

Flow Visualization
MCEN 4151

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Clouds I

Jeremy Parsons

Introduction:

Clouds are a part of people's daily life, thus their innate beauty is often overlooked. Taking a moment out of one's day to look up at the sky can offer insight to the beauty and science behind such unique and aesthetic formations. Having grown up in Colorado, I am especially spoiled. The natural terrain and variable climate yields a strong variety of cloud types and formations. The goal of this image was to capture the cirrus circulation patterns in between the stratocumulus lenticularis (mountain wave) clouds that tend to linger near the edge of the Flatirons. The Flatirons are apart of the Front Range of the Rocky Mountains and rest on the city limits of Boulder, CO and separate the plains from the Front Range. My home is at the base of these mountains and such formations a rather common, however this cirrus wisps captured in the image tucked in between the layers of the wave clouds and offered a unique perspective.

Image:

This image was captured February 19, 2013 near 2pm MST. It was taken from the roof of my apartment on 17th and Broadway. The photo was taken at about 30 degrees from horizontal on the first sunny opportunity in days; the temperature at the time was approximately 40 degrees Fahrenheit. I spotted the formation as I was walking home from class and in fear of missing the opportunity; I jogged home to get my camera. Ironically, as I climbed to my roof, it turned out the cirrus formation I wanted to capture was developing more as it matured. I waited, huddled on the roof, for about 30 minutes until the sun poked through and this image was the best of the set captured. The image turned out very well and appealingly. Unfortunately, despite a variation of photographic techniques and editing, it became difficult to separate the wisps from the grey background of the lenticularis formations. I elected to leave the outline of the pine tree in the bottom right to add contrast to the purples and blues in the edited image.

Cloud Physics:

The clouds in the picture are cirrus clouds amongst stratocumulus lenticularis clouds. The lenticularis clouds are quite common to Boulder as they form when clouds come over the mountain range. These clouds form between 2000-6500 feet from the ground. These types of clouds are affiliated with a moist stream of air that forms the clouds as they pass over the mountain range [1]. The staggered layering effect is due to turbulent winds that form as the cloud formations pass over each mountain. This is illustrated in Figure 1 seen to the below [2]. The cirrus formations are composed entirely of ice crystals and usually form above 24,000 feet in altitude. Specifically these formations are called cirrus vertebratus; the reason for this rather unique name is the fact that this type of cirrus cloud looks like a fish skeleton [1]. This formation was especially unique and interesting to me because it appeared to be forming in the gaps of the lenticularis clouds. I believe this must be due to the

high wind speeds in these areas. The same turbulent winds that separate the mountain wave clouds give rise to cirrus formations in cold weather. The turbulence must be especially strong since one can see a full spiracle eddy forming in the gap.

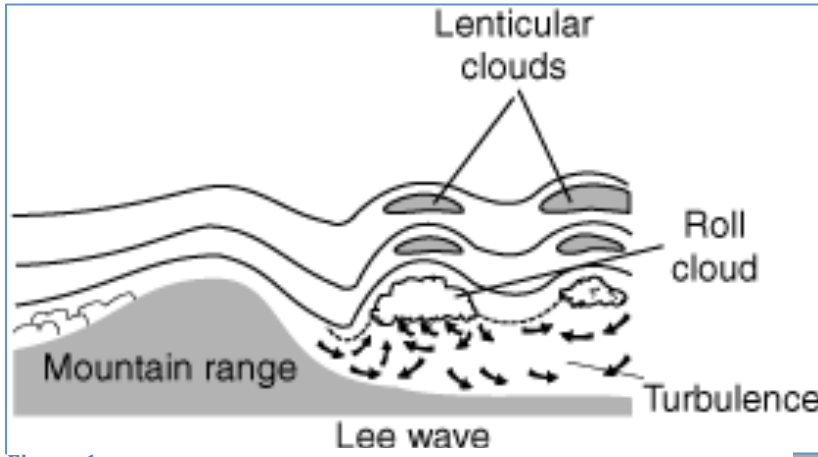


Figure 1

The following figure (Figure 2) shows the Skew-T plot for February 19 2103. The plot indicates 00Z meaning 7:00 AM MST. This most accurately represents the weather system being captured in the image [3]. The Skew-T plot is from a weather balloon launched in Denver, which is approximately 35 miles away from the image's location. The line on the right represents temperature and the line on the left represents dew point both with respect to altitude. At about 2000 meters (6500 feet) the temp line is as steep as the local adiabat thus this atmosphere may be considered stable or even semi-stable.

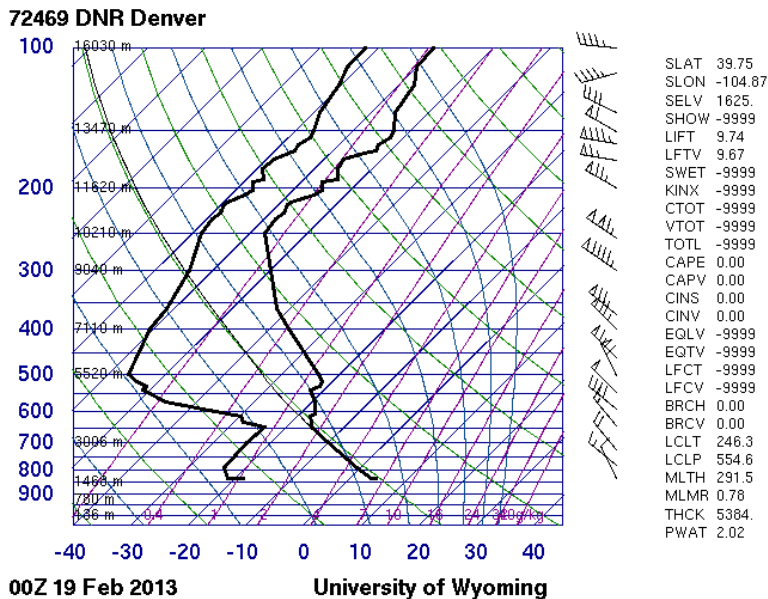


Figure 2

Photographic Technique:

The following is the settings used to capture the image.

- Camera: Cannon Rebel XT Digital
- Lens: Cannon 300mm Macroscopic Lens
- Image size: Original – 3456x2304 pixels Edited – 1612x1052 pixels
- Exposure Settings: Macro mode with flash using ISO-800, F/-4.0
- Exposure Time – 1/640 second
- Editing- Cropping and color contrast adjustments were done in Photoshop CS6

Original Image



Edited Image



The original and edited images are shown above. The edited image was cropped at its bottom edge to remove the left tree. A manipulation of color balance brought out the darker purples, a photo filter was used to separate the foreground from the background and the curves tool was used to sharpen the contrast slightly.

Commentary:

I truly do find this image aesthetically pleasing, the dark blues and purples serve as calming while also bringing out the unique cloud formations. The cirrus clouds forming in between the lenticularis clouds offer a insight to how both of these clouds behave and form. This assignment has been informative and pleasurable and I hope this will remind others as well as myself to remember to “look up”!

Citations:

- 1) Pretor-Pinney , Gavin. *The Cloudspotter's Guide*. New York: Penguin Publishing, 2006. Print.
- 2) . N.p.. Web. 4 Mar 2013. <<http://www.answers.com/topic/lee-waves>>.
- 3) . N.p.. Web. 4 Mar 2013. <<http://weather.uwyo.edu/upperair/sounding.html>>.