Hunter Hach

Cloud Image 1

Flow Visualization – MCEN 5151-001

Altocumulus Clouds in Front of Sun

Taken 5:00PM October 9th, 2020

Boulder

This cloud image was taken as part of Jean Hertzberg's graduate flow visualization course at the University of Colorado Boulder. The artistic intent for this image is to create a sense of tension and unease during a time of quite fair weather. By taking a photo with appropriate exposure settings to be able to capture the occluded sun, the bright altocumulus clouds become much more dramatic.

The image was captured shortly before 5:00PM on October 9th, 2020 in Old North Boulder. The clouds pictured were located southwest at an incidence angle of approximately 60 degrees.

There was no precipitation during the few days prior and after the image was taken. These surrounding days all featured fair weather with highs in the 80 degree range and lows in the 50 degree range. A temperature plot can be seen below in Figure 1 with a blue dot marking the time that the image was captured.

Figure 1. Temperature on the day of the image. Plot from Weather Underground.[4]

Further analysis can be conducted using a Skew-T plot. The closest plot is from Denver International Airport for the 10th of October, 00Z, UTC. This corresponds to approximately one hour after the image was captured.

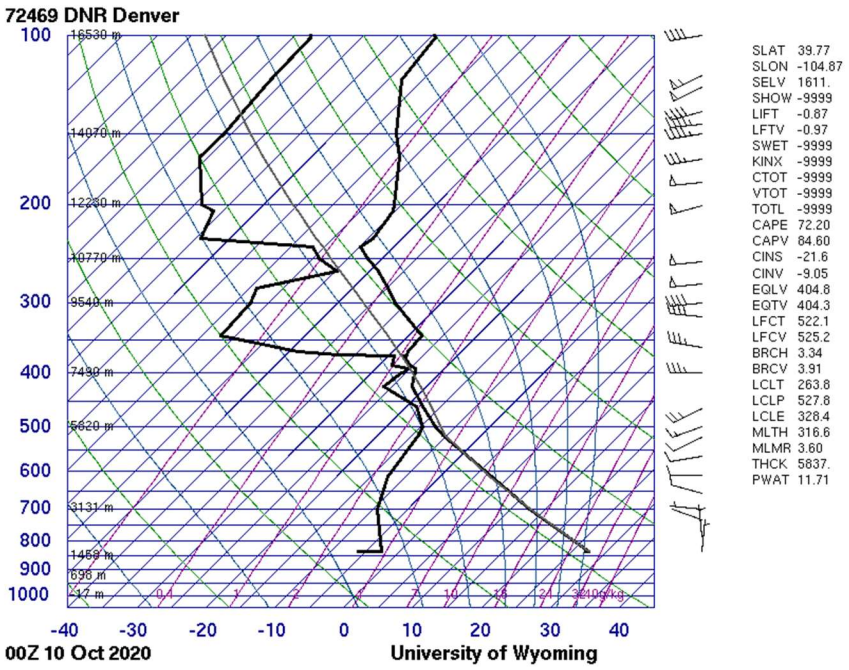

Figure 2. Skew-T Plot Corresponding to the Cloud Image.[2]

The Skew-T plot indicates a mildly unstable atmosphere with a CAPE of 72. The plot shows two main pinch points between the atmospheric temperature and dew point temperature. These two pinch points, at approximately 6,000 and 10,000 meters above sea level likely create the clouds shown in the image. The upper pinch point would be the altocumulus clouds shown around the sun at an elevation around 9,000 meters above ground. Both their altitude as well as puffy, scattered nature allows them to be identified as the altocumulus clouds, or even low stratus clouds. The lower pinch point corresponds to clouds approximately 5,000 meters above the ground. These clouds are the darker more ominous clouds in the foreground. While lower, these clouds are likely also in the cumulus family due to their puffy nature. They may also be altocumulus clouds at 5,000 meters above the ground.[1]

Below is a panoramic photo of the surrounding clouds. This photo was taken imminently following the main cloud image. This main image would have been located just past the far right of Figure 3.

Figure 3. A panoramic photo of the surrounding sky. Taken October 9th, 5:00PM.

The cloud image for this report was captured on a Canon EOS REBEL T5 camera. In order to capture detailed edges around the sun, the ISO was set to the lowest setting of 100. This was paired with an exposure time of 1/3200 seconds and a f-stop of 13. A lens was used with a focal length of 55mm. The DSLR camera captured a RAW image with a 5184 x 3456 resolution over a field of view on the order of miles, capturing clouds likely around 10 miles from the camera given the angle of incidence and their altitude. The RAW image was cropped to a final resolution of 4332 x 3012 pixels. Some other mild post processing was conducted as well, as can be seen below in Figure 4.

Figure 4. The original image on the left and the edited image on the right.

The original image was sharpened slightly, and the colors mildly more enhanced using the RGB curves in Darktable. It was also brightened by 0.38 EV. Limited editing was needed to create the dramatic intent.

By and large this image fulfilled the intent of creating a dramatic depiction of a rather calm looking sky. The strong diagonal in the lower third, and underexposed dark clouds in the foreground further help this idea. An interesting yet unexpected element in the image is the colored halos around the sun. A blueish and reddish hue can be seen concentric to the sun. This phenomenon may most likely be explained by cloud iridescence. This occurs when small ice crystals within the clouds diffract the light into distinct colors.[3] This is an occasional occurrence with altocumulus clouds as they are known to be able to contain ice crystals.[1] To scatter the light it is likely that the iridescence showing clouds have fairly uniform droplet size.[3] Further development of this idea may include finding clouds with more intense iridescence, or by using HDR techniques to capture more detail around the sun. Overall, this image does a reasonable job at conveying the artistic intent of being dramatic in a time of fair weather.

Works Cited

[1] – “Altocumulus Clouds.” *Met Office*, National Meteorological Library & Archive, www.metoffice.gov.uk/weather/learn-about/weather/types-of-weather/clouds/mid-level-clouds/altocumulus.

[2] – Atmospheric Soundings, University of Wyoming Department of Atmospheric Science, Oct. 2020, weather.uwyo.edu/upperair/sounding.html.

[3] – Cowley, Les. “Iridescent Clouds.” *Atmospheric Optics,* www.atopics.co.uk/droplets/irid1.htm.

[4] – “Denver, CO Weather History.” Weather Underground, TWC Product and Technology LLC, www.wunderground.com/history/daily/us/co/denver/KDEN/date/2020-10-9.