Cloud Photography- Flow Visualization

Presented for: Professor Jean Hertzberg

On: February 24, 2009

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The purpose of this assignment is to display the behavior of clouds according to the surrounding conditions. Clouds are nothing more than water vapor that condenses and accretes into a visible form. The usual mechanism is for moisture-laden air near the Earth's surface to be raised higher into the atmosphere either by an encroaching air mass or the heat of the sun. As the air is lifted, the pressure drops and the air is subsequently cooled. The combination of the two causes water vapor to condense [1]. Clouds are a direct result of atmospheric instability.

The intent of this image was to demonstrate an aesthetically pleasing picture of a cloud which also provided insight to the reasoning behind the formation.

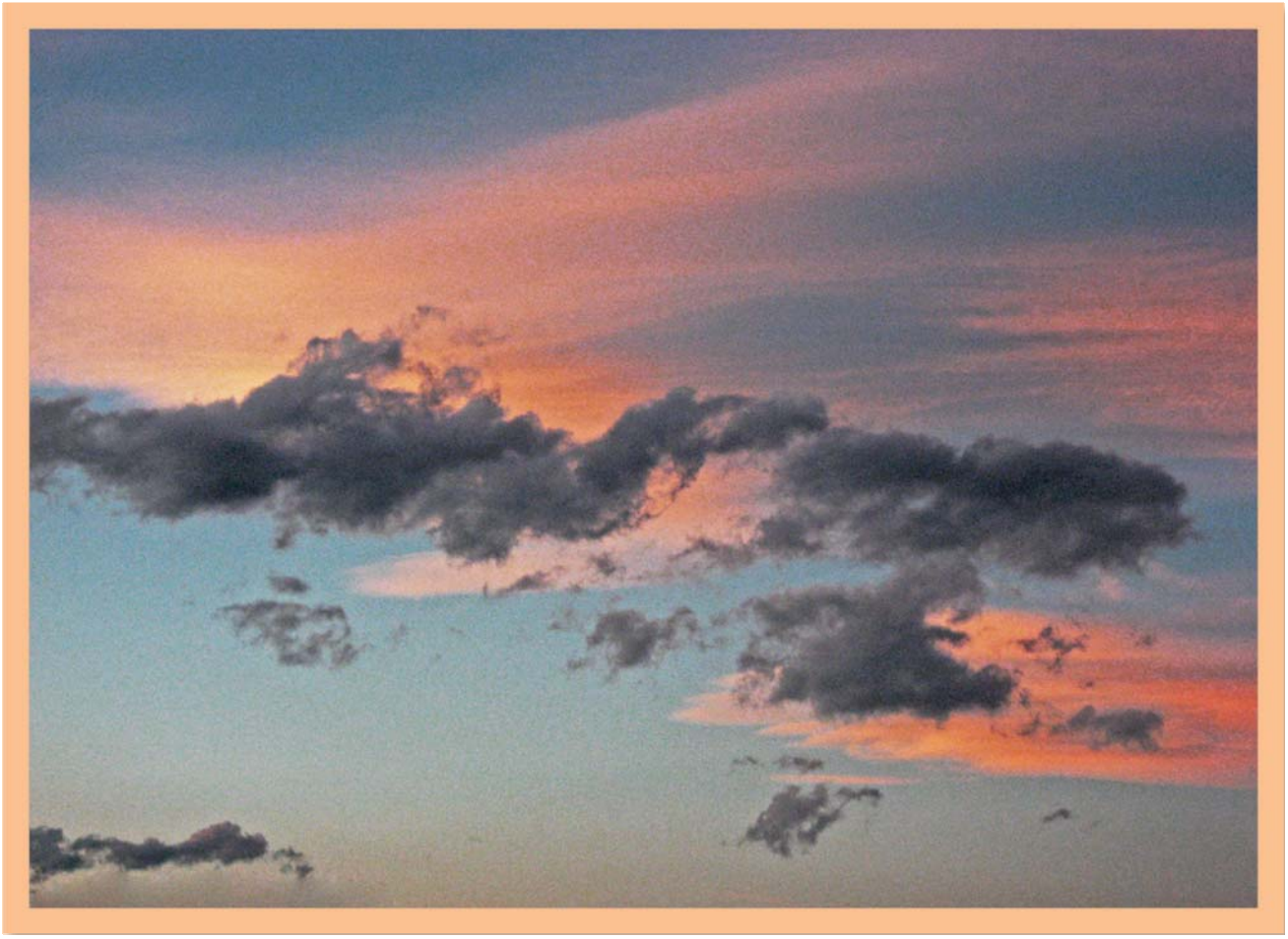

Figure 1: Final Cloud Image

This imaged was captured on February 24, 2009 at 6:00 p.m. The weather on this particular day was delightful with 5 mph winds out of the SSE and a high temperature of 65 Degrees Fahrenheit. The photograph was taken in a field which is located in between the business school and the engineering center on Regent drive at the University of Colorado. The sun was completely hidden by the flat Irons along the foothills. The direct of the photograph was due south at approximately 40 Degrees from horizontal.

This image was particularly interesting because it displays two cloud formations. In the set of clouds closest to the camera you can see an excellent example of cumulus fractus. According to Cloud Chart Incorporated, cumulus fractus clouds are fair weather clouds. There is no expected precipitation unless winds out of the NE to S are present. Altocumulus clouds exist in the background.

