Clouds 1: Sunset Colored Clouds

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Purpose

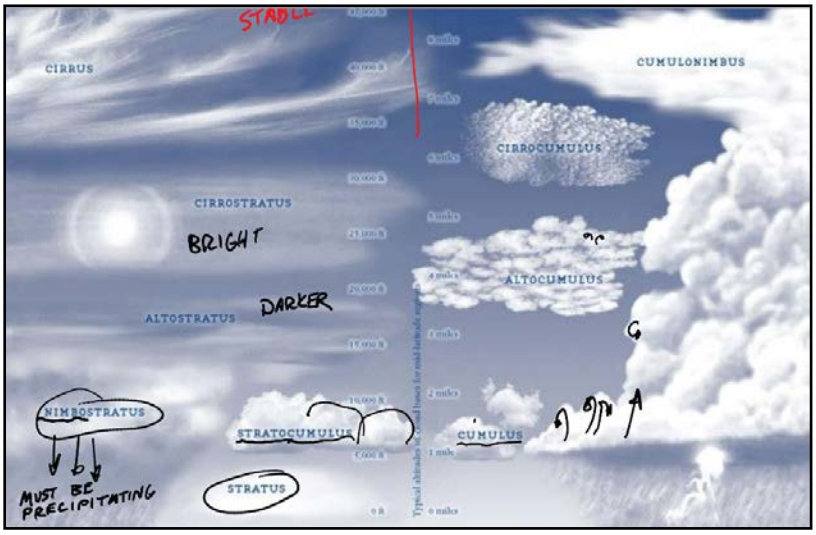
Flow Visualization can be appreciated through the medium of designed experiments and naturally occurring phenomena. In this second assignment, Clouds 1, the challenge of capturing an image of clouds is examined. The primary intent of this assignment is to create an image of (subjectively) interesting clouds, while the secondary intent of this assignment is to analyze the climate conditions under which the captured fluid flow of clouds occurs. Because this exploration is highly dependent on weather and natural lighting conditions, all clouds pictures were taken in spontaneous moments – walks to and from school, trips to the store, etc. The final chosen image is meant to depict clouds during a sunset. The subsequent report will further describe the circumstance and conditions of the image.

Circumstance

This image was taken on Wednesday, February 6th at about 5:30pm. Like most encounters with beauty in nature, I was not searching for this particular image. I was walking home after a day of classes, and happened to look over my shoulder to spot orange and pink clouds hovering over the Engineering Center at the CU Boulder campus in the moments before sunset. Though I was walking South on Frontage Road, I turned to my right side (West) to face the Engineering Center and to shoot this image. In terms of elevation, Boulder sits at 5,430ft; however, it is difficult to state the elevation of the clouds – from the human eye they seemed to be low-hanging. The orientation of the camera at the time of the image was between 30˚ - 45˚ from the horizontal surface.

