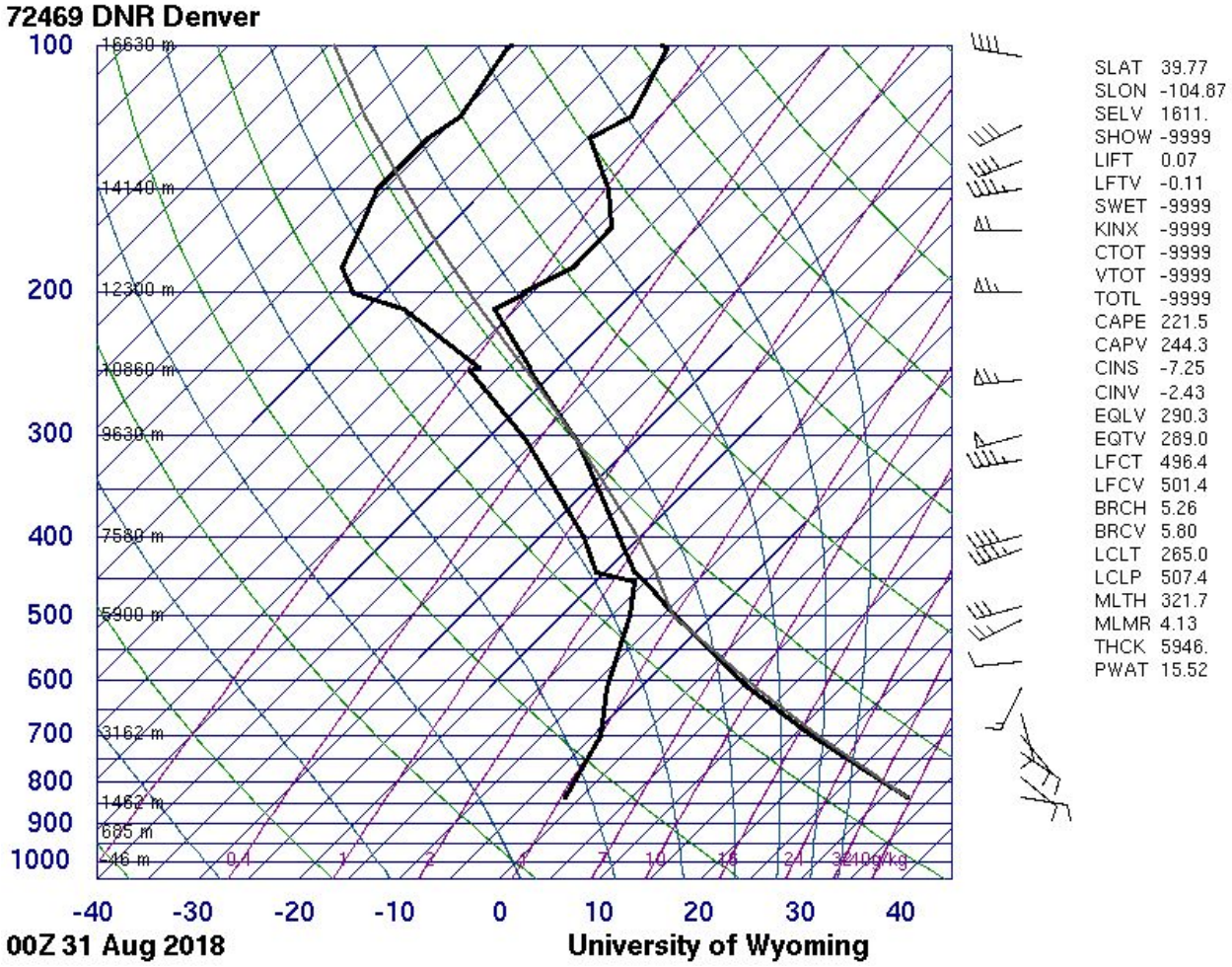
Duncan Lowery - 10/24/2018
Image of Overhead Cumulus Fractus Clouds, Taken in North Boulder at 7:46 P.M. on August 30th
FILM 4200-001 - Clouds First Report

This image of a cloudy, gray sky was taken for the first 'Clouds' assignment for the Flow Visualization course. My intent was to capture a cloud formation that looked clear so that I could gain accurate feedback about its physics during the review session, and was unique enough to spark interesting discussion and to differentiate it from other images that may be presented by my classmates. I picked this image for submission out of the several others I had taken because the clouds occupied most of the frame, and because the angle of the setting sun helped separate and give definition to both layers of cloud cover.

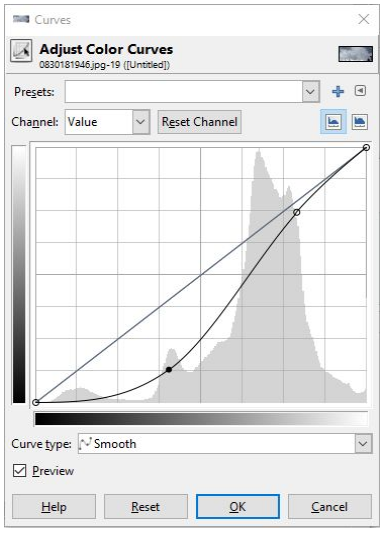
I took the image with my cell phone camera on August 30th, 2018, at 7:46 P.M. in the middle of the street outside my house in North Boulder. The closest intersection to the location that the photo was taken is the intersection of Iris Avenue and 34th Street. I pointed my camera to the East, and angled my camera approximately 45 degrees up towards the sky.

