Clouds 1 – 2016 Report

Image Context

For the image seen in Figure 1, the purpose was to take a picture of clouds for the class *Flow Visualization*. This was the first cloud assignment, and I sought to take a picture of clouds which are uncommon and make me questions why they appear the way they do. After weeks of looking and taking shots of various clouds, this image was the one which truly fascinated me the most with the apparent transition in cloud structure as will be discussed later.

Image Circumstance

This image was taken just north of Monument, Colorado travelling south on I-25 on Saturday, October 1st, 2016 at 9:56am MT. The image is looking straight upwards out of the vehicle's moonroof with the camera held flat against the moonroof glass. The latitude and longitude of the photo are

Figure 1: Clouds Final Image

39°10'33.5"N 104°51'1.04"W. The altitude from the iPhone metadata indicates the photo was taken at 2132 meters above sea level which equates to about 7000 feet or 1.3 miles above sea level.
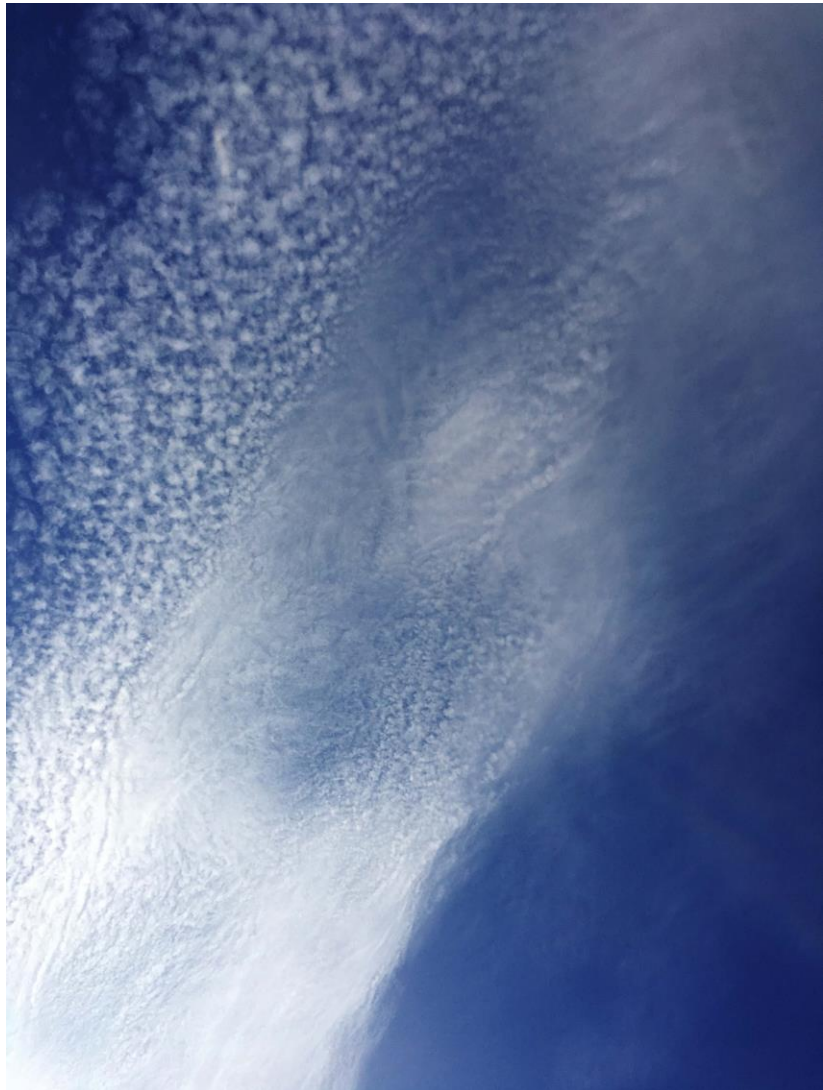
Clouds Visualization

