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MCEN 4228: Flow Visualization
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Clouds 2

Altocumulus Clouds

Figure 1 - Final cloud picture

For the second cloud assignment, I decided to focus on a larger, more dramatic cloud than I did in the first assignment. To do so I decided to wait till sunset because at that time clouds form and move over the mountains. The movement of the clouds over the mountains causes a dramatic scene that has several different cloud formations and different colors throughout them. That is the type of cloud I would like to capture.

The picture was taken on April 7th, at 6:30 p.m. in a field at the Wimbledon Condominiums. The condos are located at Colorado and 30th street. The cloud was west south-west of my location (over the Flat Irons), and I had to aim the camera at a 50^{o} angle from horizontal to capture the majority and interesting parts of the cloud. It was a very large cloud, so it could not be photographed in whole. Since it was late in the afternoon the sun was already setting in the west. This gives the nice orange tinting on the bottom of the cloud.

The clouds pictured are altocumulus lenticularis and altocumulus undulatus. This is characterized by the time of the day, location, and texture of the clouds. They are smooth and heading over the mountains, thus the lenticularis clouds. Further up, the clouds become more unstable and have a rougher texture due to the wind shearing them. This eventually results in the undulatus clouds, the wispy fingers at the top of the picture. The skew-T plot below (Figure 2) is for 6 p.m. of April 7th. To obtain the correct skew-T plot, April 8th at 00 Zulu time was used on the University of Wyoming's archive website. The

point at which clouds would form is when the dew point line (left bold line) is close to the temperature line (right bold line). This happens at approximately 8000 meters. When the air temperature approaches the dew point, the air molecules become saturated. Once the air molecules are saturated enough (high humidity), water droplets form in the sky. The accumulation of water droplets in air result in a cloud. The skew-T plot shows that the atmosphere is borderline between stable and unstable. The temperature line has a greater slope than the adiabatic lines most of the time, but there are times when its slope is less. This results in the formation of clouds. It can be seen in the skew-T that the areas with a smaller slope are around the 8000 meter range, where the clouds are estimated to have formed.

