Cloud First Report

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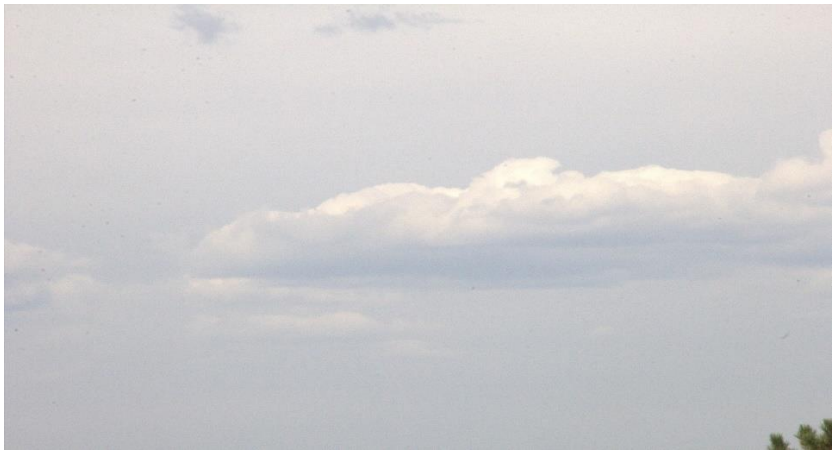
I took this image as part of an assignment for the Flow Visualization course I am enrolled in during the Fall 2024 semester. The assignment is titled cloud first and the goal is to capture both visually striking and informative images of a cloud as well as inform us, the students, on how difficult it is to photograph a picture of a cloud. This is the edited photo and post processing that has been done to it to make the target region of the photo stand out among the all-white background. Shooting an image of a white cloud on a white backdrop has proven to be a very challenging task, however, it does produce some visually stunning images if done by an artist far more talented than myself.

This image was taken in Highlands Ranch, Colorado on October 11, 2024. It was shot in the morning at 11:07am while standing on the roof of my home in the suburbs. I was facing about 275° W – NW and standing at an altitude of about 5700ft. The angle the camera lens was at in relation to the horizon was roughly 5° give or take 2° or so.

The clouds in the image are stratocumulus, characterized by their flat, layered appearance and grayish tone, indicative of low-altitude clouds typically found between 2,000 and 6,600 feet. The rest of the sky is largely covered with similar stratocumulus formations, which suggests stable atmospheric conditions. Based on the previous weather, no major changes were observed in cloud formation, indicating that no significant front was approaching at the time. Winds at the surface were mild, further supporting the idea of atmospheric stability, with no indications of strong convection or turbulence. According to the closest Skew-T plot, the atmosphere exhibited a near-neutral lapse rate, which aligns with the formation of stratocumulus clouds. The cloud height inferred from the Skew-T analysis was approximately 6,500 ft, which agrees with my visual observation of the cloud elevation. The temperature and dew point lines on the Skew-T were relatively close, indicating sufficient moisture near the surface but not enough instability to produce cumulus or cumulonimbus clouds. Stratocumulus clouds often form in stable air masses,

where warm, moist air rises slightly but cannot develop into larger, more vertically extensive clouds. In this case, the physics of the cloud formation can be attributed to weak thermal lifting combined with moisture at lower levels of the atmosphere, leading to widespread but relatively thin cloud cover. The lack of significant weather changes and the consistent cloud structure over time suggest that the atmosphere remained stable before and after the image was taken. The winds aloft, as indicated by the Skew-T plot, were light and variable, further contributing to the stable cloud formation. No significant rain or snow was observed within a few hours of the image being taken, confirming that the stratocumulus clouds were not associated with a frontal system or major weather disturbance. This observation aligns with the expected weather for stable atmospheric conditions, where stratocumulus clouds typically persist without developing into storm systems.

The cloud image was captured using a digital Canon EOS 60D camera with a 155mm focal length, providing an effective focal length of about 248mm due to the camera's APS-C sensor. This focal length was chosen to zoom in and isolate the clouds while maintaining details. The clouds were at an estimated altitude of 6,500 feet, and the field of view likely spanned several hundred feet of sky at that distance. The camera settings included an aperture of f/36, allowing for a large depth of field to keep the entire cloud formation in focus, and a shutter speed of 1/250 second, fast enough to prevent any motion blur. The ISO was set to 640, balancing light sensitivity while minimizing noise. The image dimensions were 5202 x 3464 pixels, with a file size of 23.3 MB, confirming it as a high-resolution digital photograph. The image was shot in aperture priority mode, allowing for precise control over depth of field. No flash was used, and no significant exposure bias was applied during the shot. Below is a picture of the raw image:



It is hard to see it here, however, there was a lot of dust on the lens which required me to pull the image into Adobe photoshop to clean up the black specs and sharpen the image. The only other post processing I did to this image was increase the contrast to allow the cloud to pop against the similarly colored background.

The image reveals a layered formation of stratocumulus clouds at approximately 6,500 feet, capturing the clouds' texture and structure in fine detail. What I like about the image is how the focal length allowed me to isolate the clouds, highlighting their distinct shapes and layering while maintaining sharpness across the scene. The contrast between the darker base of the clouds and the lighter top emphasizes the cloud's three-dimensional form, adding depth to the image. What I

dislike is the overall flatness in the lighting and color tones, which could have been improved with more dramatic lighting or a different time of day to enhance contrast and texture. The fluid physics of the image are represented well, particularly in the gentle undulations and layered appearance of the clouds, which suggest stable atmospheric conditions with minimal vertical movement. The image captures the slow, horizontal spread of the clouds, indicating the nature of stratocumulus formation. However, the dynamics of cloud development and the fluid processes at play could be more pronounced with a different cloud type or under less stable atmospheric conditions. One question I have is how the exact formation of these clouds relates to wind patterns at this altitude and what role atmospheric stability plays in maintaining their shape. In terms of fulfilling my intent, I did achieve my goal of isolating the clouds and showing their structure, but I think the image lacks some of the dynamism that I hoped for. To improve this image, I would experiment with different lighting conditions or shoot the clouds when they are more dynamic, possibly at sunset or sunrise. Moving forward, I could develop this idea by capturing different cloud types that form under unstable atmospheric conditions, such as cumulonimbus clouds, to showcase more active fluid dynamics and vertical development in the atmosphere.