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MCEN 4151

Cloud Second Assignment

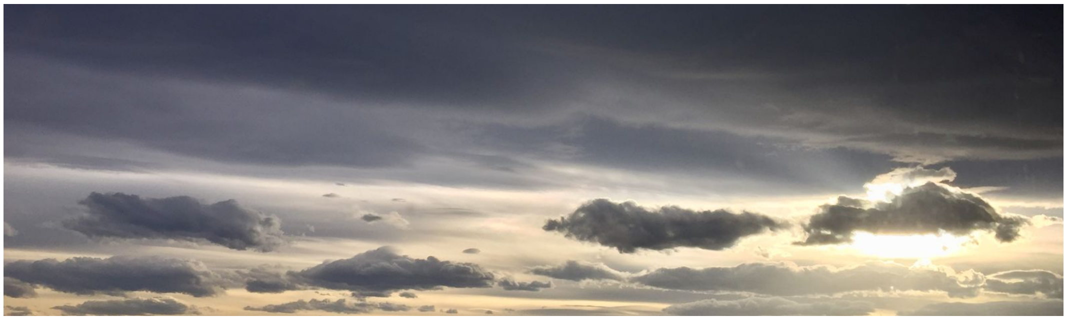

Figure 1: Cloud Second submission

I captured this image on March 30th, 2018 at 6:30 PM. The purpose of this assignment was to capture a picture of clouds and explain the type of cloud, the motion of the cloud, and the stability of the atmosphere. I captured this image on the bus from DIA to Boulder on Interlocken Loop. I captured this image using my iPhone 6 which was tilted around 15 degrees above the horizon. Having attempted numerous photos before, I found this image had the best resolution and captured the clouds how I saw them. The iPhone struggles to capture clouds with too much sunlight or higher elevated clouds, which made these clouds perfect. I also wanted to avoid any powerlines or trees which proved difficult along the ride. These Mountain Wave clouds drifting over the peaks were lingering above Denver on this afternoon. I was able to capture this image with the perfect background and no distractions. The Cirrus Fibratus clouds added a nice background to this image. These also indicate rain is coming, which it did rain after this image was captured.

Wave clouds are formed near mountain ranges with a stable atmosphere. As air travels over the range, the moisture in the air is condensed from the immediate shift in elevation and forms a cloud. These clouds appear for a short period before they evaporate from interaction with warmer air. After analyzing the Skew-T diagram, the difference between the dew point curve and the temperature confirmed these clouds were most likely Mountain Wave clouds. The average peak along the front range has an elevation of roughly 2,578 meters, so I would estimate these clouds were between 2,500 m to 3,000 m. The cape was zero, which also confirms the atmosphere was stable. The diagram also showed a pinch point around 7,500 meters, where Cirrus Fibratus clouds typically form. The temperature was 65 degrees Fahrenheit which was recorded from National Weather Service at the time of this photo. The Skew-T shows the wind was traveling west, but I observed the wind to be traveling east at the time of this photo. The wind was recorded around 5 m/s on average at this time. To calculate the Reynold's Number of this cloud, I assumed the cloud was $200\ m$ in length, a density of $1\ Kg/m^3$, and a viscosity of $1.7 * 10^{-5} Ns/m^2$. These figures were taken from Engineering Toolbox. Using the Reynold's Number Equation:

$$Re = \frac{\rho V D}{\mu}$$

$$Re = 5.88 * 10^7$$

This would suggest the cloud itself was turbulent. An iPhone 6 image is 3,600 pixels wide. If I assume the rightmost cloud takes up a fourth of the image, then the cloud is roughly 900 pixels wide. I would estimate the image is resolved to roughly 50 pixels, or 2 meter spatial resolution. In post processing, I used Raw Pics IO, an online photo editor. I increased the contrast by 15 and decreased the brightness by 10. Besides cropping, these were the only edits I made post processing. I found this highlighted the clouds while not making the image too bright. It also made the sky appear much darker which also highlighted the clouds. The sun streaks were also reduced and did not take away from the clouds. My intent was for the viewer's eyes to be drawn to the sun immediately. The wide view provides a nice image of the clouds with no additional distractions.

Overall, I was glad I was able to capture these clouds and was pleased with how the image turned out. I also believe I was able to determine the correct cloud types. In my next cloud image. In the future I would like to stop and set up my tripod for a clearer image, but since I was on the bus I had to make do with what I had. I prefer to shoot scientific flow experiments over clouds, but found these assignments were interesting.

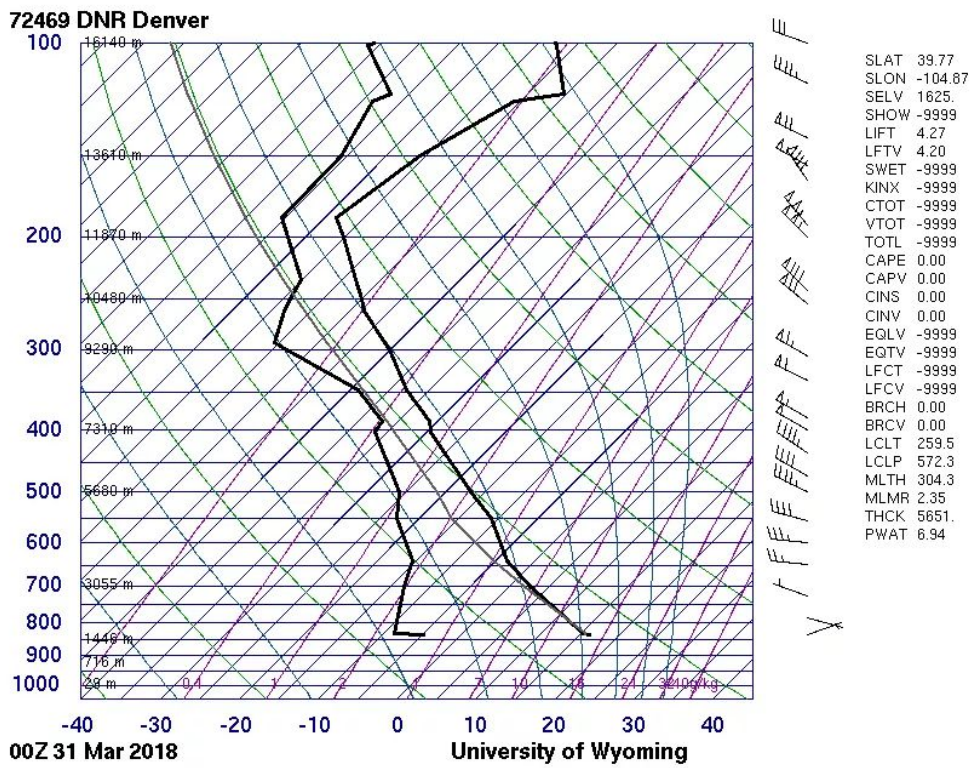

Figure 2: Skew-T graph from the afternoon of this image.

Figure 3: Original Image