Fire in the Sky

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Flow Visualization
MCEN 4151
March 5th, 2013

Introduction

While walking home from the Engineering Center one Monday evening I paused to stare at the magnificent sunset that was dropping behind the Flatirons in Boulder, Colorado. Realizing that I needed an image of clouds for my first cloud assignment in my University of Colorado Flow Visualization course, I quickly pulled my camera out of my backpack and began shooting. The clouds and lighting were changing so rapidly that as I snapped approximately twenty pictures over the next fifteen minutes; none of them were exactly the same. From these images I had to choose between two beautiful pictures with very different fields of view. The large field of view can be seen in Figure 1. While this is also a beautiful image that I

Figure 1: Image with larger Field of View

captured while facing to the southwest, I chose to use the image with the smaller field of view because it had the dramatic impact of making the sky literally look like it was on fire. This close-up view is awe inspiring to me; with the focus on such a small portion of the sky you lose yourself trying to imagine what is occurring in the surrounding area because you can only see the brilliant color contrast of the smaller bright cloud in front of the large ominous dark cloud in the background.

Circumstances

I stood on east side of Highway 36 across the street from University of Colorado's Kittredge Fields at the west end of Aurora Avenue to take these pictures. When I captured the cover image (Fire in the Sky) I was facing mostly west towards the Flatirons and slightly south. I was holding my camera up at a thirty-degree angle

above the horizon, and when I took the picture I was pointing the camera directly between Green Mountain and Flagstaff Mountain. It was 1724 in the evening as the sunlight was retreating behind the Flatirons on the 4th of February.

Clouds and Sky

The golden cloud in the front and center of the image is a stratocumulus lenticularus. The large, ominous, dark grey cloud in the back of the image is an altocumulus lenticularus. From Google Maps[1] I determined that the peak of Flagstaff is approximately 6800 feet and the peak of Green Mountain is approximately 7800 feet above sea level. The golden cloud has formed in between Green Mountain and Flagstaff on their east faces; so, it is somewhere between 6800 and 7800 feet above sea level. The elevation of the city of Boulder is 5430 feet above sea level. This puts the golden cloud at an approximate elevation of 2000 feet, and the typical range for stratocumulus clouds is 2000-6500 feet[3]. The dark grey cloud in the background towers over the smaller golden cloud, and it has formed farther away on the west side of Green Mountain. Because of this I estimated that the dark grey cloud exists between 6500-18,000 which makes it an altocumulus cloud[3]. Because the grey cloud completely blocks the sun, it could be classified even further as an altocumulus lenticularus opacus. These are both lenticularus clouds because they are forming over the mountains, and the signature 'lens'[3] shape can be seen at the top of the altocumulus cloud. It takes a stable atmosphere to form lenticularus clouds, and the atmosphere is stable; this can be seen by looking at the Skew-T diagram in Figure 2 and noting that the CAPE is 0.00 which defines it as a stable atmosphere.

