Re-Visitation of Low Altitude Clouds

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Introduction

In this final iteration of cloud analysis, I chose to adjust my methodology of capturing a cloud by examining a lower altitude cloud and utilizing any surrounding elements as a focusing point. The following photograph was taken of a cloud just above the Engineering Center at the University of Colorado at Boulder. As with my "Visual Analysis and Appreciation of Clouds" project, this project also has the similar purpose of identifying the cloud type as well as the factors involved in its formation. With this take on cloud watching, I was able to not only capture a photograph of a cloud with projective "fingers," but a photo that had a much sharper focus and contrast with the surrounding sky color. Through the use of some post processing, I was able to emphasize this further, creating a very striking blue sky against this complex cloud form. The following paper describes the experimental setup, technique, weather, and cloud analysis involved in the production of the photograph seen below in Figure 1.

Figure 1- Low altitude Stratus Cloud in a stable atmosphere taken near the ECCR

Circumstances and Weather Conditions

The photograph in Figure 1 was taken in a parking lot near the Engineering Center Electrical Engineering Wing. For the purposes of focusing, an airplane trail (not seen in Figure 1) was used. However, this airplane trail created what appeared to be a "tear" in the photograph which resulted in its removal. The directionally of this photograph was near 82.6^{o} from the horizontal point facing northwest. I did not have an opportunity to use a tripod as the airplane trail was disappearing quickly. Consequently, I used simple triangular measurements to determine this angle. Additionally, these measurements were based on a relatively simple ruler I had with me, suggesting that the uncertainty of this angle is at the very least 5^{o}. This photograph was taken on February 17^{th}, 2014 at approximately 4:52 PM. The days leading up to this photo were generally clear, with temperatures in the 60^{o}F range. Additionally, these clouds were very low altitude which allowed for the sharper focus. It is important to note that the days after this photograph were cloudy. Consequently, this suggests that these stratus clouds were the beginning of a storm front, though with no rainfall or snow.

Identification Cloud and Influencing Factors

As mentioned earlier, this cloud is most likely a stratus cloud due to both its foggy texture as well as its low altitude [1]. In addition, the finger-like projections, as seen in Figure 1, were similar to those of a typical stratus cloud, as seen below in Figure 2.

Figure 2-Stratus Cloud taken from University of Oklahoma Cloud Page [2]

In order to provide a more complete comparison, Figure 3 below is the original unedited photo that was taken on February 17th, 2014:

Figure 3-Original Cloud photo taken outside the ECCR on February 17th, 2014

As stated earlier, the airplane trail was used as a focusing point. Unlike my previous cloud photograph, there is a stark difference between the cloud color and that of the sky. Consequently, it is not difficult to see that the following cloud appeared during a relatively clear day. The boundary of the cloud itself is also much clearer. The weather leading up to February 17th was generally mild with no indications of incoming storm fronts. The following data for Temperature, Pressure, Wind Speed, and Wind Direction for the day of the photograph is displayed below in Figure 4.

