Clouds 1 - Altocumulus

Andrew Fish
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Flow Visualization

The image provided was taken to fulfill specific requirements set out in MCEN 5151: Flow Visualization at the University of Colorado at Boulder. The intent was to capture an image of a cloud that is not only visually appealing, but clearly indicates the atmospheric conditions at the time that the image was captured.

The picture was taken along CO HWY 470, just east of Chatfield Lake. The camera was facing west at about a 15 degree angle above horizontal. The image was captured at 4:30PM on February 15, 2012.

There are two basic clouds in the image, one in the center that looks to be an altocumulus, and a broader cloud below it that looks to be a stratus cloud. The sky was mostly clear, with a few clouds to the west, but not many to the east, over Denver. There were more clouds earlier in the day, close to 100% cloud cover, a drop off to about 25% cloud cover at 2pm, then a gradual increase back to 100% cover at 6pm. There was a predicted 0% chance of precipitation for that day. There were not any fronts approaching. The atmosphere was stable that day, with mostly low-hanging stratus cloud cover. The relevant skew-t plot is shown in Figure 1.

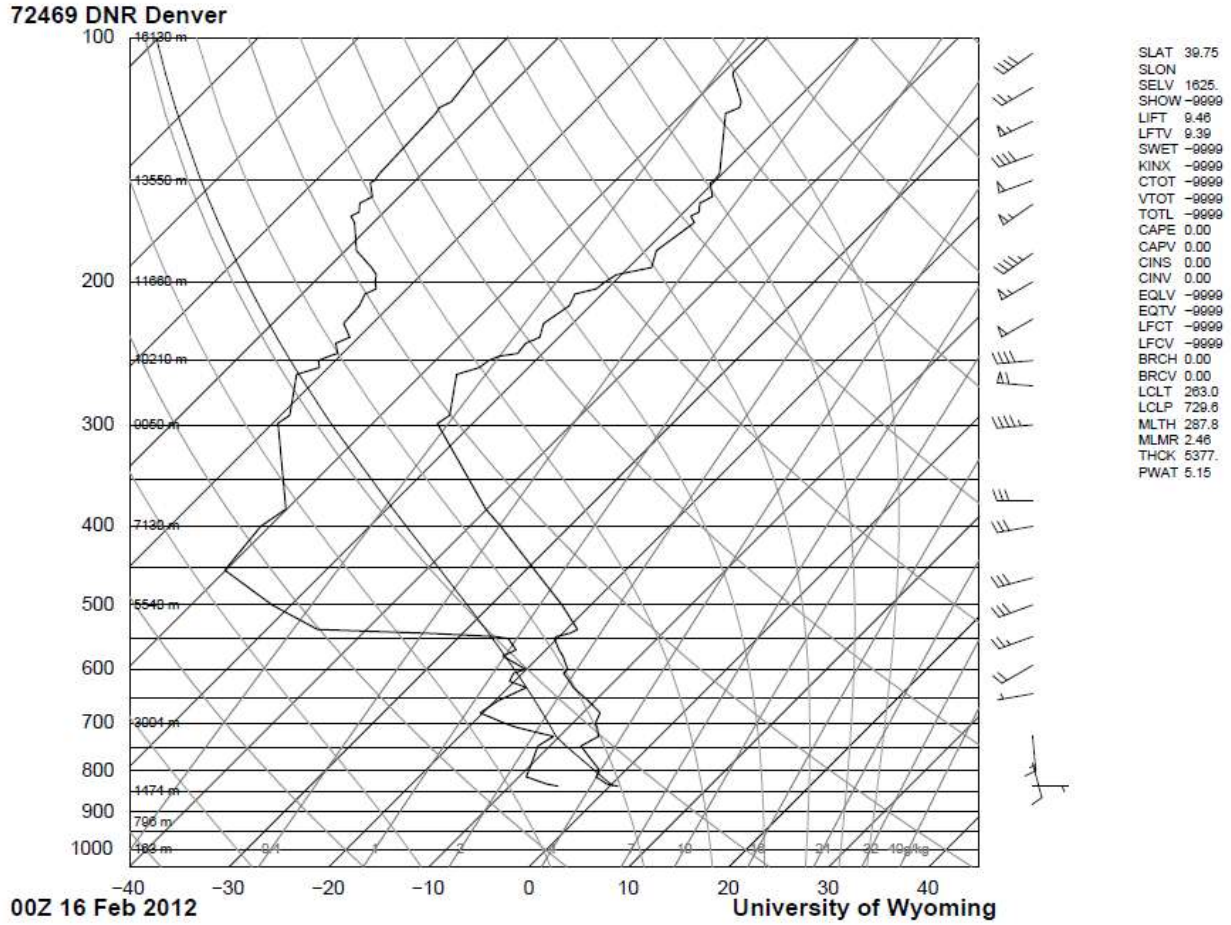

Figure 1: Skew-T Plot[1]

The stratus clouds on the lower portion of the image were at about 5,000 ft elevation, while the altocumulus clouds in the middle of the image were around 15,000 ft elevation, which agrees with the observation. Both elevation numbers are referring to height above local elevation (about 6000ft), not Sea Level. Clouds in the stratus family could be expected from the stability of the atmosphere and the

general weather, which is consistent with observation that day as well as the lower clouds captured in the image. The stratus clouds in the image are laminar and layered, which indicates that the atmosphere at that location is stable, slowly moving, and allows the moisture in the air to develop into clouds in a stable manner. The altocumulus clouds are higher in the atmosphere and are generally unstable, which indicates that there are plumes of heated moisture that rise while condensing, and then fall. This creates the puffy look of the cumulus family. The altocumuluses are comprised of a large amount of smaller, puffy clouds, because they are too high in the atmosphere to produce a larger, cohesive cloud like a cumulus.

The field of view is approximately 2,000 ft wide by 15,000 ft tall. The distance from the object to the lens, approximated using trigonometric relationships and the 15,000 ft elevation of the cloud, is approximately 60,000 ft. The focal length of the lens is 4.0mm, with the f-stop set at f/2.7. The camera is digital, producing a 3264x2488 pixel original image and a 2448x2247 pixel final image. The camera is the rear-facing 8MP camera on a Samsung Galaxy S2 (SHG-I777). The aperture for the image was f/2.6, the shutter speed was 1/6000 sec, and the ISO value was 32. The post processing of the image, completed in Adobe Photoshop, was done in four basic steps. The first was to adjust the color of the image by changing the color curves to bring out the blues in the image more. After adjusting the color curves, the yellow colors of the lower stratus clouds were changed to a purple hue using the color replacement tool. The second step was to increase the contrast of the image a little bit, to bring out the rays of the sun. The third step employed to clone-stamp tool to get rid of a few smudges in the image, caused by taking the image through the windshield of a car. The last step was to crop the image to a more aesthetically pleasing aspect ratio. The small versions of the before and after images are shown in Figure 2.

Figure 2: Before (Left) and After (Right) Post-Processing

I really like the color scheme that I was able to achieve with the post processing of the image, and how it really brought out the sun rays. The different types of clouds are very easy to see and identify, which accomplishes one of the goals of this assignment. I fulfilled my intent with the photo, with the caveat that the image isn't as clear and crisp as I would have liked it to be. For the future, I would like to try to capture a similar image, but with a higher quality camera, and under better circumstances, so that I could have a less grainy image in the end.

References

1. "Atmospheric Soundings." *Wyoming Weather Web*. University of Wyoming College of Engineering. Web. 17 Apr. 2012. <http://weather.uwyo.edu/upperair/sounding.html>.

Self Assessment: