# Clouds 1



MCEN 4151
Kyle Thatcher

The image described in this report was the first experience in cloud photography intended for the University of Colorado's Flow Visualization class. The purpose of this image was to capture an interesting fluid flow phenomenon in one of the most everyday common places… clouds. For this assignment, I intended to capture the cloud formations that the sun lights up during its daily rise.

To achieve my goal, I decided to embark on an early morning hike to the top of the Flatiron rock formations which preside over the city of Boulder, CO. Beginning my trek at 5:30am on February 18th, I was able to arrive at my destination, Malory's Cave, by 6:15am allowing time to set up my camera and capture the entire event of the sun rising. I positioned my tripod, pointed my camera due east at zero degrees elevation and waited for the majestically event scheduled to occur at 6:48am.[1]

The sky was unfortunately sparse in clouds on the day of this image, however, there are some nice rolling Altocumulus clouds in the left portion of the image and a glimpse of what I believe are Altostratus encroaching from the south. From figure 1, it is seen that the temperature was a steady 52°F with a dew point of 9°F and winds were from the west and steadily slowing from around 38mph. The skew-T plot shown in figure 2 describes the atmosphere on the morning of February 18th to be very stable with no storm or precipitation in sight with a CAPE of 0.00. One would actually expect to not see any cloud formations on this particular day based of both figure 1 and figure 2. I was lucky enough that there were a few wispy specimens in the distance, however, cloud cover that morning was probably less than 5%.

