Clouds 2

MCEN 5151 – Flow Visualization

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Introduction:

The purpose of the clouds assignment is to get a nice picture while also learning about clouds and the atmosphere. This particular assignment was really fun. It made me keep my eye on the clouds to try to find some really good ones. I finally took the picture over spring break while on vacation in Kailua on the Island of Oahu, Hawaii. I liked this image because, despite the fact that there are only clouds, it looks like a cumulus cloud over and behind a mountain. That dark stripe cloud is very interesting, and I'm not sure how the lighting worked out to cause it.

Circumstances:

This photograph was taken from the beach of Kailua, Hawaii. It was taken on Saturday March 29th at around 1:00 pm Hawaii time or 5:00 pm here in Colorado. I was looking northeast and up at about a 15 degree angle. This means the camera was about 6 feet off the ground with only a slight upward tilt.

CLOUDS!

This image captures several cumulus and cumulonimbus clouds. I determined this by looking at several sources. First of all, I had to determine the cloud elevation. WeatherSpark[1] is a great resource for finding this out, see figure 1 below.

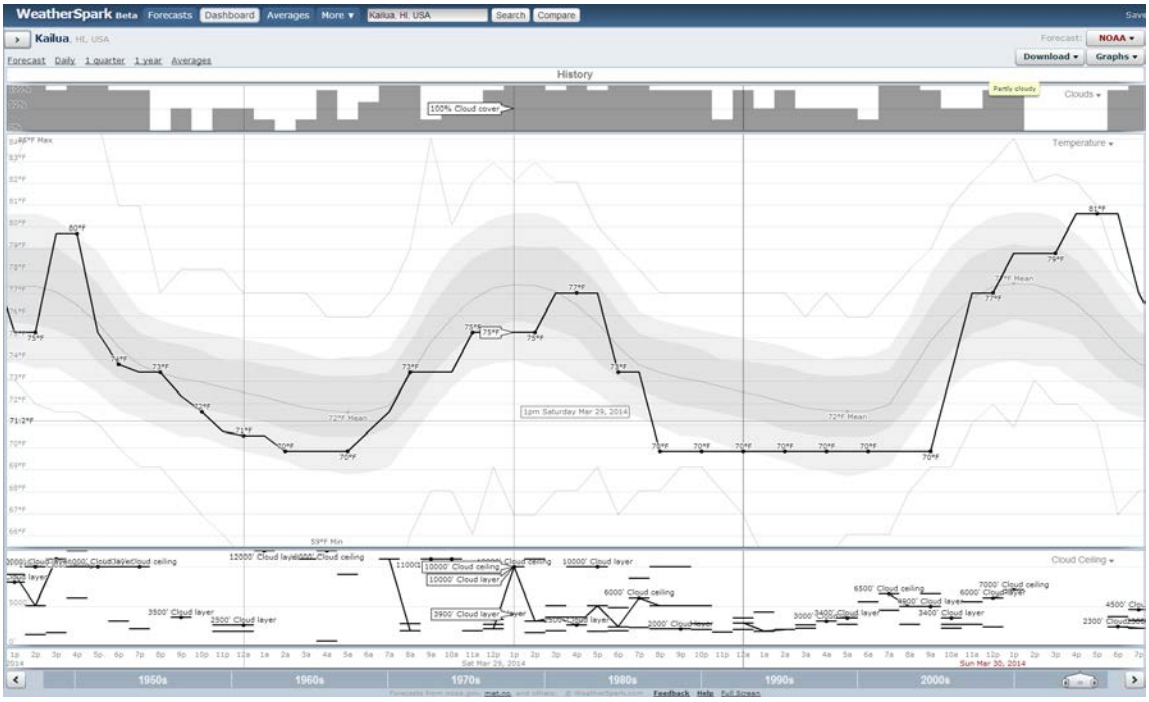

Figure 1 - Weather data from WeatherSpark.com[1]

As you can see, the lowest cloud layer was at 3900 feet. With this data in hand, we can turn to the handy *Cloudspotter's Guide*[2] to figure out what type of clouds are in the image. Looking at the big classification picture, figure 2, with shape and elevation in mind, it is obvious that these clouds are either stratus, cumulus, stratocumulus, or cumulonimbus.

