Cloud Report 1:

Altocumulus Lenticularis Clouds

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This photograph was taken for the first clouds assignment. The intention of this assignment was to capture an interesting and beautiful image of the clouds that can be described. I took many pictures on many different days, but the final picture happened to be from the first session of picture taking.

This image of clouds was taken right next to the City of Boulder Open Space and Mountain Parks Administrative Offices in South Boulder, CO off of S. Boulder Rd. and S Cherryvale Rd as seen on the star in the map in figure 1 on the right. The clouds were captured at 12:25 pm on February 14, 2014 facing southeast. The angle from horizontal (ground) of the camera was approximately 135 degrees.

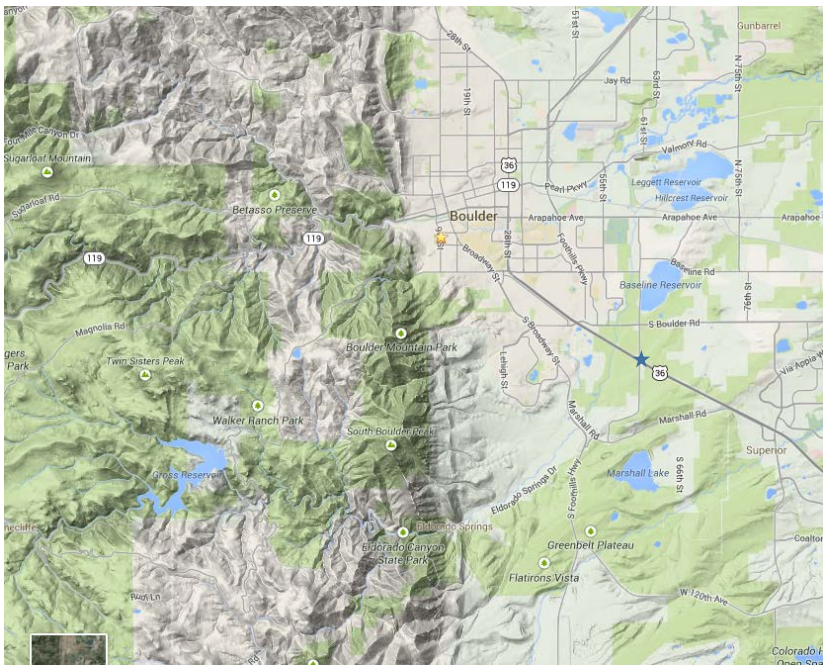

Figure 1: Topographic map of section of Boulder, CO with photo location marked with star (from https://www.google.com/maps/))

Skew-T diagrams can provide hints to where cloud formation occurs. When the temperature and point lines (the darker lines on the plot) are close to equal, relative humidity is large and clouds develop.[i] The Skew-T plot shown in figure 2 shows the relative humidity and temperature being closest at about 5,500 meters (18,000 feet) and about 7,750 meters (25,000 feet), which fall in the range of the middle clouds. However, the Skew-T diagram was created at 6:00 am, so the validity of this for the 12:25 pm clouds seen in the picture is questionable. However, figure 3 below shows the cloud layer to be at 3,000 meters (10,000 feet), which still puts these clouds in the middle range. There is no