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[1] http://www.timeanddate.com/worldclock/astronomy.html?n=75&month=2&year=2014&obj=sun&afl=-11&day=1
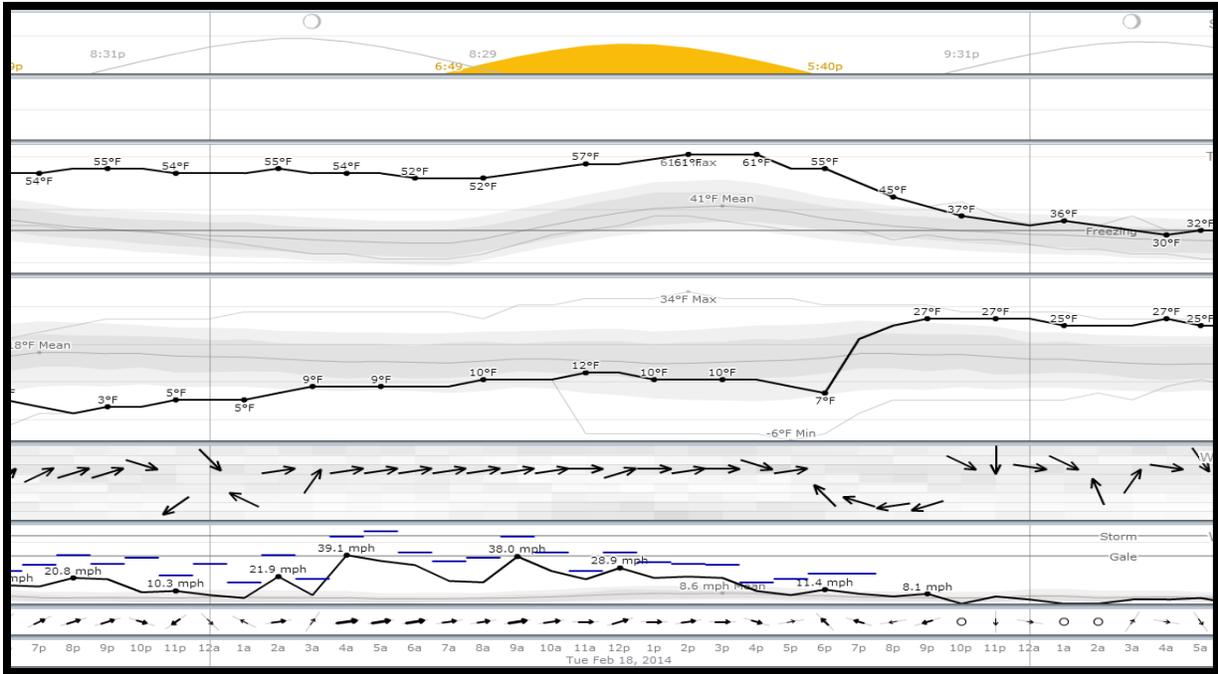
Figure 1: WeatherSpark history graph of solar/lunar cycle, temperature, dew point, wind direction and wind speed for February 18th , 2014
(http://weatherspark.com/#!dashboard;q=Boulder%2C%20CO%2C%20USA).
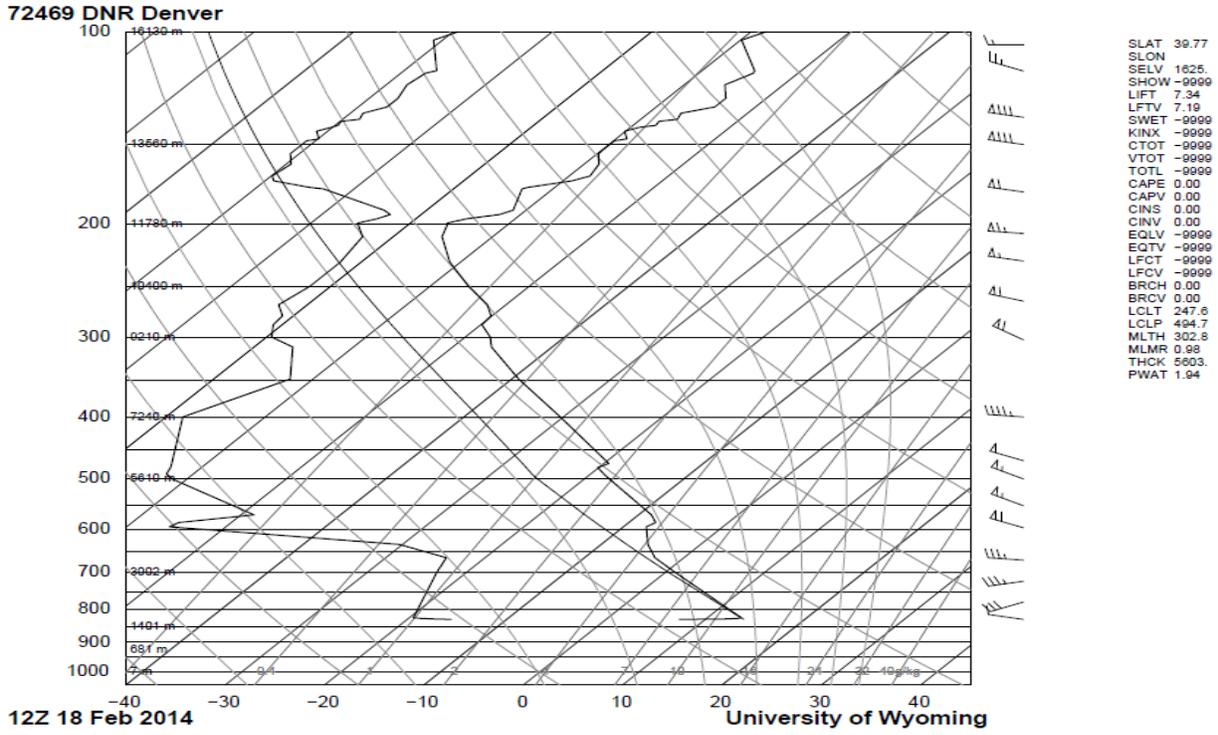


Figure 2: Skew-T plot for the morning of February 18th, 2014 generated by the University of Wyoming
(http://weather.uwyo.edu/upperair/sounding.html).