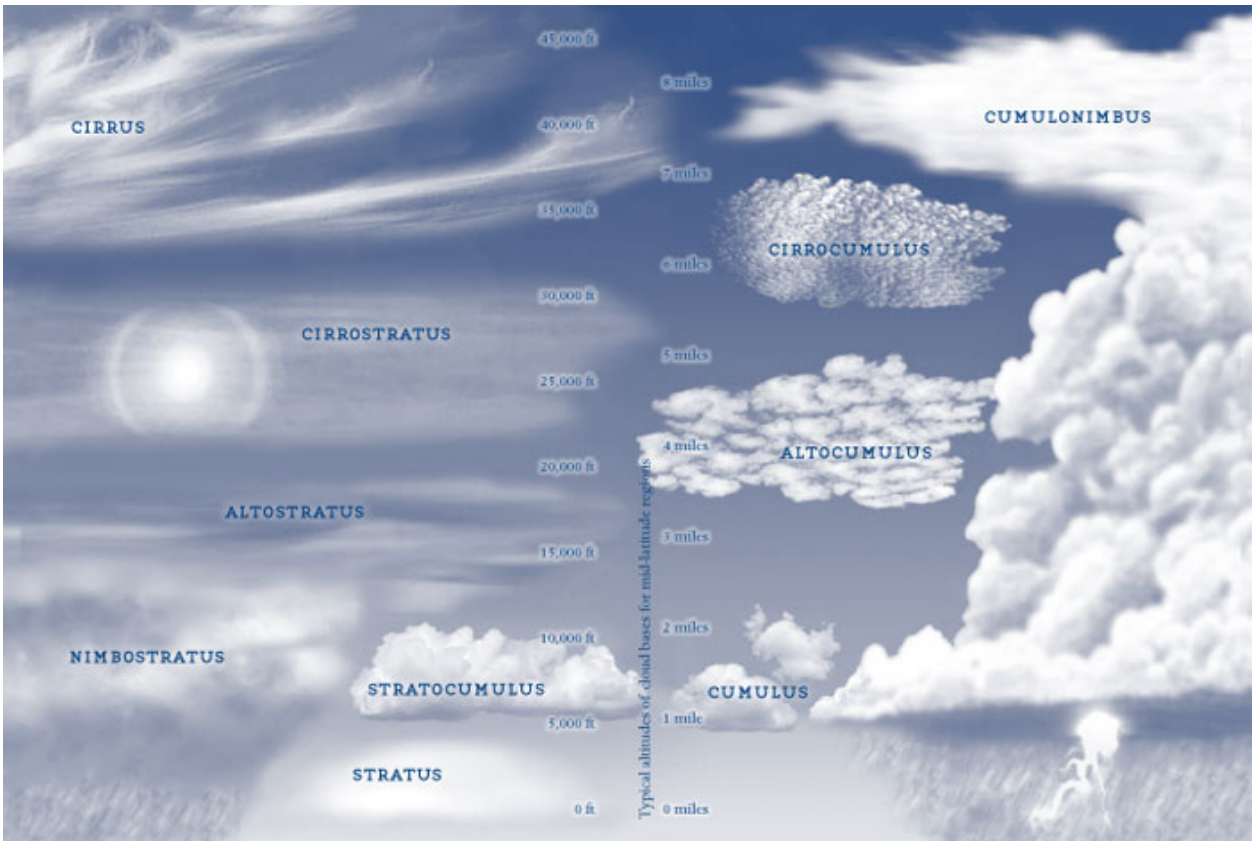

Figure 2 - Cloud classification figure[3]

According to *The Cloudspotter's Guide* stratocumulus clouds have flat tops and are typically attached to form a layer. The clouds in this image definitely don't have flat tops at consistent heights, so we can rule out the stratocumulus. The guide also says that stratus clouds are very diffuse and misty. These clouds seemed far too crisp to be classified as stratus. That leaves cumulus and cumulonimbus. There are definitely cumulonimbus clouds as they are very tall, it had been raining that day, and there was fairly large instability. I believe there were also some cumulus clouds because there were a few smaller clouds scattered around.

