Clouds Second

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I. Introduction and Background

While fluid dynamics can be incredibly complex mathematically and scientifically, all humans have an inherent intuition for the motion of fluids thanks to their everyday exposure to the formation and movement of clouds. Nearly every day we witness clouds form, shift, change, and dissipate. My goal with this project was to capture a timelapse of clouds from my apartment to show how any given day you can see an abundance amazing cloud activity in the places you frequent so much, you are not used to going out of your way to notice beauty. While I took a few photos and short videos on my phone throughout November and early December, I wanted a longer timelapse to capture more activity. To accomplish this, I borrowed a GoPro HERO 9 Black camera so I could take a longer timelapse without having to leave my phone unattended for a long period of time. The image on the title page is taken from the beginning of the timelapse video, at approximately 7:45 am.

II. Context of Image

This video was captured in Boulder, CO just east of campus on College Ave. near 28th street and Colorado Ave. The date was December 7th, 2023 and the video was taken from 7:45am to 9:15am. The camera faced north at an angle of approximately 30-45 degrees from horizontal. The clouds come into frame from the west and move almost directly east before dissipation. The nearest weather station is located in Grand Junction, CO which is approximately 250 miles WSW of Boulder. Boulder has an elevation of roughly 5430 ft or 1655 m while Grand Junction sits at 4583 ft or 1397 m. Grand Junction is also located deeper in the Rockies than Boulder, which sats at the foothills. These factors could lead to considerable differences between data like the Skew-T diagram and the actual cloud activity shown in the video.

III. Cloud Classification and Weather Data

The majority of the clouds in this image appear to be cumulus clouds. In the video, you can clearly see a large number of individual, fluffy, low-altitude clouds over the hour and a half. These are characteristic features of cumulus clouds, which are common in clear weather, like the conditions shown in the video. The Skew-T diagram generated at the Grand Junction weather station can be seen below in Figure 1. Cloud formation is most common at altitudes where the two curves on the Skew-T chart are close together, and as can be seen in Figure 1, the majority of cloud formation occurs at low altitudes below 5000 m. This matches what is seen in the video as all the cloud activity appears to be very low in the sky.

