Spooky Night's Dream

Figure 1: Final, edited image

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Clouds 1 Report
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Introduction

This image was produced for the initial 'Clouds 1' assignment for the Fall 2015 Flow Visualization course offered in the University of Colorado School of Engineering. The objective of the assignment was to produce an aesthetically appealing image that captures a unique weather phenomena that can be used to analyze the salient atmospheric conditions. This photo was taken shortly after the supermoon eclipse of September 2015 in an attempt to capture the remains of a collection of mountain clouds as they blew eastward toward the plains and were illuminated by the moon. The image is fairly unique in its use of the moon as its light source.

Image Background

The photo was taken at Flagstaff Summit, just outside the city of Boulder, CO. At about 10:30pm on September 27th, when the picture was taken, the moon was at approximately 40 degrees elevation above the horizon[1]. Given this information, camera angle can be predicted to be about 30 degrees above the horizon, and is facing southeast.

Image Analysis

This image captures a collection of altocumulus clouds, specifically those of the altocumulus floccus variety[2]. Their puffy appearance distinguishes them from stratus clouds and the rough segmentation into individual cloud units indicates that they lie within the mid-level of the atmosphere, between 2000 and 6000 meters. Data analysis affirms this observation by suggesting that the cloud level is located at approximately 4300m above ground level (about 14000ft AGL), an ideal location for altocumulus formation. As shown on the skew-t diagram below[3], at approximately 5800m above sea level the temperature profile (thick black line on the right) nears the left-hand side of the adiabat (thin black line), which is a condition that is indicative of a fairly unstable atmosphere and, consequently, cumulus cloud formation. Additionally this point is the location where the dew point profile (thick black line on the left) most closely approaches the temperature profile.

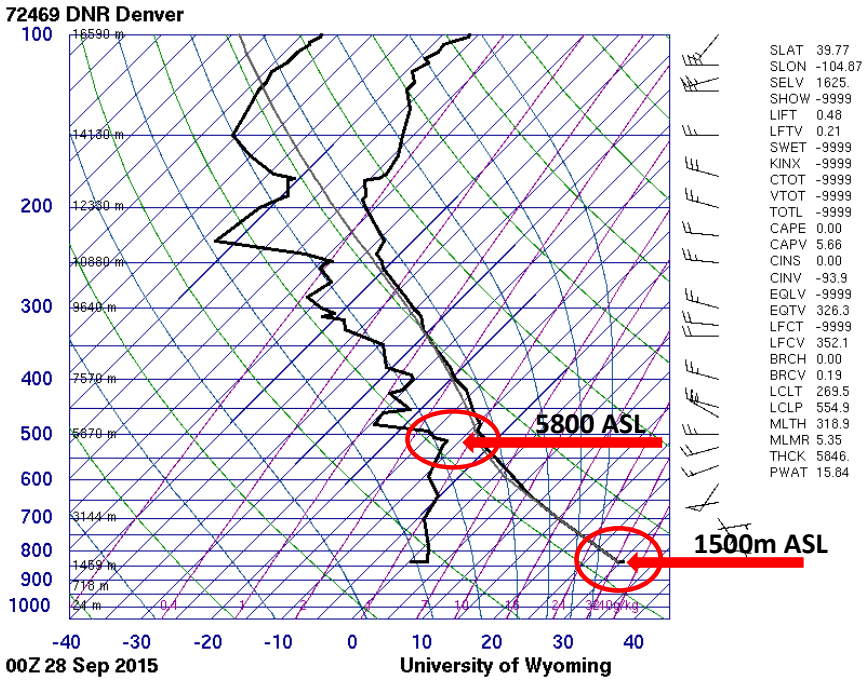

Figure 2: Atmospheric sounding from DIA at 1800 hours on 27 Sept

Subtracting the launch altitude of approximately 1500m, the clouds can thus be said to be at 4300m AGL. The skew-t above provides data from the DIA sounding at 6:00pm local time.

The weather conditions surrounding these clouds suggest that the atmosphere was stabilizing over the course of the night. Earlier in the evening the sky was more unstable and experienced a significant amount of overcast, enough to block the initial stages of the lunar eclipse. As the night wore on the atmosphere stabilized and a steady breeze blew the weather system out east until, not long after this image was taken, there were no more clouds left in the sky. The skew-t diagram shown below[2] is the Denver sounding for 6:00am (local time) the next day. It indicates a stable atmosphere in that the temperature profile does not approach the adiabat as it did before.

