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MCEN 5151

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Clouds 2



Cumulus Humilis Clouds

1. **Purpose:** For this assignment, I was lucky enough to capture the remnants of a rare clouds event I only learned about in this class, the Kelvin Helmholtz clouds. Unfortunately, I missed the perfect wave like formation of these clouds over the mountain range just west of Boulder but was able to get a photo of some of the dissipating wave formations. Artistically, I got a pretty sharp separation of these wavelike clouds, but also was able to include the eerie fog like clouds along the mountain range that add some context to the image.

2. **Circumstances:**

Circumstances Overview

- **Location:** Boulder, CO - 39° 59' 11.37" N - 105° 14' 1.17" W
- **Direction and Elevation:** ~S & ~45 degrees from horizontal
- **Date/Time:** November 11, 2021 – 3:12PM

3. **Cloud Analysis:** From how the clouds are formed, the Skew T from Figure 1, and the local photograph in Figure 2, I do believe these are the remnants of Kelvin Helmholtz clouds. By furthering examining the Skew T diagram, one can see that the CAPE value was 0, meaning that the atmosphere was stable, which is the condition that these clouds occur in (1). Also, by following the dew point and environmental sounding line, the altitude of these clouds is somewhere around 6000m or 19,600 feet. This again coincides with the hypothesis that these are Kelvin Helmholtz clouds, as they usually appear in stable atmospheres above 16,500 feet (1). Another indicator that these clouds are of Kelvin Helmholtz origin is the wind data, as these clouds are formed by wind shear due to strong higher elevation winds being separated from weaker lower elevation winds (1). The wind plot in Figure 1 show that the lowest elevation wind was fairly slow, but it drastically increases as it increases in elevation, and also maintains the same general direction, which aligns with the creation of Kelvin Helmholtz clouds. The weather at this time was also fairly average and November 11th was not out of the ordinary for that week, but weather data also shows high wind speeds for the 10th and 11th, further complementing the wind forces necessary to create this cloud formation (2). Even though



Figure 2: Local photo of the Kelvin Helmholtz phenomena captured in Boulder

4. **Photographic Technique:** For this photo, I unfortunately could not use my full frame camera, as I was riding my bike back from class and wanted to make sure I captured this formation in time. Still, by just using my iPhone, I made sure to get a clear image of the cloud formation making sure they were the subject. I tried to eliminate any distracting foreground and background objects as I could, but I feel like the mountains in the distance add to the scene as they help corroborate the Kelvin Helmholtz phenomena. For post processing, I only had to do some simple cropping, adjust the whites and highlights, and finally add a bit of saturation to make the blue sky stand out a little more.

Photographic Details Overview

- **FOV:** ~1400m x 900m
- **Object Distance:** 20,000ft
- **Lens:** iPhone XS 2x Lens 6mm (35mm equivalent: 52mm)
- **Camera:** iPhone XS

- **Resolution:** 4032 x 3024 Original, 3252 x 2602 Final
- **Aperture:** f2.4
- **Shutter Speed:** 1/2800
- **ISO:** 16



Figure 4: RAW Image

5. **Self-Assessment:** This image captures one of the more uncommon cloud formations, the Kelvin Helmholtz formation, in a well-defined and contextualized way. Unfortunately, the structure was beginning to dissipate, and the angle may not have been the best to demonstrate the perfectly formed waves that are known for these conditions, but still details the rounded structure and separation present. I would have liked to get an image more like that of Figure 2, but I think this image still demonstrates the unique conditions that are present in Boulder and how the mountains of the Front Range interface with different wind currents and conditions to produce some of the most interesting, and most beautiful, cloud formations.

References:

1. Skybrary, “Kelvin-Helmholtz Waves”, <https://skybrary.aero/articles/kelvin-helmholtz-waves>
2. “Past Weather in Boulder, Colorado, USA - Yesterday and Last 2 Weeks.”
Timeanddate.com, <https://www.timeanddate.com/weather/usa/boulder/historic>.