CU Boulder

Clouds Second Report

MCEN 5151-002

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Introduction

This image was captured as part of a cloud observation assignment intended to document and analyze atmospheric phenomena visible from the ground. The purpose of the image was to reveal how layered clouds can become visually striking when illuminated from below by the rising sun and to identify those clouds and their atmospheric environment.

Image Circumstance

The photograph was taken in Castle Rock, Colorado, on December 5, 2025, at 6:39 a.m. MDT, facing east with the camera angled approximately 20° upward from the horizon. The scene occurred as the sun was rising, providing a vibrant illumination to the morning clouds.

Cloud Identification

The clouds in the image are primarily altostratus and altocumulus, indicated by their mid-level altitude, extensive horizontal coverage, and textured, cellular patterns. The vivid morning coloration reflects illumination from below, consistent with clouds positioned roughly between 2–6 km altitude, where optical scattering occurs efficiently under low solar-angle lighting [1]. The Grand Junction skew-T sounding from 00Z on 2 December 2025, the closest upper-air profile, shows a saturated layer beginning near 600–500 mb, aligning with typical mid-level cloud heights [2]. The temperature and dewpoint curves converge through this layer, indicating sufficient moisture for cloud formation. Stability analysis of the sounding reveals a conditionally unstable profile in the lower to mid-troposphere, with localized layers where the environmental lapse rate approaches dry adiabatic conditions, favoring vertical development within altocumulus clouds [3].

Winds veer from southwesterly near 700 mb to westerly above 500 mb, suggesting vertical wind shear capable of stretching cloud elements into elongated, streaked formations, which are visible in the photograph [4]. No precipitation occurred immediately before or after the photograph, consistent with altostratus and altocumulus clouds that frequently create vibrant coloration without producing surface weather. The estimated cloud base height of 8,000–14,000 ft agrees with both the visible structure in the image and the sounding data. Overall, the observed cloud types match those expected from the atmospheric stability and moisture pattern shown on the skew-T diagram (Figure 1).

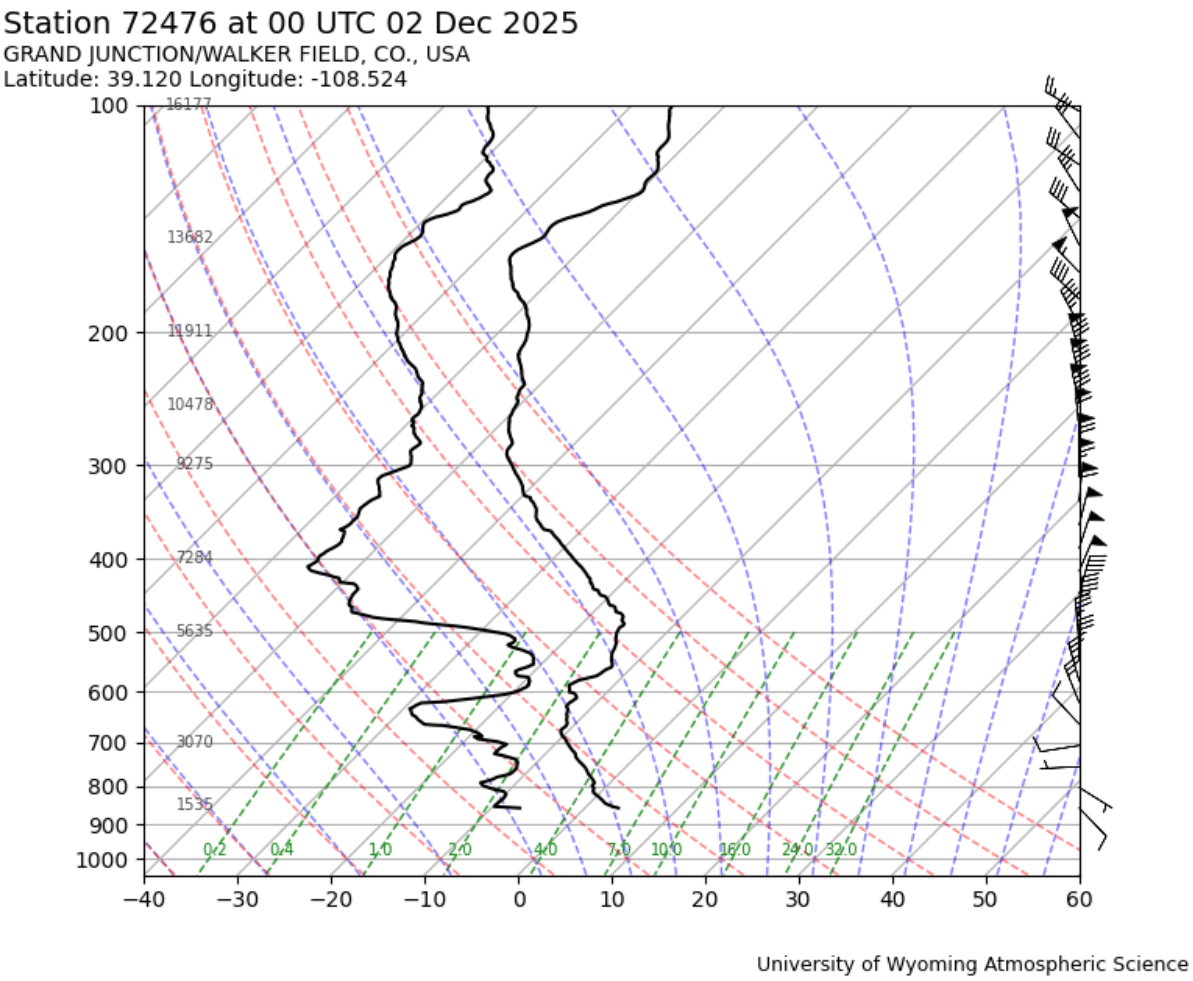

Figure 1. Skew-T

Photographic Technique

The image was captured using an iPhone 14 Pro Max digital camera, which automatically records exposure metadata. The original image resolution was 3024 × 4032 pixels, and the camera used a 26 mm equivalent focal length through the primary lens. Exposure settings included a wide aperture and moderate shutter speed appropriate for low-light dawn conditions, allowing the camera to balance the bright illuminated cloud bases with the darker upper sky regions. ISO adjustments were handled automatically to maintain proper brightness levels. Post-processing was minimal and consisted only of slight contrast enhancement to accurately represent the observed colors. No cropping or large tonal modifications were used to preserve the original geometry of the cloud formations.

