Clouds 1 Assignment
Jeff Payne
MCEN 4228: Flow Visualization
2/25/09

Introduction

The purpose of this assignment was to capture an interesting and artistic image of clouds that demonstrates atmospheric phenomena. This was the first cloud assignment for the semester.

Image Circumstances

This image was taken in Boulder, CO at Shady Hollow Apartments on February 24th, 2009 at 6:50 AM, about 10 minutes after sunrise. The angle from the horizon was approximately 30 degrees. The cloud was seen to the south east relative to the observer.

Cloud Classification

The cloud seen in the image is an isolated cumulus fractus ("fair weather cloud") that appears to be broken up by wind shear [1]. The rest of the sky was relatively empty other than a few scattered cumulus fractus. Typically these types of clouds have a ceiling of about 6000 meters over mountainous regions [2]. In the skew-T diagram, fig. 1, the closest point between the Dew Point and Temperature profiles is around 6000 meters, which supports the classification of the cloud taken in the image [3]. The skew-T plot shows strong wind shear around this altitude, another indication of cumulus fractus. The local packet also appears to be warmer than the neighbors, suggesting an unstable atmosphere. This is a characteristic of cumulus cloud types.

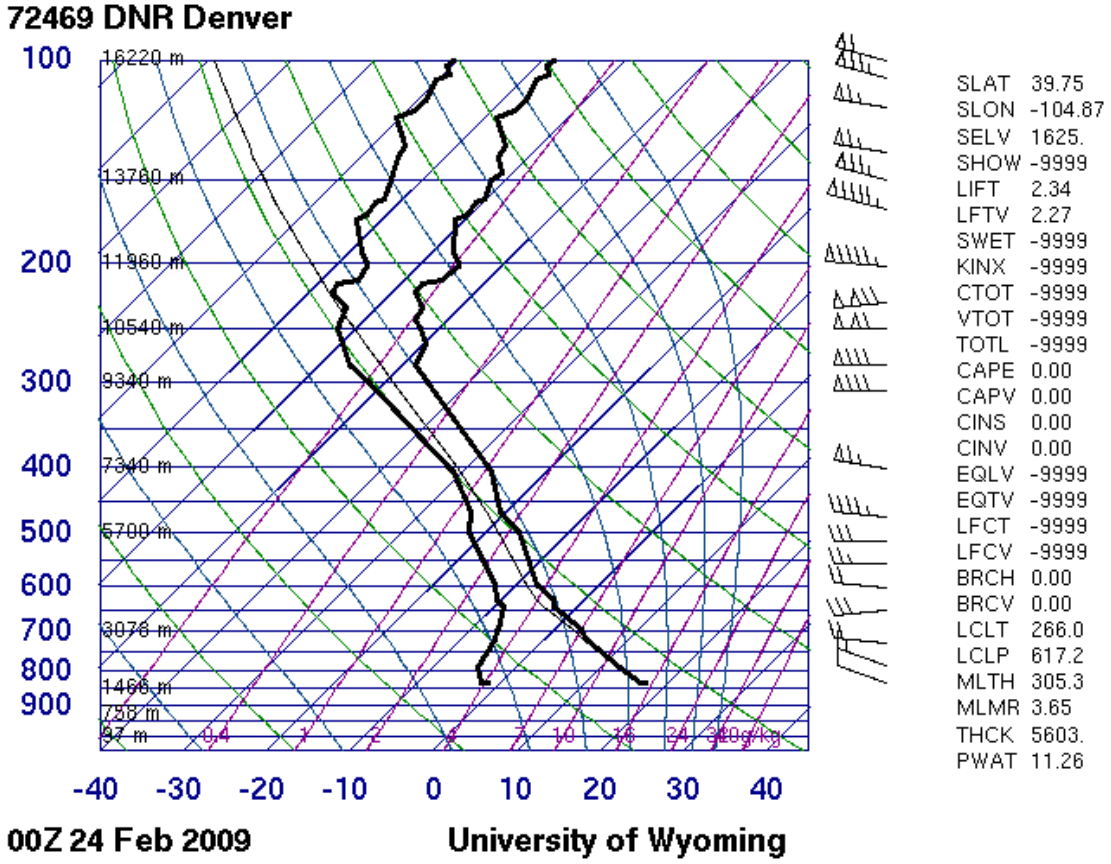


**Figure 1: Skew-T Sounding Data for 2/24/09 @ 0-12 hrs**

Photographic Technique

Digital photography was used to capture the image. The camera used was a 6 MP Nikon Coolpix L1 with a Nikkor 5X Optical Zoom lens (6.3-31.4mm, 1:2.9-5.0). The original and final image width and height was 2816 x 2112 pixels and 2816 x 1831 pixels respectively. The field of view (FOV) was about 3215 m x 2410 m with an object distance of 10,400 m (6.5 miles). The object distance was determined using trigonometry, since the approximate altitude and angle to the horizon were known. The FOV was calculated by multiplying the camera's