# Clouds Report #2

Michael Chilton

4/16/12

Flow Visualization 2012

This is the second cloud assignment and for this image I had initially wanted to capture a very unique and interesting cloud formation; one that I figured would not be presented by too many others in class. Having my camera on the ready was no easy task, but I was able to find a few formations that appealed to me, however, the life of a graduate engineering student who also works 40 hours/week does not result in too much time spent outdoors. On the evening of March 3rd, I was out picking up a friend when I noticed the sunset. It took me a while to even remember to get my camera out, as I was so fixated on colors and brightness of the scene. After not being able to find my camera, and seeing the sunset slowly fade away, I had to use my iphone's camera to capture the scene. In this image, I really was just trying to capture the entirety of the scene; the colors, the cloud texture, and the darkness of the surroundings. I took multiple images, a few using the HDR setting on the camera and a few taken with different photography apps on my phone. The final image I chose was the first one I took, as I felt it best captured the scene, without diminishing any colors or textures. As the image was taken with my phone's camera, there is an obvious amount of blur and I wish I could have used a better camera. Following some post-processing though, I am extremely happy with the image.

The image was captured on the evening of March 3, 2012 around 6:00pm off of 8th street in south Boulder, near Chautauqua Park. I had just picked up a friend and was about to head out when we both noticed the sky. The light was fading fast and I needed to capture the scene the best way I could, so I used my phone's built-in camera to get the shot. The direction of the image is looking up towards the first flatiron, which from my position would be directly south-west with an elevation angle of about 60 degrees.

*Figure 1: Original Image*

The cloud formations shown in the image are very distinct and reminiscent of a typical mountain wave cloud. The mountain wave cloud is technically referred to as an altocumulus lenticularis, and is caused during a stable atmosphere when descending air overshoots a mountain ridge, causing it to rebound on the other side and bounce back up. This bouncing motion causes cloud formation in the though the heating and overcooling process being applied to the moving air. This type of cloud is referred to as an orographic cloud, as it is caused by topography.[1] The position of the cloud west of the mountain ridge would indicate the wind was travelling in a westward direction, as this is the typical formation pattern for the mountain wave cloud. I was not paying attention much to the weather earlier that day, however, the sky was mostly clear at the time and the only clouds that could be seen were those just west of the ridgeline. There was no precipitation before or after the capturing of this image, meaning that nimbus-type clouds would not have been observed. After analyzing the skew-T plot, shown below in Figure 2, the atmosphere was stable and the cloud formations were most likely at an elevation near to 3000m. This elevation follows typical mountain wave characteristics and correlates well with the direction change in wind, as the typical altocumulus lenticularis would be travelling in an East-West direction. [2]