This photo was taken on a Nikon P7100 10.1 Mega Pixel digital camera. The focal length was $6mm$ with a sensor size of 7.6x5.7$mm$ resulting in a 87.1° horizontal and 70.9° vertical angle of view when calculated using equation 1.

$$\alpha = 2arctan\left(\frac{d}{2f}\right)$$   Equation 1[2]

where $\alpha$ is the angel of view, $d$ is the chosen dimension (sensor dimension in this case) and $f$ is the effective focal length. This field of view was chosen as to capture as much of the morning sky as possible. The camera was set to a fixed ISO 100 value and a small f-Stop of f/4.0 was chosen to decrease image noise, allow for the greatest density of light to reach my camera's sensor and allow a large focal area in this low light shot. A shutter speed of 1/800 sec was selected to allow adequate exposure without washing out the image. Finally, Photoshop was utilized to alter the image. In Photoshop, the image was rotated .78° to make the horizon perfectly horizontal and cropped to give it the 'panoramic' effect. The brightness/contrast was adjusted as well as vibrance to achieve my personal aesthetic aim. These changes can be witnessed in the original vs. final image comparison in figure 3.
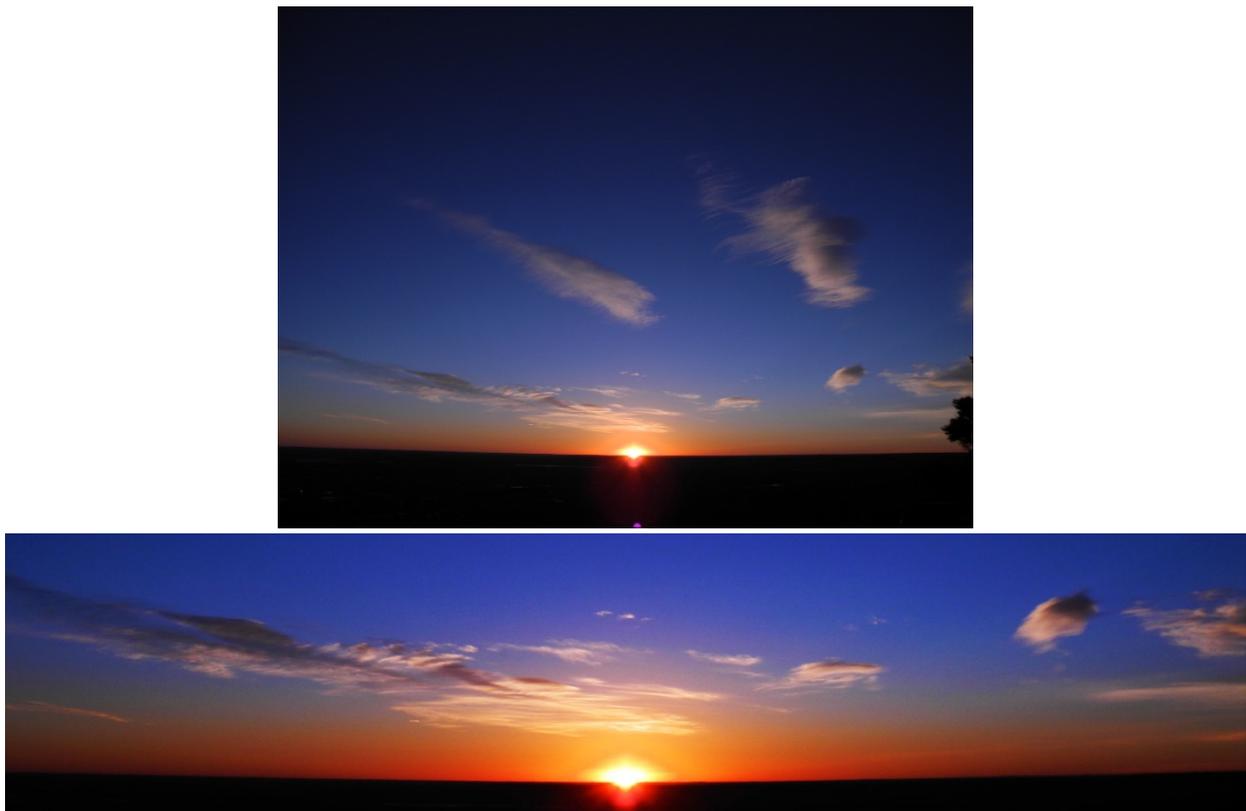


Figure 3: Comparison of original image (upper) and Photoshop altered image (bottom).