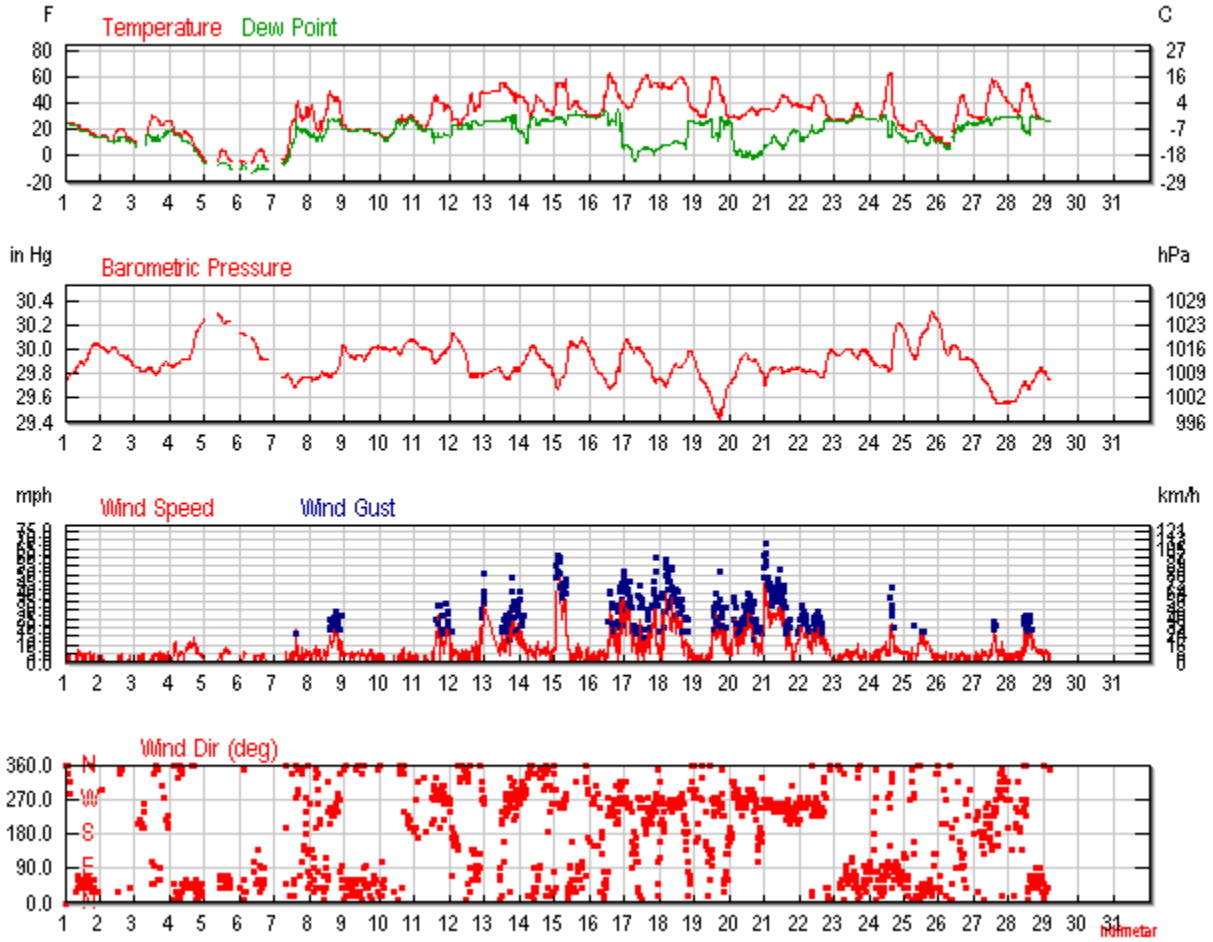

Figure 4-Temperature, Pressure, Wind Speed, and Wind Direction for the day of February 17th, 2014 [3]

The following data shows that on that Monday (February 17th, 2014) the temperature was relatively high with a low dew point, which is consistent with the conclusion that the cloud captured was a stratus cloud. Additionally, the higher wind speeds on the 17th suggest that the stratus cloud was a precursor to a cloudy day. This observation is also consistent with the weather conditions after the date of the photograph. Figure 4 below is a weather map for the date the photograph was taken.

