Clouds Second Assignment
Stratocumulus and Altostratus
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Flow Visualization | MCEN 4151-001
Broomfield, CO 5:42 PM | 7 November 2020

I noticed this cloud formation and wanted to photograph it for my second clouds assignment. I wanted to capture the beautiful variety of clouds and range of colors on the evening of November 7th in Colorado.

I took this image in Broomfield, Colorado at 5:42 PM on November 7th, 2020. I was facing Southeast looking at about a 45º angle above horizontal.

The lower clouds in my image are stratocumulus clouds and the higher elevation clouds form an altostratus layer.

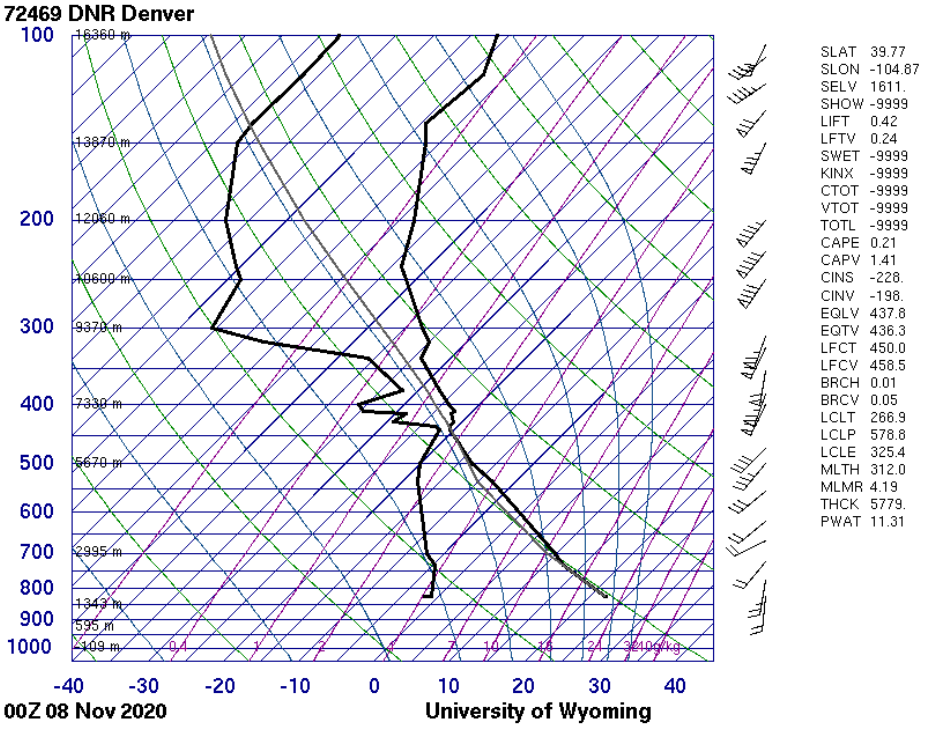

Figure 1. Skew-T diagram from the Denver airport on November 7th at 6 PM [1].

The two pinches we see in the Skew-T diagram are presumably the two elevations of clouds in my image. Additionally, we can see that the CAPE value is just above zero at 0.21 so the atmosphere is mostly stable. This gives more evidence that the clouds in the image are stratocumulus and altostratus since these cloud types tend to form in stable atmospheres. In class, Dr. Hertzberg also explained the reason for the altostratus layer in context of the incoming weather system. From Figure 2, we can see that there was a significant drop in temperature in the next couple of days following November 7th when this picture was taken. This indicates an incoming cold weather front. We can also see this incoming cold front in Figure 3. This surface weather map indicates a cold front approaching Colorado from the West as seen in the Easterly-pointing blue triangles. Dr. Hertzberg explained in class that this approaching cold front could have been the cause of the altostratus layer we see in my image. As the cold front comes in, it could push the warm air in the region East. This warm air then rides up over the cold air in the East, thus

creating the necessary upward motion for cloud development. Therefore, we see the altostratus layer out east.

