Context of Image

For the second cloud image, I chose a photograph I took at the beginning of the year. This image was taken at dusk with large lenticular clouds moving over Boulder from the east, towards Green and Flagstaff mountains. I found one isolated altocumulus cloud that formed quickly and disappeared only minutes after this image was captured.

The image was taken from the top of Flagstaff Mountain at approximately 7000 ft above sea level. The camera was facing west but aimed at an angle of about 75 degrees, as this cloud formed almost directly overhead. I chose to take pictures of the sky that day at dusk for more dramatic lighting. This image was taken at approximately 4:30 PM on January 14, 2009.

Discussion of Atmosphere and Sky Conditions

In the image, the background is altocumulus lenticularis clouds forming over Flagstaff Mountain. The object of interest in the image is a small, isolated, altocumulus stratiformis cloud formation roughly the shape of an upside-down heart. The portion of sky just above Boulder and Green Mountain was filled with large altocumulus lenticularis clouds while the sky west of the Boulder mountains was cloudless. The result was dramatic lighting on the leading (western) edges of the clouds.

According to a skew-T plot generated for the Denver-Boulder area on Jan. 14, 2009 (**Figure 1**), the atmosphere was marginally stable to stable, depending on the elevation. From the closeness of the dew-point line and the adiabatic temperature curve at around 5000 meters (16, 400 feet), it makes sense that clouds would likely form around that elevation. There is also a section of slightly unstable air below 5000 meters down to about 2500 meters. Above the cloud-forming section of the atmosphere (around 5000 meters) there is stable atmosphere at all elevations.

Clouds form under supersaturated conditions and when condensation nuclei (usually dust and small particles in the air) are present, water vapor will condense onto the particles to form small water droplets held up by moving air masses. In the atmosphere, there are pockets of warm air travelling upward and cool air moving downward. As warm, saturated air moves up higher into the atmosphere, it loses energy and becomes cooler than neighboring air pockets and starts to fall down until it is surrounded by air pockets that are the same temperature or cooler. This circulation of moist air causes the formation of water droplets on condensation nuclei when warm, wet air is cooled and cannot hold more water vapor at the saturation point so some water vapor has to condense to liquid water. Saturation pressures are determined by molecules' temperature and warmer air can retain more water vapor. The relation between saturation pressure and temperature is given by Antoine's Equation below:

$$\text{Log}\,(P_{sat}) = A - B/(C + T) \quad \textbf{(1)}$$

In this expression, the constants A, B, and C are tabulated constants found from experimental data [1].

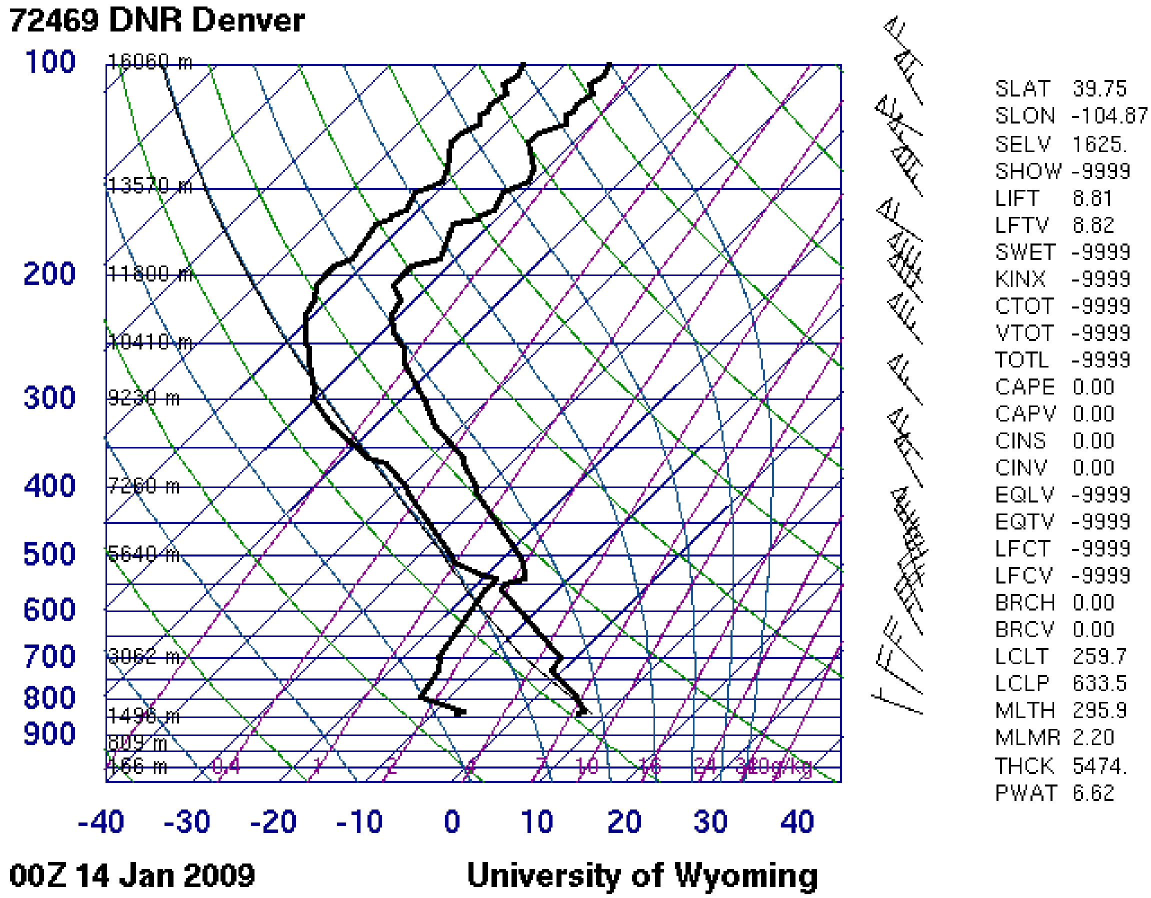

Figure 1. Skew-T Plot for 1/14/09 00Z (6pm) [2]

Photograhic Technique

The field of view for this image is approximately a half-mile if the angle between the camera view and horizontal is about 75 degrees, and if the distance between the camera lens and the object is about 9,000 feet. The camera was set to a focal length of 28mm and f-stop of f/8. A digital Canon EOS Digital Rebel was used to capture this image whose final dimensions are 1628 by 2988 pixels. The original image has dimensions of 3072 by 2098 pixels. The digital camera was also set for a 1/125 second shutter speed and 100 ISO. The final image was edited in Adobe Photoshop CS4 to increase the contrast between light and dark portions of the image. This contrasting was done using the Curves tool.

Final Thoughts

To me, this image reveals the transient, random beauty of nature. This cloud formed in a matter of minutes and disappeared just as quickly. With so much action in the atmosphere, it's surprising that I even noticed this tiny isolated formation. I like that the cloud looks like an extended heart flipped upside down and the depth of field it creates with the large lenticular cloud in the background. I also like the gold-yellow coloring of the cloud. This image also illustrates the turbulence in the air, with its swirling tail and stratified middle portion, as a result of the air moving over the moutains behind Boulder. One aspect I would like to improve is the sharpness and use a deep focus to see the lines of all objects in the image more clearly.

References

[1] Rodgers, R. R. (1976). *A Short Course in Cloud Physics.* Oxford; New York: Pergamon Press.

[2] Wyoming, U. o. (2009, January 14). *University of Wyoming, Department of Engineering*. Retrieved April 15, 2009, from Department of Atmospheric Science Atmospheric Soundings: http://weather.uwyo.edu/upperair/sounding.html