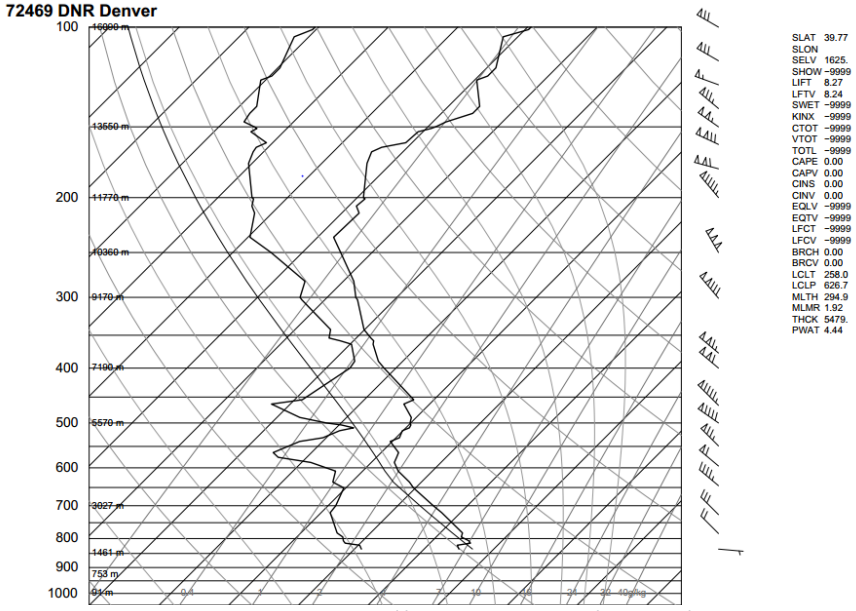

Figure 2: Skew-T Diagram (from http://weather.uwyo.edu/upperair/sounding.html)

instability in the clouds, because the CAPE (Convective Available Potential Energy) is zero[ii]. The CAPE value can be seen to the right of the Skew-T plot in figure 2.

Altocumulus clouds are mid-level clouds containing patches and layers of regularly spaced cloudlets[iii] (Pretor-Pinney, 113), which is exactly what is seen. Due to the geographic

