

Cumulus clouds over Utah desert
MCEN 5151-Clouds Image #2
Wayne Russell



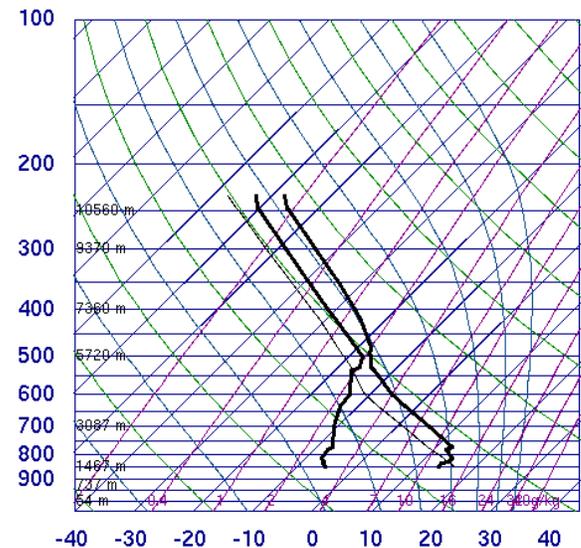
This is the second of a pair of pictures of cloud formations for the Flow Visualizations class at the University of Colorado. The intent of the assignment is to capture an interesting cloud formation and describe the atmospheric phenomenon responsible for its formation. This image, taken on Friday, April 5, 2013 at 1120 MST, captures cumulus clouds forming west of Moab, Utah, and being blown towards the La Sal mountain range.

This image was taken near the Klondike Bluffs (39.78° N, 109.71° W) at an altitude of 1410 m. The camera bearing was roughly 200°, looking over the desert west of the La Sal mountains. The camera angle was nearly horizontal.

The bottom of the clouds further east were slightly higher than the mountains, which are about 3500 m. According to weatherspark.com^[1], there was a cloud layer at ~3650 m when the picture was taken, confirming the estimated altitude. The sky was mostly overcast, but in the distance, the fluffy tops of cumulus clouds were visible. Based upon the height of the clouds, they were most likely altocumulus^[2].

A skew-T diagram for Grand Junction, CO (160 km northeast)^[3] (Figure 1) shows a neutral atmosphere, but instability is likely to increase as the day progresses. Additionally, the dewpoint approaches the atmospheric temperature near 500 mb (~5400 m), higher than the observed clouds. However, the lifting condensation level was at 600 mb (~4100 m), much closer to the estimated height of the clouds. The sounding from 1800 MST^[3] (Figure 2)

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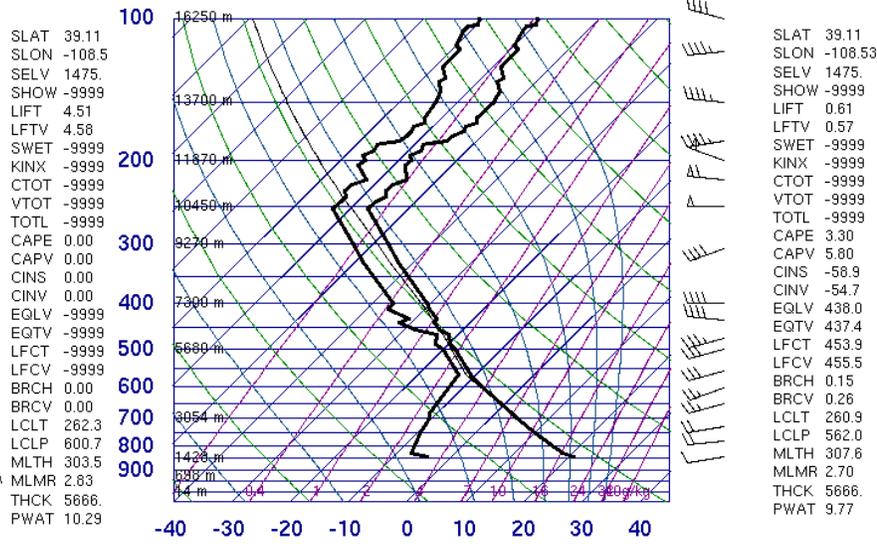


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Figure 1: The morning sounding showed a neutral atmosphere with an LCL at 4100 m.