To confirm this classification, the atmosphere should be at least slightly analyzed. The most important tool in analyzing the atmosphere is the Skew-T diagram. A Skew-T diagram for this time is shown in figure 3. The website goes off Greenwich Mean Time, so even though the figure says March 30th, it's actually for March 29th in Hawaii. Unfortunately, there is no atmospheric data on Oahu. The closest I could get was in Kauai, about 100 miles away. While this diagram is probably fairly accurate, I cannot say for certain, so all analysis should be taken with a grain of salt.

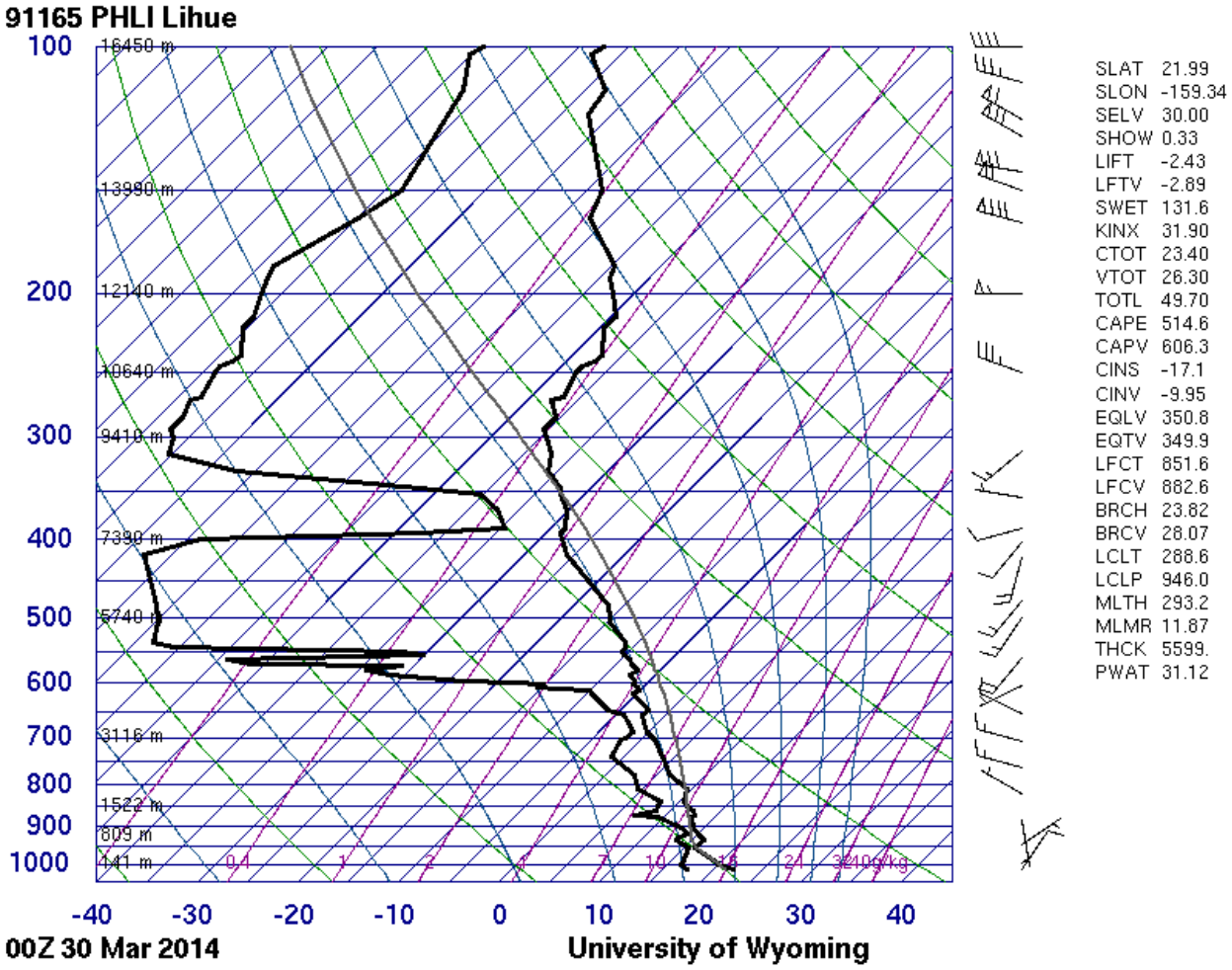

Figure 3 - Skew-T diagram of March 29th at 6:00pm[4]

This figure shows a CAPE of 514.6! That means the atmosphere was quite unstable at the time of this picture. This further confirms the conclusion of cumulonimbus clouds because they are known to only form in unstable atmospheres, while cumulus clouds can form in either stable or unstable atmospheres. The clouds pictured were about at an elevation of about 4000 feet according to WeatherSpark. This is expected considering the two dark lines (temperature and dew point) are very close together at a height of about 1200 meters. The lines get further apart at higher elevations, so this is definitely where you would expect clouds to form.

This day was a fairly stormy day. It was windy all day and rained on and off most of the day as well. While there was never a heavy rain, the slight rain was also a sign of an unstable atmosphere and the formation of cumulonimbus clouds.

Photo Technique:

The photos were taken with a Canon EOS Rebel T2i D-SLR camera. The original photo can be seen below in figure 4.

Figure 4 - Unedited cloud image