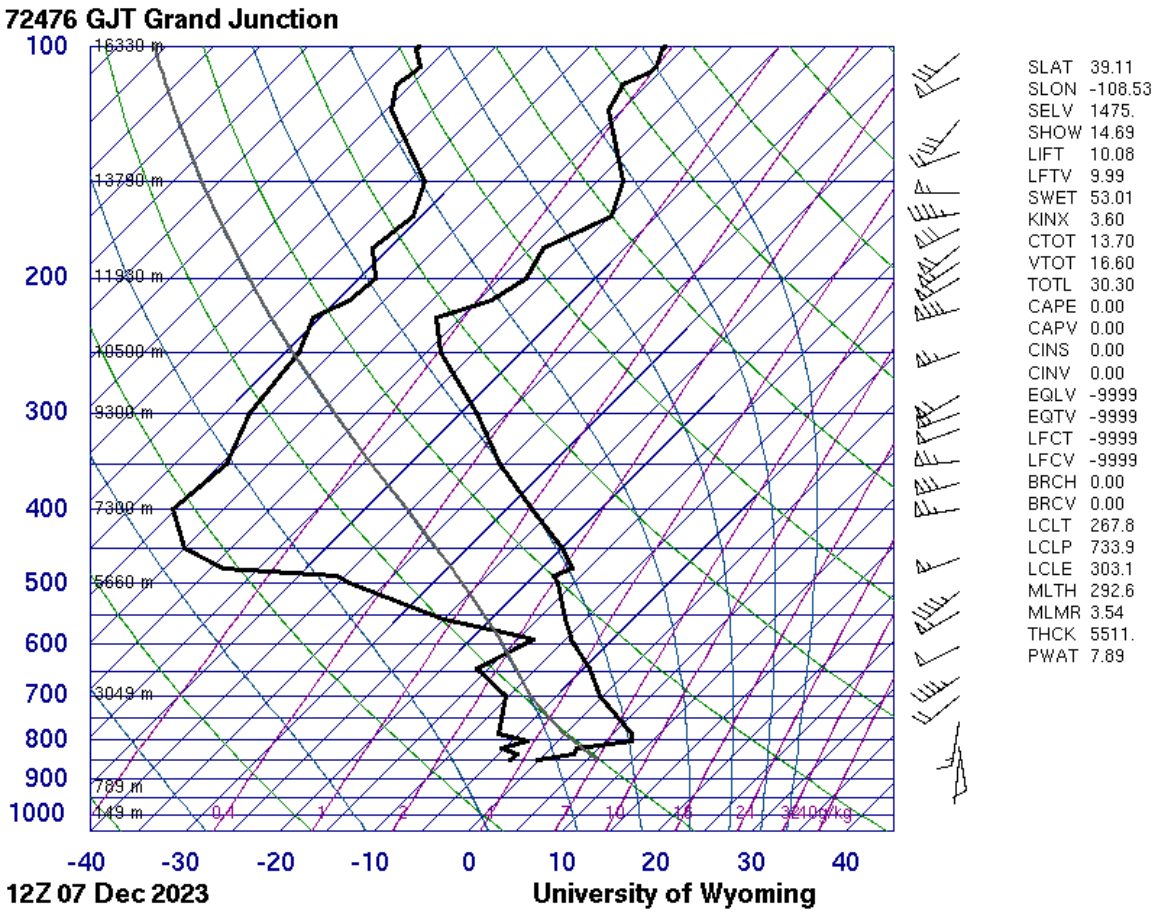

Figure 1: Skew-T diagram from Grand Junction, Colorado at 12Z or 5am MST on December 7th, 2023

Figure 2 shows weather data collected by the ATOC program at CU Boulder, which can add some useful contextual information to help explain some of the cloud patterns in the video. It can be seen that temperature, air pressure, and humidity are very stable from 8 to 10 am, but it can be seen that this time period is right after a significant drop in pressure from the night before. This change could have some effect on creating the cloud systems that move eastward from the mountains. Looking at the wind direction graph, it can be seen that from 8 to 9 am local time, which makes up the majority of the video, the wind direction varies but generally blows east and southeast. This also matches the video, as the clouds move right across the frame and the camera is pointed north, meaning the clouds are moving east.

