UNIVERSITY OF COLORADO AT BOULDER

Altocumulus Above Boulder:

Cloudspotting

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Background/Purpose

The purpose of this image was to capture and analyze a cloud formation that was interesting. Clouds are visible masses of condensed water (or ice crystals) that are in the saturated atmosphere [4]. Whether a particular cloud forms close to the ground, in the troposphere, or higher up in the stratosphere or even the mesosphere is dependent on the moisture content of the air and the atmospheric conditions that surround the cloud. Stability, moisture, wind speed, temperature, pressure and other factors all contribute to the appearance of the cloud and define it such that it can be classified. The Cloud Appreciation Society, a group that keeps an active record of what defines and classifies cloud types, has good information on all sorts of cloud species and examples [2]. In my particular image, I was trying to capture the uniqueness of the altocumulus floccus virga that can be seen in the lower-center portion of the image (it looks vaguely like a shooting star) as well as the periodicity of the surrounding altocumulus castellanus clouds. The original image looked as follows:

Figure 1 – Original Photograph

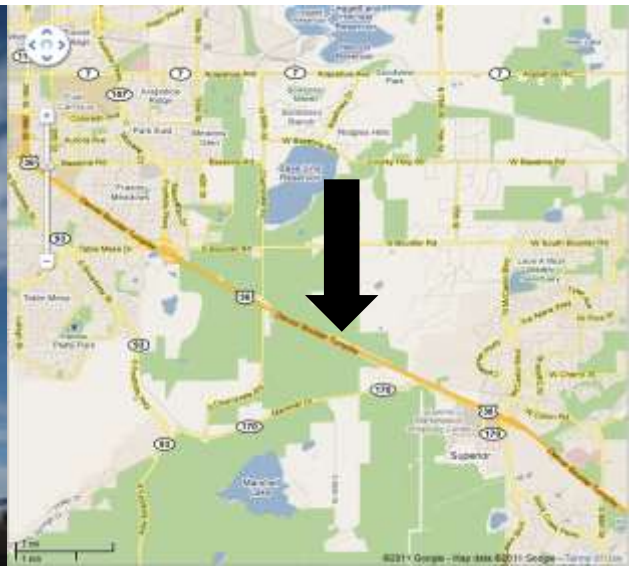

Figure 2 – Location [3]

Image Circumstances and Geography

This image was taken at 1:32 P.M. on the 16th of February, 2011, just off of Highway 36 coming into Boulder (Figure 2). The photograph was taken facing southwest, at an angle of approximately 45 degrees to the horizontal. I would have liked to keep the mountains in my final image for aesthetic reasons, but the power lines and Mini Cooper are less than organic-looking and would

have detracted from the overall composition. The clouds depicted, as mentioned before, are altocumulus of a couple varieties (floccus virga and castellanus). The sounding data below shows the condensation point for the clouds.