Clouds are classified by the cloud base, not the cloud top [3]. We generally classify them as layered or convective to describe the altitude. For example; cirro is the prefix given to high clouds, those with bases above 20,000 feet, alto is the prefix given to mid-level clouds, those between 6,000 and 20,000 feet, and adding nimbo (nimbus) to the beginning or end of a cloud name means the cloud is producing precipitation. Many sub categories exist to better characterize clouds.

The approximate distance to the cloud was found to be 8,300 m (~27,000 ft). The height of the image was estimated at 7000 m (~23,000 ft). The camera used was a Digital Canon Power Shot SD630 including the following properties.

Field of View: 8 miles
Focal Length: 14.4 mm
Aperture: f/4.5
Shutter Speed: 1/125 sec
ISO: 400
Photo Dimensions: 2816 x 2112
Dew Point: 28 F
Flash did not fire

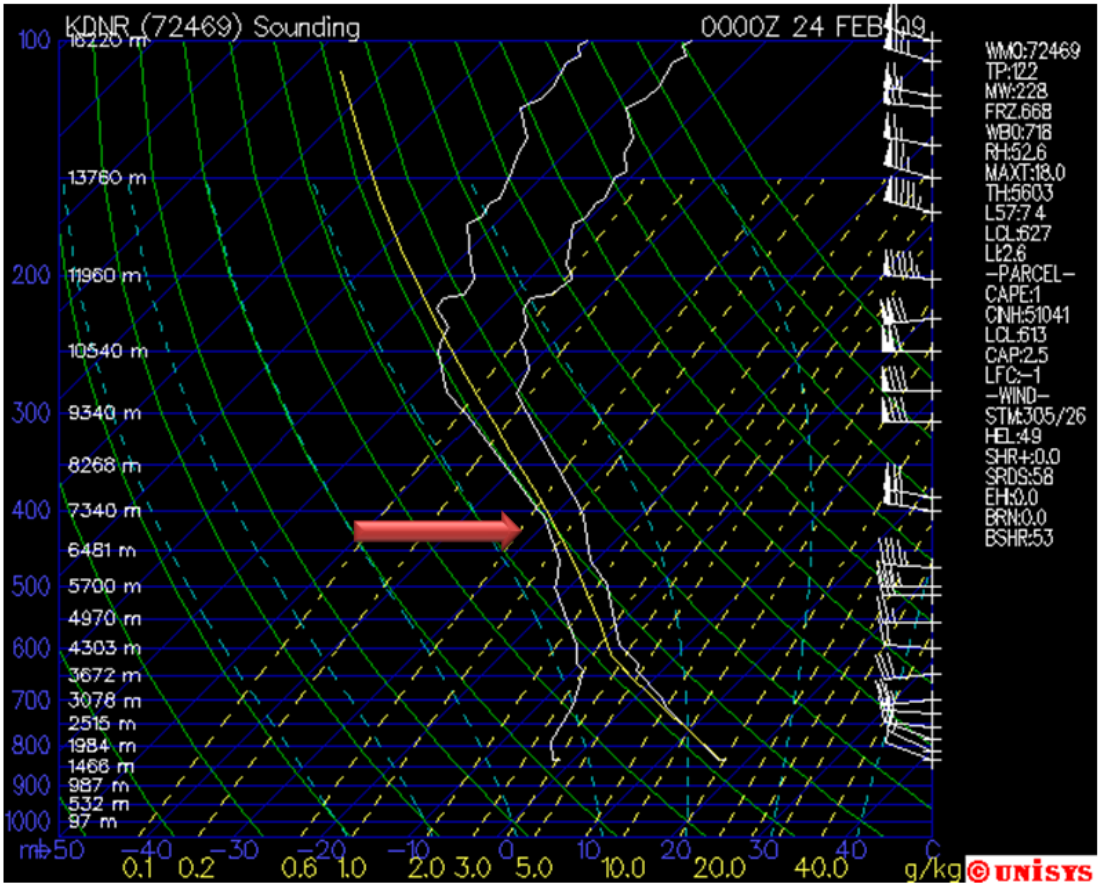

Figure 1: 24 hr Skew T diagram for Denver CO February 24, 2009

A Skew T plot is a standard plot used by meteorologists to analyze data from a balloon sounding. This is a plot of temperature with height as denoted by pressure. The pressure lines are plotted horizontally in blue and are also on an inverse log scale. The concept of Skew T means that the temperature is not plotted vertically but angles off to the right at a 45 degree angle. The temperature lines of the Skew T are in blue. The green lines are called dry adiabats. The light blue dashed lines are saturation adiabats. The yellow dashed lines are lines of constant mixing ratio. The sounding is plotted as two white lines. The right line is the temperature profile. The left line is the dew point profile [2].

The final image was manipulated using Photoshop CS3. The picture was altered by distorting the original color curve. An S-curve on the color grid enhances the depth of the clouds. The photo was also slightly cropped to exclude some trees that were present in the original.

Conclusion

This project was an excellent chance to investigate the behavior as a result of instability within the atmosphere. I was very excited about this picture because I was able to demonstrate two cloud phenomena in one shot. However, I am a bit disappointed in the quality of photo. It turned out more “pixely” than I had hoped. I would have liked the shot to be sharper.

References:

[1] http://www.carlwozniak.com/clouds/bluesky.html

[2] http://weather.unisys.com/upper_air/skew/previous/skew_KDNR-2.html

[3] http://en.wikipedia.org/wiki/Cloud