On first glance, this image appears to show the transition from -stratus to -cumulus clouds in either the cirro-or alto- region. This is speculated due to the apparent line between the more uniform and wispy -stratus clouds to the splotchy -cumulus clouds. This transition is highlighted in Figure 2, and this transition was easily visible driving along the highway viewing this cloud section from different angles. The -cumulus clouds were east of the -stratus clouds which could be due to the relation between cumulus and stratus clouds. Figure 3 shows that -cumulus clouds are often present at an altitude just above their -stratus counterpart (Pretor-Pinney, 2006). This leads to one hypothesis for this cloud phenomenon. The cloud was present in a confined region just east of the
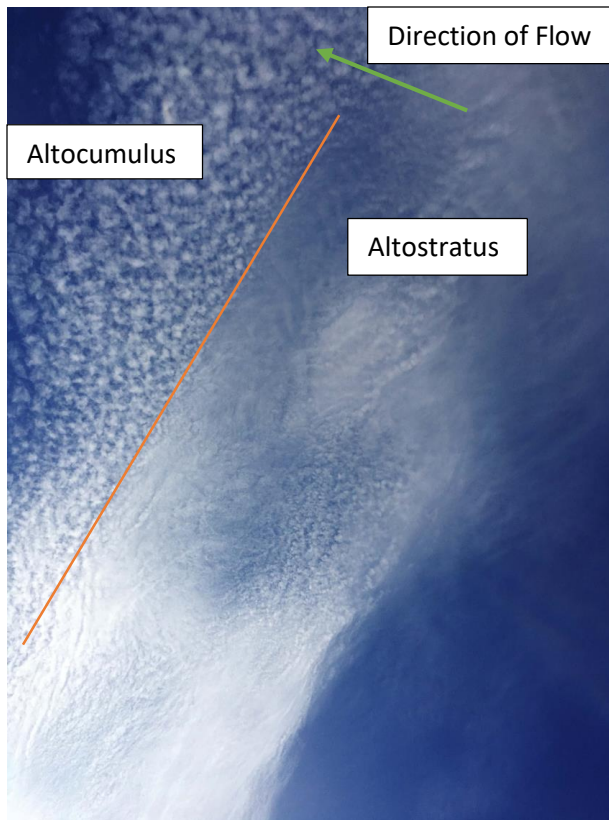
Figure 2: Cloud Transition and Flow Direction

foothills, so it could have been a standing wave created by the air bouncing in a sinusoidal nature after the foothills. The observed cloud could then depict the peak of the wave around the transition of the region so that as the air bounces higher it transits from -stratus to -cumulus. Another possibility, is that with the warming day, the air was rising to the higher altitude and becoming more unstable. The morning sounding at DIA from Figure 4 showed a CAPE of 0 which depicts a stable atmosphere, though this image was taken well south of DIA so may not be entirely representative (Wyoming, 2016). The atmosphere did indeed appear stable at the time of this picture, but later in the day, unstable clouds rolled in over Colorado Springs and the front range. These clouds were evidence that the atmosphere was becoming increasingly unstable over the course of the day. Thus, this image could show the atmosphere becoming more unstable with the transition from -stratus to -cumulus clouds.

The last step to fully identify these clouds is to estimate their altitude. The Skew-T diagram in Figure 4 shows a high relative moisture around 5000m which is in the range of alto- clouds from Figure 3. Thus, this image most likely depicts a combination of altostratus and altocumulus clouds with the transition between the two regions.
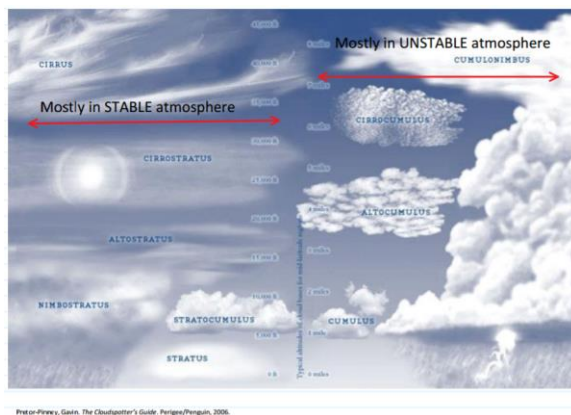

