Clouds Second

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Figure 1: Layered sunset cloud formation over Broomfield, Colorado, 10 Nov 2025.

Abstract

This photograph captures a layered sunset sky over Broomfield, Colorado, on the evening of 10 November 2025. I used an iPhone 16 Pro Max in portrait mode, stabilized and aimed toward the western horizon, to preserve smooth gradients in the sky while recording the intense oranges and magentas in the mid level cloud deck and the deep blues of the upper atmosphere. To interpret the atmosphere, I analyzed the Riverton, WY upper air sounding. The sounding shows a dry lower troposphere, a broad moist mid level layer between about 600 and 420 mb, and a thinner moist region near 250 mb. These layers support altostratus/altocumulus at mid levels and cirrus aloft in a generally stable, stratified profile with no CAPE, consistent with the smooth, sheet like clouds seen in the image.

Imaging Setup and Location

This image was captured from a neighborhood in Broomfield, Colorado, looking west toward the Front Range. At this time of year, the sun sets behind the Rockies, so the primary illumination on the cloud field comes from low angle sunlight passing underneath the mid level deck and reflecting off higher clouds.

To capture the scene, I used an iPhone 16 Pro Max in portrait mode. Portrait mode helped separate the silhouetted foreground from the layered sky, allowing the camera to emphasize color and tonal gradients in the clouds. The image was captured in ultra wide, with a 13mm focal length, an aperture of 2.2, ISO 100, and a shutter speed of 1/99 s. This gave a moderately wide field of view. This framing allowed me to include both the bright mid level deck and the overlying high clouds while keeping the horizon and foreground low in the frame. The composition deliberately follows roughly the lower third rule for the horizon, reserving most of the frame for the vertical structure of the atmosphere.

Atmospheric Analysis

To connect the photograph to the actual state of the atmosphere, I used the University of Wyoming Skew T log p diagram for Riverton, Wyoming (station 72672) at 00Z on November 11, 2025. While Riverton is north of Broomfield, it sits at a similar elevation on the high plains, so the profile is a reasonable proxy for the environment over the Colorado Front Range.

One important feature in this sounding is the surface pressure: the lowest plotted level is near 800 mb rather than 1000 mb, reflecting the station elevation of roughly 1.7 km. Broomfield sits at a comparable elevation, so the sounding already starts well above sea level and directly represents high plains conditions.

From the Skew T diagram, the lower troposphere from the surface around 800mb, up to roughly 600 mb is relatively dry, with a wide separation between the temperature and dew point curves. This matches the clear air and good visibility in the photograph. Above this, from about 600mb to 420 mb, the temperature and dew point lines move much closer together, indicating a broad moist mid level layer. This is the layer most likely to host the altostratus and altocumulus that dominate the image. These clouds are thick enough to scatter and transmit low angle sunlight, producing the intense orange and magenta bands seen in the photo.

Higher in the profile, near 250 mb, the sounding shows another, thinner moist region. This layer supports cirrus clouds composed of ice crystals. In the image, these appear as faint, higher clouds that carry softer pink tones, lit from below after the solar disk has dropped beneath the horizon.

Between the moist layers, the air is relatively dry, which helps sharpen the visual separation between the mid-level deck and the high cirrus veil.

Dynamically, the sounding exhibits little to no convective available potential energy (CAPE), indicating a stable or only weakly unstable column. Without significant buoyant energy, deep convection and cumulonimbus towers are suppressed, and the cloud field remains stratiform. The smooth, sheet-like structure and the absence of towering cumuliform elements in the photograph are consistent with this stable, layered environment.

Discussion and Interpretation

The photographed scene can be interpreted as portrayal of a stable, stratified mid-latitude troposphere at sunset. The dry air near the surface eliminates much of the low-level haze, so the colors originating in the mid-level deck remain clean and saturated by the time they reach the camera. As sunlight travels through a long slant path near the horizon, shorter blue wavelengths are preferentially scattered out of the direct beam by molecules (Rayleigh scattering), leaving a spectrum enriched in reds and oranges.

