Cloud Image #2

MCEN 4151: Flow Visualization
Professor Jean Hertzburg

Alex Unger

(alex.unger4@gmail.com)
Mechanical Engineering, University of Colorado at Boulder

University of Colorado **Boulder**

I. Introduction

This panorama was taken for the second cloud image for the course Flow Visualization at the University of Colorado. The purpose of this image is to not only display the natural beauty of clouds, but to also identify cloud types and use atmospheric conditions to predict how and why particular clouds form. My intent with this submission was to capture clouds in a big blue sky juxtaposed with the red rock of the southern Utah desert.

II. Location and Time

The photos that comprise this panorama were taken along Comb Ridge, a monocline in southern Utah at a camping site about 30 miles southwest of the town of Blanding at 6:32pm MST on March 28, 2014. The final panorama encompasses about 150° of the southern horizon. The camera was pointed nearly due east for the image that makes up the left side of the panorama, and due west on the right side of the frame. The images were shot with the camera lens parallel to the ground from the top of a 15-foot boulder.

III. Cloud Types and Atmospheric Conditions

The cloud type seen in this image is cirrus fibratus. These are high-altitude clouds composed of ice crystals that form in stable atmospheric conditions. They are defined by the thin, wispy appearance of independent cloud stands. Cirrus clouds form high in the sky, typically at elevations between 20,000-45,000 ft above ground level, well into the upper troposphere. These clouds characteristic wispy shape can be attributed to the cooler temperature and high wind levels this high in the atmosphere. These conditions cause ice crystals to form, which appear as a cloud from ground level. After forming, these ice crystals begin to fall through the atmosphere, where they will encounter slower wind speeds, and thus start to lack behind the higher ice crystals. This effect creates the long tailing feature of cirrus clouds known as fallstreaks. The ice crystals will continue to descend until they reach an area of the atmosphere hot enough to melt [1].

As mentioned, cirrus clouds form in stable atmospheres. The stability of the atmosphere can be determined from skew-T diagrams of upper atmospheric soundings taken by weather balloons. Data is collected at only a handful of stations, and the closest data to Blanding, UT, near where this photo was taken, is Grand Junction, CO, about 150 miles northwest. As such, the sounding data may not be the best representation of atmospheric conditions, but it can give an indication. The sounding is for 6:00pm on March 28, 2014 and is shown in the following figure.

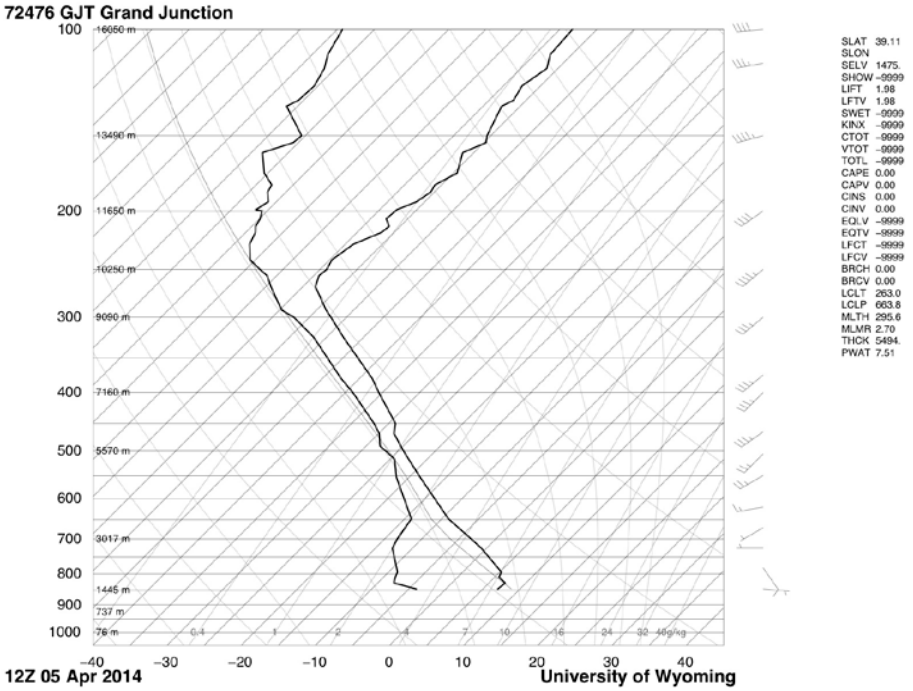

Figure 1:Skew-T Diagram [2]

The diagram does indeed verify the stability of the atmosphere. This is seen graphically since the two black lines do not intersect, and also since the CAPE value, listed to the side of the diagram, is equal to zero. Although cirrus clouds form in stable atmospheres, they are often indications for short-term changes in weather, occurring at the heads of both warm and cold fronts. During both of these fronts, warmer, moister air encounters cooler air, and with its lighter density, the warm air is thrust upwards, created the conditions for cirrus cloud formation discussed earlier. I suspect that the cirrus clouds seen in my image are indicating a warm front. The day before the photo was taken was very stormy and rainy. On the morning of the day of the photo, though, conditions cleared up and we were treated to a beautiful afternoon of low, fast moving clouds followed by the streaky cirrus clouds captured in my image.

IV. Camera, Settings, and Post-Processing

This panorama is made up of 5 images taken on a Canon EOS 60D equipped with a Canon EF-S 18-135mm IS lens. The images were shot at a focal length of 18mm to maximize the field of view of each photo. Due to the relatively high light conditions, a shutter speed of 1/800 second, an aperture of f/5, and ISO of 250 were used. The 5 photos were stitched into one 12,792 x3,336 pixel image in Photoshop using the function “photomerge” with the “reposition” setting. The images were not aligned perfectly straight after the “photomerge” function was used, so the panorama had to be cropped to get a rectangular frame. The colors were also modified slightly in Photoshop to increase the contrast between the clouds and the sky and the red rock

and the sky. This was done using the curves tool, where the darker colors were made darker and the lighter colors were made lighter. This effect is very discrete so as to avoid making the colors look artificial.

V. Conclusions

This photo succeeded in capturing interesting cloud formations next to the beautiful and distinct red rock of southern Utah. The slight Photoshop color manipulations highlight the contrast between the red rock, the sky, and the clouds. The setting of the sun adds another element and really fills in the space of the panorama. I am very pleased with how the final image turned out. For future work, I would love to keep photographing the clouds of this region and incorporate new and more dramatic landscapes.

VI. References

[1] Pretor-Pinney, Gavin. *The Cloudspotter's Guide.* New York: Penguin Group, 2006. Print.

[2] "Atmospheric Soundings." *University of Wyoming College of Engineering Department of Atmospheric Research*. Web. 18 April 2014. <http://weather.uwyo.edu/upperair/sounding.html>.