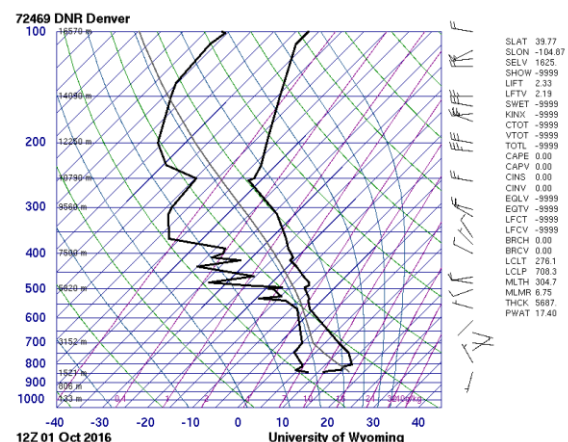Figure 3: Cloud Regions from Lecture (Pretor-Pinney, 2006)

Figure 4: Skew-T plot of 6am Sounding

Photographic Technique

This photo was taken on my iPhone 6S due to the quickly approaching clouds as I was travelling on I-25. The original image shown in Figure 5 was 4032 x 3024 pixels for around a 12MP image.

The metadata indicates an ISO of 25, aperture of f/2.2, shutter speed of 1/279 sec, and focal length of 4mm. These specs are interesting and not typical of most digital images produced with a DSLR due to the purely digital nature of the iPhone. The iPhone produced a very short focal length and odd shutter speed with an abnormally low ISO–all decided by the camera's programming to make the shot well resolved. To go from the original to final image, minimal processing in Adobe Photoshop was conducted to provide more contrast and create a bluer sky. The curves manipulation is depicted below in Figure 6. The original and final image maintained the same size with no cropping.

Figure 6: Photoshop Curve
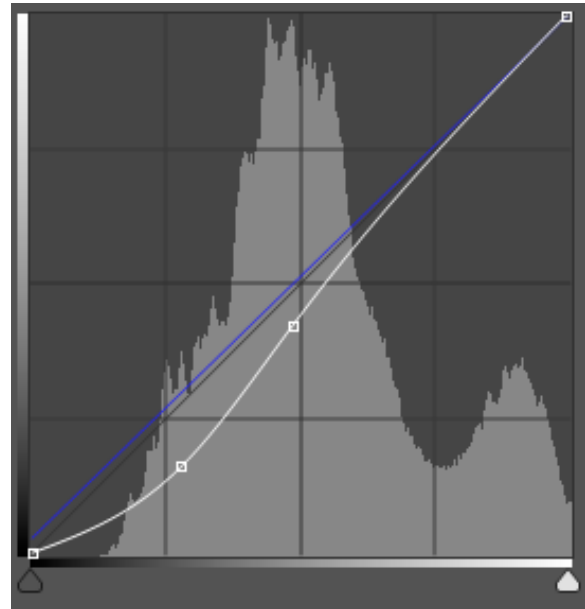

Figure 5: Original Image

Conclusion

In the end, this image reveals a curious cloud phenomenon that I attempted to uncover. Based on my analysis, it is most likely a patch of moisture consisting of altostratus and altocumulus clouds. I like the transition line which is visibly apparent in the clouds, but the image does not have any foreground which I often try to capture when observing clouds in order to give a better frame of reference and increase the artistic nature. I fulfilled my intent with this image to capture a phenomenon which is not often apparent when observing clouds, but it also leaves many lingering questions as to whether my hypotheses are correct and the true nature of the clouds which will likely never be known since analysis relies on just observation and data taken at a distant location. To develop this further, it would be helpful to look for other clouds with similar patterns and observe the conditions at the time of their passing.

References

Pretor-Pinney, G. (2006). *The Cloudspotter's Guide*. Penguin.

Wyoming, U. o. (2016, October 01). *Weather*. Retrieved from Department of Atmospheric Science: http://weather.uwyo.edu/upperair/sounding.html