The Calm

Clouds 2 Image Report

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This report lists and describes the techniques performed to capture the photo *The Calm* as part of the second Clouds assignment. The image attempts to depict atmospheric fluid dynamics in clouds. The intent of this assignment was to capture an image that effectively displays the beauty and complexity of cloud flow phenomena. The relevant meteorological data will be discussed and used to analyze the cloud type and formation. The final image was one of several captured during the project period; it was chosen because it was found to be the most aesthetically-pleasing.

The image was captured on April 7 at 5:14 pm on Flagstaff Road in Boulder, Colorado. The temperature was approximately 63°F with a relative humidity of 13%, dew point temperature of 25°F and wind speed of 11 mph [3]. As indicated in Figure 3, the cloud cover was relatively high on the day of photography. The image was taken during one of the most heavy periods of cloud cover.

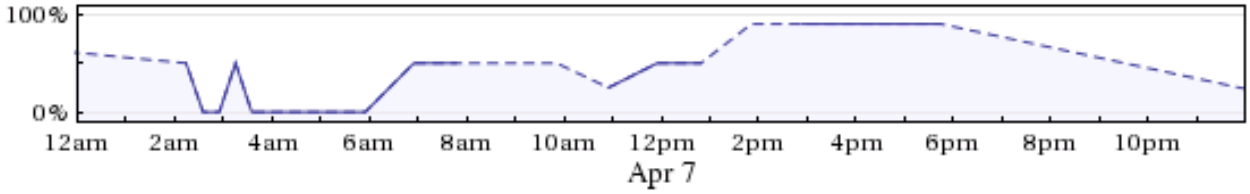

Figure 1: Cloud cover in Boulder, CO

The clouds congestus in the image are cumulus congestus, which are lower in elevation and exhibit extensive vertical development and sharp edges. The formation of cumulus clouds is a result of atmospheric convection. Warm air near the surface rises and begins to decrease in temperature during its ascent, causing the relative humidity to also rise. The temperature log for the day is shown in Figure 2. These clouds were most likely precipitation-bearing and formed from water vapor rather than supercooled water droplets or ice crystals, based on the ambient temperature. Cumulus congestus clouds occassionally produce light rain. If these clouds continue to undergo convection and increase in humidity, they may form cumulonimbus clouds, which are associated with unstable atmospheres and thunderstorms. While there was no observed precipitation on the day of photography, rain and snow did fall the following night.

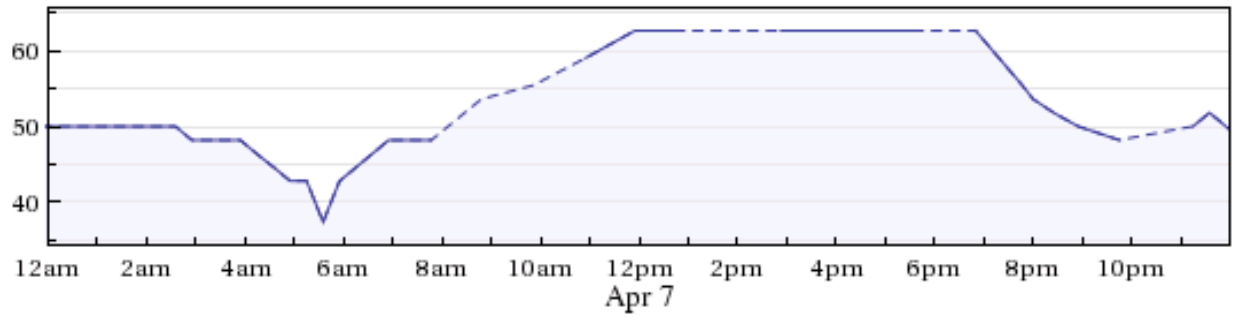

Figure 2: Temperature in Boulder, CO

Cumulus clouds generally form at or below 20,000 ft in elevation. Given the cloud type and size, as well as the elevation at photography, the altitude of the clouds in the image can be approximated at about 18,000 feet. Analysis of the appropriate skew-t diagram, shown in Figure 3, reveals additional details about the formation of these clouds.