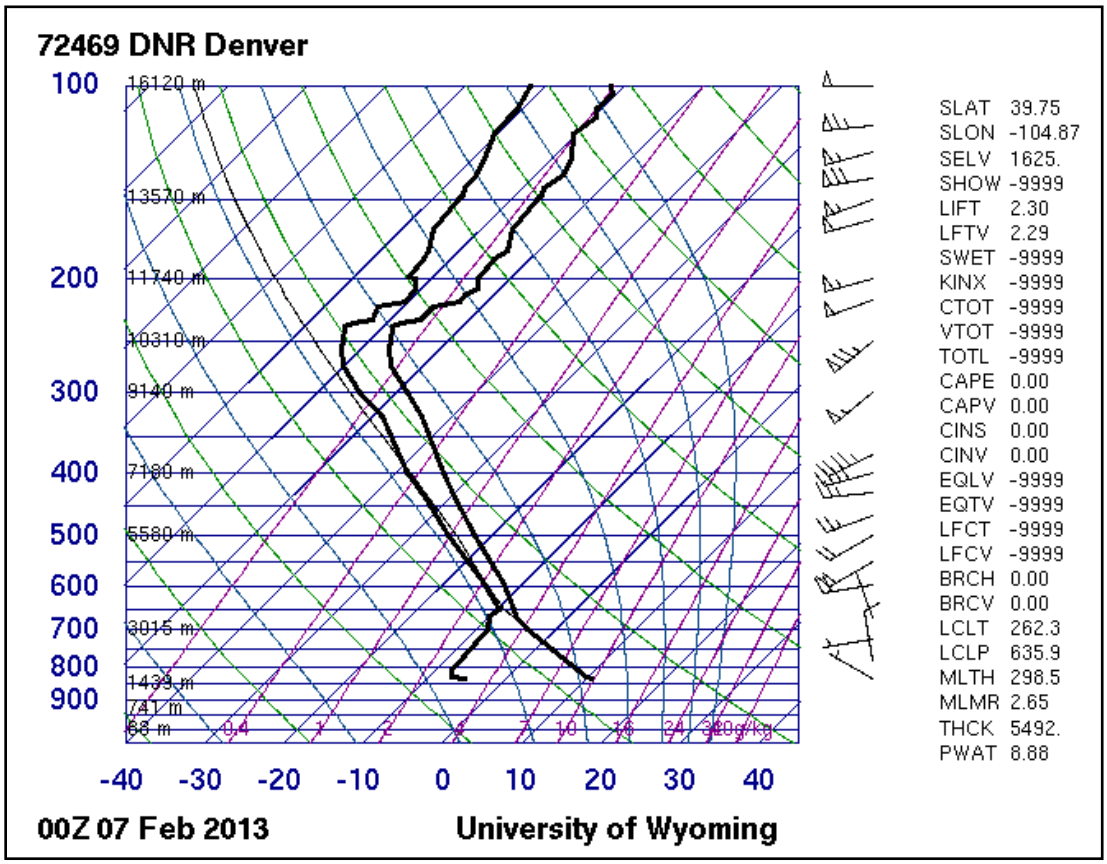
Conditions

From the image, it is evident that the captured clouds are stratocumulus clouds. This is visually confirmed based on the cloud diagrams shown in the lecture notes for Flow Visualization from Lecture 8. In this diagram, the stratocumulus cloud is not only low in elevation (~5,000ft), but it is also shown to have a flat bottom surface similar to a stratus while its sides and top surface retain the fluffy quality of a cumulus. This diagram can be seen below.



To better understand the stability of the environment at the time of this image, the weather is also important to analyze. At 5:30pm on Wednesday, February 6, the temperature in Boulder was

45˚F. According to WeatherSpark.com, the wind speed was 3.4mph going North, slightly North-West. The humidity was 34% while the pressure was 29.87 Hg. The humidity was steadily increasing and Boulder actually experienced a moderate rain later that evening, almost an hour after the time of the image. From a non-numerical standpoint, I recall feeling moderately warm during my walk home that day and I remember that we had experienced two days of "good weather". As seen in the image, the sky is relatively clear, other than the low-hanging stratocumulus clouds moving in. As stated earlier, it is difficult to guess the elevation of these clouds; however, because Boulder is above 5,000ft, these clouds were most likely between 6,000 and 7,000ft high in elevation. Additionally, in order for a stratocumulus cloud to exist, the environment must be stable. Visually, this is shown in the image by the clear sky discussed earlier. Proof of stability can further by actualized with the use of a skew-T plot. Below, a skew-T plot for 00Z on February 7th is shown – because the image was captured around 5:30pm on February 6th, the skew-T plot is merely 30 minutes out of synch.