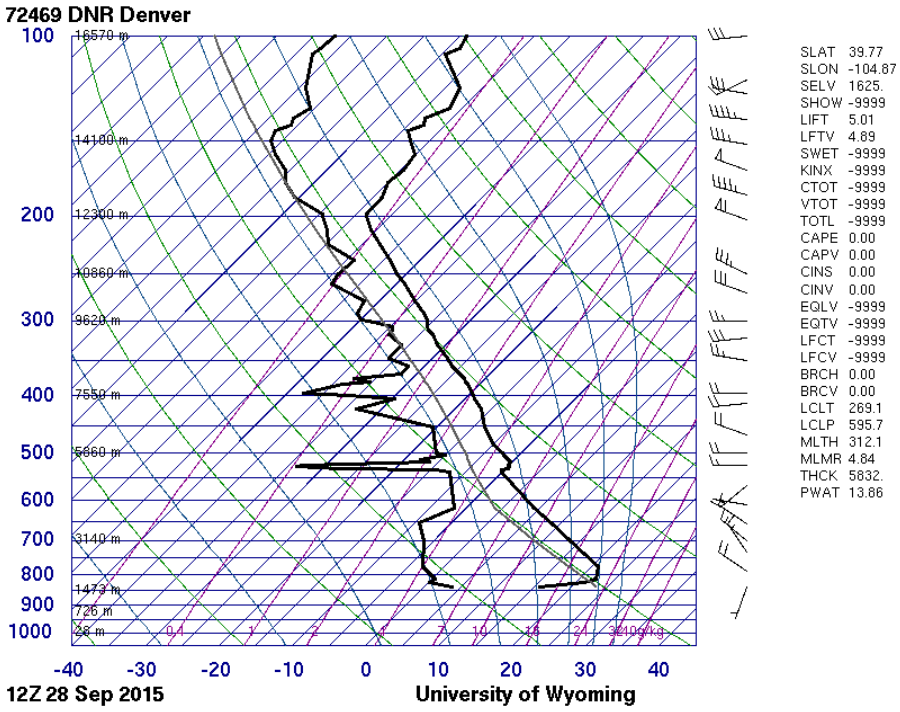

Figure 3: Atmospheric sounding from DIA at 0600 hours on 28 Sept

Photographic Technique

The field of view was intended to capture the majority of the cloud cluster that was centered around the moon at the time. Given an altitude of approximately 4300m AGL at an elevation of about 40 degrees, as previously discussed, the distance from the camera to the clouds can be determined with a bit of trigonometry to be almost 6700m. The photo was captured using a 55mm diameter lens with a focal length of 18mm. Judging by the elevation of the moon and an image size of 4592 x 3056 pixels, the field of view of the image can be taken to be roughly 60 degrees wide by 40 degrees high. It was captured using a Sony DSLR-A290 which was adjusted to the following settings: aperture = f/3.5, exposure time = 1.3 sec, ISO speed = ISO-400, exposure bias = 0 step. The resulting raw image is shown on the next page.

Figure 4: Original, unedited photo

The only edit made to the original photo was to increase its mid-tone contrast by increasing the "Clarity" slider in Photoshop to 100. The final image is shown in Figure 1 on the cover page.

Critique

The final image does an excellent job of accentuating the details of the clouds and highlighting their edges. Ultimately, this large cluster of cloud units appears as though it could be the result of a larger, singular cloud breaking up as it moved over the mountains, through unsteady atmospheric conditions. As it passed overhead, the cluster continued to dissipate until eventually none of it was left.

The way the moon illuminates the clouds from behind is a particularly appealing aspect of this image. Its light is so intense that the moon itself disappears from the image behind the illuminated clouds and it cannot be identified even with extreme manipulation of the image. Even despite its disappearance, its glow contrasts starkly against the darkness of the trees in the foreground and makes the image much more dramatic. The trees themselves add a unique perspective to the image, as does the warm yellow radiance from the city below; both help to ground the image and frame it. Despite the failure to capture a quality image of the lunar eclipse itself, this follow-up image definitely succeeded in capturing the awesome nature of the night sky.

Bibliography

[1] https://weatherspark.com/#!dashboard;q=Boulder%2C%20Colorado%2C%20United%20States

[2] https://en.wikipedia.org/wiki/List_of_cloud_types

[3] http://weather.uwyo.edu/upperair/sounding.html