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Figure 2: The evening sounding again showed neutral stability with an LCL near 4600 m.

shows a neutral atmosphere with a lifting condensation level near 560 mb (4600 m). Although both soundings would indicate that the clouds were forming at higher altitudes, it is important to point out that Grand Junction is 160 km away and separated by mountainous terrain.

Both skew-T diagrams show a neutral atmosphere in Grand Junction. Other clues near Moab, however, hinted at a greater instability. Clouds had been forming and moving east throughout the day. As the afternoon wore on, the wind began to increase. Dust was being picked up and carried, indicating a rising air mass. Additionally, many of the clouds showed virga and a light rain developed, indicating there was enough vertical motion for precipitation to form. All of these factors point towards an unstable atmosphere, making it likely that the clouds pictured were of the cumulus variety, as opposed to, for instance, altostratus.

This image was taken using a Canon 400D. The shutter speed was 1/500 s, the aperture was F13, the focal length was 88.0 mm, and the ISO was set to 100. The exposure was 3,888 x 2,592 pixels. The selected image was used due to the eye-catching nature of the original file. Most of the picture was underexposed, but bright highlights were noticeable in the clouds. To generate the final picture, the white balance of the raw file was adjusted to -2, -1, 0, +1, and +2. These images were then blended using enfuse^[4]. The resulting file was used as a background in GIMP with the original image overlaid with a 55% opacity. The final picture was rotated and cropped to 3,712 x 1,359 pixels.

The clouds in the image aren't particularly interesting, and the image is slightly out of focus. It did, however, provide an excellent opportunity to learn about post processing techniques. The original file was nearly unusable, but the final picture has some level of detail and provides some insight into the atmospheric processes that were taking place.

References

- [1] [http://weatherspark.com/#!
dashboard;a=USA/UT/Moab;rd=2;ropts=speed:6,loop:1,alpha:0.7;fcs=0;msl=temperatureC;mol=radar;units=temperature:f;graphs=pressure:0,siitg:1,snowDepth:0,humidity:0,spaitg:1,cloudCeiling:1,solarPosition:0,stidpg:0,clouds:0,subZero2:0,precipitation:0,smeisg:0,dewPoint:0,temperature:1,visibility:0,precipitationAmount:0,saf:0,tiles:0,windDirection:0,precipitationRate:0,windSpeed:0,sdpitg:0,windIcons:0](http://weatherspark.com/#!dashboard;a=USA/UT/Moab;rd=2;ropts=speed:6,loop:1,alpha:0.7;fcs=0;msl=temperatureC;mol=radar;units=temperature:f;graphs=pressure:0,siitg:1,snowDepth:0,humidity:0,spaitg:1,cloudCeiling:1,solarPosition:0,stidpg:0,clouds:0,subZero2:0,precipitation:0,smeisg:0,dewPoint:0,temperature:1,visibility:0,precipitationAmount:0,saf:0,tiles:0,windDirection:0,precipitationRate:0,windSpeed:0,sdpitg:0,windIcons:0)
- [2] Zillman, J. W., Burroughs, W. J., Crowder, B., Robertson, T., Vallier-Talbot, E., Whitaker, R. *Alto cumulus*. 9 Sept, 2005. Web.
<<http://www.theairlinepilots.com/met/altocumulus.htm>>.
- [3] University of Wyoming. "Atmospheric Soundings." Wyoming Weather Web.
[http://weather.uwyo.edu/cgi-bin/sounding?region=naconf&TYPE=GIF
%3ASKEWT&YEAR=2013&MONTH=04&FROM=0512&TO=0600&STNM=72476](http://weather.uwyo.edu/cgi-bin/sounding?region=naconf&TYPE=GIF%3ASKEWT&YEAR=2013&MONTH=04&FROM=0512&TO=0600&STNM=72476)
- [4] <http://enblend.sourceforge.net/>