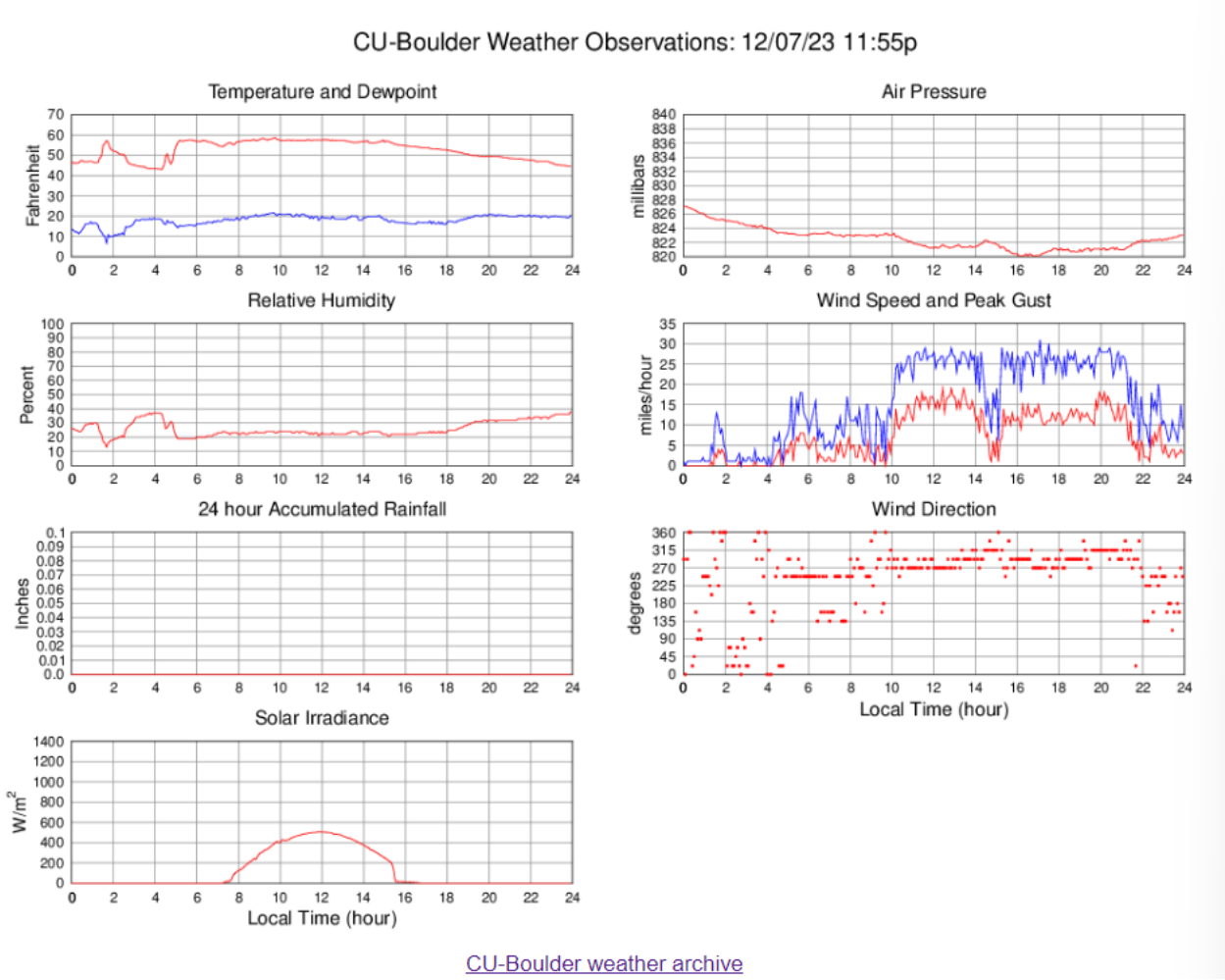

Figure 2: CU ATOC weather data for Boulder on 12/07/23

IV. Camera Settings and Photograph Properties

The properties of the GoPro Hero 9 Black camera used are shown below in Table 1. The original timelapse video was 4 minutes and 54 seconds before I sped it up further by a factor of 16 to result in a final video length of approximately 18 seconds. The camera recorded at about 30 frames/s. Other than speeding up the footage, I did not no editing because I wanted to retain the natural look of the video, specifically the blue tone of the sky. I considered cropping the frame to focus more on the clouds and remove the ground and people passing by; however, based on feedback from the critique in class, I decided to leave this aspect of the video intact. According to some of my fellow students, the people on the ground passing by help create a sense of the passage of time. I agree and think this is an important part of the video, making the time and size scales of the cloud dynamics much more understandable.

Length	04:54
Frame rate	29.97 frames/s
Frame width	1920 pixels
Frame height	1080 pixels

Table 1: GoPro Video Settings

V. Conclusion

I think this video does a good job of capturing the large amount of cloud activity and dynamics visible in every day over a relatively short period of time. By recording a video first thing in the morning while I got ready for the day, I was able to highlight a period of time where people generally, and myself specifically, are not as aware of the natural beauty and learning opportunities all around us due to the hustle and bustle of life and the lack of attentiveness right when you wake up. I think this aspect is also captured in the people walking through the frame, most of them on their way to campus for the day. While everyone is tired and stressed trying to make it through their day, hundreds of clouds appear and disappear within a single hour, and we rarely recognize the opportunity to look up and appreciate this phenomenon.

References

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"CU-Boulder Weather Observations: 12/07/23 11:55p." *University of Colorado Weather Network*, CU Boulder ATOC, 08 Dec. 2023, https://sundowner.colorado.edu/weather/atoc1/PAOSweather20231207.html.

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