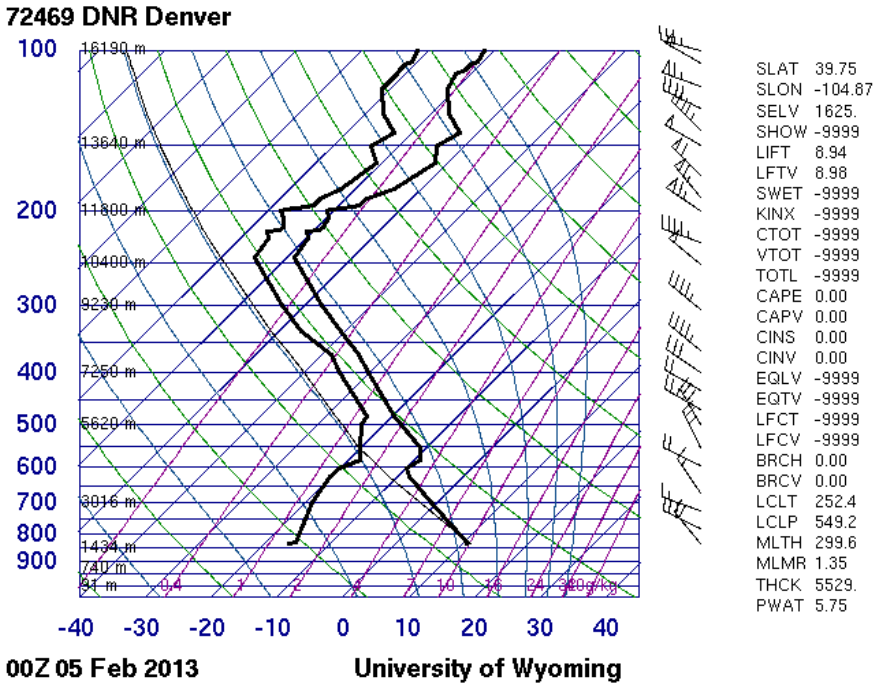

Figure 2: Skew-T Diagram[2]

From looking at the Skew-T diagram, clouds can be expected to form, with sufficient water content in the air, between 19,000 and 26,000 feet above sea level, which corresponds to 13,000 to 20,000 feet above ground level over the mountains near Boulder. For this reason I further estimate that the altocumulus lenticularus opacus cloud is probably between 13,000 and 20,000 feet above ground level. The Skew-T shows this because the dew point temperature (left thick black line on Figure 2) is near the actual temperature (right thick black line on Figure 2) for those elevations. When the dewpoint temperature is near the actual temperature there is a high possibility that clouds will form at that elevation given that there is enough moisture to create a cloud. This explains the large altocumulus lenticularus opacus clouds which appear above and on the west side of the mountains. With this being said, this Skew-T data is from Denver, Colorado and these clouds were forming above the mountains. The mountains have their own effect on creating clouds. The shape of the mountains force trapped warm moist valley air upward in the evening as the air that is above the mountains cools, which resulted in the golden stratocumulus cloud that formed.[4] The majority of the clouds that evening existed over the mountains. There were mostly low and mid-level clouds that evening leaving the upper atmosphere a beautiful blue during the sunset. After looking at the Weather Spark[5] data and recalling the weather from that week, I remembered that there was not a front moving in during the couple days before or after the image was taken. The Weather Spark data in Figure 3 confirms that there is no drastic temperature or pressure change (two of the signs of a front moving through the area) during the 3 days surrounding the image.[5]

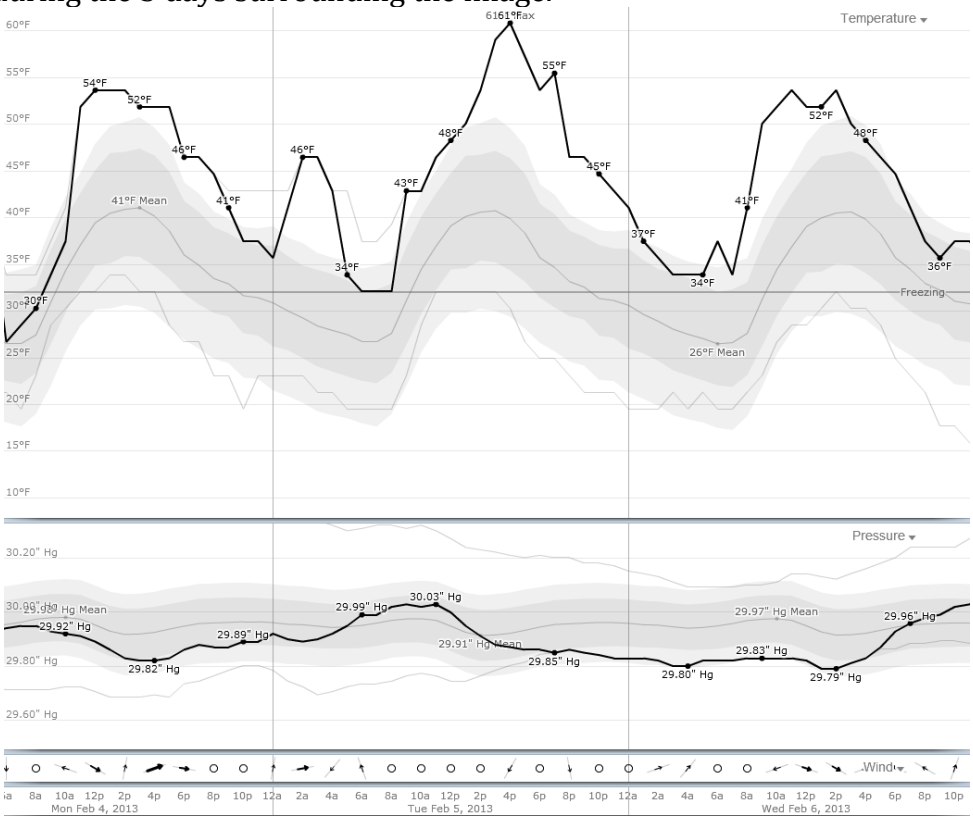

Figure 3: Weather Spark Data[5]