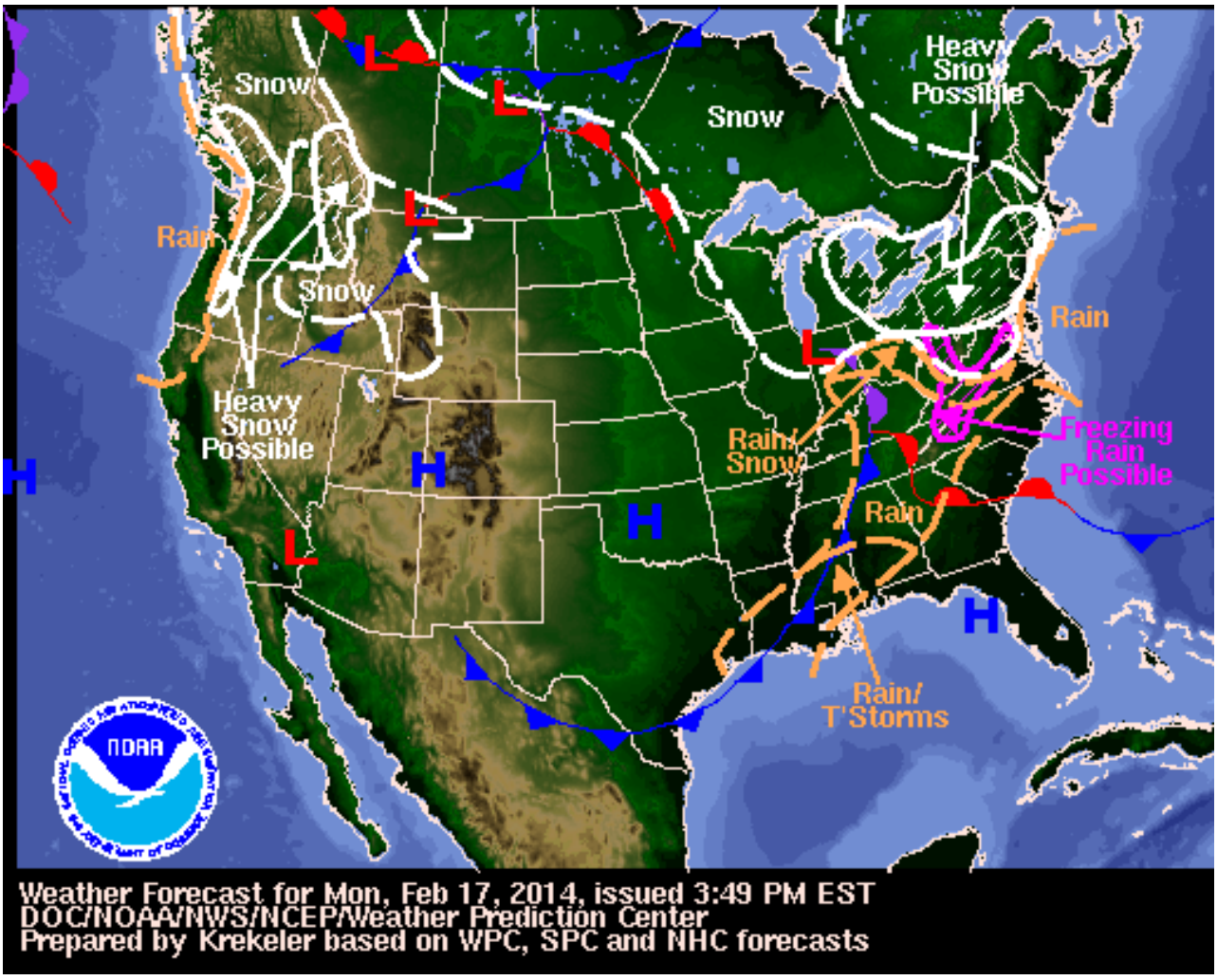

Figure 5-Weather forecast for the date of the photograph during the afternoon [4]

Note that in the Colorado region, no precipitation was present. However, this weather forecast does not provide information regarding cloud cover. Regardless, it is likely the cloud observed was indeed a stratus cloud due to the lack of heavy precipitation in the Colorado region [4], the high temperature and relatively low dew point observed on that day [3], the low altitude, and the finger like projections observed in both my photograph and that in Figure 2.