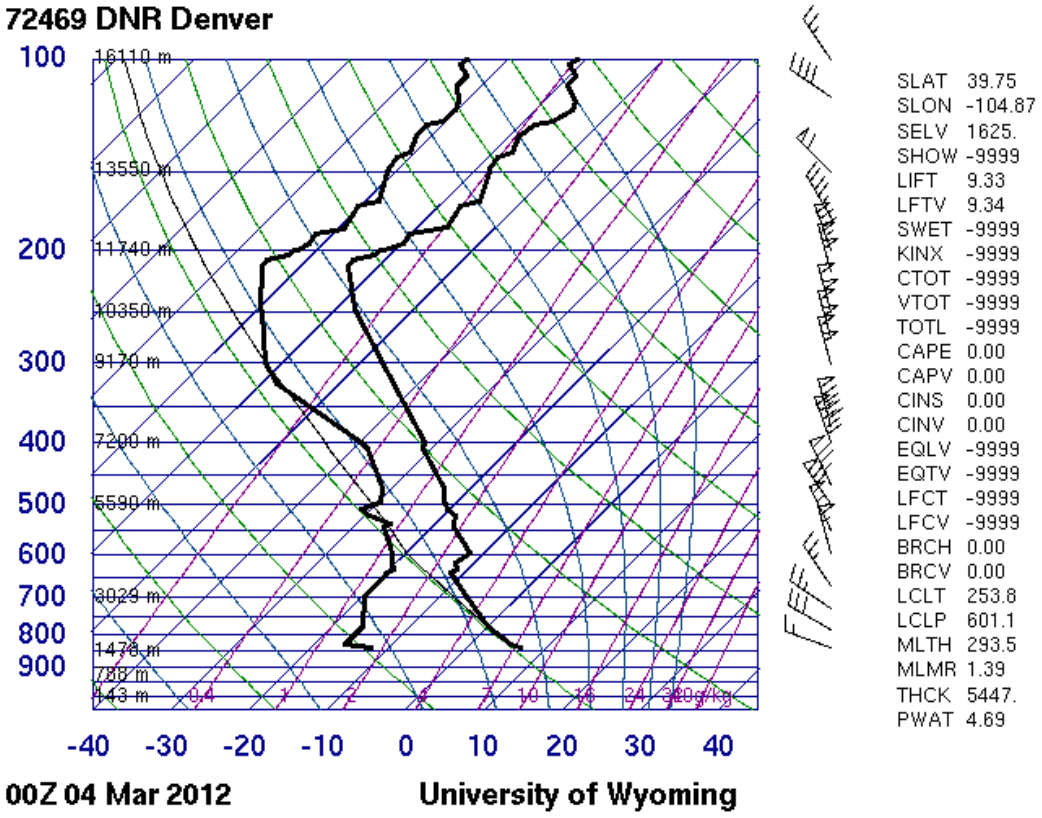


*Figure 2: Skew-T Plot for 3/4/12 - 00Z [3]*

As I was restricted to using my phone's camera for this image, my photographic technique was rather limited. The clouds were estimated to be about 2 miles away from the camera, resulting in a rather large field of view on the range of 1 mile. The lens focal length on my Iphone 4's camera was 3.9mm and the original image had dimensions of 2592x1936 pixels. The exposure was not controllable on my camera and no special program was set. The f-stop was set at f/2.8 and the ISO was automatically set at 125. The

built-in flash on the camera was used, but this was not intentional and presumably had little to no effect on the final image. In Photoshop, I adjusted the curves so as to completely black out the foreground and darken the tones while bringing out more detail within the cloud's texture. Once I felt the foreground was sufficiently blackened, I tried sharpening the image, however, this has little effect. I left in the trees and rooflines protruding out of the foreground, as I thought they gave a nice contrast to the fluffy texture and bright colors of the background clouds. I would have liked the cloud to be sharper and more in focus, but I was limited by the capabilities of my phone's camera.

The image reveals just how amazing sunsets in the Rockies can be, when captured right. I was amazed to see just how nice of an image could be captured using my phone. I really like the contrast between the dark, structured foreground shapes and the flowing, fluffy bright texture of the background clouds. I think the colors are really well represented and I only wish I could have gotten the cloud's texture sharper and more in focus. I would like to know if there are any differences in mountain wave cloud formations when they are travelling east vs. west over the Rockies and just how the physics of those two different flows would operate and how different resulting clouds would be. It would be interesting to get individual images of a mountain wave cloud being created by both eastern and western winds, and then stitch the two images together. I think this would be a really cool demonstration of how slight differences, such as wind direction, can dramatically affect cloud formation.

**References**

[1] *http://www.brockmann-consult.de/CloudStructures/orographic-clouds-description.htm*

[2] *Neiman, Paul J., and Joseph A. Shaw. "Coronas and Iridescence in Mountain Wave Clouds Over Northeastern Colorado."* Bulletin of the American Meteorological Society*84.10 (2003): 1373-386. Print.*

[3] University of Wyoming, College of Engineering, Department of Atmospheric Science. *http://weather.uwyo.edu/upperair/sounding.html*