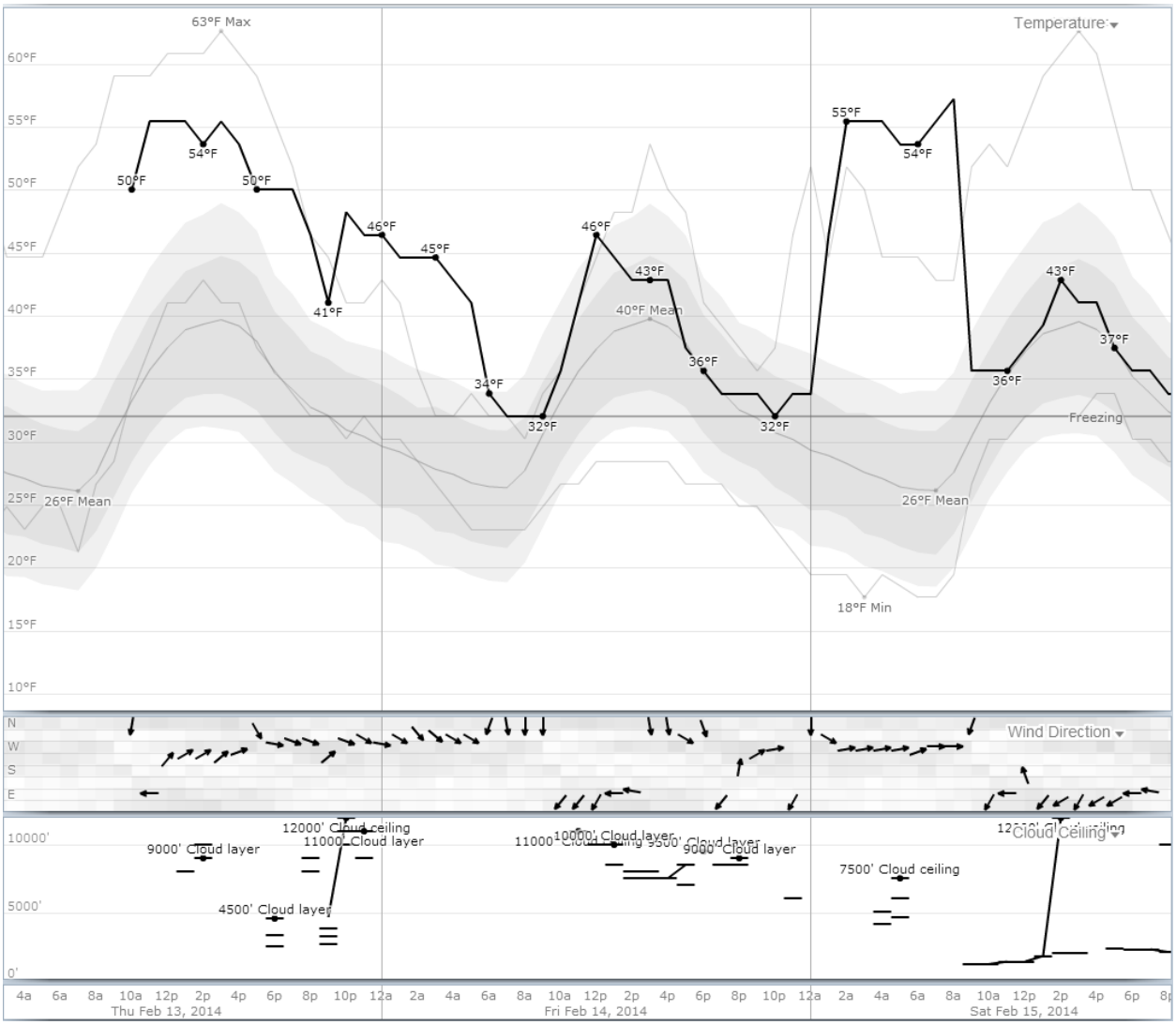

Figure 1: Temperature, wind direction, and cloud layers for day before and day of cloud photograph (from weatherspark.com)

location and appearance, these clouds are orographic clouds. Orographic clouds form "when air cools as it is forced to rise in order to pass over the mountains" (Pretor-Pinney, 118). This usually results in the formation of lenticularis clouds, which are "one or more individual almond or lens-shaped masses that appear dense, with pronounced shading" (Pretor-Pinney, 114). In the picture, two dense almond shapes are seen in the main cloud and three more in the clouds seen further away to the right. It can be assumed that these clouds are lenticularis.

Further detail into the cloud photograph reveal duplicatus variety in this cloud formation, which are different layers in the cloud at different altitudes. In the second layer,

there is a possibility of shear or Kevin-Helmholtz instability, which causes the wavy look seen. This condition is caused when two layers of fluid are moving in the same direction but at different speeds.[iv] This cloud can also be classified with the variety of perlucidus, or gaps between cloudlets that display an undalatus, or parallel lined, pattern (Pretor-Pinney, 114). In addition, this photograph illustrates the formation of a corona on the top and right side of the photograph in the clouds. A corona is produced when the sunlight is diffracted through the small water droplets in the cloud.[v] Overall, the main cloud is comprised of orographic lenticularis altocumulus clouds with a duplicatus, perlucidus, and undalatus variety.

Because the clouds were most likely at an altitude of around 3,000 meters (10,000 feet), the distance from the object to the lens is about 1350 meters (4,600 feet), because the altitude of Boulder, CO is 1655 meters (5,430 feet).[vi] The camera used was the digital camera, Canon PowerShot SX260 HS. The depth of field is infinite. The ISO was at 200, the focal length at 4.5mm, the aperture at f/8, the shutter speed at 1/2000, and the resolution at 4,000 x 3,000. My goal was to enhance the blueness of the sky and the contrast of the cloud layers with post-processing. The before and after pictures can be seen below in figure 4. For editing, iPhoto was used. The contrast was increased to 10, the saturation increased from 50 to 60, and the definition increased to 100.

Figure 2: Before and after post-editing (before on left, after on right)

I believe the image reveals a lot of very interesting variations of an altocumulus cloud. I like the waviness near the top, and the great contrast that turned up in the photograph. The blueness of the sky is very beautiful and I believe the trees along the bottom help give perspective. However, I believe too many clouds are in the picture itself to properly explain every detail of the clouds. A more effective photograph for educational purposes would have a smaller field of view. Still, the photo has many astonishing elements and is a spectacular sample of one of Mother Earth's finer creations, clouds.

Bibliography

[i] http://www.ucar.edu/communications/gcip/m8clclchange/m8pdfc1.pdf
[ii] http://www.colorado.edu/MCEN/flowvis/course/Lecture2012/09.Clouds3.pdf
[iii] Pretor-Pinney, Gavin. *The Cloudspotters Guide: The Science, History, and Culture of Clouds*. New York, NY: Penguin Group, 2006. Print.
[iv] Allaby, Michael, Encyclopedia of Weather and Climate, Volume 1
[v] http://en.wikipedia.org/wiki/Corona_(optical_phenomenon)
[vi] http://en.wikipedia.org/wiki/Boulder,_Colorado