

# Clouds First – Denver

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**Flow Visualization**

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## Introduction

The purpose of this paper is to describe the details of my first cloud image for the fall 2016 flow visualization course. For this image I captured large a cloud formation over Denver. The intent is to show how enormous and beautiful rocky mountain sky's can be.

## Image Circumstance

This image was taken on October 2, 2016 at 5:18 PM. By taking this image as the sun was lowering in the sky I was able to capture some interesting lighting affects. Above the clouds there was a bright sky that resembles an earlier time of day. Below the clouds the environment is darker and golden sunrays can be seen in the bottom left side of the image. The scientific name for sunbeam or sunrays is Crepuscular rays. Having parallel beams of light passing though gaps in the clouds causes crepuscular rays. Because of perspective affects it looks like the rays are converging when in fact they are parallel. (Markus Billeter, 2010) For this image I was on the top of a parking structure in downtown Denver. I was facing west towards the mountains.

## Clouds and atmospheric information

The clouds in this image are Stratocumulus. This is fairly obvious for several reasons. They are low in the sky when compared to other types of clouds like cirrus or Altocumulus. The only other cloud type that could be considered is Cumulus. Due to the flat layered nature of these clouds indicates that they are Stratocumulus. According to the Skew-T graph bellow the CAPE was 252.8 witch indicates an unstable atmosphere. This is not what I expected based on the cloud formation. Stratocumulus clouds tend to form in a stable atmosphere in the lower-tropospheric conditions. (WOOD, 2012) The Skew-T plot shows that the adiabatic cooling line is

above the temperature line throughout the lower atmosphere. At about 6,000 m the lines cross at a point where the temperature spikes but after that point they cross back. The atmosphere finally becomes stable at about 9500m. Unstable atmosphere usually leads to clouds building due to the fact that the air has a tendency to rise in an unstable environment. Therefore it would be reasonable to expect Cumulus clouds based on the Skew-T plot below.

