Clouds 1

Cumulus Humilis

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MCEN 4151: Flow Visualization

Purpose

The intent of this image was to capture a visually appealing photograph of a cloud that would also provide information about clouds and the current atmospheric conditions at the time the photo was taken.

Circumstances

This image was taken at the top of Wolf Creek Pass Summit near Pagosa Springs, Colorado. The elevation this photo was taken at is approximately 11,900 feet. The clouds in this image were approximately another 5,000 to 7,000 feet above the summit at which the photo was taken. The image is taken facing east but with the camera facing upwards towards the sky with the back of the camera at an angle of about 50 degrees relative to the ground. This image taking technique was used to have minimal landscape or foreground in the image. The intent of doing so was to focus solely on the clouds for the purpose of this assignment and not be distracted by other objects in the image. This photograph of clouds was taken at 1:28 pm on October 3, 2015.

Atmosphere

The clouds that appear in this image are a family of Cumulus clouds. In fact they are known as Cumulus Humilis clouds.[1] These clouds are relatives of Cumulus clouds that generally form over mountainous terrains. They have less vertical extent than normal Cumulus clouds and indicate fair weather. However, these clouds generally appear in unstable atmospheric conditions. The fact that the atmosphere was unstable makes sense for that day. The temperature at the time that the photo was taken was 66°F and the wind was strong at the top of the summit. The previous weather that day was sunny and calm in the morning but more clouds moved through as the day went. The weather conditions were fair that day until about 8pm that night when we experienced a little rain. This explains the Cumulus Humilis formations that were seen above the mountains earlier that day. The day before this photo was taken there were thunderstorms.

These atmospheric conditions can also be described by the skew-T diagrams. Because this image was taken in Pagosa Springs, the skew-T plots for Grand Junction and Denver were both considered. Also, because this image was taken mid-day at 1:28 pm, the diagrams for 6am and 6pm were observed to ensure correct assumptions for the weather at the time of the photo were used. A relatively easy way of quickly looking at these multiple diagrams is to consider the CAPE (Convective Available Potential Energy) value for all these diagrams. The CAPE will be equal to zero if the atmosphere is stable, it will be greater than zero if the atmosphere has unstable layers, and a CAPE of 500 or greater indicates thunderstorms. It was mentioned earlier that the day before we had thunderstorms, the CAPE value for the evening of October 2nd, 2015

[1] "Cumulus Humilis Cloud." *Wikipedia*. Wikimedia Foundation, n.d. Web. 15 Oct. 2015.

(October 3rd 00z) was 470 for Denver and 238 for Grand Junction. The CAPE values for 6am of October 3rd (October 3rd 12z) were both zero for Denver and Grand Junction which aligns with the fair weather conditions observed that morning. However, it was decided to take the 6pm data for the day the photo was taken since the time of the photo is closer to the 6pm data and the atmospheric conditions are explained better by this data. The CAPE values for the evening of October 3rd (October 4th, 00z) are 39 for Denver and 2 for Grand Junction. These values indicate unstable layers in the atmosphere for the time my photo was taken which aligns with the fact that I was able to capture Cumulus Humilis clouds that day.

Overall, I decided to look at the skew-T diagram for Denver for the evening of October 3rd, 2015 to represent the atmospheric conditions I observed in this image since Denver was slightly closer to my location than Grand Junction. The skew-T diagram for these conditions can be seen below[2]:

