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Flow Visualization 5151-002

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Clouds First | Altostratus with small Cumulus Humilis

September 24th, 2024 | Boulder CO



Figure 1: Final Edited Image

The purpose of this image is to capture and analyze cloud formations I witnessed in front of the setting sun on September 24th, 2024. This report will document and discover the atmospheric conditions leading to the formation of both the altostratus clouds and the small cumulus humilis clouds seen in Figure 1. I will discuss the phenomenon of sunsets and what lead to the lighting effects of the pictured cloud formations, and my editing techniques that give the final image its luster.

The image was taken in Boulder Colorado facing westward at an elevation angle of approximately 15 degrees from the horizon on September 24, 2024, just before 7 PM Mountain Standard Time. The sunset was predicted to occur at 6:54 PM in Boulder on that day. The timing was chosen to capture the optimal lighting conditions which produce vibrant colors present within the clouds during the late afternoon.



Figure 2: Surrounding Sky Conditions

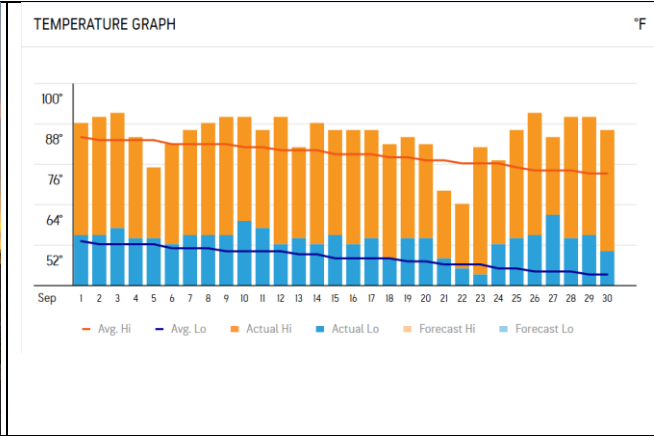


Figure 3: Daily Temperature Plot September 2024

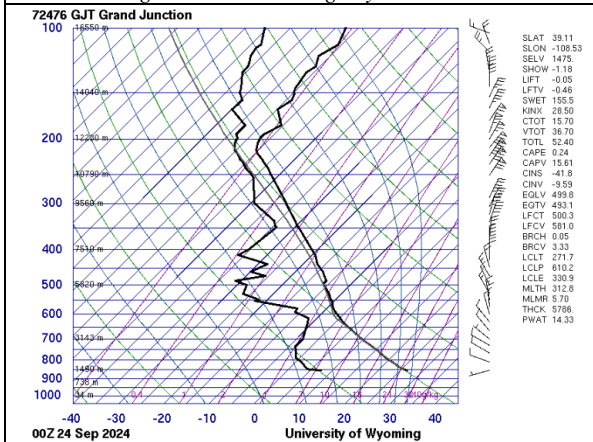


Figure 4: Relevant Skew-T Plot

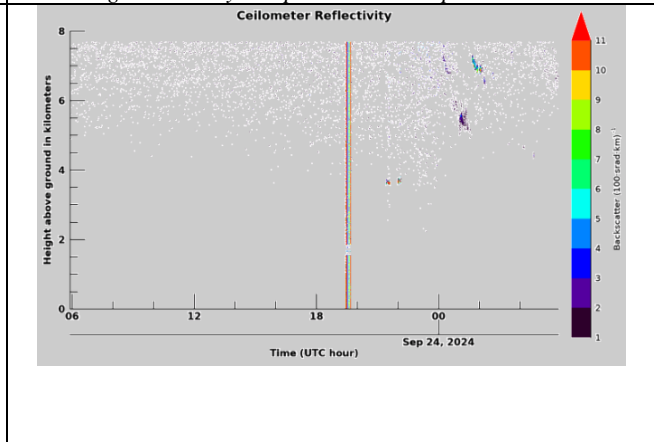


Figure 5: Relevant Ceilometer Data

The clouds captured in the image present primarily as altostratus clouds in the top two thirds of the image, while the five smaller cloud bodies at the bottom of the image appear to be small cumulus clouds, specifically cumulus humilis. The rest of the sky was relatively clear at the time of the image, with cloud cover concentrating on the western horizon above the foothills of the Front Range. On the 24th, there was little wind with a temperature dip following the recession of a cold front two days prior. Atmospheric sounding data taken an hour before the image suggests a fairly stable atmosphere with a CAPE value of 0.24. The Skew-T plot from Grand Junction shows a temperature inversion around 700 mb, indicating limited vertical motion and stability: this reaffirms the

conditions supporting stratus clouds. The ceilometer data indicates cloud heights ranging from 5,500m to 7,000m aligning with the observed altostratus clouds. This data does not directly support the presence of the small cumulus clouds seen at the bottom of the image; instead, I believe these humilis clouds to be a result of localized heating.

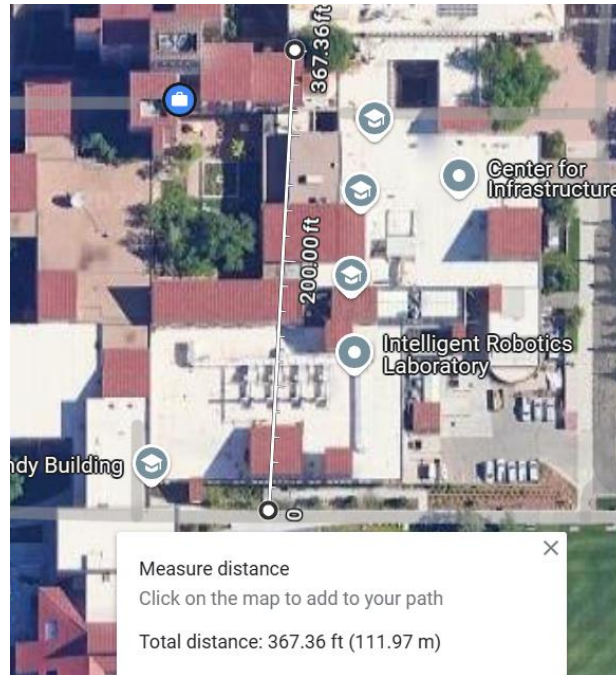


Figure 6: Satellite View of the Location



Figure 7: Unedited Image

Figure 1: Final Edited Image

In Google Maps satellite view, the measured distance between the building peaks to be 112m, giving a FOV of roughly 112m x 84m, and the distance to the clouds was several kilometers. The photograph was taken on a Samsung S24+ Smart phone, utilizing the ultra-wide, 12MP lens with a focal length of F2.4 and 69mm focal length. The original image was

4000x3000 pixels, and the edited image was cropped to 3986x2944 pixels. I utilized an ISO of 25 to minimize camera noise and set the shutter speed to slightly underexpose the image, at 1/120s. In editing, I raised the highlights and the shadows with the goal of increasing the dynamic range of the image, while slightly adjusting the contrast to remove the details of the buildings. I then used the generative AI, native to the phone, to remove the distracting elements from the building skyline, and the remaining details from the buildings.

The image reveals a layered structure of altostratus clouds with the presence of small cumulus humilis clouds, highlighting the stability of the atmosphere. I appreciate the contrast between the unstable cumulus clouds being framed within the skyline of the buildings below the vast expanse of cumulus clouds. The rich oranges against the pastel blues add a layer of visual contrast that I quite rather enjoy. In the future I would really like to capture a cloud formation with a proper camera and compare and contrast the details I am able to record with each setup.

References

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