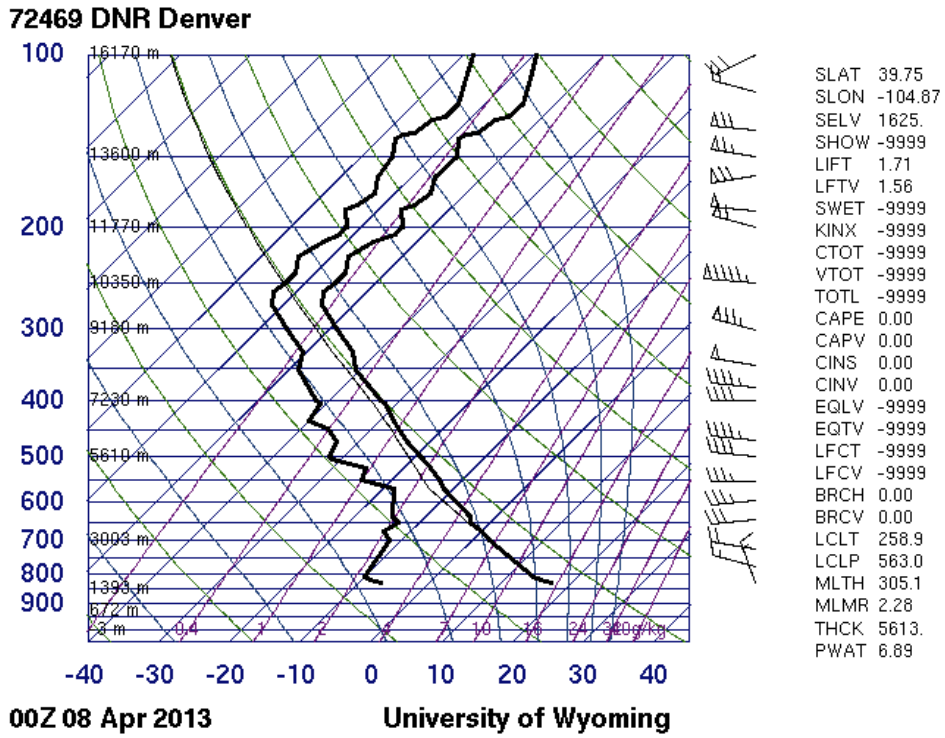

Figure 3: Atmospheric Sounding for Denver, CO on April 7, 2013

The skew-t shows no significant CAPE, indicating a stable atmosphere. Stability of individual air parcels of an atmospheric layer can be determined by comparing the slope of the virtual temperature to that of the saturation adiabats. The similarity of slopes also suggests a stable atmosphere. The dew point lines (the jagged line running south to north) distance from the environmental surrounding line suggests a greater relative humidity, and subsequently more clouds, around 20,000 feet.

Weather forecasts were used periodically throughout the day to determine when and where optimal cloud formations would be present. This image was taken on Flagstaff Road in Boulder to get a eye-level view of these forming cumulus clouds. Several photographs were taken over a two hour period. The approaching sunset provided the images with several shadows among the clouds, which adds to the depth of the picture. The final photo was taken facing north Boulder from Flagstaff at 5:14 pm.

The specifications for the final image are shown in Table 1. Based on the focal length and image dimensions, the field of view of the image was estimated as 3.29°, in the horizontal dimension. While not directly measured, the angle at which the image was taken can be estimated to be approximately 0°.

Camera	Canon EOS 5D Mark II
Dimensions	5616 x 3744 pixels
ISO Speed Rating	100
Focal Length	85 mm
Exposure Time	1/125 s
F-stop	f/20
Aperture Value	f/20

Table 1: Photo specifications

The final image effectively displays the beauty and complexity of cloud dynamics. It clearly illustrates the vertical development of these convective clouds. The clouds captured exhibit the typical cauliflower-like structure of cumulus congestus structures. Additionally, the image displays striking contrast between the shadows and highlights within the cloud formation. I am extremely satisfied with the outcome of this image. Several post-processing techniques were employed using Photoshop to achieve the desired aesthetic. The original and final images are shown in Figure 4.

Figure 4: Original and final image

In Photoshop, the image was cropped improve the cloud formation's centrality. The curves were adjusted to darken the overall tone and the contrast was increased. Specks present on the camera lens were edited out of the image to improve the image quality. HDR toning was implemented to improve the sharpness of the cloud edges. The photo is titled *The Calm* as a reference to "the calm before the storm," which I feel the image invokes.

References

[1] "Boulder Month Weather Monthly Forecast for Boulder, CO. AccuWeather.com. AccuWeather Inc., Apr. 2013. 16 April 2013

[2] International Cloud Atlas (1956) by WMO. 16 April 2013. http://nephology.eu/altocumulus

[3] Weather Underground. 16 April 2013. http://www.wunderground.com/weather- forecast/US/CO/Boulder.html