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Flow Visualization  
Clouds 1

Figure 1. Cumulus and Altocumulus, Mountain wave clouds. Feb. 12, 2010, 4:02PM Boulder, CO looking west at the Flatirons from HWY 93.

### Clouds 1

The intent of this cloud image was to capture the interaction of the sun, Flatirons, and clouds with each other. My goal was to capture how the sun both reflects and penetrates through the clouds and how the altocumulus clouds cast shadows onto the cumulus clouds. I also wanted to make the Flatirons a part of the image and highlight their features without taking away attention from the clouds.

#### Weather Conditions:

The image above was taken in Boulder, CO on February 12, 2010, at 4:02PM off of HWY 93 at the end of Broadway facing west towards the Flatirons. At the time the picture was taken it was a sunny day with mountain wave clouds coming in from the west. According to weather underground Boulder, the conditions were as follows:

Time (MST): Temp.: Dew Point: Humidity: Sea Level Pressure: Visibility: Wind Dir: Wind Speed: Gust Speed: Precip: Events: Conditions:

3:52 PM 44.6 °F 15.8 °F 31% **29.84** in 50.0 miles WNW 4.6 mph - N/A Mostly Cloudy

4:50 PM 46.4 °F 10.4 °F 23% **29.84** in 50.0 miles NW 6.9 mph - N/A Mostly Cloudy

5:48 PM 42.8 °F 12.2 °F 29% **29.85** in 50.0 miles Calm Calm - N/A Scattered Clouds

#### Cloud Identification:

The clouds in the image are Altocumulus and Cumulus mountain wave clouds. Altocumulus are mid level clouds, between 6,500 and 23,000 ft, and often come before a cold front. These clouds are made mostly of water droplets, and when water temperatures are very low droplets turn to ice crystals. The altocumulus clouds are in the upper portion of the photo above the larger cumulus cloud. Cumulus clouds, known as fair weather clouds are also present in the photo right above the Flatirons. Cumulus clouds are low level clouds made of water droplets that have flat bases and bumpy tops. Cumulus clouds often form on sunny days. The photo was taken at approximately 4PM with winds ~5 mph coming in from the WNW. Based on the Skew-

T plot for February 12, 2010, at 6PM the atmosphere was stable with a CAPE of 0, and the clouds would be expected to be at approximately 20,000 ft. The atmosphere for these clouds is neutrally stable based on the Skew-T.

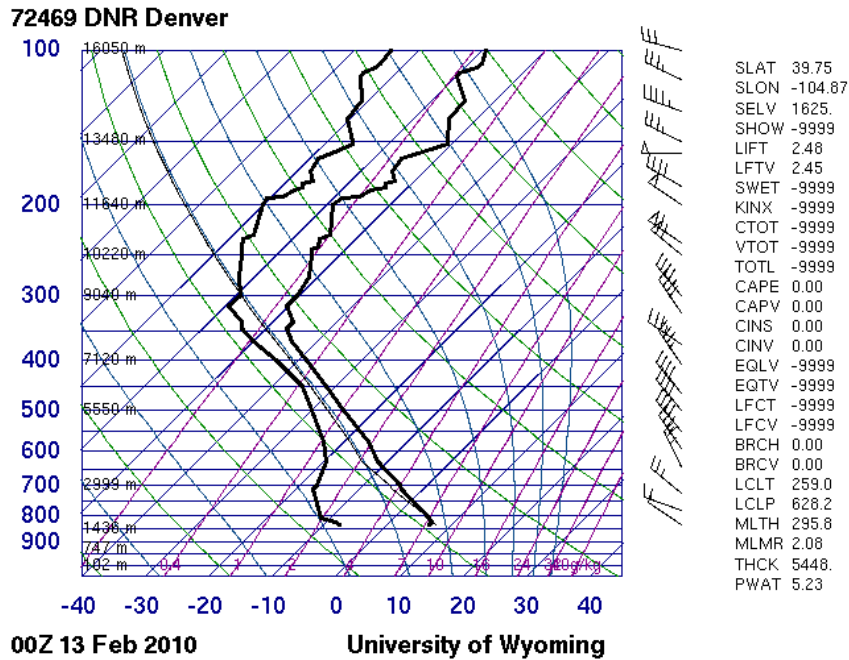


Figure 2. Skew-T Plot for Denver, February, 12, 2010 6PM.

