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MCEN 4228: Flow Visualization
2/23/2009
Clouds 1

Altocumulus Clouds

Figure 1 - Final cloud picture

Clouds are one of most underappreciated scientific phenomenon that occurs naturally. Each and every cloud is just as unique as snowflakes and with just as much complexity. Temperature, humidity, altitude, and wind all affect the formation of clouds, resulting in complex fluid dynamics. The purpose of the project is to capture a picture of a cloud and identify the conditions and phenomenon that caused the cloud to form the way it did.

The picture was taken on February 6th, at 11:21 a.m. in a field at the Wimbledon Condominiums. The condos are located at Colorado and 35th street. The cloud was due south of my location, and I had to aim the camera at a 45^{o} angle from horizontal to capture the cloud in full.

The clouds pictured are altocumulus. This is characterized by the height at which they form, which is approximately 4500 meters. The skew-T plot below (Figure 2) is for 6

a.m. of February 6th. 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). 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 result in a cloud. The skew-T plot shows that the atmosphere should be stable because the air temperature line has a greater slope than the adiabatic lines at all times. This means that the rising air is cooler than the surrounding air packets. The resulting environment isn't conducive to clouds, but yet they formed anyways. The rest of the clouds in the sky were similar to mine.

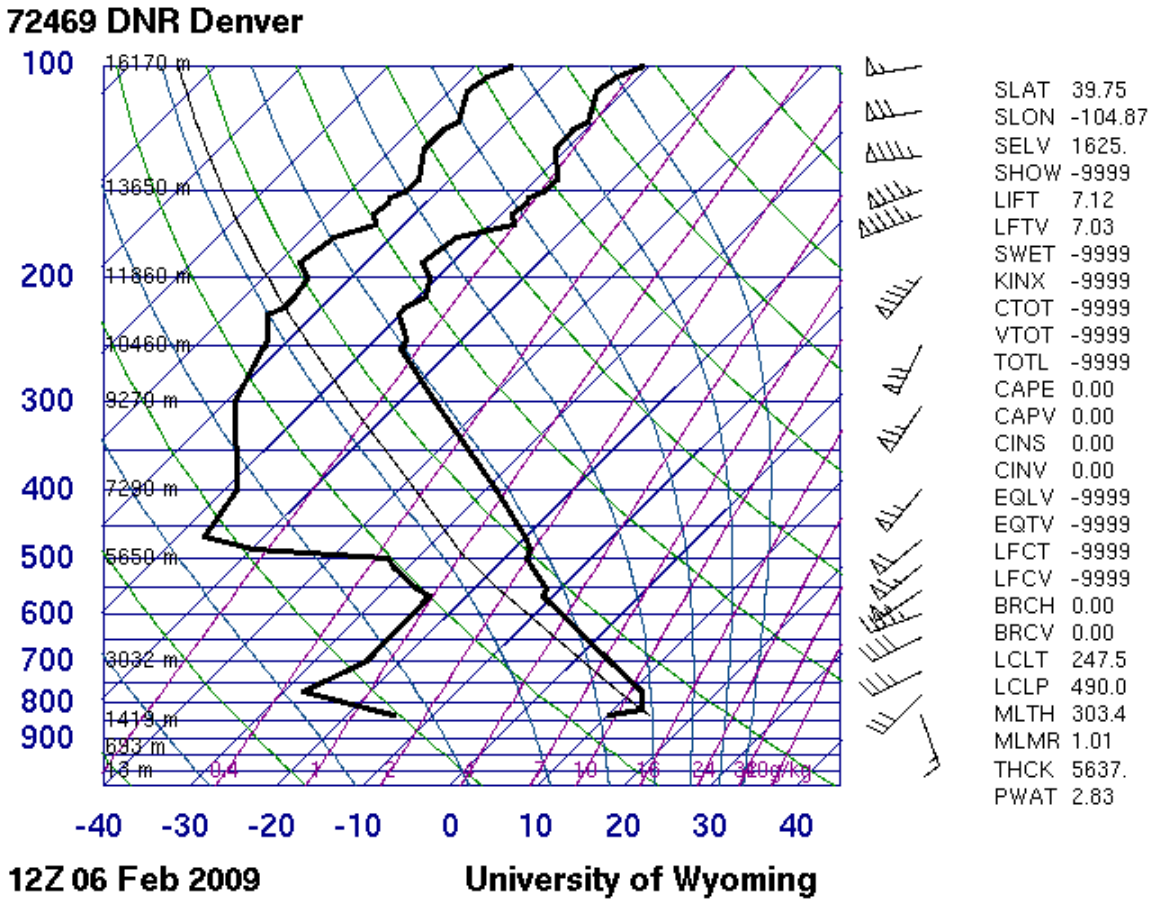

Figure 2 - Skew-T plot

Because of the height of the cloud relative to the width it is hard to decide between Cumulus with vertical growth and altocumulus. Fortunately rest of the clouds in the sky, as well as the skew-T plot, indicated an altocumulus cloud. Rest of the clouds in the sky were similar to my picture, and some were grouped together forming rain clouds. The wind for the day was generally heading towards the northeast. Because the wind was fairly steady in the NE directions, precipitation could results. The sun was shining on the cloud from the left side of the picture.

Table 1 - Image Settings

Photographic Technique	Value
Field of view	500m x 358 m
Distance from object to lens	2.54 miles
Lens focal length	90mm
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	2736 x 1964
Aperture	F/6.3
Shutter speed	1/640 sec.
ISO setting	100

Table 1 gives all of the image and camera setting used to capture the atomization of the milk. I set the focal length at just the right zoom so that the cloud would fill my field of view. The other settings were automatically set by the camera. After the initial image was captured, two Photoshop techniques were performed to further emphasis the complexity of the cloud. In Photoshop I decreased the overall contrast of the photo to show the texture of the cloud and decrease the washed out parts caused by the sun. I then cropped the photo to completely fill the frame.

The image shows a classic cloud formation that occurs in Colorado: Altocumulus. This cloud formation usually results in rainfall if winds persist. I believe that the physics of its formation are evident given the environment and skew-T plot for the day. If I was to redo the picture I would have included more clouds in the shot. This would have given the clouds size and type relative the other clouds in the sky. Every cloud is unique, for instance, this particular cloud looks like a turkey with drumsticks sticking out. This is the main reason I like the image. I also like how much vertical growth there is for the amount of horizontal growth.

Sources:

University of Wyoming Department of Atmoshperic Science. "Atmospheric Soundings." Wyoming Weather Web. 22 Feb. 2009 <http://weather.uwyo.edu/upperair/sounding.html>.

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