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Clouds Assignment 2 Report
ARTF 5200

Overview

This photo was taken approximately one block east of the intersection between College Avenue and 28th Street Frontage Road in Boulder, Colorado, facing east, around 1:00 pm on December 11th, 2021. Although there was also an interesting cloud formation to the northwest as well, this image was chosen due to the wave-like behavior that is captured near the center of the frame. The final image can be seen in Fig. (1).

Figure 1: Final image used for the second clouds assignment.

Atmospheric State and the Skew-T Diagram

We examine the skew-T diagram, shown in Fig. (2), to help understand the state of the atmosphere when the picture was taken. We note the closeness of the temperature and dew point lines, which makes sense, as there were many clouds in the sky. Furthermore, it seems that, based on their relative locations, the altitudes of approximately 6500 m and 9000 m are the elevations that are most conducive to cloud formulation. As both of these elevations, there is also a significant increase in wind speeds, which strongly contributed to what appears to be a Kelvin-Helmholtz instability, although it does not appear to be fully developed. Unfortunately, a fully developed Kelvin-Helmholtz instability was not reached before the formation dissipated. Based on the shape and texture of these clouds, as well as the fact that they are most likely between 6500 m to 9000 m, I believe these clouds to be of the altostratus variety.

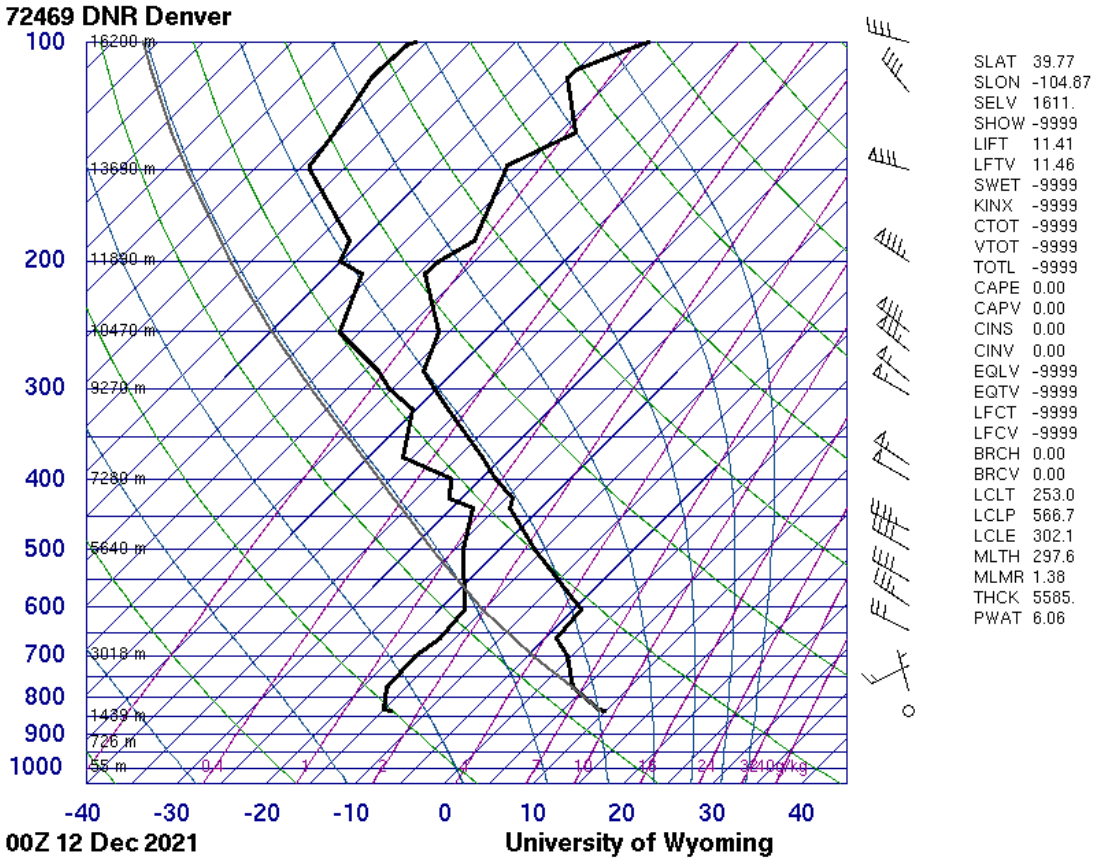

Figure 2: Skew-T diagram for 00Z, December 12$^{\text{th}}$, which is synonymous with 5:00 pm (MST) on December 11$^{\text{th}}$. The skew-T diagram was generated using the atmospheric soundings website of the University of Wyoming [1].

Photographic Techniques

The photo was taken with a Nikon D90 using an AF-S DX VR Zoom-Nikkor lens. An aperture of f/16.0, an exposure of 1/125, and an ISO of 159 were used. Post processing of the image was conducted in darktable, which primarily utilized lens correction, color correction, modification of the color zones, and increase of local and general contrast. The original image, in lower resolution, can be seen in Fig. (3) for context regarding initial image quality and field of view.

Figure 3: This was the original photo taken, unedited other than to reduce it's size for display purposes. The original image was 4310×2868 pixels.

Final Thoughts

I am in general relatively happy with the outcome of this photo, and what I was able to do with the raw image during post processing. Unfortunately, I don't think that I quite have the intuition down for what the balance between aperture, shutterspeed, and ISO should be in order to capture clouds as effectively as I want to. Having said that, the formation that was captured is very interesting, and I am glad that I was able to obtain a clean picture of a fluid instability in nature.

References

[1] L. Oolman, Ed., “Department of Atmospheric Science,” Atmospheric soundings, 2021. [Online]. Available: http://weather.uwyo.edu/upperair/sounding.html.

[2] L. Gramer, "Kelvin-Helmholtz Instabilities," University of Miami, April 27, 2007. [Online]. Available: https://www.researchgate.net/publication/228394911.

[3] J. Haby, “Skew-T Basics,” The Weather Prediction. [Online]. Available: http://www.theweatherprediction.com/thermo/skewt/.