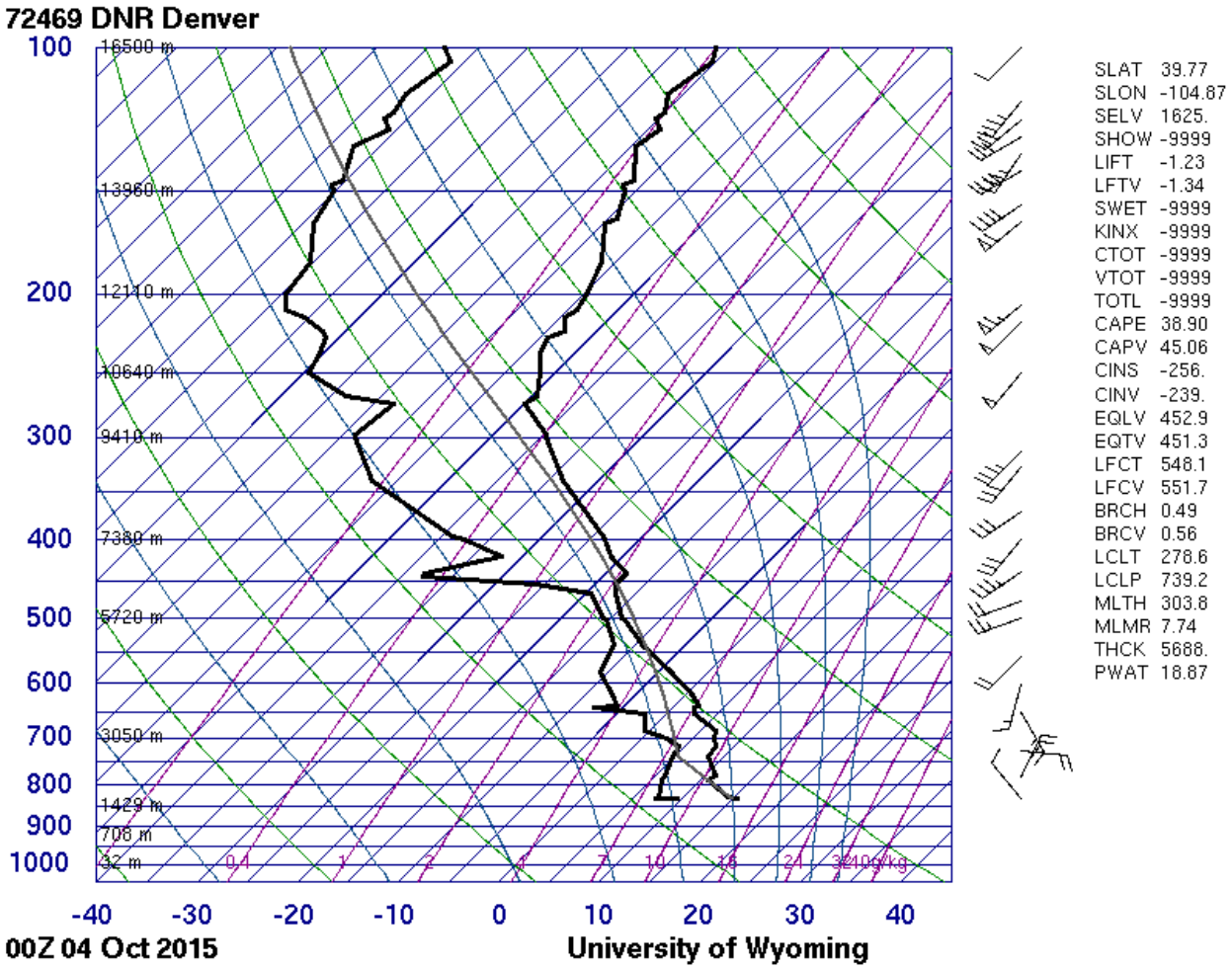

Figure 1: Skew-T Diagram

[2] "Atmospheric Soundings." *Atmospheric Soundings*. N.p., n.d. Web. 16 Oct. 2015.

From this skew-T diagram it can be seen that clouds that day could be expected to be seen in the range of approximately 5000 to 6000 m as seen where the lines of the diagram come together. This is approximately 16,000 to 20,000 ft. This makes sense for the clouds I saw since I estimated them to be between 5,000 and 7,000 ft above the summit at roughly 12,000 ft. Also, from the stability of this diagram, the clouds I observed seem reasonable.

Photographic Technique

This photograph was shot using a Sony α 5000 E-mount camera with an attached 16 – 50 mm power zoom lens. This point and shoot mirrorless camera has manual focus capabilities with an ISO up to 16,000.[3] The image size shot is 5456 x 3632 pixels and the final image after processing is 5192 x 3200 pixels. The focal length used for this shot was 16 mm which is equal to 24 mm for a 35mm equivalent range. Many techniques were used to get the cloud photos taken into focus. By focusing on a distant mountain top, one can usually get a clear image of clouds. Because the clouds were far away, an infinite zoom was used in this image. For this photograph, the shutter speed used was 1/800th of a second since there was moderate sunlight and an ISO of 100 was used to reduce blurring and noise.

Minimal post-processing was used in the final image of the Cumulus Humilis clouds. The image was cropped a little to remove any distracting elements from the photograph such as trees, mountain top, etc. and a color enhance filter was used in Gimp. This color enhance filter was able to increase the saturation of the blue in the photograph without affecting the contrast or hue of the photo. This process was used because changing the contrast in this photo would wash out the clouds. By using the color enhancement, the clouds looked more defined. I also played with adjusting the color curves; however, I decided to avoid using them as there appeared to be information lost in the clouds by doing so. A pre-processed and post-processed image can be seen below in figure 2.

[3] "Sony α5000 E-mount Camera with APS-C Sensor." *Sony*. N.p., n.d. Web. 16 Oct. 2015.


Figure 2: Before and After Processing Images

Conclusion

The image reveals a lot of information about Cumulus and Cumulus Humilis clouds. I chose this image among nearly 60 different cloud photos taken because I really like the lighting of the photograph. By capturing the sun behind the clouds, I was able to have diffused lighting that made for a great photograph. Also, because of this, I felt more was revealed about the clouds since the varying densities and thicknesses of the clouds could be seen. However, if I were to change something about my final photograph I would probably tone down the saturation of the blue in the photograph. I did this to put the focus on the clouds and make the photograph have a classic feel but it does seem to take some of the realism about the sky out of the photograph. Overall, I think the fluid physics of these types of clouds and atmosphere in the mountainous terrain are demonstrated well in this photograph and I therefore feel that I have fulfilled my intent through this image. If I were to develop this idea further, I would try to capture a time-lapse video to show how quickly the clouds were moving by due to the wind conditions that day and how Culumus Humilis clouds can morph into other forms of Cumulus clouds quite quickly.