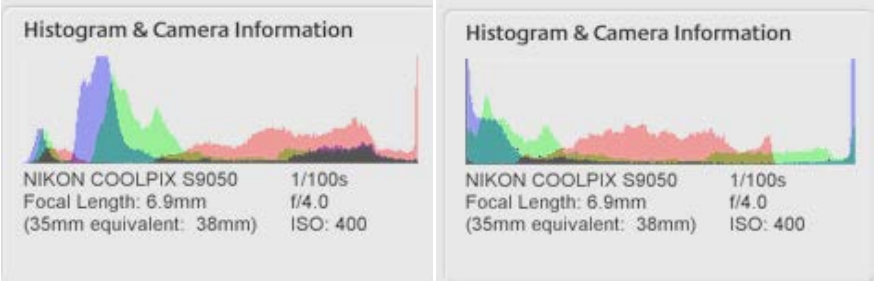


In the skew-T plot, the angle between the isobar (Boulder is about 829mb) and the T-curve is small and thus the environment can be concluded to be stable. It is important to note that, despite this stability, the wind speed increased shortly after this image, as did the humidity, resulting in moderate rain that evening.

Photographic Technique

Because this assignment entails capturing a natural phenomenon that is particularly large and distant from the observer, it is critical to understand the size of the field of view and the

distance between the camera and the clouds. As stated earlier, the clouds are estimated to be about 6,000 to 7,000ft above Boulder. This puts a vertical distance of about 1,500ft between the camera and the clouds – this is a conservative estimate. The digital camera used in this experiment is a Nikon S9050. Due to the spontaneity of the image, the settings on the camera at the time were not intentional and were the standard settings decided by autofocus. The focal length is 6.9mm or 38mm in 35mm film; the exposure time is 0.01 seconds; the f number is f/4; the ISO is 400; the maximum aperture is 3.7; no digital zoom is utilized. The original image is 4,000 by 3,000 pixels in size. During the editing process, the color temperature was decreased in order to bring out vivid blues in the sky, while the shadows were increased in order to retain the texture and shading of the clouds. Some cropping across the top and bottom of the image was performed in order to generate greater focus on the eye-like shape created by the clouds and to remove the flatness of the clouds spanning from this shape. The histograms below depict the change in the color spectrum after editing the image.



The final image is 4,000 by 2,487 pixels in size and a comparison between the original and final images is demonstrated subsequently.

Conclusion

While sunsets and sunrises are coveted times of day, they are extremely difficult to capture and do justice in an image. This image attempts to capture the effect of a sunset on its surroundings by depicting a sunset-lit stratocumulus cloud hovering over the Engineering Center. A few key choices were made in the editing process in order to accentuate colors and evoke a mood – the shadows were increased so that the buildings were silhouetted, and the color temperature was changed so that the blue hue of the sky was more vivid. However, it is

unreasonable to take credit for the aesthetic beauty of the cloud itself due to its natural creating in its environment. Still, two aspects of this image are unsatisfactory. To begin, some of the pink and orange hues in the clouds were lost during the editing process due to the shift in color temperature. A more sophisticated program could perhaps temper this loss. Additionally, the street light in the left side of the image can be distracting to the image as a whole – though, it can also be argued that the lamp adds perspective to the depth of field. Moving to a new location or different cropping might combat this aspect; though, the speed of the sunset prompted me to stay in one place and capture the image before the sky darkened. Despite these aspects, this image is fascinating in its context. Because the sunset-lit stratocumulus cloud occurred prior to evening rainfall in Boulder, this hovering cloud draped by a clear sky gives insight into the weather to come. Overall, the image – in its vivid colors, contrast, and texture – demonstrates the sunset-lit intersection of the end of a warm, clear day and the beginning of a rainy night.

Works Referenced

http://www.atmos.millersville.edu/~lead/SkewT_Stability.html
http://www.colorado.edu/MCEN/flowvis/course/Lecture2013/08.Clouds2.pdf
http://weatherspark.com/#!dashboard;q=Boulder%2C%20CO%2C%20USA
http://weather.uwyo.edu/upperair/sounding.html