



## **MCEN 4151- Flow Visualization**

### **Cloud First Report**

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## **I. Background and purpose**

This image was taken on September 2<sup>nd</sup>, 2023 at 6:46 am for the Cloud's First assignment for MCEN 4151. The picture was taken at Powder Horn Mountain Resort, which is roughly 20 miles due east of Grand Junction. The base of the resort, where the image was taken sits at an elevation of 8200 ft [1]. I took this image when I was camping out of the back of my truck for a mountain bike race. It had been raining lightly throughout the night, and this was the view I woke up to. Since the image was taken from the back of my truck, I would estimate the angle from horizontal to be about 25 degrees. The image captures a nimbostratus cloud, which are generally found around 6,000- 23,000 ft in elevation.

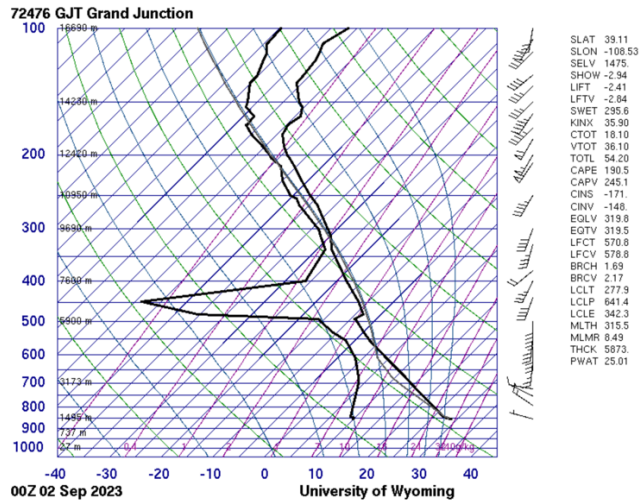
## **II. Flow description**

Nimbostratus clouds usually form along warm weather fronts. As warm air meets cold air, the warm air begins to flow upwards. As the warm air rises, it cools, which causes water to condense. As the cloud becomes denser, it results in a large cloud that blankets the whole sky [2]. These clouds are commonly accompanied by precipitation because the more the cloud cools, the less moisture it can hold, so water droplets fall as rain or snow.

On the right side of the image, you can see sunbeams radiating upwards. These are known as crepuscular rays, which are formed when sunlight shines through holes in a cloud in the presence of dust [3]. The dust scatters the sunlight which can be seen against the darker background of the sky [3].

The orange highlights are caused by scattering [4]. Since the sun is lower in the sky when it rises, the sunlight passes through more of the atmosphere, meaning the light has more interactions with molecules in the air [4]. Since violet and blue light have shorter wavelengths than red and orange light, the blue and violet light get filtered out through the longer journey through the atmosphere [4]. Because of this, sunsets and sunrises appear red and orange.

The Skew- T diagram for September 2<sup>nd</sup> in Grand Junction is shown below:



Based on the bump at 6,250 m, I would estimate that the clouds I was looking at were at a similar altitude. Since the lift index was -2, I would classify the atmosphere as marginally unstable at the time the image was taken [5].

### III. Visualization and photo technique

This image demonstrates a marked boundary technique; you can clearly see the boundary between the clouds and the sky. After taking many photos of clouds over the first two months of the semester, I wanted to explore this image further because of the contrast between the sunrise and the clouds behind it. I was trying to focus on the cloud itself, but I was camping on a mesa, so it was difficult to minimize the trees in the photo. I took the photo on an iPhone 11 pro with the 26mm lens and an aperture of f1.8. The ISO was 125 and the shutter speed was 1/121 seconds. The original image was 4032 x 3024 pixels and the edited image is 2977 x 1601 pixels. Both images are shown below.



In cropping, my main goal was to focus on the cloud itself, so I tried to crop out the trees as much as possible. I was also trying to emphasize the orange in the sunrise. I lightened up the image a little bit. I also increased the saturation and vibrance slightly. I also lowered the green part of the RGB curve. Finally, I increased the definition.

## IV. Conclusion

I think that this image turned out well. I really like how the orange of the sunrise contrasts with the dark nimbostratus clouds. I would have liked to have taken this image from a higher vantage point, where the clouds themselves would've been less occluded. Nimbostratus clouds are not always the most visually interesting since they're so large, and generally don't have tons of texture. However, I think I was lucky to have woken up once the rain had been overhead and in time to capture the light reflecting off the bottom of the cloud in an interesting way.

## V. References

[1] *Powderhorn Mountain Resort- Mesa*. Free Colorado Travel Guide Vacations Travel and Tourism. (n.d.). <https://www.uncovercolorado.com/skiing-snowboarding/powderhorn-mountain-resort/>

[2] Windy Weather World Inc, USA. (n.d.). *Nimbostratus clouds and the precipitation they cause*. WINDY.APP. <https://windy.app/textbook/nimbostratus-clouds.html>

[3] Crepuscular and anticrepuscular rays. (n.d.). <http://home.moravian.edu/users/phys/mejg01/retirement%20activities/pages/meteo/CrepuscularRays.html>

[4] *Curiosities: What determines the colors of the sky at sunrise and sunset?*. News. (2007, November 6). <https://news.wisc.edu/curiosities-what-determines-the-colors-of-the-sky-at-sunrise-and-sunset/>

[5] *Skew-T parameters*. Skew-T Parameters and Indices. (n.d.). [https://www.weather.gov/source/zhu/ZHU\\_Training\\_Page/convective\\_parameters/skew/skewtinfo.html](https://www.weather.gov/source/zhu/ZHU_Training_Page/convective_parameters/skew/skewtinfo.html)