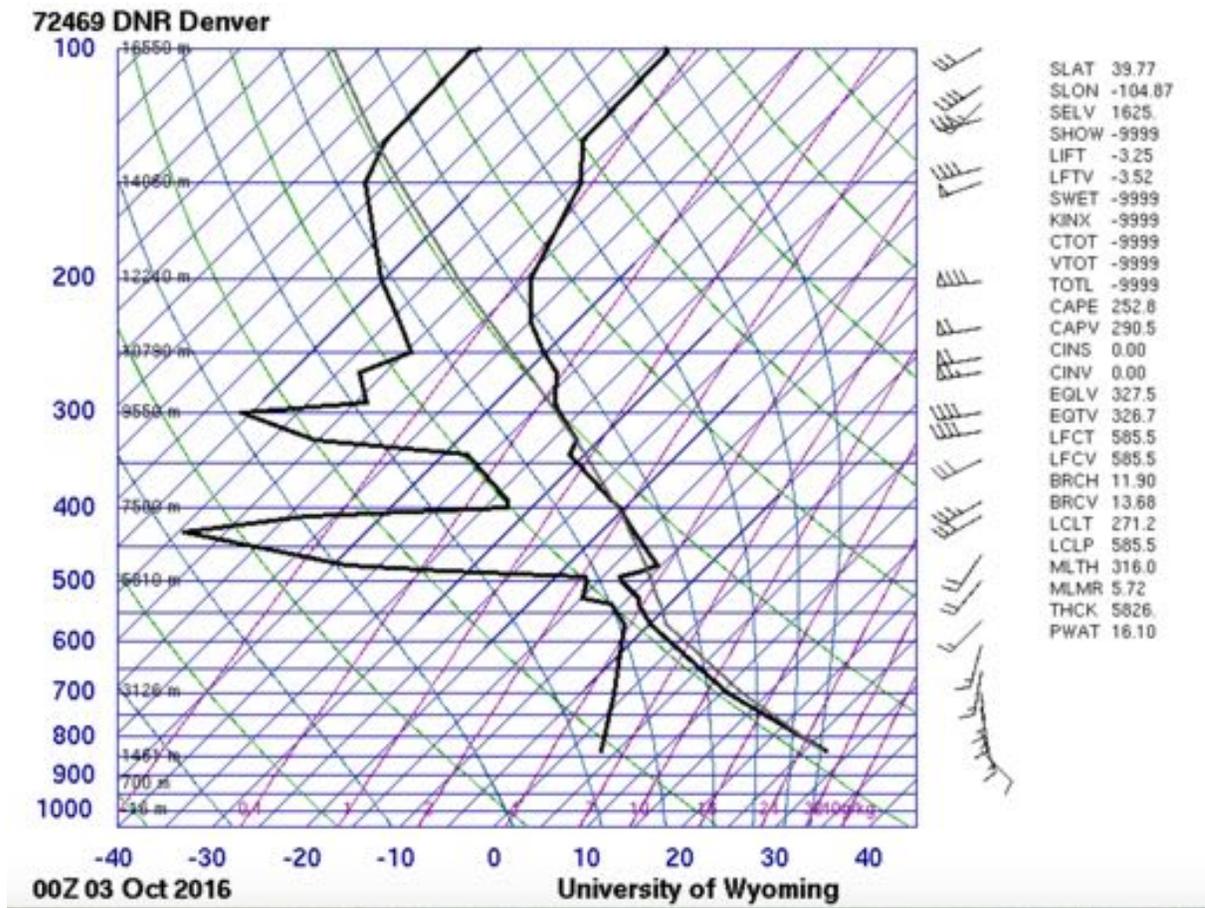


Image 1 – Skew-T Plot

This skew-T plot was taken at a point south east of the actual location these clouds and was released about 40 minutes later. Although the Skew-T may be a bit misleading due to the location it is still helpful in defining other interesting details. By reading the Skew-T plot we can determine that it was about 24 °C at ground level about 1,600m. At the highest point these clouds would be at about 3,500 m and a

temperature of about 6 °c. On this day there was little to no wind at ground level. The weather for this day was mostly sunny with some cloud development in the afternoon. This made for a beautiful environment to take photos.

## Photography technique

For my first cloud image I spent a lot of time working with my camera settings and learning how to capture such a large environment. I found it difficult to capture exactly what I was seeing in real life. Although I improved with practice I still feel that my image does not quite capture the beauty of the reality. The focal length was 29mm. The lens I was using is called The Canon EF-S 18-55mm f/3.5-5.6 IS II. The camera I used is a DSLR Canon EOS Rebel T3. The original raw image was 2,848 pixels high and 4,272 pixels wide. The final image after cropping and editing was 2,585 pixels high and 4,191 pixels wide. The IOS setting was IOS400. This made for a clear image but for such a large image it may not hurt to allow for more granularity in exchange for more sensitivity. The aperture was set at F10 with a shutter speed of 1/665. After taking the photo I made some slight adjustments using GIMP photo editor. I cropped the photo and brightened it using the contrast map. Estimating the size of my image is difficult. As you can see at the bottom of the image there is a large mountain range. Using this as a guide I estimate that I captured an image of 20 to 30 miles wide. Below is my unedited image, which clearly shows the enormous size because of the inclusion of the city in the foreground.



Image 2 – Image Before Editing

## Conclusion

I am excited about how my image came out for this project. I think there are a couple of things that I want to work on for my next image. First I would like to have a slightly cleaner and better-focused image. On my first attempt to edit my image I over brightened it and it was a bit blown out and I feel like I will be able to really perfect my image next time in post processing. I would like to get an image that captures a more interesting phenomenon. Over all I was pleased with how my image. I liked the fact that I was able to show scale by incorporating the mountains in the bottom of the image. I now find myself constantly looking at clouds and can't wait to capture my next cloud.

## Bibliography

Markus Billeter, E. S. (2010). *Real Time Volumetric Shadows using Polygonal Light Volumes*. Chalmers University of Technology, Sweden. Gothenburg: High Performance Graphics.

WOOD, R. (2012). *REVIEW Stratocumulus Clouds*. University of Washington. Seattle: MONTHLY WEATHERRE VIEW.