Anna Gilgur
MCEN 5151
2/28/2013
Clouds 1 Report

Introduction

This project was the first cloud assignment for the flow visualization course that takes place at CU Boulder during the Spring Semester and is taught by Professor Jean Hertzberg. The purpose of this report is to describe the clouds that were captured by explaining the background of when the image was taken, atmosphere when the image was taken, cloud type, physics, and photographic technique used. For this assignment, an image of a cloud or set of clouds was captured—between January 10th and February 20th—and documented. In the sections of the report following, the background information leading up to the final, edited image of the clouds captured is discussed. The final, edited image of the clouds can be seen in figure 1, below, and in figure 8 within the Photographic Technique section of the report.

Figure 1 - Final, edited image

Image Background

This image was captured at Eldora Ski Resort on January 20th, 2013 at approximately 1:30pm at the top of the run called "Challenge". The elevation the photographer was at when the image was taken was estimated to be about 10,000 feet. The direction that the clouds were in the image was taken was roughly South, South-East.

Atmosphere and Clouds

The type of cloud in this image is an Altocumulus Lenticularis. According to Russell et al, lenticularis clouds are formed "in regions of uplift driven by the atmospheric waves that are created downstream of hills and mountains."[1] Since this image was taken at Eldora, i.e. in the mountains, this explanation supports the hypothesis of cloud type. When this image was taken, the rest of the sky was mostly clear, with a few clouds here and there. The weather at Eldora on January 20th for the last few years was very similar to the weather experienced this year. This is seen in figures 2, 3, and 4 below—where figure 2 is the information from 2011, figure 3 from 2012, and figure 4 from 2013. As also seen in figure 4, there was no front coming through around that day, nor was there any rain/snow. The wind stayed below 10mph all day, though it increased as the elevation increased—seen in the skew-T plots of figure 5. [2][3]

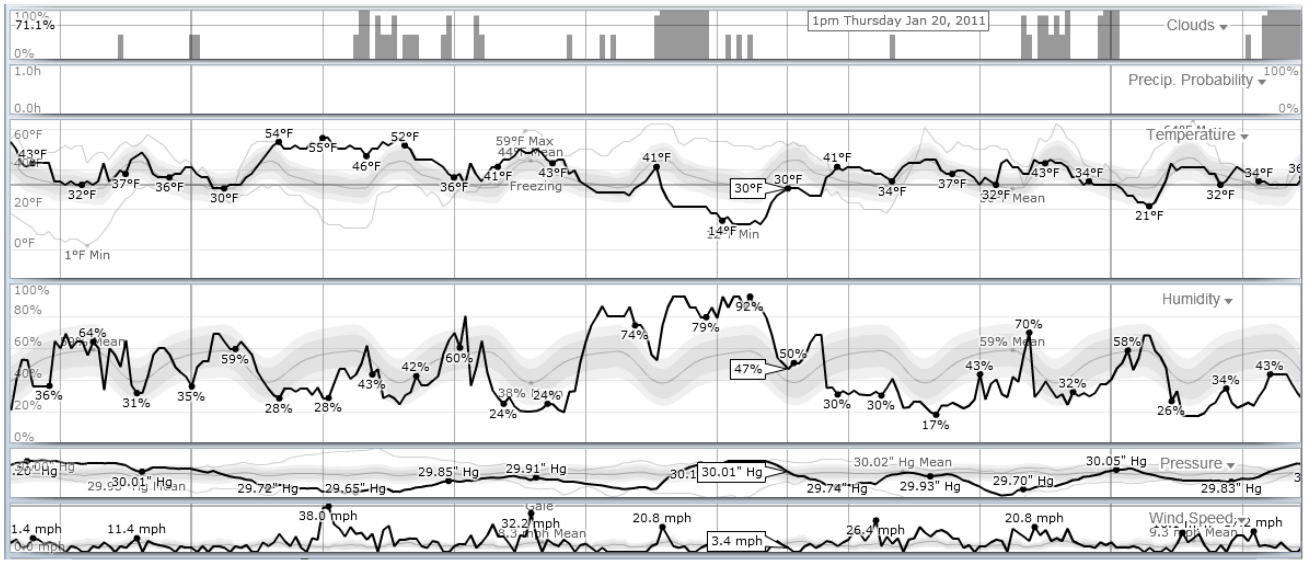

Figure 2 - Weather Data from January 20, 2011 (taken from [2])