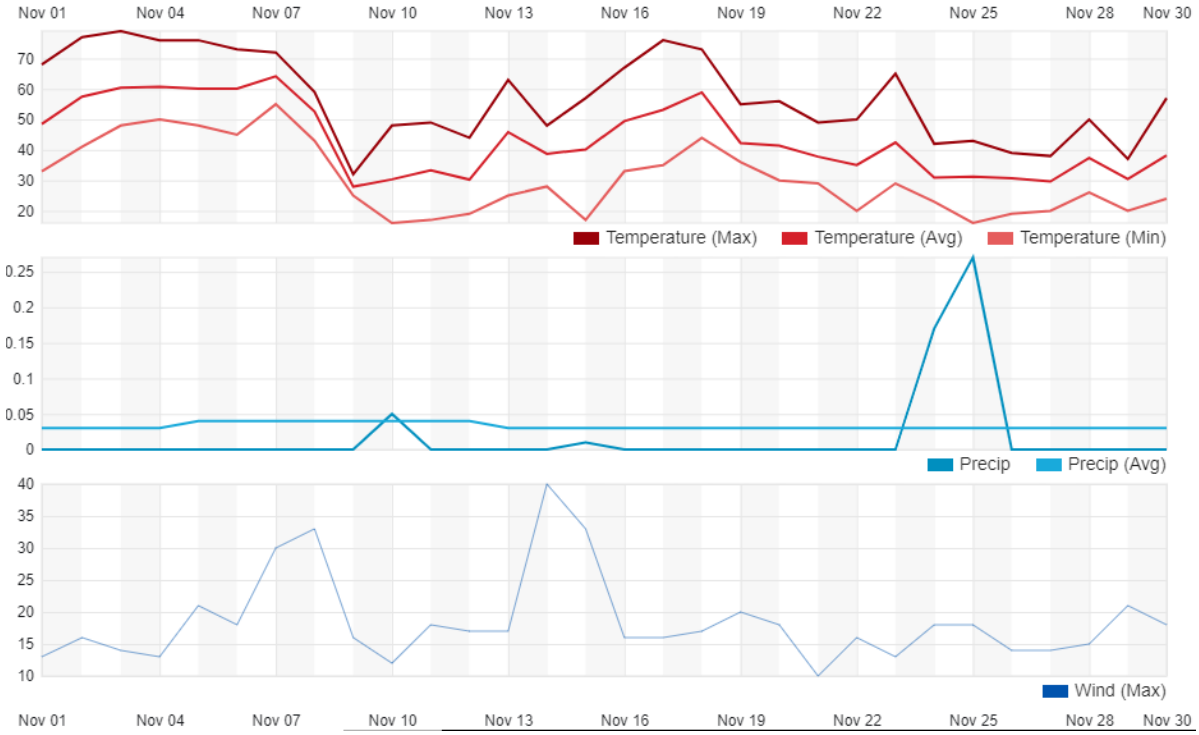

Figure 2. Temperature (ºF), precipitation (in), and wind (mph) data for the month of November 2020 [2].