Although I am not certain what the exact altitude was, my estimation would be somewhere in the range of 39,000 ft [5]. It is likely that the cloud altitude is in excess of this value as the trail seen in Figure 3 was in front of the cloud itself. Due to the presence of the airplane trail, a general altitude was estimated based on the standard cruising altitude of commercial airliners. For the purposes of this project, the airplane trail was assumed to be that of a passenger carrying aircraft. Aircrafts designed for commercial transit have cruising altitudes from 39,000 ft to 42,000 ft. However, it is important to note that this range is also an estimation based on pressurization of airplane cabins [5]. Consequently, I was unable to determine an exact

value for the altitude. Regardless, I would estimate based on my research that the cloud was approximately 40,000 ft above land.

Along with an analysis of the weather conditions and altitude of the cloud, an examination of the Skew-T diagram was performed to assess and determine the stability of the atmosphere. The Skew-T for the photograph in Figure 3 above is displayed below in Figure 6.

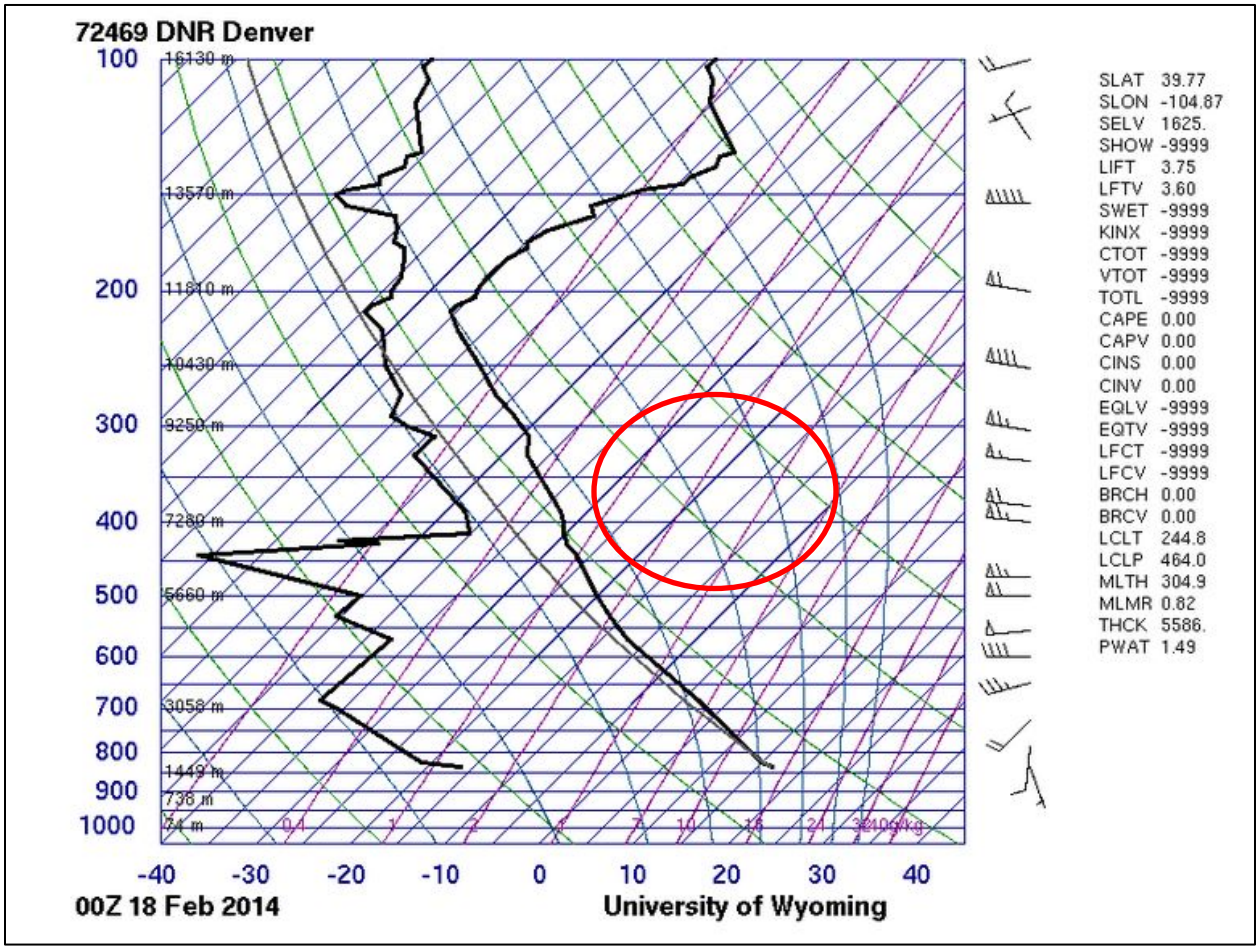

Figure 6-Skew-T for the date of the photogram taken from the University of Wyoming Weather Archives

Analysis of the Skew-T diagram above for the given time suggests that the atmosphere was stable, but just barely. If we examine the region highlighted by the red circle, the slope of the right most dark line and that of the green Dry Adiabat line are nearly parallel. Although it appears that the darker line had a slightly lower slope, it was difficult to tell based on this resolution of the Skew-T for the date of the photograph. It is important to note that the CAPE factor is 0.00, which indicates that the atmosphere is stable. Additionally, the observed and recorded weather conditions stated above suggest that the atmosphere was stable despite the graphical data represented on the Skew T.

Overall, from my analysis of the weather conditions, Skew-T diagram, and visual comparison, I believe that the characteristics of a stratus cloud were observed.

Photographic Technique and Artistic Approach

The image was captured using a Panasonic Fs15 Digital Camera. Due to the lack of a tripod at this exact moment as well as the large distance between the airplane trail and myself, I am unable to give a concrete estimation of my distance from the lens to the trail. Consequently, my only basis for estimation lies in the cruising altitude of commercial airlines. In this sense, I would infer that the distance from my lens to the cloud is close to 39,000 ft. However, it is important to note that this is only an inference and not a concrete data point. For