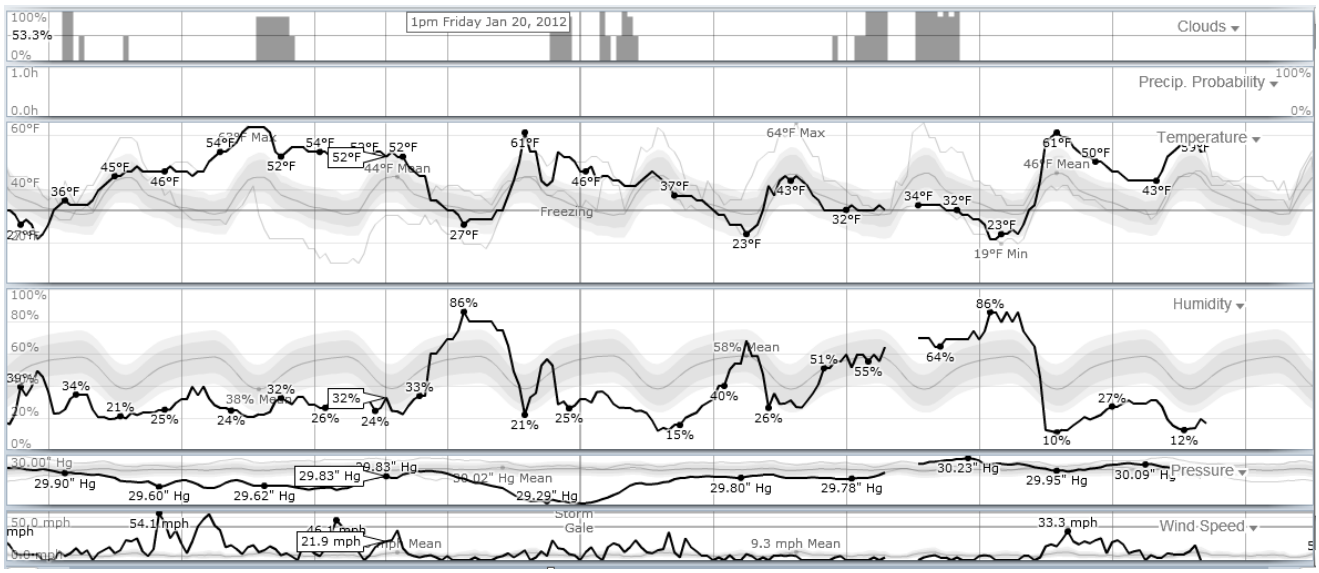

Figure 3 - Weather Data from January 20, 2012 (taken from [2])