The original photo is shown in Figure 2 below.

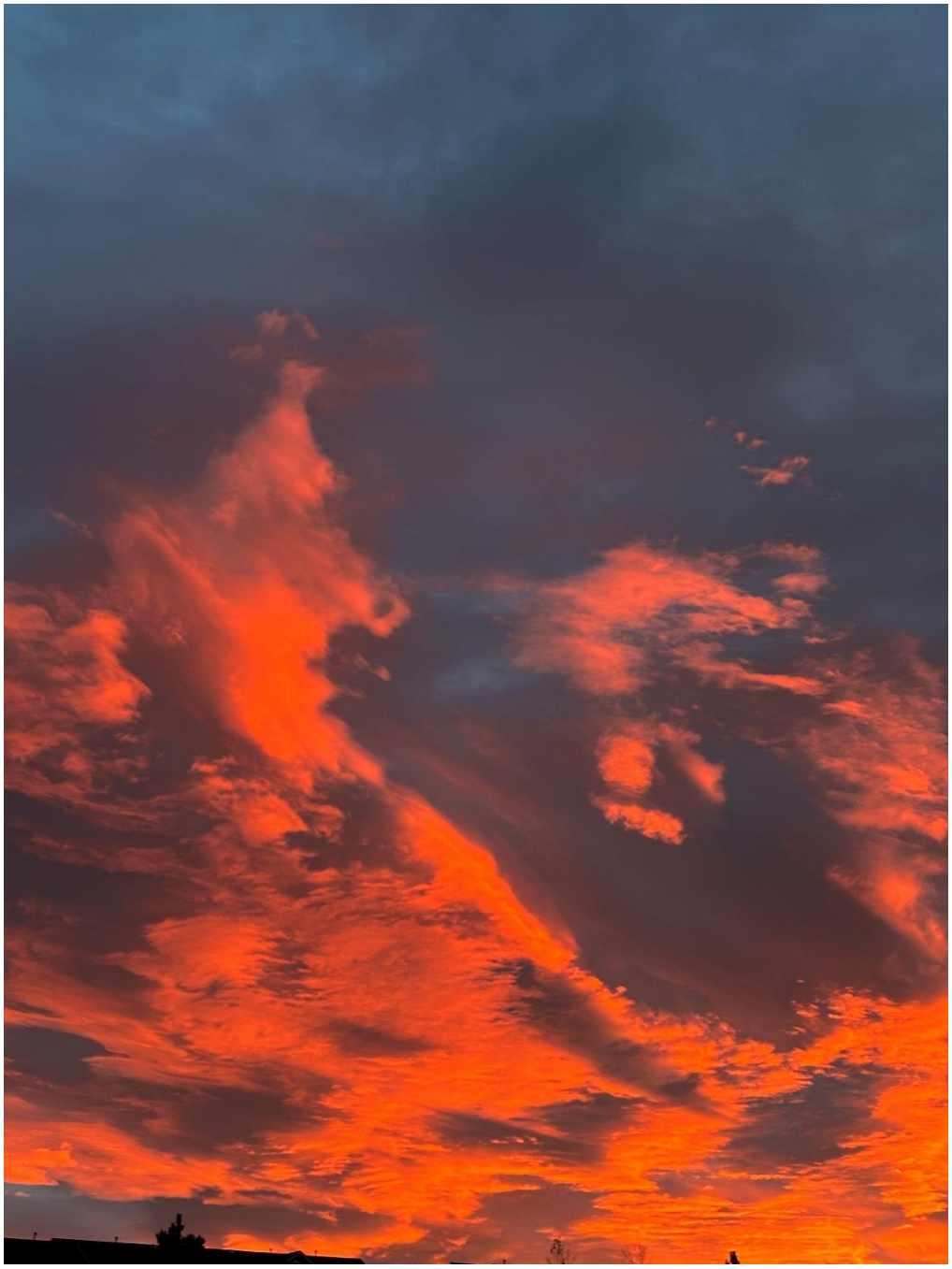

Figure 1. Original Image

Conclusion

The final image reveals the dynamic layering and directional stretching of mid-level clouds influenced by early-morning light and modest atmospheric instability. The strong contrast

between the illuminated cloud bases and darker surroundings highlights gradients in cloud thickness and the effects of shear-driven advection. The photograph effectively captures the sculpted, sweeping structures characteristic of mid-level flow. One limitation is the frame of this image does not capture much of the surroundings, and this would better help orient the photo and provide a better understanding of scale.

References

1. National Weather Service. *Cloud Chart and Classification Guide*. NOAA, 2023.
2. University of Wyoming Atmospheric Science Department. *Upper-Air Sounding Archive*. 00Z 2 December 2025 – Grand Junction, CO (Station 72476).
3. Wallace, J. M., & Hobbs, P. V. *Atmospheric Science: An Introductory Survey*. Academic Press, 2006.
4. American Meteorological Society (AMS). *Glossary of Meteorology*. "Wind Shear," "Altocumulus Castellanus," 2024.