The field of view in this image is huge and I don't even know how to approximate it. It's probably at least a mile across. The photo itself has a pixel measurement of 5184x3456. For this photo, I really let the camera do everything automatically. I didn't want to start messing with shutter speed, ISO, and aperture and end up getting a blurry or oversaturated picture. Since the clouds are well defined and there is plenty of light, the camera is able to handle it much better than with other fluid pictures where there are no distinct edges. In this setting, my camera came up with a shutter speed of 1/250 second, and ISO setting of 100, and an f number of 10. These ended up being good settings. There is no motion blur despite the fact that I didn't have a tripod and the picture is well lit without any oversaturated points.

After the image was taken, there was some minor post processing done in Gimp. The image was cropped to emphasize the dark cloud in the middle. This cropping also removed some interesting clouds in the bottom half of the image, but that's fine with me. After that I went to color curves tool and upped the darks and dropped the lights to further highlight my favorite dark cloud. This has probably been my favorite post processing job. Typically, I might overdo the little I do, but this time I thought it was all done tastefully.

Conclusion:

I'm generally quite happy with this picture. Typically, a picture of clouds for me ends up looking very boring. This time however, I feel that it's a really interesting picture of only clouds. The post-processing worked out well and I feel it really enhanced the image.

References

1. "WeatherSpark Dashboard." *WeatherSpark*. 16 Feb. 2014. Web. 6 Mar 2014. <http://weatherspark.com/#!graphs;ws=29761>.

2. Pretor-Pinney, Gavin. *The Cloudspotter's Guide: The Science, History, and Culture of Clouds*. New York: Berkley Pub. Group, 2007. Print.

3. "Moisture, Clouds, and Percipitation." *Wallacegensci9.* Web. 6 Mar. 2014. <http://wallacegensci9.wikispaces.com/Moisture,+Clouds+and+Precipitation>.

4. Atmospheric Soundings." *University of Wyoming College of Engineering*. N.p., 16 Feb. 2014. Web. 06 Mar. 2014. <http://weather.uwyo.edu/cgi-bin/sounding?region=naconf&TYPE=GIF%3ASKEWT&YEAR=2014&MONTH=02&FROM=1700&TO=1700&STNM=72469>.