this photograph, the lens focal length was 16mm with an aperture of 3.44, shutter speed of 1/200 sec, and an ISO of 80. The original photograph was 4000 pixels x 3000 pixels. However, due to my dislike of the "tear like" appearance the airplane trail left in my photograph, my post processed photo was 4000 pixels x 1878 pixels. Unlike my first cloud project, I spent a significant amount of time on post processing using Photoshop CS5. Due to the sharper contrast between the cloud and the sky, I adjusted the saturation of blue in the photograph. In addition, I adjusted the darkness of the surrounding sky using the curves tool in order to sharpen the white and blue contrast. As a result, the photograph in Figure 1 has a much darker sky than that of Figure 3.

Overall Summary

Due to the much sharper difference between the sky and the cloud itself, I was able to identify the type of cloud as well as create a more artistic photograph than my first cloud photo. Furthermore, the presence of the finger projections in this photo made identification of the cloud significantly easier. However, through my use of a very far but clear object as a focusing point, I was unable to narrow down specific camera parameters when capturing this photograph. Consequently, my process was not as concrete as I would have liked due to the need to estimate multiple parameters. From an artistic point of view, I am particularly proud of this photograph due to the more dynamic nature of the cloud. While my previous project only contained the "cotton ball" like texture of the cloud, my second cloud photo was able to capture the interesting phenomenon of projection and its associated textures and details. The addition of the darker sky and the post processing of the photograph enabled me to visualize these projections in more detail as well, which provided me with a highlight point for my photograph. Furthermore, the identification of the cloud was significantly easier due to the clarity of the cloud's details. My previous photograph contained an illusion in which areas of the cloud matched the background sky perfectly, making it difficult to determine where the break in the cloud was [7]. The use of a tree as the focal point also added a greater amount of difficulty as it was not closer to the cloud itself, making it difficult to resolve the details clearly [7]. In contrast, my stratus cloud contained evidence of low altitude, as well as clear break regions which provided clear indications of where

the cloud began and ended. In this sense, I am very satisfied with my second cloud photograph as I was able to concretely identify my cloud and create a more artistic photo overall.

Work Cited

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