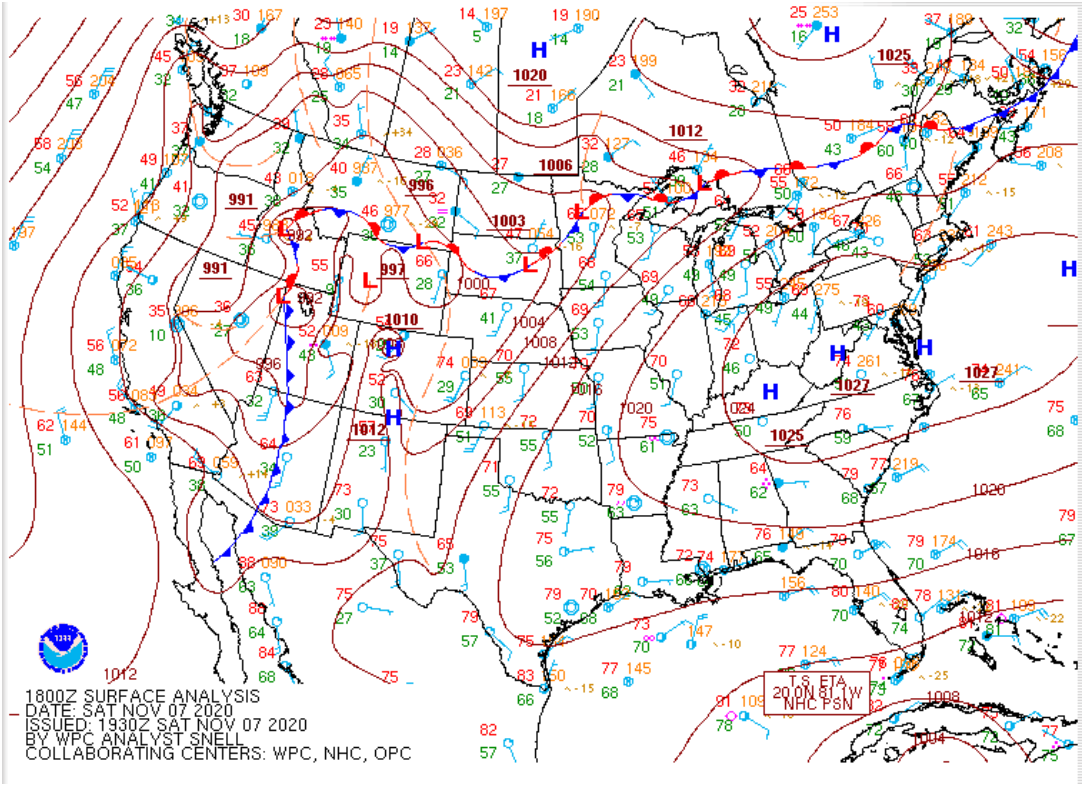

Figure 3. Surface weather map from November 7th, 2020 of the continental US [3].

In this image, I would estimate the foreground to be about 200 feet wide and the height in the same plane to be about 500 feet. Since the clouds in the image are so far away, the focal point of the image would be effectively infinite distance from the lens. For this image, I used a Nikon D7000 DSLR camera with a 17-55 mm lens to capture this image. I took this image with a 1/800 second shutter speed and an aperture of f/2.8 with a focal length of 26 mm. My ISO was set to 400. These settings allowed me to capture the detail and the color in this image without being too dark or too washed out. Then in post-processing, I was able to enhance the colors further and increase their contrast. I adjusted the color levels by increasing the threshold for darker tones. I also adjusted the s-curve by increasing the midtone contrast and increasing the shadow darkness in Photoshop Elements. I also cropped the image to focus on the clouds and frame the image with trees. The tree frame also allowed me to capture the details of further clouds since I did not crop out the lower part of the picture. The two images below compare my post-processed image to my pre-processed image with their corresponding sizes.

Post-processed image
- Processed image size: 3563 x 2079

Original image (with some cropping to remove houses, etc.)
- Original image size: 4928 x 3264 (before cropping)

My image reveals two distinct cloud regions. I like that my post-processing darkened the lower clouds so they could be more easily distinguished from the higher-level clouds in the

background. I would like to know more about why the stratocumulus clouds formed and what the clouds looked like in the days preceding and following the date of this picture. I fulfilled my intent in this photo and am happy with the colors in it. Further steps to this project could be to look for pictures of the sky around the same date this photo was taken. Also, more weather maps in the surrounding days could be analyzed to look for clues about the formation of the lower stratocumulus clouds. I would also like to know why the focal length used to take the image was not at the maximum capability of my lens since the object of focus was so far away.

References

[1] “Atmospheric Soundings.” *Department of Atmospheric Science*, University of Wyoming College of Engineering, weather.uwyo.edu/upperair/sounding.html.

[2] “Denver, CO Weather Historystar_ratehome.” *Weather Underground*, TWC Product and Technology LLC, www.wunderground.com/history/monthly/us/co/denver/KDEN/date/2020-11.

[3] “WPC Surface Analysis Archive.” *Weather Prediction Center (WPC) Home Page*, NOAA/ National Weather Service, www.wpc.ncep.noaa.gov/archives/web_pages/sfc/sfc_archive_maps.php?arcdate=11%2F07%2F2020.