or out of it. The flat lifting condensation level phenomena is shown in Figure 2:

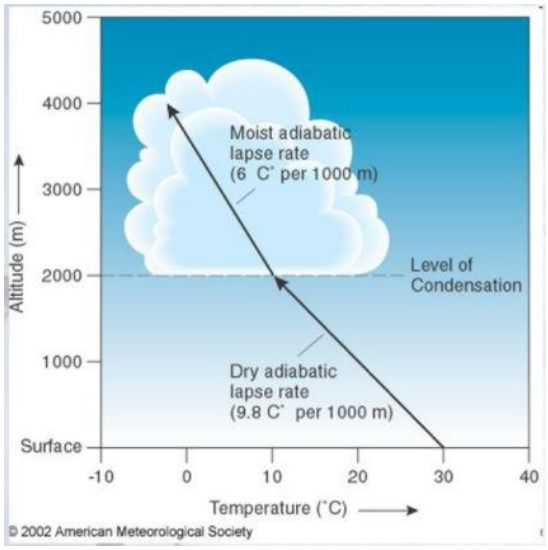

Figure 2: Flat Lifting Condensation Level[2]

The height of the clouds can be estimated using both the flat lifting condensation level and the skew-T diagrams shown in Figure 3 below. The skew-T on the left shows the atmospheric conditions for the morning of the 26th and the skew-T on the right shows conditions for the evening of the same day. Both diagrams are given because a cold front and snow storm began to come in right around 1:00 pm when the image was taken. The cumulus clouds indicate that, at the time, the atmosphere was most likely stable, so the skew-T for the morning will suffice for these purposes.

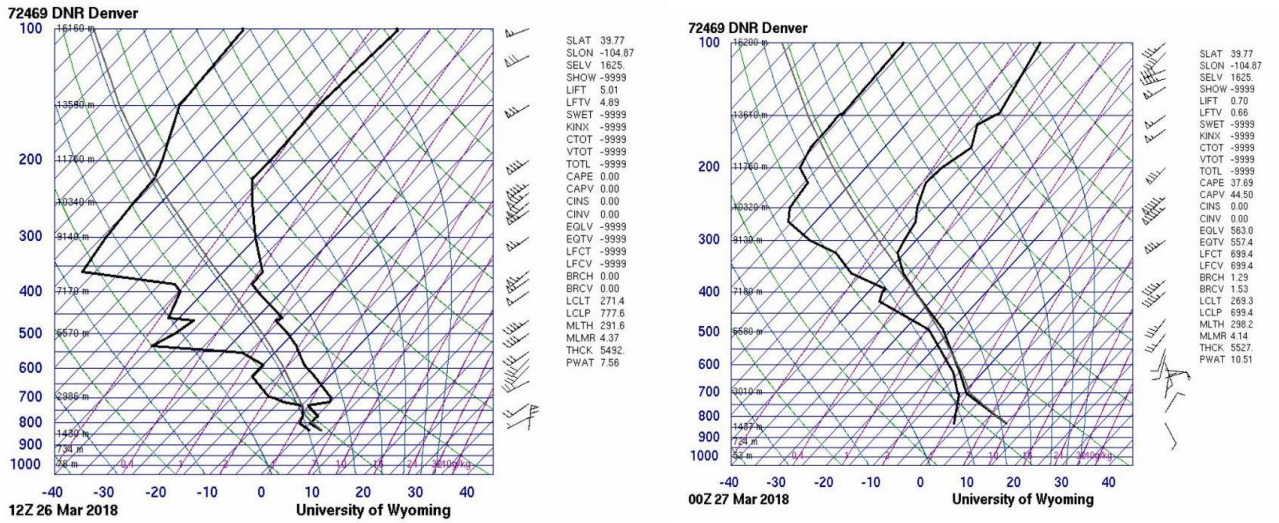

Figure 3: Skew-T Diagram (Left: Morning, Right: Evening)[5]

As evidenced by the diagram, the temperature profile (right black line) and the dew point (left black line) come closest together around 2,000 m above ground. Due to the storm front moving in throughout the day, the winds gradually picked up. Winds aloft at the cloud height are the most likely culprit for the formation of cumulus fractus clouds, which have ragged edges and look broken up[3]. These clouds can be seen in the front-most clouds in Figure 1.

Around 4:00pm, the clouds began to build up and it started to snow. The skew-T diagram on the right shows that the atmosphere became unstable in the evening, which supports the fact that a cold front came in during the afternoon. The right diagram in Figure 3 also shows that clouds were forming all the way from 2000 m to about 5000 m, showing a cloud build-up characteristic of a storm.

PHOTOGRAPHIC TECHNIQUE

This image was taken with an Apple iPhone 6 with a focal length of 4 mm. The exposure time was 1/13333 sec, the f-number was f/2.2, and the ISO speed was ISO-32. The visibility on March 26th was about 8 miles[1], and the width of the photo was probably around 1 mile from the left mountain foreground to the right. The original photo, shown in Figure 4, had dimensions 3264x2448 pixels and the final image had dimensions 3264x2370 pixels.

Figure 4: Original Photo

Very little editing was done in Photoshop. The contrast was increased slightly to bring out the dark trees against the white snow, and the saturation was increased slightly to bring out the blue sky. Minor cropping was done to get rid of a ski lift at the bottom of the original photo, and a few touch-ups were made to eliminate any distracting elements. I wanted to keep the photo as natural as possible, because I felt as though all the colors were captured quite well in the original photo.

CONCLUSION

This photo came out well despite the fact I was using a phone camera. I believe I captured the clouds very well and the foreground does not overpower the image, rather, it adds to it and helps accent the white, puffy clouds. Because a phone camera was used, the resolution is not as good, but it is hardly noticeable in the image. Perhaps if the image is displayed larger it would become noticeable. I think it would be interesting to see what this photo looked like as a panorama, so I could capture even more of the cloud formations to the left and right of the original image. With the resources and timing I had with this photo, I wouldn't change anything as I believe it came out nicely.

REFERENCES

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