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MCEN 5151

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Clouds First Report

Taken 10.14.2023 at 6:28 PM in Boulder

I found taking pictures of clouds to be much more time consuming and a much longer endeavor than the other projects up until this point. Of course, the assignment could have been completed very quickly if I just went outside on the day it was assigned and took a picture of whatever cloud formation there happened, but to get a picture that looked nice and I was willing to present took more time and patience. The two elements that I considered when looking for clouds were the type of cloud formation, and the time of day. Trying to find a balance between the two is what took so long to take pictures of the clouds, because in other flow experiments, you can create flow that changes in a matter of seconds, so in an hour you can photograph a wide variety of flows. After weeks of photographing clouds, I had a photo of a very interesting cloud formation during a less dramatic time of day, and a nice sunset photograph with some nice cloud formations, but they weren't anything special. As you can probably see, I decided to go with the sunset picture because it is more attention grabbing and figured people would be more likely to look at it on the website. Other pictures that I took for this assignment will be posted at the bottom of the report because I feel like they are still worth sharing.

The clouds in the picture are stratocumulus because the cloud layers are more flowing and uniform than cumulus but higher in altitude than stratus. Stratocumulus clouds can form as standing lenticular clouds which are clouds that form over mountains due to cooling as they pass up and over (figure 1). Of course, I can't say for certain that this cloud formation is lenticular, because from my perspective it might not actually be exactly over the top of the mountain seen at the bottom of the picture, but slightly further behind where there isn't a prominent peak that would send the air to a higher altitude.

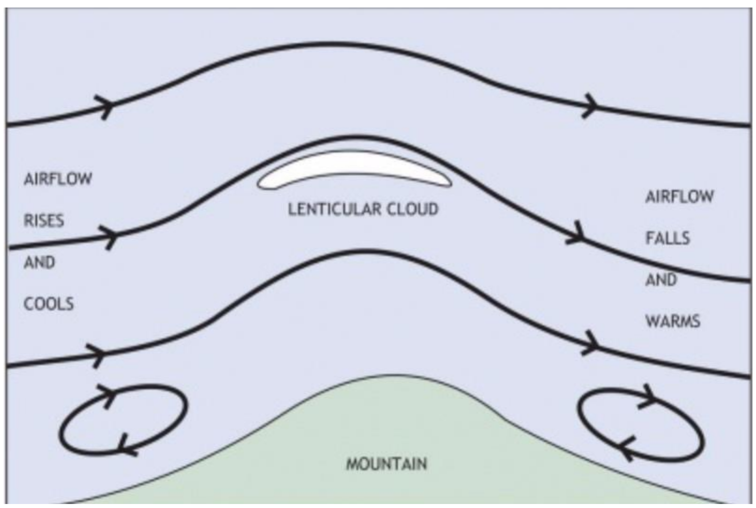

Figure 1.

Lenticular cloud formation over a mountain due to decrease in temperature

as a result of an increase in altitude.

Looking at the Skew-T chart from Grand Junction on October 14th tells us some information about the conditions that caused the clouds to form. The squiggly line on the left side is referred to as the dew point line and the line to the right is the temperature line (Figure 2). Clouds are likely to form where the lines are nearest to each other because the moisture in the air would begin to condense as it approaches the dew point at a given altitude. The altitude on the y-axis of the chart is absolute (measured from sea-level) which is why the data begins around 1500 m. We see the temperature line and dew line are near to each other from 1,500 m to 3,300 m and then again from 6,000 m to 11,000 m telling us the potential altitudes that clouds could form at on that day. This matches what we see in the picture as the clouds appear to be at least 6,000 m high, with the max altitude being hidden from view since the view of the cloud was from the bottom.