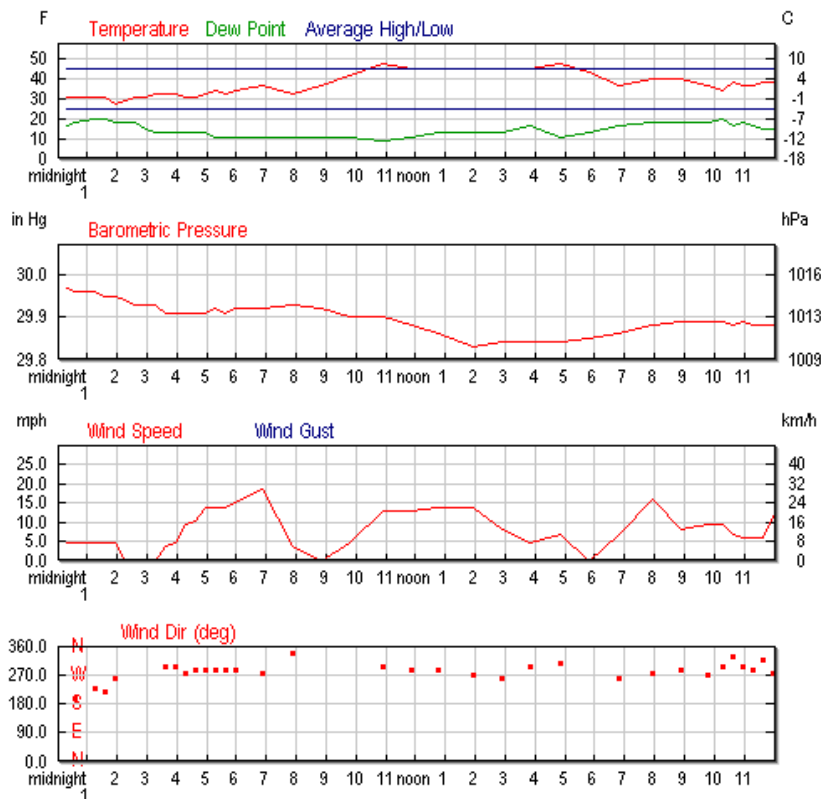
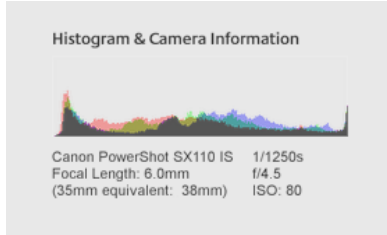


Figure 3. Weather Conditions. February, 12, 2010. Weather Underground Boulder.

Photographic Technique:

Distance from object to lens: ~ 2 miles (HWY 93 to Flatirons)

Camera Settings:



Property	Value
Dimensions:	3456 x 2592 pixels
Camera make	Canon
Camera model	Canon PowerShot SX110 IS
Camera Date	2010:02:12 16:02:56
Resolution	3456 x 2592
Orientation	Normal
Flash	Not Used
Focal length	6.0mm
35mm equivalent	38mm
CCD width	5.82mm
Exposure time	0.001s (1/1250)
Aperture	f/4.5
ISO	80
Exposure bias	0.00
Metering Mode	Matrix
Thumbnail	160 x 120 pixels
JPEG Quality	95 (422)
Unique ID(DB)	3f879f8b80b32a4500000000000000...

Photoshop:

The only adjustments made to the photo were an adjustment in the levels to bring out the contrast of the photo. First, I selected the Flatirons using the smart selection tool and increased the contrast using curves in order to see the edges of the Flatirons, and then I adjusted the overall levels of the photo to make the sky appear bluer and the clouds to stand out in the photo more dramatically.

Reflection

This image captures the key characteristics I was looking for in a cloud. I was able to capture the clouds and the sun penetrating through the clouds, as well use the flatirons to show the grand scale of the clouds in the image. Due to the perspective I was not able to capture the shadows cast from the altocumulus to the cumulus clouds. This would require me being at a higher elevation to capture this phenomenon. Overall I am very happy with how the cloud image turned out and next time I would like to focus on and capture a single cloud rather than a formation of clouds over a landscape.