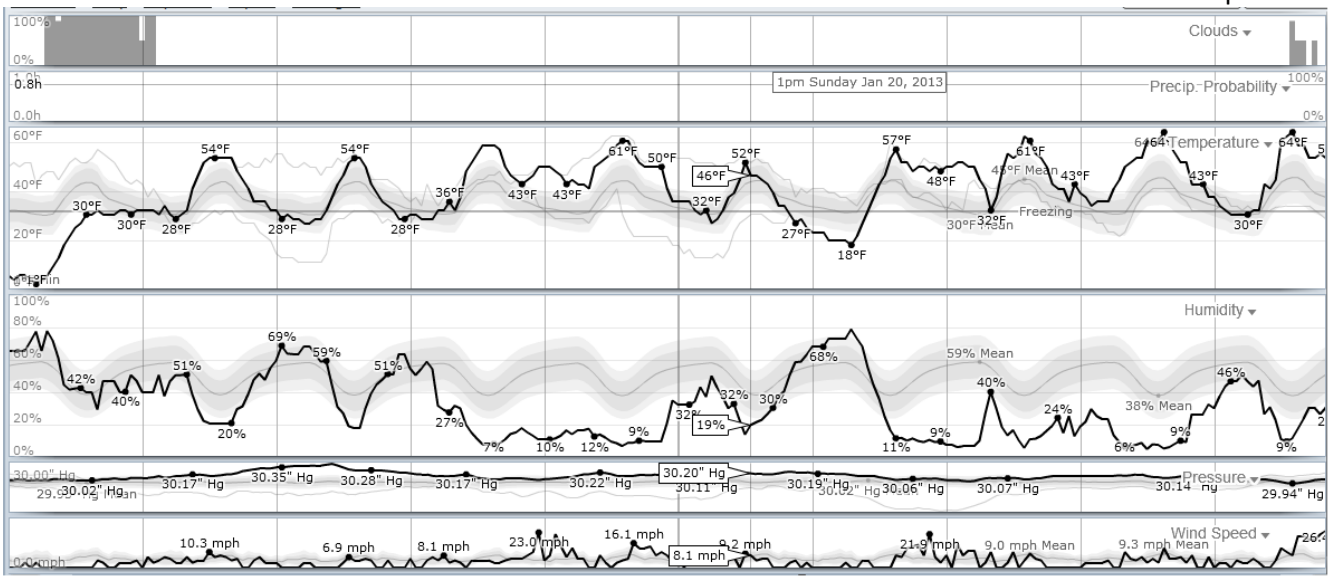

Figure 4 - Weather Data from January 20, 2013 (taken from [2])

Based on the Skew-T plot, figure 5 below, the atmosphere was stable at both 6am and 6pm that day. Judging from the image, the hypothesis is that the clouds were about 20,000 feet from sea level this is confirmed in the skew-T plots. Based on the skew-T plots for both the morning and the evening, the clouds were expected to do so at an elevation above 6000m (or 19685 feet), since that's where the dew point line is nearest to the temperature line on the skew-T plots. Based on the fact that the photographer was in the mountains and the weather was good that day, at an elevation of 10,000 feet, the cloud types expected were mostly lenticularis clouds, in other words the cloud types expected were the cloud types that were observed.

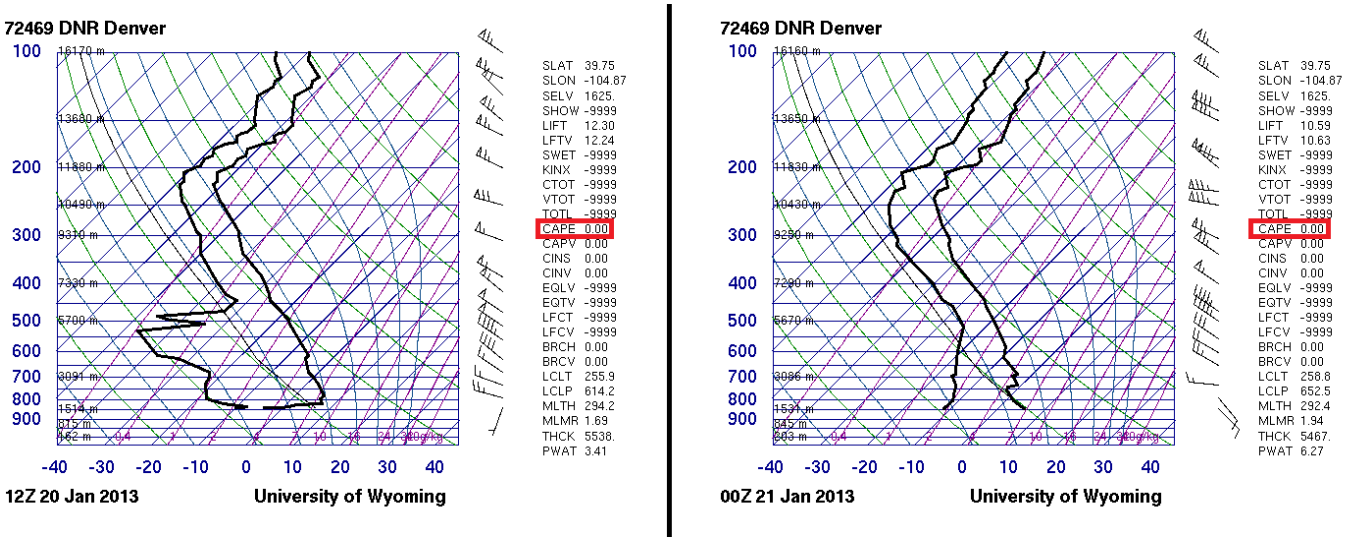

Figure 5 - Skew-T plot for 6am and 6pm on January 20th, 2013 (taken from [3])