Photography

I estimated both the field of view and the distance from the camera to the clouds using Figure A-1 of the appendix which I took from Google Maps[1] and used the legend to measure these distances to the best of my ability. I estimated the distance from the camera to the front cloud to be approximately 1100 feet, and I estimated the field of view to be approximately 5000 feet horizontally. I used the location of my clouds relative to Flagstaff and Green Mountain to do this. I then used the number of pixels to calculate my vertical field of view to be 3750 feet. I estimated that my error using this method was near +/- 1000 feet. There was a lot of error in this measurement, but it gives the reader some relation to the size and distance of the clouds. I used the automatic focusing function on my camera by locking onto the mountain crest. I shot with a focal length of 31.2 millimeters. I used my Cannon Powershot SX 260 HS which is a digital film camera with 12.1 megapixels. The original and final image are both 4000x3000 pixels because I was very happy with everything that I had in the image, and I did not want to crop any of it out. The leafless tree in the bottom right corner really adds to the idea that the sky is on fire. I set the aperture to f/8 to give myself the maximum depth of field. This resulted in being able to clearly see the golden stratocumulus cloud float in front of the dark grey altocumulus cloud. I used an ISO setting of 400 and an exposure of 1/125 seconds. In hindsight, I probably could have used a lower ISO and decreased my shutter speed to obtain a sharper image, but I still really like how it turned out. I did almost no editing to the image; I did not want to do very much editing because I wanted to capture a picture of the actual natural beauty of a sunset. The only Adobe Photoshop editing that I did was create an 'S' curve using the curves function to obtain a greater contrast between the light and dark clouds. Both the curve function and the original image can be seen in the appendix (Figure A-2 and A-3 respectively).

Conclusion

When I set out to create my cloud image for the Flow Visualization course I wanted to capture beautiful clouds with brilliant colors. These altocumulus lenticularus opacus and stratocumulus lenticularus clouds are not too uncommon over the mountains in Boulder on a stable day, but the lighting contrast and color that the setting sun provided really made the shot pop out at the viewer in a magnificent way. I do not like that I was unable to show the magnificence of all the clouds that were present on that day with a single image, and that is why I included an image with a greater field of view than my image to enhance the knowledge and beauty of the sky from February 4th. The reason that I chose the small field of view is because it looked like there was fire in the sky, and that beauty and dramatic impact is what I wanted to portray in my cloud image.

