Report for second cloud assignment

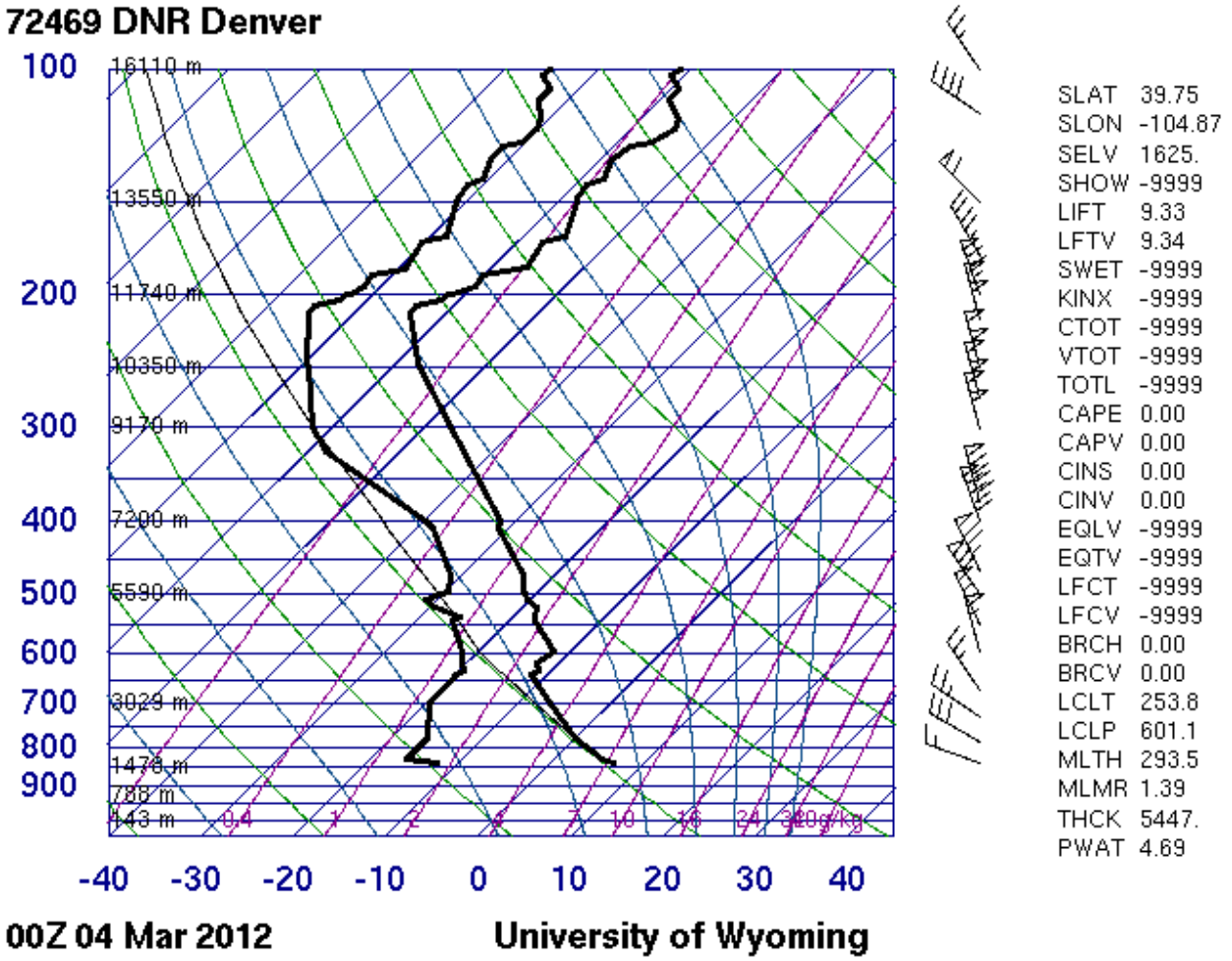
Qian Li

Mechanical Engineering

Clouds are seen every day and have been discussed in daily life. However, the types of the clouds, what kind of weather they represent, and what are the mechanisms behind the cloud movements are not clear by many of us. The purpose of this image is to shoot a scene with clouds in it, analyze the type of the cloud and then discuss the movement of the cloud.

The image presented here was shot from the campus. It was about 4:00PM in the afternoon on the top floor of the Engineering garage. The camera was held by hand and heading to the north. The shooting angle was about $0\text{-}20^0$, which was almost horizontal due to the height of the garage. The clouds just covered over Boulder and stayed quite stable. The image was taken in 03/03/2012.

Firstly, from the appearance of the clouds in the image, since they accumulated together, fairly flat at the base, quite bumpy, and thick they could be a certain cumulus. Besides, the weather that day was sunny, which is the weather likely to have cumulus [1] .



According to the skew-T plot that day[2], the atmosphere that day was quite stable since the CAPE data was 0[3]. The closest location on the two thick black lines is at the elevation of about 4000m which is about 2.5miles. Given the altitude in Boulder (~1mile), the clouds should form at the altitude between 1 to 2 miles. So the clouds in the image should be stratocumulus[4]. The stratocumulus clouds are usually accompanied by drizzle. However, there are non-drizzling stratocumulus clouds. There was wild wind that day from the west. So the clouds presented a

wedge shape (thinner in the west direction and thickness in the east direction). The clouds were heated on the bottom by the long wave radiation from the earth surface and cooled on the top by radiation and convection[5]. The temperature gradient resulted in density gradient so that there were vertical movements within the clouds. And the shear force also resulted in turbulence movement in the clouds. Besides, due to the evaporation effect the clouds that rotated from the bottom to the top finally disappeared. This is one reason that the stratocumulus clouds are thick in the bottom and thinner on the top. The non-drizzling stratocumulus clouds also break up as the stratocumulus-topped boundary layer (STBL) deepens and it becomes more difficult to maintain buoyant production of turbulence through the entire depth of the STBL[6]. So we could see a lot of coalescence, break up and disappearing of the stratocumulus.

The size of the field of view is about 1mileX3miles based on the dimensions of the district of the city covered by the clouds. The distance from the object to the lens should be 2 miles based on the skew-T plot that day where the clouds most likely to form and the distance between the camera and the clouds. The focal length of the lens is 4mm. This image was captured by the camera on my iphone4. The pixels in width and height are 2592 and 1936, respectively. The shutter speed is 1/2320 second, the f number is f/2.8, and the ISO is 80. No flash light was used since that was such a sunny day. The post-process was finished in the Photoshop. The first step was to adjust the levels. Then the brightness and contrast were adjusted. Followed by that, the redness of the image was adjusted to make Boulder more red. The before image is shown in the following.

I really like this image since I am so obsessed by light travelling from the sun through the clouds. The strong contrast and the great light gradient are so amazing. However, pointing the camera directly to the sun was careless. The type of the clouds is not so easy to be identified

even with the assistance of the skew-T plot. Next time when I take pictures of the clouds, I would first try to identify the type of the clouds and take more detailed notes of the weather that day.

[1] http://cloudappreciationsociety.org/collecting/about-cloud-classifications/
[2] http://weather.uwyo.edu/upperair/sounding.html
[3] http://weather.uwyo.edu/upperair/indices.html
[4] http://cloudappreciationsociety.org/collecting/
[5] I. Richter, C.R.Mechoso, "Orogaphic Influences on the Annual Cycle of Namibian Stratocumulus Clouds", Geophysical Research Letter, Vol. 31, pp. L24108(1)-(4), 2004
[6] R. Wood, "Stratocumulus Clouds", Review Paper, University of Washington, Seattle, WA, USA