CLOUD IMAGE REPORT

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Flow Visualization - Hertzberg

Purpose

This image was taken to satisfy the first "Clouds" assignment of the Spring 2011 semester for the Flow Visualization course at CU-Boulder. The goal was to capture an image of an interesting cloud formation and document the meteorological circumstances surrounding its existence.

Circumstances

This image was taken in the City Park neighborhood of Denver, about two miles east of downtown. It was taken at 4:45 pm (about one hour before sunset) on Thursday, February 17th, 2011. The camera was facing southwest and the sun was setting behind the building on the right.

Cloud Formation

The type of cloud captured in this image is a cumulus cloud. Specifically, it is a cumulus humilis cloud dissipating into a cumulus fractus. The humilis portion of the cloud is shown on the right with the fuller, thicker, more opaque nature. The fractus portion of the cloud is shown on the left by the thin, transparent, dissipated formation. Cumulus clouds are relatively low-level clouds. The formations captured in this image were between four and six thousand feet above the ground. As you can see in the Skew-T plot to the right, above Denver International Airport, the altitude at which the atmosphere came closest to producing clouds was around 3200 meters above sea level. This equates to about one mile above the ground in Denver.

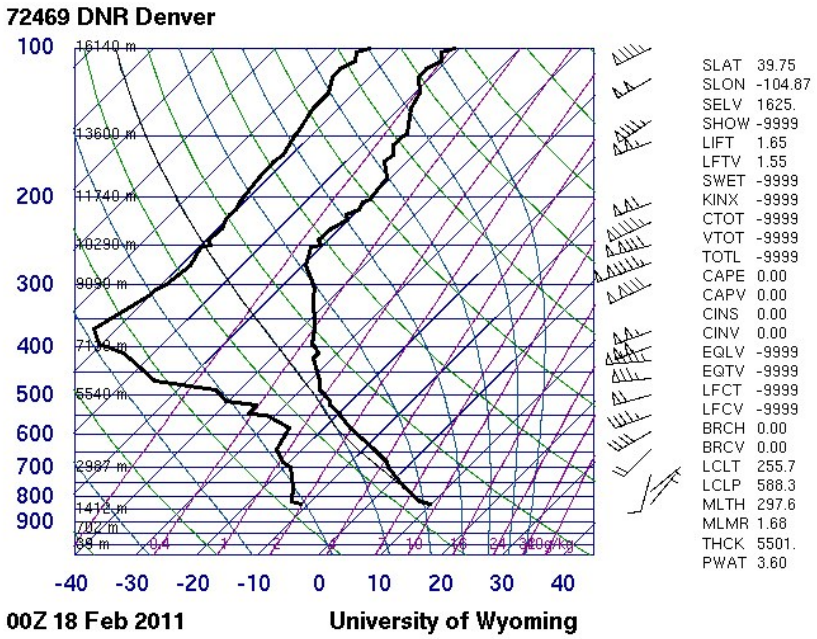

Figure 1: Skew-T plot[2]

Cumulus clouds are often referred to as "fair-weather" clouds[1]. They tend to develop on rather clear, sunny days and have relatively short lifespans. This "fair-weather" classification holds for the day this picture

was taken. It was a very sunny day with a high temperature around 53 degrees Fahrenheit and slight winds out of the southwest. There were several groups of cloud formations like this in the sky at the time, but overall still quite clear. Earlier in the day, there were even less clouds. The next day was approximately the same weather-wise.

Clouds like this develop as bubbles of warm air rise from the earth's surface. On a nice, clear day (such as February 17th in Denver) the sun will heat the earth's surface and create thermals, which will rise upward. As the warm air rises in the atmosphere, the water vapor within will begin to cool and eventually condense. This forms a cloud. In this case, we can tell that the cloud is not in the "young" stages of a cumulus lifespan. When first formed, the cumulus humilis (Latin for "humble") will have relatively defined edges. As it ages and the supply of warm air rising and condensing diminishes, the edges of the cloud erode and the body of the cloud will dissipate[3]. A typical cumulus cloud will last only 5-45 minutes. The cloud captured in this image is in the second half of its life as a significant portion of the cloud as become fractus in nature.

Upon further examination of the Skew-T plot for the time of the picture, we see that at these low altitudes (between zero and 2000 meters above ground) the atmosphere is relatively unstable[2]. We conclude this based on the steep slope that the atmosphere displays in relation to the adiabatic line. Once we get above this altitude, things begin to stabilize until the upper atmosphere. This instability in the atmosphere is conducive to creating such clouds as unstable air favors convection – and as discussed before, convection is integral in the creation of cumulus clouds. The level of instability in the atmosphere dictates the height and "congestion" of these clouds[3]. If our skew-T plot showed a taller column of unstable air, we would expect relatively tall cumulus clouds, eventually on the order of cumulus congestus clouds. These clouds are similar looking to the humilis variety but are much taller than they are wide and can eventually turn into thunderstorms[1].

Photographic Technique

In order to create this image, I utilized very basic camera settings. There was a relatively large amount of light and I wanted to accentuate the sky color gradient as well as the stark contrast between the silhouetted foreground and bright subject. The settings I used are listed below.

Field of view: approximately 3000 feet
Distance from object to lens: approximately 6500 feet – based on estimated height of 5000 feet and approximate angle of camera axis to horizon of 50 degrees.
Focal length: 26.0 mm
Camera type: Digital still camera – Canon EOS 7D
Exposure specifications:
- Aperture: f/9
- Shutter speed: 1/200 sec
- ISO setting: 100

Photoshop processing – I did no cropping of the original image. The oringal and final both maintained dimensions of 5184x3456 pixels. The only processing I did in Photoshop was raising the contrast to the point that the buildings in the foreground became silhouettes. They were already relatively dark in the original image so by darkening the darks just a little more, they became silhouettes. This also gave the blue background a nice gradient from light to dark. It also helps to highlight the altitude difference of the clouds captured. The darker clouds at the bottom right of the image are in the shadow of the higher clouds and display a somewhat ominous dark gray color. I think this also adds to the effect of the image. The original and final images are shown below(left and right respectively).

Conclusion

This image captures the middle-life transformation that these short-lived clouds encounter. It clearly shows the dissipating nature of a cumulus cloud. And these "fair-weather" clouds are not typically eye-catching. We, as humans, have become rather used to seeing them on a day-to-day basis. Clouds in general have become simply a part of life that we accept as being there and not necessarily worth our attention. Not until I set out to capture such an image did I realize the natural beauty that is constantly above us. I find myself looking up much more regularly and being amazed by the extremely varying formations that naturally occur.

In my next project I hope to create a time-lapse video of cloud formations. I feel that while this image clearly shows an important aspect in a cumulus cloud's life, it would have a much greater effect with a time-lapse, as the addition of the time dimension would help to more clearly define the entire life span – from convective creation to dissipating end.

References

[1]The Cloud Collector's Reference – http://cloudappreciationsociety.org/collecting/
[2]University of Wyoming – http://weather.uwyo.edu/upperair/sounding.html
[3]"Stable and Unstable Air" – http://www.pilotoutlook.com/aviation_weather/stable_and_unstable_air