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[2]  http://en.wikipedia.org/wiki/Angle_of_view

This image reveals the inspiring beauty that can be witnessed when one puts forth the effort to witness it. I especially like that sun is perfectly centered in the image along with the horizon 'notching' caused by the refracting light. In addition, I enjoy the color gradient captured from deep dark red to rich royal blue. Unfortunately, the clouds did not display any interesting fluid physics on this day, and I would very much like to improve upon this in the future.

# Image Assessment Form

## Flow Visualization

## Spring 2014

Name(s): Kyle Thatcher

Assignment:     Clouds 1                          Date:     2/18/14

Scale: +, ! = excellent  √ = meets expectations; good.  ~ = Ok, could be better.  X = needs work. NA = not applicable

| Art | Your assessment | Comments |
|---|---|---|
| Intent was realized | ! | |
| Effective | √ | |
| Impact | ! | |
| Interesting | √ | |
| Beautiful | ! | |
| Dramatic | ~ | |
| Feel/texture | ~ | |
| No distracting elements | ~ | |
| Framing/cropping enhances image | ! | |

| Flow | Your assessment | Comments |
|---|---|---|
| Clearly illustrates phenomena | X | |
| Flow is understandable | X | |
| Physics revealed | X | |
| Details visible | ~ | |
| Flow is reproducible | NA | |
| Flow is controlled | NA | |
| Creative flow or technique | NA | |

| | | |
|---|---|---|
| Publishable quality | X | |

| Photographic/video technique | Your assessment | Comments |
|---|---|---|
| Exposure: highlights detailed | ! | |
| Exposure: shadows detailed | ! | |
| Full contrast range | ! | |
| Focus | ! | |
| Depth of field | ! | |
| Time resolved | ! | |
| Spatially resolved | ! | |
| Photoshop/ post-processing enhances intent | √ | |
| Photoshop/ post-processing does not decrease important information | √ | |

| Report | | Your assessment | Comments |
|---|---|---|---|
| Collaborators acknowledged | | NA | |
| Describes intent | Artistic | ~ | |
| | Scientific | X | |
| Describes fluid phenomena | | X | |
| Estimates appropriate scales | Reynolds number etc. | X | |
| Calculation of time resolution etc. | How far did flow move during exposure? | X | |
| References: | Web level | ! | |
| | Refereed journal level | X | |
| Clearly written | | √ | |
| Information is organized | | √ | |
| Good spelling and grammar | | ! | |
| Professional language (publishable) | | ~ | |
| Provides information needed for reproducing flow | Fluid data, flow rates | NA | |
| | geometry | NA | |
| | timing | NA | |
| Provides information needed for reproducing vis technique | Method | NA | |
| | dilution | NA | |
| | injection speed | NA | |
| | settings | NA | |
| lighting type | (strobe/tungsten, watts, number) | NA | |
| | light position, distance | NA | |
| Provides information for reproducing image | Camera type and model | ! | |
| | Camera-subject distance | ! | |
| | Field of view | ! | |

| | Focal length | ! | |
|---|---|---|---|
| | aperture | ! | |
| | shutter speed | ! | |
| | Frame rate, playback rate | NA | |
| | ISO setting | ! | |
| | # pixels (width X ht) | X | |
| | Photoshop and post-processing techniques | √ | |
| | "before" Photoshop image | ! | |