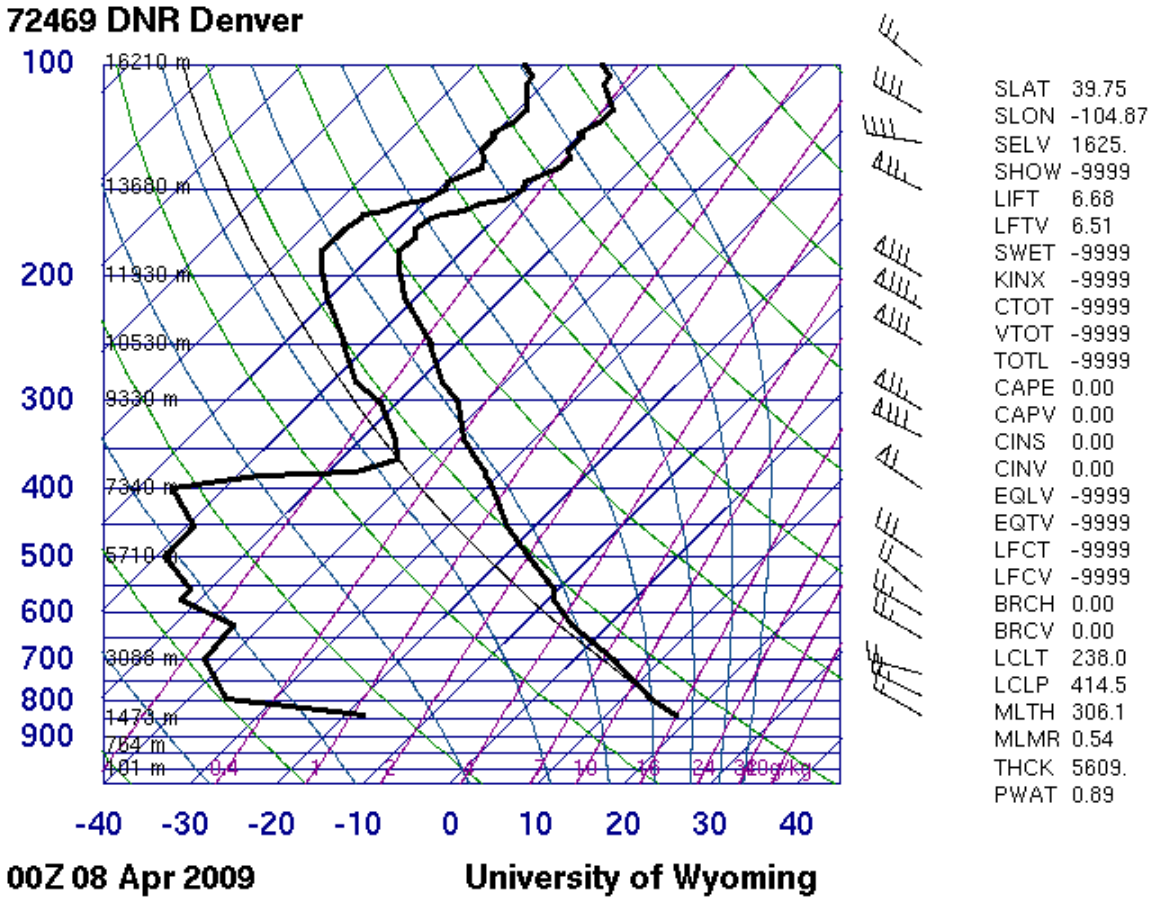

Figure 2 - Skew-T plot

Because of the height at which they form it was hard to decide upon the altocumulus cloud family. This is because altocumulus clouds form in the 2600m to 6100m range, which is well outside the altitude of my cloud. Despite this fact, the resemblance and circumstances of the cloud made me decide on the altocumulus cloud family. To estimate the cloud distance from my location, I used basic trigonometry. The height of the cloud from the ground level is 7345m (9000m-1655m), and the angle of the hypotenuse is 50^{o}. This gives the distance as 9588m. After that calculation, the field of view can be

calculated using an online resource. The distance to lens is 9588m, the lens focal length is 18mm, and the focal length multiplier is 1.6. This resulted in a field of view being 12318m x 8212m.

Table 1 - Image Settings

Photographic Technique	Value
Field of view	12318m x 8212m (7.7mi x 5.1mi)
Distance from object to lens	9588 m (6 mi)
Lens focal length	18mm
Type of camera	Nikon D80 w/ AF-S Nikkor 18-135mm, 1:3.5-5.6G ED lens
Original picture size	3872 x 2592
Final picture size	3660 x 1480
Aperture	F/9.0
Shutter speed	1/640 sec.
ISO setting	200

In table 1, all of the camera and lens settings are listed that were used to take the picture. I set the focal length to capture a large portion of the cloud that contained several different formations. This ended up being 18mm, which is the widest angle my lens can provide. The camera was set to the night mode so it would not use the flash. The other settings were automatically set by the camera. After the initial image was taken, I converted the RAW image to a Photoshop document and performed several procedures. The image was cropped to eliminate the apartments on the bottom and the tree branches on the top of the picture. Next, the clone stamp tool was used to get rid of the remaining tree branches on the bottom right corner, and then the healing tool was used to create a smoother color gradient. Finally the contrast was darkened to create a more dramatic scene.

The image shows a classic cloud formation that occurs at sunset in Colorado: altocumulus lenticularis. It can be seen that the clouds get pushed over the top of the mountain. As the clouds get higher, the wind speed increases, causing the clouds to be sheared. This results in choppier clouds, and in some cases altocumulus undulatus clouds. I like how the clouds transition from one type to the other and there is an orange glow from the sunset. I believe it has fulfilled my intents of a beautiful, dramatic cloud. To improve the picture, I would like the mountains to be included to show their position in relation to the clouds. To do that, I would need to be closer to the Flat Irons to avoid having buildings in the frame.

Sources:

"NWS Denver-Boulder, CO." National Weather Service - Central Region Headquarters Home Page. NOAA. 7 Apr. 2009 <http://www.crh.noaa.gov/den/>.

"Flow Visualization Course : Links." University of Colorado at Boulder. 12 Apr. 2009 <http://www.colorado.edu/MCEN/flowvis/links/index.html>.

University of Wyoming Department of Atmoshperic Science. "Atmospheric Soundings." Wyoming Weather Web. 12 Apr. 2009 <http://weather.uwyo.edu/upperair/sounding.html>.

TawbaWare -- Digital Camera Software and Photography. 12 Apr. 2009 <http://www.tawbaware.com/maxlyons/calc.htm>.