Appendix

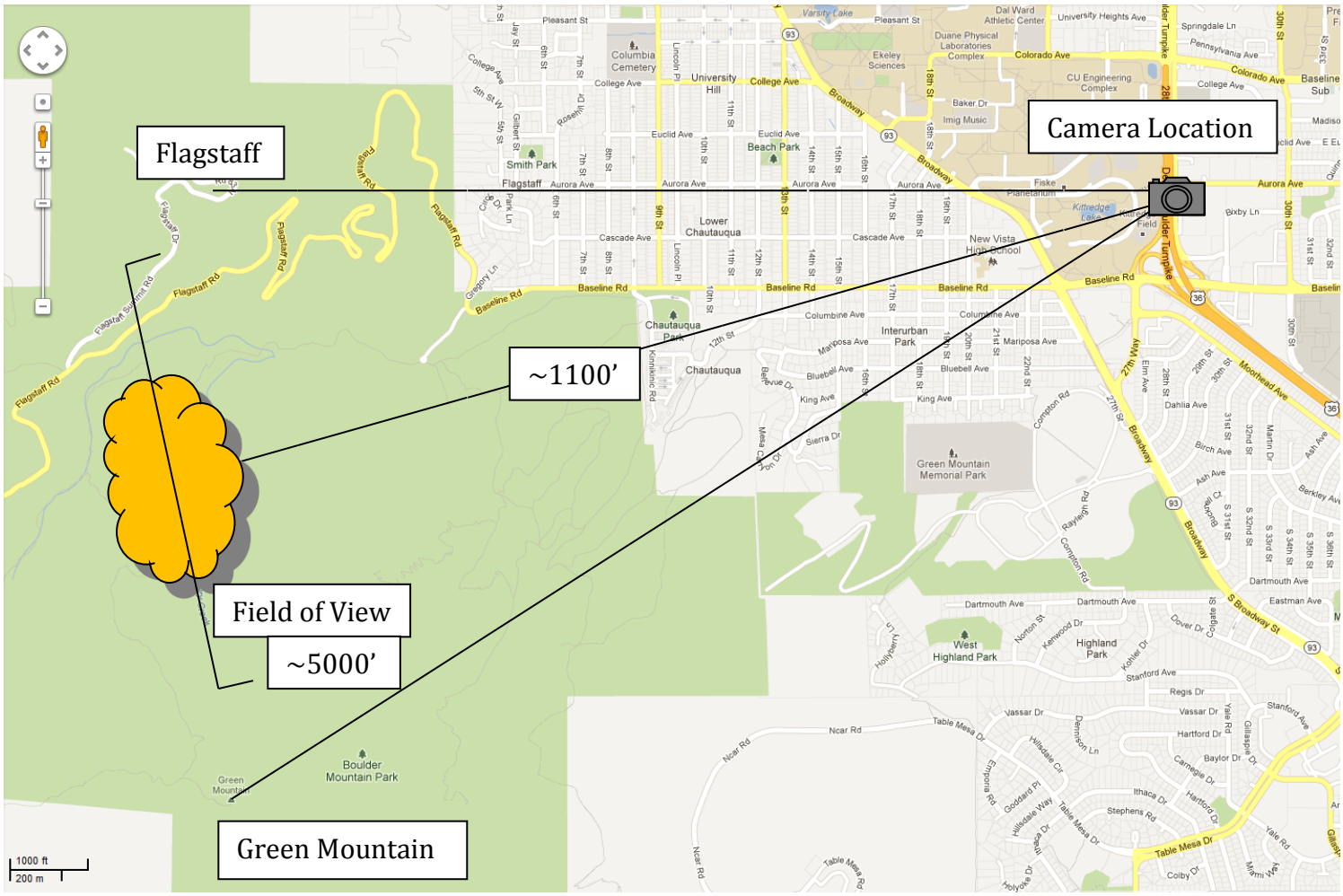

Figure A-1: Map of Camera and Image Location[1]

Figure A-2: Original Image

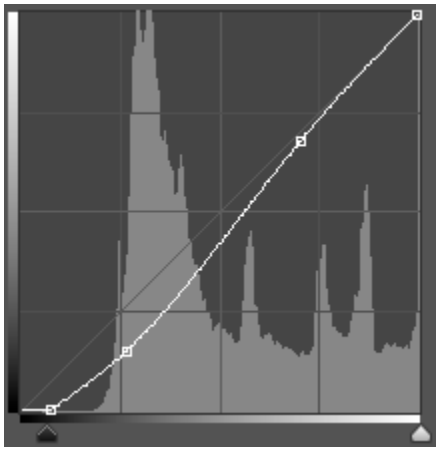

Figure A-3: Curves Function

References

[1] "Google Maps." *Google Maps*. N.p., n.d. Web. 05 Mar. 2013. <http://maps.google.com/>.
[2] N.p., n.d. Web. 05 Mar. 2013. <http://weather.uwyo.edu/cgi-bin/sounding?region=naconf>.
[3] Pretor-Pinney, Gavin. *The Cloudspotter's Guide*. London: Sceptre, 2006. Print.
[4] *Guided Flight Discovery.* Englewood, CO: Jeppesen Sanderson, 2006. Print.
[5] "WeatherSpark Beta." *Beautiful Weather Graphs and Maps*. N.p., n.d. Web. 05 Mar. 2013. <http://weatherspark.com/>.

Notes: I would also like to thank Professor Jean Hertzberg and my flight instructor (wishes to remain anonymous) for helping with my understanding of clouds and weather.