# Clouds

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**Flow Visualization**

**2/27/2013**

## Introduction:

The perfect day to me is a day without a single cloud in sight, but now it is time to appreciate the funny shaped objects floating above us. The tree main types of clouds I could think of before taking this class were clouds that carry lots of snow, summer thunderstorm clouds, and small ones that would annoyingly block the sun. After discussing actual classifications of clouds, the purpose of this image assignment was to capture at least one type of cloud and be able to classify it. Luckily Colorado has many types of clouds to offer and sometimes you only have to wait 15 min for the sky to paint a totally different picture.

## Image:

This image was taken on February 18$^{th}$ 2013 at 2:20 PM Mountain Standard Time. It was taken from the balcony on the seventh floor of the engineering tower, facing south, overlooking campus, and with the Flatirons on the right. For the original image, the camera was held level and simply pointed south trying to capture the three main attractions. The outside temperature the day the picture was taken was 41°F with a 21.9 mph North-West wind. The humidity during that time was 14%. The same day last year had an outside temperature of 37 °F, a 4.7 mph North-East wind, and a humidity of 48%.

## Cloud Physics:

There are at least two types of clouds captured in this image, Stratocumulus and Altostratus. These types of clouds occur at altitudes between zero and up to 45000 feet. The lowest possible cloud would be considers a Stratus cloud and dependent on how low it is, it might be considered fog. These types of clouds usually occur in a stable atmosphere.

To accurately identify what types of clouds are occurring, one has to look at an appropriate Skew-T diagram for the area. The Skew-T diagram show if the atmosphere is stable or not and indicates the most likely altitude where clouds have the potential to form. Figure 1 is the appropriate diagram for the day and location the image was taken. The left solid black line shows the dew point temperature in the atmosphere based on altitude, and the right black line shows the temperature in the atmosphere at a given altitude. When the two lines are closest together, the likelihood of clouds occurring is greatest. Based on this Skew-T diagram, clouds are likely to occur from 2800m to about 6000m above sea level. Since the elevation in Boulder is about 1600m, the clouds are likely to occur between 1200m and 4400m above ground. The CAPE number indicates if the atmosphere is stable or not. Since this number is zero, the atmosphere on 2/18/13 was stable.

Based on the fact that the atmosphere was stable that day, and the most likely altitude for clouds to occur was less than 6000m, it is confirmed that the clouds in the image were part of the Stratus cloud family.

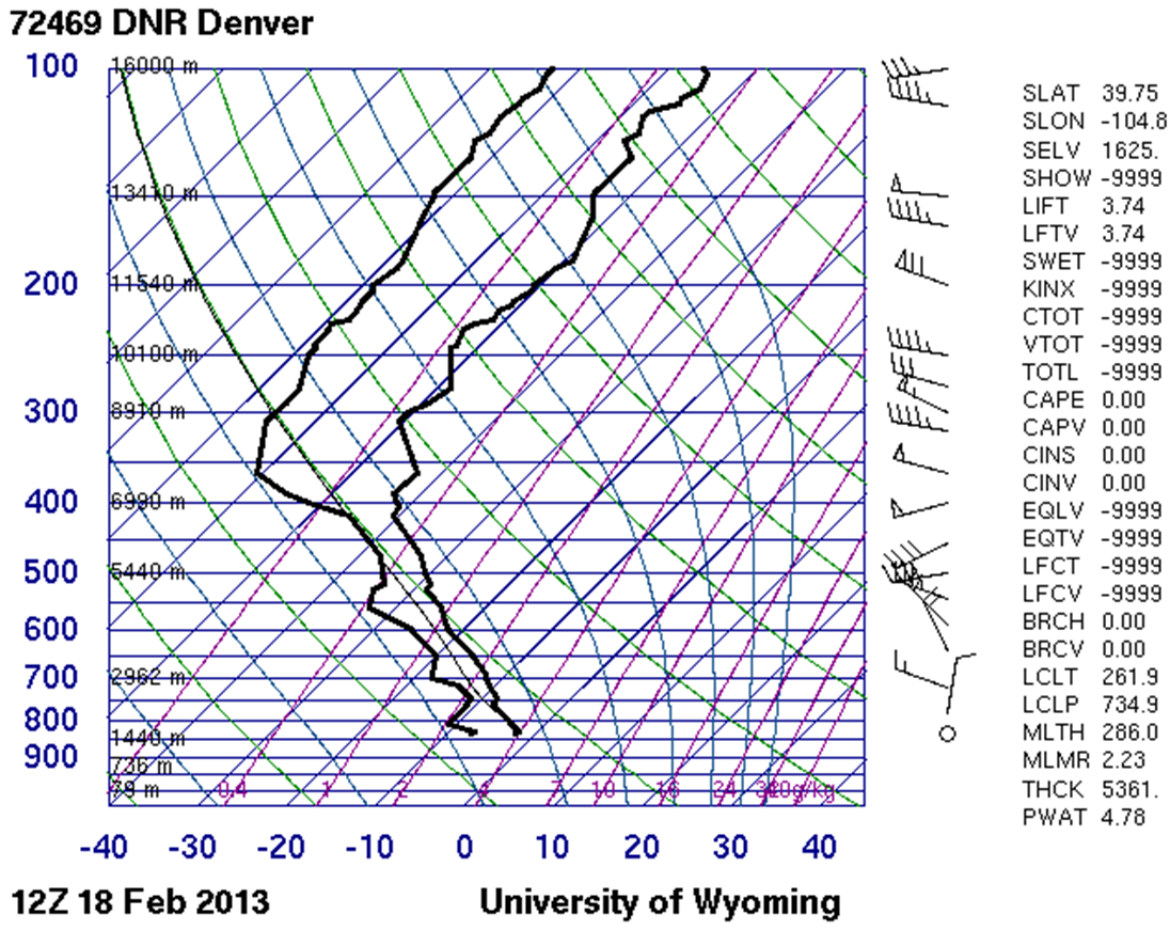


Figure 1: Skew-T diagram for Denver CO 2/18/13

## Photographic Technique:

This image was taken with a Nikon D60 with a F-Stop of f/11, ISO of 200, and a shutter speed of 1/500 sec. The original image dimensions were 3872 by 2592 pixels. The approximate cloud height was 1500m above ground.

The processing techniques used, in Adobe Photoshop, to arrive at the final image were the use of the copping tool, curves for slight contrast adjustment, and the use of the clone tool to remove some glare from the sun on the lens. A comparison of original and final image can be seen in Figure 2. The final image dimensions were 3872 by 2073 pixels.


Figure 2: Original Image (left) Final Image (right)

## Discussion:

The image shows two types of clouds, Stratocumulus and Altostratus. Based on the Skew-T diagram and the range of altitude these types of clouds usually occur, their identification was confirmed. By capturing campus and the Flatirons in the image, it gives good sense of space the image is capturing. I'm pleased with the final image since it captures a typical Colorado winter day and features my two favorite every-day sights.

## References:

[1] "UNDERSTANDING A SOUNDING/SKEW-T." *Lead to Learn*. N.p., n.d. Web. 18 Feb 2013. <http://www.atmos.millersville.edu/~lead/SkewT_HowTo.html>.
[2] "Boulder Weather Graph." *WeatherSpark*. N.p., n.d. Web. 18 Feb 2013. <http://weatherspark.com/