The atmospheric sounding from 00Z on August 31st over Denver registered a CAPE value of 221.5, indicating an unstable atmosphere. This condition of atmosphere is conducive to the formation of low, distinct and fluffy-looking clouds.[1] I believe the lower clouds in my image are Cumulus fractus clouds, and above them is an Altostratus cloud. These lower clouds are puffy and detached from one another, signifying that they are of the Cumulus variety. These clouds also display the characteristics of the fractus variation of Cumulus clouds, which are defined by ragged edges and separations within the cloud body.[1] Higher up is a large and featureless gray cloud that takes up nearly the entire background of the image. This is an Altostratus cloud, distinguishable by its indistinguishable smooth surface texture, light gray tone, and large, blanket-like appearance.[1] The day after I took this photo, the skies over Boulder looked remarkably similar, as evidenced by Brandon Gushlaw's cloud image.[2] The same was true for August 29th, the day before, according to a photo taken in downtown Boulder by Ziwei Zhao.[3] On August 30th, and on the days before and after, no precipitation was recorded to have fallen in Boulder.[4]

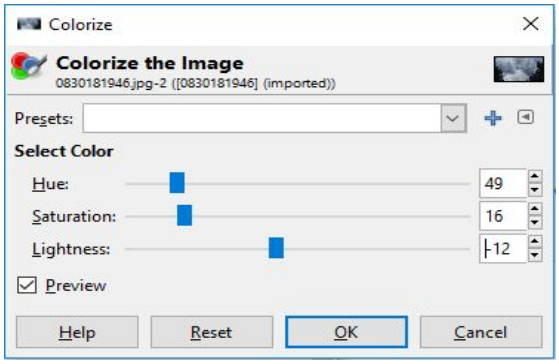
Below is the Denver sounding from the weather sounding archives of the University of Wyoming. The time of the data recording was 00Z on August 31st of 2018, one hour and 46 minutes before my photo was taken. Winds blew from the East at 40-45kt at 6000m, and 65kt from the East at 10,860m. From the lifting condensation level, the expected base of the lower clouds lies at approximately 6000m. The temperature and dew point lines continue to stay close until around 12,000m, and I predict the Altostratus cloud in my image was this high above the ground, as it is a middle elevation cloud[1].



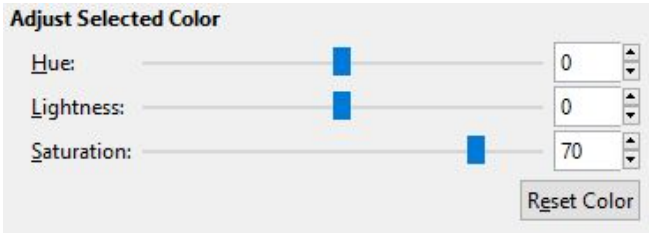
The camera used to image this scene of clouds was the wide-angle camera on my LG G5 smartphone. The original photograph was 5312x2398px, shot at f/1.8 at ISO 200 for 1/24 sec. The focal length of the lens used is 4mm. The field of view visible in my image is between one and 1.5 miles. In GIMP, I cropped the image to 2631x1191px, centering on what I thought was the most interesting section of the image. After reframing, I changed the curve of the image to fill dynamic range and increase contrast between the shadows and highlights.



Next, I duplicated the image and placed it in a layer above the original, before changing the hue of the entire image to an unsaturated gold color with the Colorize tool:



I then lowered the opacity of the top layer to 68%, which warmed the image color temperature, but preserved the red-pink highlights cast by the setting sun. I then added a very hard-to-see watermark to the left side of the image. The final image was increased in saturation by a value of 70:



Before Editing (Top) and After Editing (Bottom)

While I am pleased with the way my image turned out, I believe I could have captured a better base photo considering the resources I had available, and the extended amount of time allotted to me. The clouds in my frame were documented clearly and in sharp focus, but much of the detail was lost when I cropped in. The wide angle I used was also difficult to work with, as the trees on either side of the road I was standing in intruded into the bottom of the frame. In the future, I'd like to use a camera

with a bigger sensor and telephoto lens, to capture more detail in the structures of the clouds, and hopefully revealing more about their physics, while avoiding obstructions such as the trees and power lines visible in my image. I think travelling outside of Boulder would help break the monotony of the familiar landscapes and cloud types we see everyday. I'd also like to experiment with time lapse and extended exposure in addition to neutral density filters to achieve a more unique image.

References:

1. Pretor-Pinney, Gavin, and Bill Sanderson. *The Cloudspotters Guide: The Science, History, and Culture of Clouds*. New York: Perigee Book, 2007.
2. "Cloud First//Brandon Gushlaw." Flow Visualization. http://www.flowvis.org/2018/08/31/cloud-first-brandon-gushlaw/.
3. Ziwei Zhao//Cloud First." Flow Visualization. http://www.flowvis.org/2018/08/29/ziwei-zhao-cloud-first/.
4. "Boulder Muni, Boulder, CO, CO History." Weather Underground. https://www.wunderground.com/history/daily/KBDU/date/2018-8-30?req_city=Boulder&req_state=CO&req_statename=Colorado&reqdb.zip=80303&reqdb.magic=1&reqdb.wmo=99999.