Clouds II: Cumulus

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This image was created as a part of the *Clouds II* Assignment for the University of Colorado MCEN 4151: Flow Visualization course. This was the second cloud-based assignment of the Spring 2012 semester. The purpose of this assignment is capturing an image of a cloud, a medium though which various fluid phenomenon can be observed.

Spring in Colorado does not lend itself to the formation of cumulus clouds. Because this image was taken in early March, this cloud specimen was a rare occurrence. It is not common to observe cumulus clouds in the Boulder Country area until mid-May through early October (Clouds 2012).

The pictured cumulus cloud was captured towards the east on March 3, 2012 at 6:15 pm MST from the location at 40.01ºN, -105.26º E. Figure 1 shows the original image, reveling the base of the cloud to be approximately 25º above the horizon. The angle was determined using the size and location of the street lamps in the foreground relative to the location of the camera.

Figure 1: Original Clouds II Image

Cumulus clouds are characterized by their flat bases and light, fluffy, cauliflower tops (Cloud Collector 2012). The background and subject of the image is a cumulus mediocris cloud. These clouds are neither small (humulis species) nor as tall as the congestus species. In the foreground, a darker, cumulus fractus appears. A cumulus cloud usually has a lifetime of approximately 15 minutes and as it dissipates, cumulus fractus appears. This particular cloud appears dark due to the shadow from the mountains to the west (left) of the image. A cumulus mediocris usually does not produce rain, but can grow into the larger cumulus congestus, which can produce rain as it grows in size (NWS 2012). This type of cloud is most commonly seen in unstable atmospheres, and often precede a cold front (NWS 2012).

Figure 2 shows the skew-T plot for the time that this cloud was sighted (Atmospheric 2012). The CAPE for this day and time is zero, which is very unexpected given the clouds in the image – a CAPE of zero indicates a stable atmosphere, and the clouds in this image are most definitely the result of an unstable atmosphere. Cloud height can be indicated by a sharp turn towards vertical in the temperature line on the skew-T diagram. Examining the plot in Figure 2 reveals only one possible cloud formation height, approximately 3500 m, which is in agreement with the height of the cloud as predicted by the angle above the horizon. The original image has many unstable clouds and no clouds typically present in a stable atmosphere. The day prior to this image (March 2, 2012) had a high temperature of 35ºF and a mean temperature of 27ºF. The date this picture was taken (March 3, 2012) had a high temperature of 48ºF and a mean temperature of 32ºF. The day after this photograph (March 4, 2012) had another set of upward trending temperatures, with the daily high temperature being 62ºF and the daily mean temperature at 52ºF. These upward trending temperatures, with a 22ºF increase in mean temperature over the course of 3 days is indicative of the unstable atmosphere and rapidly changing atmospheric pressures causing the formation of the cumulus cloud captured in the image.

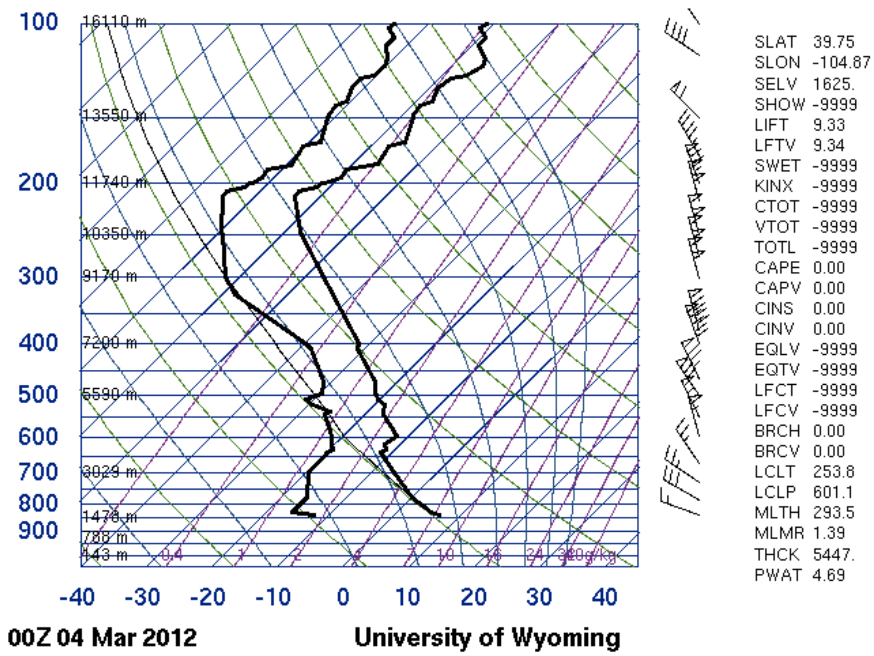

Figure 2: Skew-T plot for 6:00 pm MST, March 3, 3012 (Atmospheric 2012)

Using local references (some are outside the field of view), it is possible to estimate the size of the field of view. The field of view is probably approximately 1.5-2 miles across. The cloud is a minimum of 1 mile from the camera. The camera used to capture this cloud was a Cannon DIGITAL IXUS 100 IS with a focal length of 14.8 mm. The original image is 4000 x 3000 pixels and was cropped to 3168 x 2148 pixels. The exposure specifications for this image include an aperture of f/14, shutter speed of 1/160 and ISO 80. The low sensitivity (ISO) paired with the long shutter speed was selected to decrease noise in the image while still exposing the sensor to enough light to capture detail. The aperture for this image is on the large size. Ideally, a cumulus cloud is captured with a small aperture setting in order to increase depth of field. The depth of a cumulus clouds is what makes them appealing to observe, and this is why such a small aperture was selected.

This image shows the instability in a cumulus cloud, especially at the leading vertical edge. I like how the definition and focus increases as the eye moves from left to right – this serves to guide the viewer to the part of the cloud that has the most interesting “cauliflower” formation. The puffs show the physics of convection, although a sharper image, perhaps with a longer exposure time, smaller aperture, and more stable placement (perhaps on a tripod) would have helped to improve the quality of the image. Taking this image made me very curious about many famous pictures of clouds and experimentation with a tinted lens. If retaking this picture, I would also work to improve the coloring – make the whites brighter and improve the overall contrast.

Sources

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