

Flow Visualization

Cloud Second Report

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1 Introduction

The purpose of the "Cloud Second" project is to continue apply all the cloud knowledge we have taught by Professor Hertzberg after the project "Cloud First". After learning all the cloud knowledge from class such as identify cloud types, atmospheric stability and skew-T plot, the cloud first is our first chance to photograph the cloud and utilize the atmospheric information.

2 Image Circumstances

The image was captured on Sunday April 8, 2018. Denver local time 11:48 pm. The weather at 12 pm was around very sunny and temperature is 43°-61° Fahrenheit. I drove up the flagstaff road and parked at one the scenery view parking lot facing East. The original, untouched image as shown below:



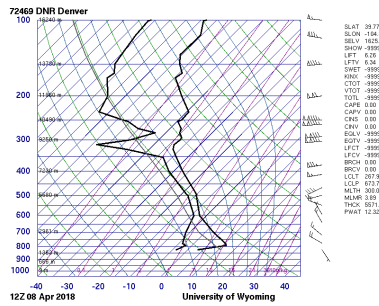
Figure (1) Original, untouched image.

The camera was pointing at 45° angle up and took a shot with the cloud, the sun is located at top right of the imae. The local elevation of Boulder is 5430 ft(1655 m). The weather on April 8th was most sunny from morning to 2 pm, and getting cloudy and windy in the afternoon.

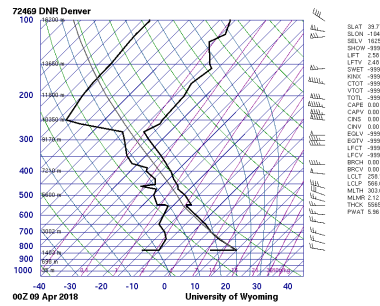
3 Clouds Captured

The image was captured on Sony A7RIII with Sony FE 35mm f/1.4 lens. Here are some details of the image info:

- 35mm



(a) Skew-T at 6am



(b) Skew-T at 6pm

- f/16
- 1/80 sec
- ISO 100

To maximum the depth of the field, I used the maximum f/16 aperture. Also ISO 100 to maximum the power of CMOS capture as many details as possible. Also a circular polarizer filter is used. In order to analyze the cloud we captured in the image, a good way to start is to look at the Skew-T diagram. From a University of Wyoming website (<http://weather.uwyo.edu/upperair/sounding.html>), we can download Skew-T diagram for selected date. The Skew-T diagram is updating twice a day at UTC 0 and 12, which corresponding to 6 am and 6 pm Denver local time. The following two plots show the Skew-T diagram for Denver area at 6 am and 6 pm local time.

We need to take a look of both Skew-T diagrams since the picture was taken at 12 pm. The atmosphere is pretty consistent in the large scale, so we can use the Skew-T for Boulder area. The clouds will most likely occur where two black lines stay closest. From the 6 am Skew-T, we can see the cloud is somewhere 3800 meters. And if we start parcel and raise it, we can see the neighboring parcels are cooler and more dense, it tends to be stable. Also we can check the CAPE value on the right which is 0, means the atmosphere is stable. Then we can compare the plot on the right, the 6 pm plot shows that the atmosphere is becoming less stable, which proved what observed, the weather in the afternoon is more windy and cloudy. The Skew-T diagram also gives us the corresponding wind speed at different evaluation, from the plots we can see that the wind speed at 6 am is 15 knots (17 MPH) and 25 knots (28 MPH) at 6 pm. The speed at the height of cloud formation is relative low. However, for the plot we can see that at high altitude we have wind speed around 100 knots. In the image, we can identify the type of cloud is stratocumulus.

4 Post Processing

For post processing, my first version of edited image as show below which I have large area of unnecessary foreground. What I did was increasing the contrast, and tweaked shadow/black so that we can see more clouds in the image. Also increase the saturation and hue on blue make the sky looks nicer. The following two figures shows the Lightroom Setting I have used in this picture.

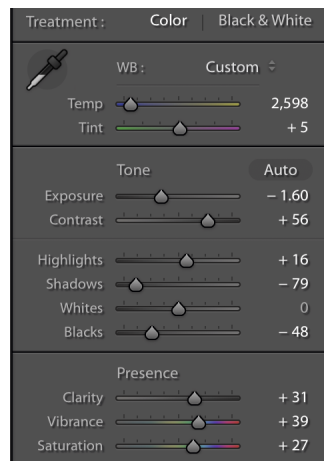


Figure (3) Edited image before critique

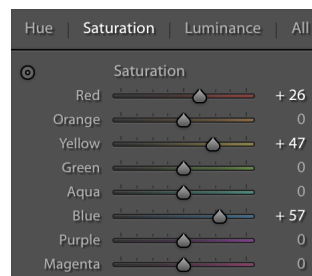


Figure (4) Edited image after critique

5 Reference

<https://www.timeanddate.com/weather/usa/boulder/historic?month=4&year=2018>