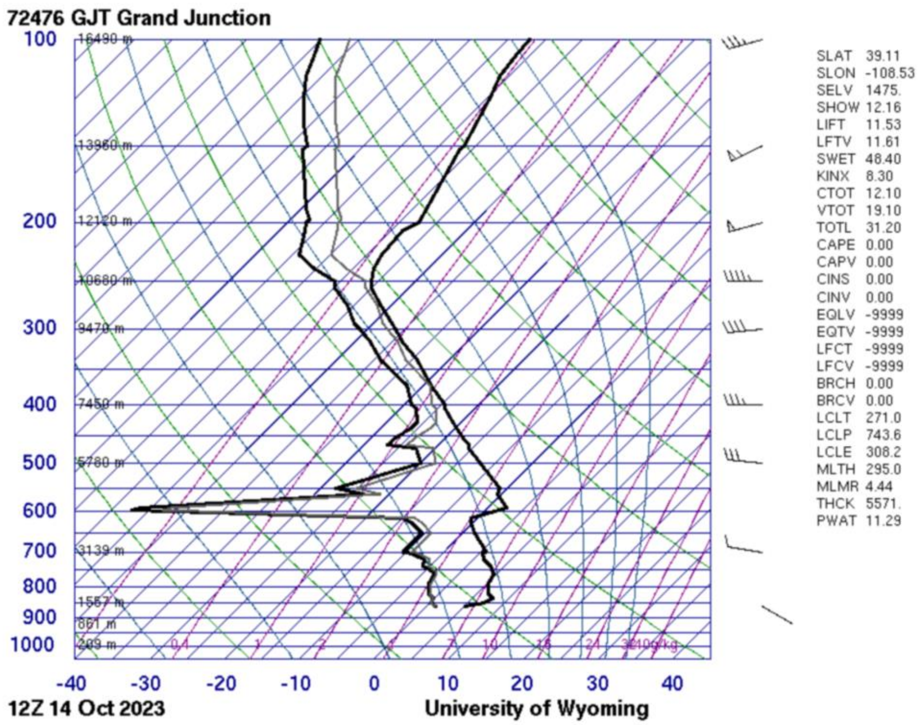

Figure 2.

Skew-T chart from 10.14.2023 in Grand Junction

For capturing the picture, I used a Nikon D800 with the following settings:

Setting	**Level**
ISO	1250
Aperture	f/9
Shutter Speed	1/320
Exposure Bias	+.07
Focal Length	210 mm

I set the camera up on a tripod to reduce any motion blur that might occur as well as to have a consistent set-up between shots. This allowed me to take a shot and easily reframe the cloud if I wanted to make adjustments. The reason I used exposure bias was to brighten up the image a bit from the automatic settings to capture more of the detail in the darker parts of the cloud. I figured that was bet7ter than adding brightness in post processing since it would just mean more information is being taken in by the camera when the shot is taken instead of trying to crank the brightness artificially in post processing.

There was minimal editing done to get the final picture. I added the tiniest s-curve to the tone curve, and cropped a bit off of the bottom because there were lights in the way. The most significant change that I made in editing was removing a bit of a building that was in the bottom left corner of the picture. This can be seen in the original unedited picture included below. I made this change because it was very distracting and drew attention away from the cloud. If I were able to get to a higher vantage point, I would have been able to avoid having any obstructions in the picture, but there wasn't anywhere that wasn't a few minute walk away and during a sunset the clouds can change in a matter of seconds. I used the retouch tool to sample a bit of the tip of the mountain and the cloud next to it and place it over where the roof of the building was.

Clouds are a very difficult thing to photograph well, and I think I did an ok job with my picture. If I always had a DSLR on hand and spent more time outside or in the mountains I might have been able to find something a bit nicer looking or interesting from a fluid mechanics perspective. As mentioned earlier, below are some additional photographs I took for this project that I didn't end up using. Please take a look if you are interested.

Sources:

Schick, Larry. "Lenticular Clouds - Explained." *OpenSnow*, 27 Apr. 2020, opensnow.com/news/post/lenticular-clouds-explained.

"Soundings from Rap, GFS, Nam, and Other Model Analyses and Forecasts, RAOBS, or Aircraft (Restricted)." *GSD SoundingDisplay*, rucsoundings.noaa.gov/gwt/?data_source=Op40&start_year=2023&start_month_name=Oct&start_mday=14&start_hour=6&start_min=0&n_hrs=1.0&fcst_len=shortest&airport=&gwt=Interactive&startSecs=1697263200&endSecs=1697266800. Accessed 30 Oct. 2023.

Appendix

Unedited picture

Additional pictures