Clouds Second Report:
Stratus Clouds Shaped by Mountain Orographics

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Figure 1: The final image submitted to FlowVis for the Clouds Second assignment. This image was taken on November 24th 2025 and shows what appears to be stratus clouds with orographic shaping of the cloud boundary.

1 Introduction

This image was taken for the FlowVis 'Clouds Second' assignment which encourages students to keep an eye out for clouds in our day to day life and to photograph various clouds types. We are interested in clouds in this class because they are able to both show off the fluid physics going on in the atmosphere in these grand scales while being both interesting, beautiful and accessible to photograph.

This image was taken on November 24th at 2:27 pm from Parkside Park in Boulder Colorado. This image was taken facing south-west towards the mountains and shows was I believe to be part of Flagstaff Mountain after checking the location and angle with Google Earth [1].

2 Cloud Identification

The clouds in this image appear to mainly be stratus type clouds. This is supported by how the clouds are in these thick blanket structures. We have a few layers of lower stratus and then also some thinner

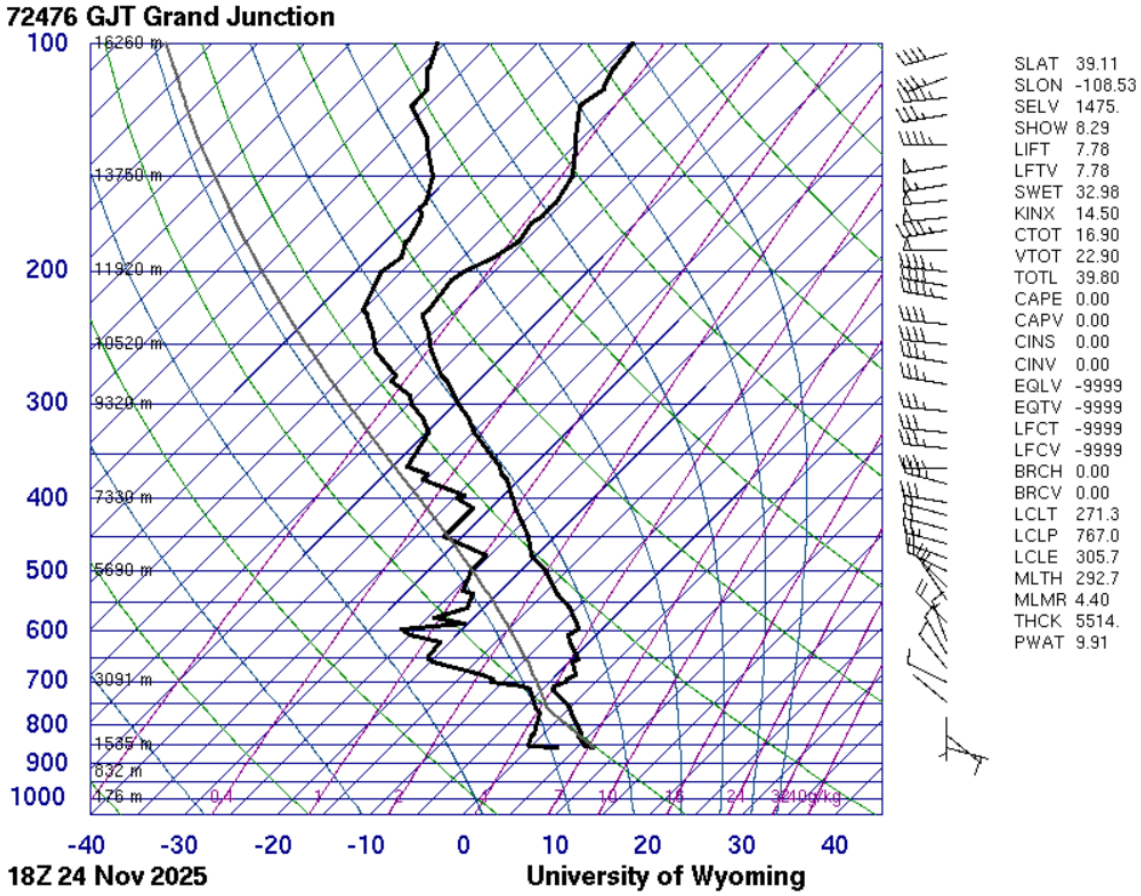

Figure 2: Skew-T from the Grad Junction weather station which was acquired using the University of Wyoming catalog [2].

altostratus at the top of the image where more sunlight is peaking through. Having stratus clouds would also make sense looking at the skew-T diagram from around this time which is shown in figure 2. This skew-T is from Grand Junction, which is about 300 km from Boulder, but is still able to give us some insight into the atmospheric conditions. We do have a CAPE of 0 which suggests a stable atmosphere. We can also see that the lowest place we expect to see clouds is around 1500 m - 3000 m which matches where these clouds look to be. We can also see from this data that there were winds going west to east across most of the atmosphere.

One more factor that we can consider in this situation is the orographic effects going on. Orographics deal with how the topography plays into cloud formation and structures. In this case we have mountain ranges with canyons along this direction, more specifically on the left we have part of Flagstaff Mountain that slopes down into Boulder Canyon Dr. With the winds coming from the west, any clouds on the west side would experience orographic lift and shear coming over the mountain. This would also also explain why the shaping looks very lenticular in some places.

3 Visualization and Photo Details

This image was taken with a Nikon D3100 with 50 mm focal length, f/20, 1/100 exposure time, and iso 100. The original image size was 4644 x 3084 pixels and was taken at 40° with respect to the horizon. The final image was cropped slightly to 4624 x 2601. For the editing of this image I increased the exposure to create some more contrast with the brighter and darker areas. I also added a s curve to the RGB color curve. Both of these adjustments were made in the darktable program. This cloud appeared to be around 5 km away from the camera, judging by how it appears to be just over and behind Flagstaff Mountain. The field of view is around 1 km across.

Figure 3: Original image captured before post-processing.

4 Reflection

In the end, this snapshot shows some of the effects topography has on cloud shape. In this case we see how various layers of stratus clouds overlapping and shearing due to the orographic lift of the mountains. I also like how I was able to get an interesting image of stratus clouds because in many cases they can be boring to photograph. These clouds have clear boundaries that give some idea of where the different stratus layers are in the sky giving us an idea of the flow structures in this part of the sky. I am curious how these clouds evolved with time. A time lapse would have been an interesting way to have explored their evolution.

References

[1] Google. Google earth. https://earth.google.com. Version: 9.2.78.1; Imagery Date: 2025; Location: Boulder Colorado, United States; Coordinates: 40°02'21"N 105°15'48"W, elevation 1627; Accessed: 2025-12-04.

[2] University of Wyoming Department of Atmospheric Science. Atmospheric sounding data. http://weather.uwyo.edu/upperair/sounding.html, 2025. Accessed: 2025-10-20.