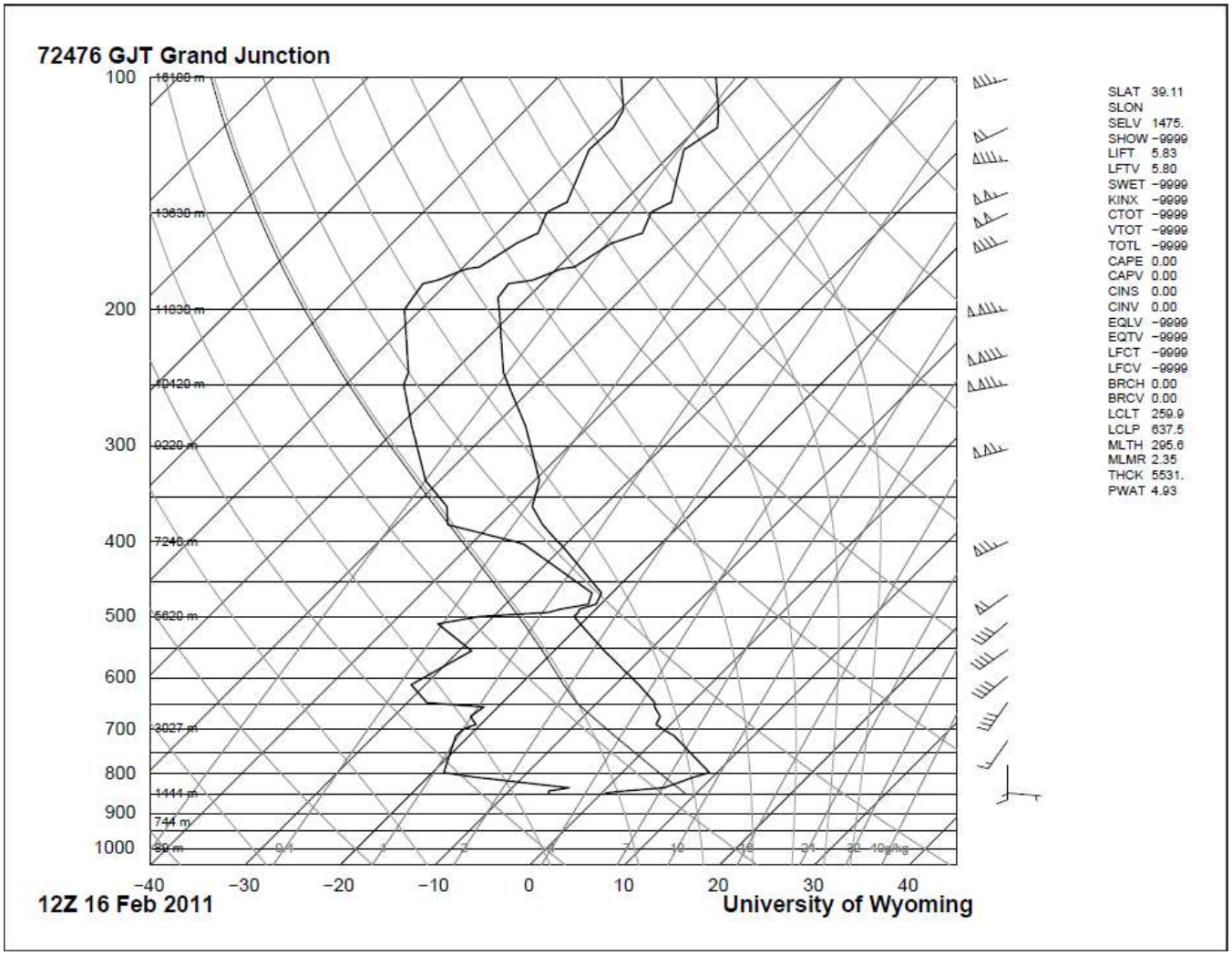

Figure 3 - Skew-T plot [1]

The photograph that I took happened about 7 hours after the above data was acquired, but it should give some general indications about what was going on in the atmosphere due to its location and the progression of the weather. Figure 3 shows a saturation point (where the two lines are close to touching and condensation occurs) of approximately 5700m. This is consistent with the "alto" part of the altocumulus classification [2]. Altocumulus clouds come about due to unstable convective forces, which are reflected by the sounding data despite the low CAPE (a hydro lapse is at the boundary between the almost saturated lower troposphere and dry mid-levels) [4]. The surprising part is the altocumulus floccus virga in the middle of the image. Although it appears to be a cirrocumulus, which normally looks this way [2], the data places it closer to the ground, which does, in fact, classify it as an altocumulus.

Camera Configuration

Camera Model	**Canon Powershot A480**
Lens	**6.6 - 21.6 mm**
F-Stop	**f/4.5**
Exposure	**1/1600 sec**
ISO Setting	**ISO-80**
Exposure Bias	**0 step**
Focal Length	**8.7 mm (35 mm equivalent = 122 mm)**
Aperture (Max)	**3.125**
Subject Distance	**Roughly 5700 m**

Digital photography was the technique used to capture the image. The actual settings are displayed above, and the approximate field of view dimensions would be:

$$FOV = \frac{Camera\ Sensor\ Dimensions * Object\ Distance}{Focal\ Length} = \frac{Approx.5mm\ x\ 4mm * 5700m}{8.7mm}$$

$$= \mathbf{3275\ \boldsymbol{m}\ \boldsymbol{x}\ 2620\ \boldsymbol{m}}$$

No flash was used, as it would be useless for this application, and the natural, outdoor lighting was used. The only image adjustments were cropping the image down from 3648 x 2736 px to 3648 x 2313 px, and raising the blue channel's levels a little bit (using The GNU Image Manipulation Program) to add contrast and deeper color. The final result was Figure 4.

Figure 4 - Final Image

Conclusion

Overall, I am pleased with how the final image came out. The clouds are periodic and display the characteristics that their individual genus and species identify for them. Additionally, the sounding data does not match perfectly with the observations, but it is not entirely far off. Something that I might have changed was the perspective; since some of the clouds are cut off by the limited field of view of the camera, it would have been nice to do a panoramic image, perhaps. Also, as mentioned before, I think that the mountains would have been a nice aesthetic addition, and it is a shame that they had to be omitted because of the power lines and car. A small horizon line with mountains could have given a nice perspective to the photograph. If I could re-do the photograph, I may have used a camera with manual focus, and more carefully have picked the exposure and shutter speed.

Sources Cited

[1] "Atmospheric Soundings." *Wyoming Weather Web*. University of Wyoming. Web.

<http://weather.uwyo.edu/upperair/sounding.html>.

[2] "Glossary of Meteorology." *AMS Glossary*. Web.

<http://amsglossary.allenpress.com/glossary/>.

[3] “Google Maps.” *Google.* Web.

<http://www.google.com/maps/>.

[4] "SKEW-T BASICS." *WEATHER PREDICTION EDUCATION*. Web.

<http://www.theweatherprediction.com/thermo/skewt/>.