When this reddened light encounters the mid level altostratus/altocumulus layer between roughly 600 mb and 420 mb, it is further scattered by cloud droplets (Mie scattering). Because the droplets are much larger than molecules, the scattering is less wavelength selective, making the entire layer glow in orange and magenta tones. The darker interior patches and shadows within this deck likely correspond to locally thicker cloud regions or areas where the viewing angle increases the optical depth, reducing transmitted light.

Above, the thin cirrus near 250 mb interacts with the remaining light in a different way. Ice crystals can refract, reflect, and sometimes diffract sunlight, often producing softer pinks or even subtle halos. In this case, the high cloud layer takes on a delicate pink hue as it is illuminated from below by light passing under the mid level deck. Because the cirrus is optically thin, the underlying deep blue of the upper atmosphere still shows through, producing a gentle gradient from pink tinted cloud to darkening sky.

Conclusion

This Clouds Second image shows how a simple smartphone photograph can be used to diagnose the vertical structure of the atmosphere over the Colorado Front Range. By correlating the observed color gradients and cloud textures with an upper-air sounding from a nearby, high elevation station, I identified a dry lower troposphere, a broad moist mid level layer supporting altostratus/altocumulus, and a thinner upper moist layer supporting cirrus. The stable, low CAPE environment favored smooth stratiform clouds rather than deep convection, and the sunset geometry enhanced the contrast between the layers through Rayleigh and Mie scattering.

References

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[3] Stull, Roland B. *An Introduction to Boundary Layer Meteorology*. Springer, 1988.

[4] Wallace, John M., and Peter V. Hobbs. *Atmospheric Science: An Introductory Survey*. 2nd ed., Elsevier Academic Press, 2006.

[5] University of Wyoming, Department of Atmospheric Science. *Upper Air Sounding Archive: Grand Junction, CO (72476) — 00Z 30 September 2025*. Available at: `http://weather.uwyo.edu/upperair/sounding.html`, accessed 04 Dec. 2025.

Appendix

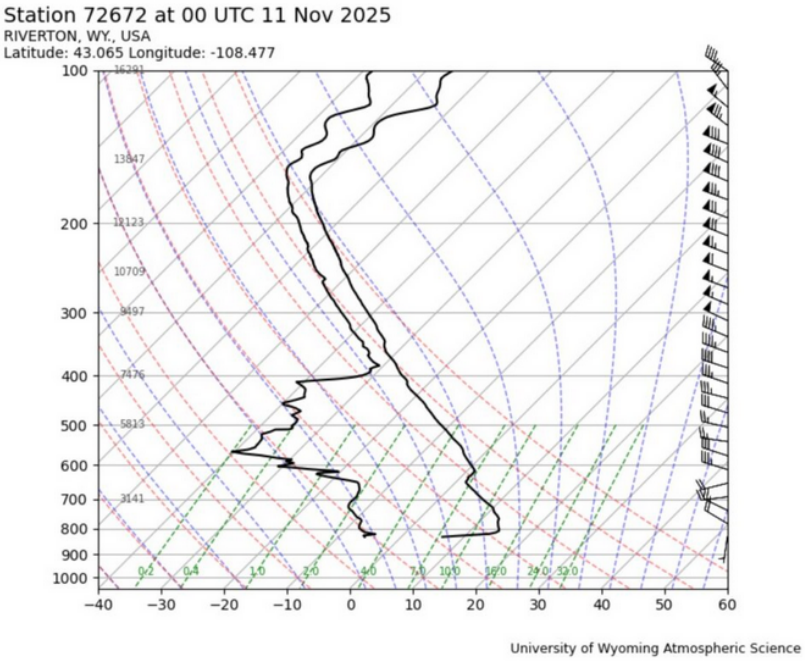

Figure 2: Skew-T Diagram from University of Wyoming