

# Clouds Project 1

*Altostratus Clouds East of Flagstaff Mountain, 1/21/09*

Chip Fisher

MCEN 4228

Fluid Flow Visualization

Due 2/25/09

QuickTime™ and a  
decompressor  
are needed to see this picture.

### **Image Context**

For the first clouds project of this semester, I tried to capture images of the stunning sunsets experienced in Boulder on a regular basis. The image discussed in this report was taken on January 21, 2009 at dusk, or approximately 5:00PM MST. From a point-of-view near the top of Flagstaff Mountain, in Boulder, this image displays the cloud formations and dramatic color scale of the sky that evening. The camera was roughly horizontal at the time this image was taken, looking straight out to the eastern horizon.

### **Discussion of Cloud and Atmospheric Data**

The clouds depicted in the image are altocumulus clouds, with some stratocumulus near the bottom right of the image (i.e. further southeast). Other clouds were present that evening to the south and west including altocumulus lenticularis [3]. However, the color gradient in the sky was not present in any other direction than east. Figure 1 is the Skew-T plot and sounding data for January 21, 2009, reveals that atmosphere was essentially stable throughout all elevations, with some slight instability from about 7000 to 9000 meters above sea level. Supplemental data for the atmospheric stability comes from the CAPE (Convective Available Potential Energy), shown to the right of the Skew-T plot in Figure 1. A CAPE equal to zero indicates that the atmosphere is quasi-stable, or quasi-unstable, both are equivalent [1].

## 72469 DNR Denver

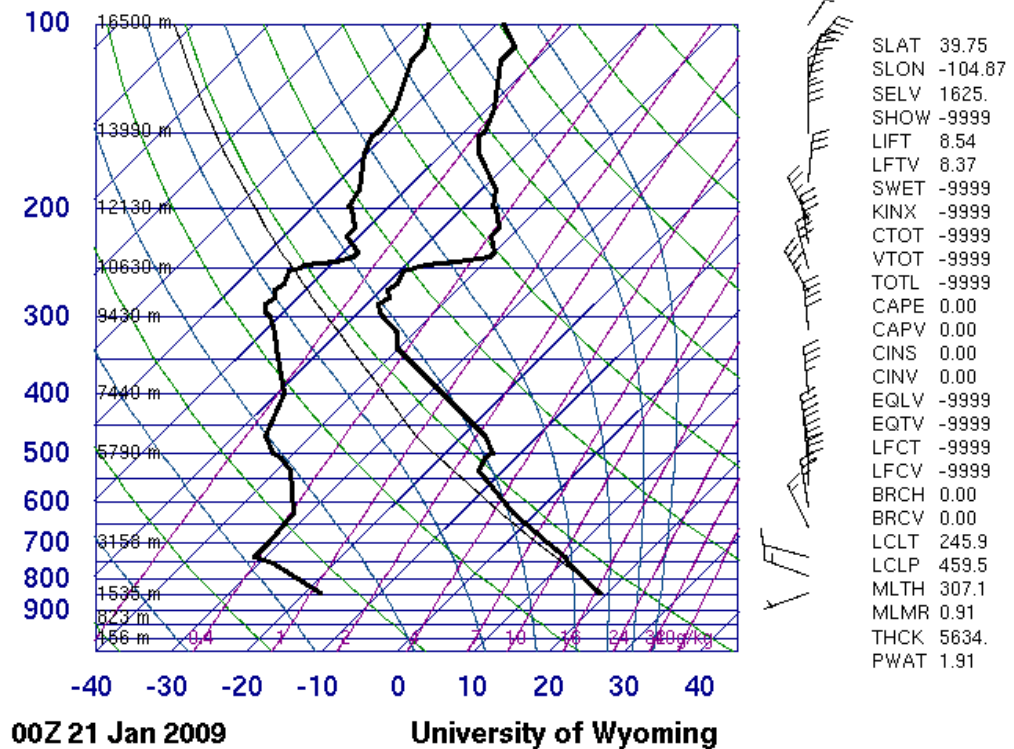


Figure 1. Skew-T plot for 1/21/2009 [1]

The left-most dark black line shows how the dewpoint changes with elevation for this day. Large separation between the left and right dark black lines shows that the atmosphere was quite dry because the air would have to be cooled by almost 40°C for water to condense. Considering altocumulus are mid-level clouds and that the air was quite dry, it is estimated that the clouds formed in the image of this report were at 7000-8000 meters, the upper limit of the mid-level cloud elevation. Altocumulus clouds indicate convective forces acting on pockets of the atmosphere, which cools some air enough to cause the long, soft clouds to form at the mid-level elevations [3].

### Photographic Data

Considering that on high visibility days, Denver International Airport (approximately 40 miles from Boulder) can be seen from the Third Flatiron, it is estimated that the field of view in this image is about 50 miles; visibility was quite good that evening so it seems reasonable that the visible horizon was beyond 40 miles. From the top of Flagstaff Mountain (approximately 7000 ft) to the clouds in the image is likely 15000 to 18000 ft. The focal length on this shot was 54 mm for the Canon EOS Digital Rebel. The image has pixel dimensions of 1588 x 2018 (X x Y). The exposure settings consisted of 1/200 sec shutter speed, ISO sensitivity of 100, and aperture set to f/8. The final image was enhanced using Adobe Photoshop CS4, utilizing the Curves function to increase the contrast in the image. No other alterations were made to the image.

### Conclusion and Final Thoughts

This image reveals the natural beauty of our state and city and it isn't until images like these are seen that you begin to truly admire the sky. One aspect I really appreciate in this image is the color gradient, from red to orange to green to deep blue; it's almost as if you can feel what kind of mood the earth was in at that particular moment. I dislike that the clouds are somewhat colorless, although perhaps they may have taken attention away from the sky if they were different. I would like to improve the field of view on this image—I did not have access to a panoramic camera at the time. I think that would have produced a truly stunning image because the sky was so dynamic that night.

## References

- [1] Engineering, U. o. (2009, 1 21). *Atmospheric Soundings Archive*. Retrieved 24 2009, 2, from 72469 DNR Denver Soundings: <http://weather.uwyo.edu/cgi-bin/sounding?region=naconf&TYPE=GIF%3ASKEWT&YEAR=2009&MONTH=01&FROM=2100&TO=2100&STNM=72469>
- [2] *Flagstaff Mountain*. (n.d.). Retrieved 2 24, 2009, from MountainZone.com: <http://www.mountainzone.com/mountains/detail.asp?fid=906145>
- [3] UCAR. (2007, 9 24). *Alto cumulus*. Retrieved 2 24, 2009, from Windows to the Universe: <http://www.windows.ucar.edu/tour/link=/earth/Atmosphere/clouds/altocumulus.html&edu=high>