Gavin Pretor-Pinney does a good job at explaining the physics behind the altocumulus lenticularis clouds. According to his book, altocumulus lenticularis clouds are formed when air passes over a mountain or hill, and as such are common in mountainous areas. [4] Furthermore, he defines lenticularis as "lens-

shaped" and states that this means that the cloud can look like a UFO, a stack of pancakes, etc. [4] Pretor-Pinney also states that lenticularis clouds are a type of orthographic cloud—clouds that are formed "when air cools as it is forced to rise in order to pass over an obstacle such as a mountain." [4] He continues this thought by stating that the shape of a lenticularis cloud is formed "when the air stream takes on a wave-like motion in the lee of the summit." [4] A supporting image that can be used to further explain this was taken from Environment Canada and is seen in figure 6, below. [5]

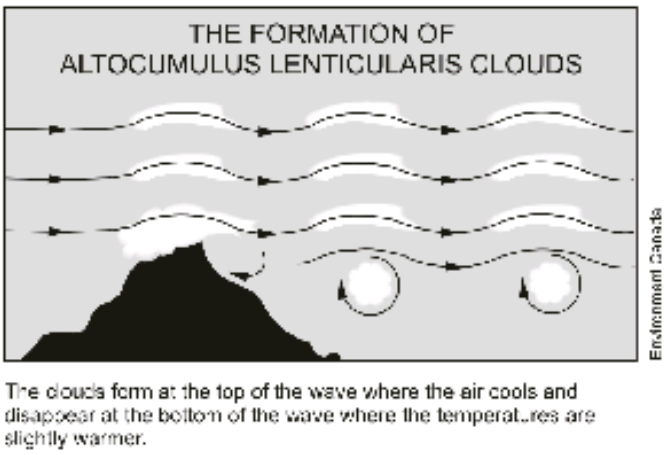

Figure 6 - Pictorial explanation of Altocumulus Lenticularis Formation (taken from [5])

Photographic Technique

The camera used to capture this phenomenon was a Canon Powershot A2300 point and shoot camera that was zoomed all the way out during the capturing of this image. The size of the field of view of the original image is approximately 4km tall by 6km wide. The clouds were located at least 2km away from the lens. The shutter speed, f-stop, aperture value, ISO speed, and focal length were 1/1000 sec, f/10, f/10, 200, and 7.5mm, respectively. The original, unedited, image has pixel dimensions of 4608 pixels wide by 3456 pixels tall, and the final image has pixel dimensions of 4134 pixels wide by 2005 pixels tall. Refer to figure 7 for the original image and figure 8 (or figure 1) for the final image.

Adobe Photoshop CS2 was used to edit the original image. The tools used were: crop, unsharp mask, and curves. Unsharp mask had an amount of 100%, radius of 10.0 pixels, and threshold of 0 levels. These edits produced the final image seen in figure 8.

Figure 7 - Original, unedited image

Figure 8 - Final, edited image

Conclusion

The image clearly reveals Altocumulus Lenticularis clouds. I like the clouds presented and how the trees in the bottom left corner frame the final image, but I don't like the graininess that appeared in the edited image. I think that cloud and fluid physics are well defined and detailed in this image. My intent at showing a cloud different from what is normally seen this time of year was fully realized. To further develop this image, I would have taken another one, with the date not displayed on the camera and have cropped the whole image some—to give a better idea of scale. While there is always room for improvement, I am pleased with the fact that I managed to turn around and capture these gorgeous clouds.

References

[1] Russell, Andrew, Hugo Ricketts, and Sylvia Knight. "Clouds." *Physics Education* 42.5 (2007): 457-65. Print.

[2] WeatherSpark Beta." *Beautiful Weather Graphs and Maps*. N.p., n.d. Web. 27 Feb. 2013. <http://weatherspark.com/>.

[3] "Atmospheric Soundings." *Atmospheric Soundings*. University of Wyoming, College of Engineering, n.d. Web. 27 Feb. 2013. <http://weather.uwyo.edu/upperair/sounding.html>.

[4] Pretor-Pinney, Gavin. *The Cloudspotter's Guide: The Science History, and Culture of Clouds*. London: Sceptre, 2006. Print.

[5] "Sky Watchers." *Government of Canada, Environment Canada*. N.p., n.d. Web. 27 Feb. 2013. <http://ec.gc.ca/meteoaloeil-skywatchers/default.asp?lang=En>.