sensor dimensions (5.75 x 4.31 mm) by the object distance and dividing that quantity by the focal length. The lens focal length was 18.6 mm. The exposure setting on the camera was set to 0, with the white balance setting on automatic. No flash was used, and natural light from the sunrise was used to create the image.

**Table 1: Photographic Technique**

| | |
|---|---|
| Field of View (FOV) | 3215 m x 2410 m (width x height) |
| Object Distance | ~10,400 m (34,000 ft)→6.5 miles |
| Focal Length | 18.6 mm |
| Aperture | f/2.8 |
| Shutter Speed | 10/1076 sec |
| ISO setting | 50 |
| Exposure | NONE, set to 0 |
| Original Image Size | 2816 x 2112 |
| Final Image Size | 2816 x 1831 |

Photoshop

The only adjustments made in Photoshop were cropping the height of the photo to the above dimensions and using the curve adjustments tool, as seen below in figure 2.

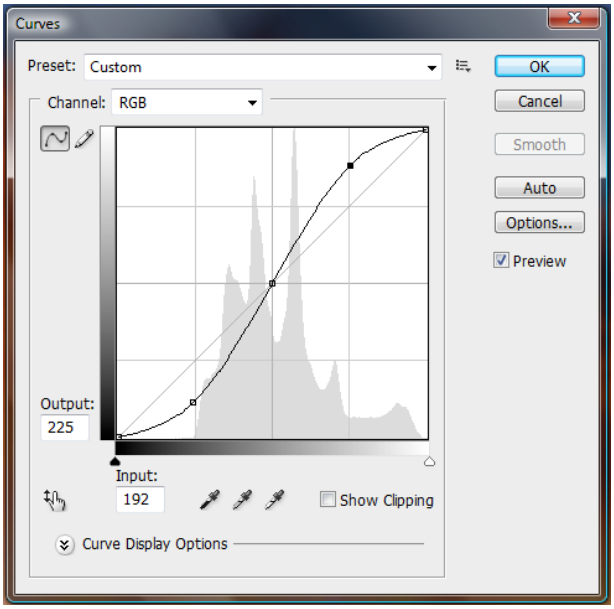


**Figure 2: Curve Adjustment**

## Conclusions

This image reveals pretty standard atmospheric conditions that arise in Boulder, which are usually pretty mild. I really like the contrast of colors, mostly between the deep blues and fiery oranges. The only thing I do not like about the image is the field of view, which I would have like to be larger to accommodate the entire cloud. The atmospheric fluid physics are quite visible. The edges of the cloud appear as though the wind is shearing it apart. After 5 minutes, the cloud looked completely different, supporting the classification of cumulus fractus. A wide angle lens or panoramic view might have been better to capture this image. To develop this image further, I think taking multiple shots or video to get a time lapse would allow a better atmospheric flow visualization, especially considering the classification of this cloud.

References


1. http://en.wikipedia.org/wiki/Fractus_cloud
2. http://en.wikipedia.org/wiki/Cumulus_humilis_cloud
3. http://weather.unisys.com/upper_air/skew/details.html