Clouds Report #1

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Flow Visualization 2012

Rather than photographing the typical altocumulus lenticularis, or mountain wave cloud formation, I wanted to capture something different for the first Cloud Image Assignment. Not being able to control the weather, I was at the mercy of the storm, waiting out more typical cloud patterns in hopes of catching something unique. There were numerous instances days before my image was taken in which I captured excellent mountain wave formation clouds, but I wasn't overly satisfied with their composition. My hope was to really capture a layered formation with varying types of cloud in one image. I also wanted to include some interesting post-processing in the image, as I figured most other submissions would maintain a more "natural" look.

On the morning of February 23rd, I found grey skies and my time fading fast. As these clouds typically resemble infinite plates of grey covering the entire sky, I wanted to get a capture an image contrasting this flatness by demonstrating their depth and turbulent nature. The only way I was going to show this kind of feature was to wait for the cloud formation to part slightly and allow light through. There were a few breaks in the overhanging clouds, allowing slight rays of light to shine through and provide some relief from the grey gloom overhead, but they were infrequent and typically in difficult to shoot areas of the sky. Being only equipped with my point and shoot limited my options, mainly in focus and exposure so I waited for something to the east to appear, as this was the best vantage point off my balcony. After getting around 20 shots of slight blue skies peeking through the grey, I finally captured something I was satisfied with. I took the image facing due east from my balcony located near the intersection of Folsom and Pearl St. at around 7:30 am with an elevation of around 45 degrees from horizontal. The image captured displayed many different layers of cloud, including some distant stratus formations far above the lowest formation. The original image, shown in Figure 1, was rather murky and monotone, so I decided in post processing to really adjust the curves and contrast. I found that by adjusting the color scale to give a purple hue over the entire image really helped to bring out some of the cloud details in the upper left corner.

Figure 1: Original Image

The re are many different types of clouds shown in the image as it peeks through a hole created in the dense cloud layer typical of most overcast days. From the Skew-T plot for the day and time, shown in Figure 2, the atmosphere was stable and a weather front was clearly moving through the area. At the time

of capture, it was snowing slightly leading me to the understanding that the lowest clouds were nimbostratus. The existence of some fractus in this lower layer would also indicate a stratus formation. There are also some indicators that the lowest layer may have been perlucidus stratus, however, due to the precipitation I felt this was inaccurate. The uppermost layers appear to be an altostratus, possibly even translucidus as light is easily seen through it. There was not much wind at the time of capture and the clouds were not similar to those from previous days.

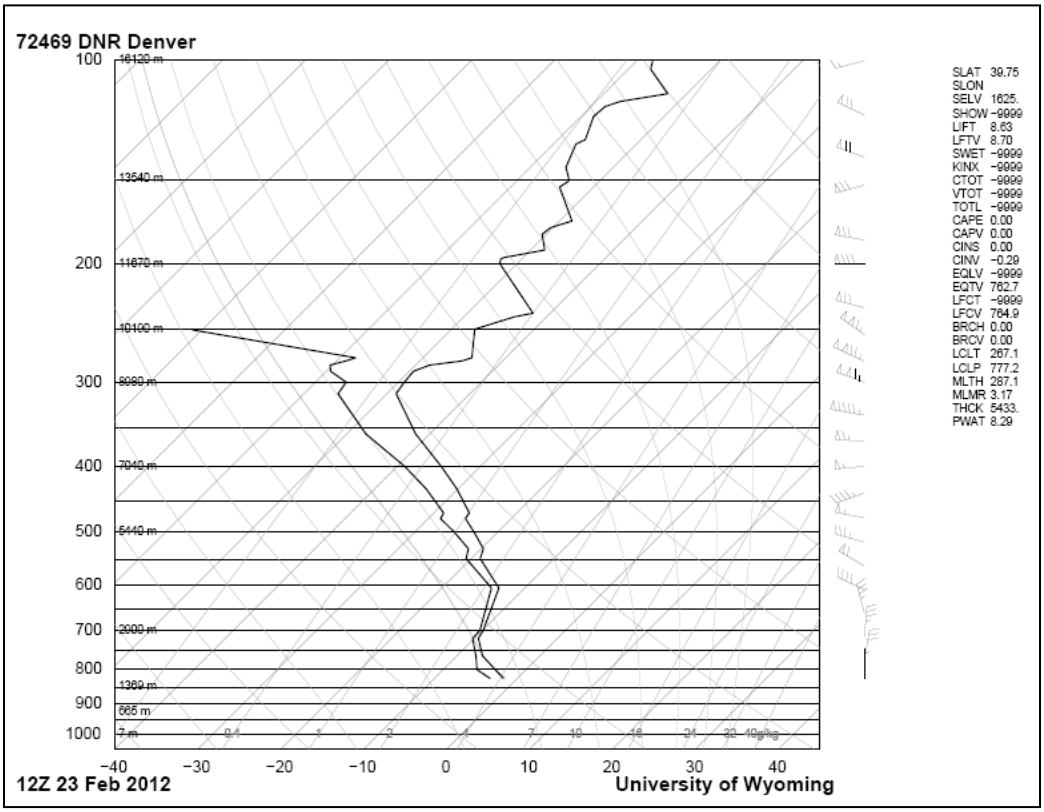

Figure 2: Skew-T Plot for 2/23/12 - 12Z

From analyzing the Skew-T plot for the atmosphere at the time of the image, it was clearly stable with indication of low elevation clouds and precipitation. Based off the stability and general weather at the time, I would have expected nimbostratus formations, as these are the only precipitating formations found in a stable atmosphere. I would have also expected stratocumulus, as there were some periods of little to no precipitation. The clouds are estimated to be at an elevation around 8,000-9,000 ft., judging from the Skew-T plot, class notes, and the estimated distance from the top of the Flatirons. These elevations are measured above sea level, following the notation of Skew-T plots. Nimbostratus formations are typically the result of increasing altostratus clouds that eventually consist entirely of rain, ice crystals, or snowflakes. There are instances when a nimbostratus formation can include 'super cooled droplets', reaching temperatures as low as -40F. [1]

As I was restricted to using a standard point-and-shoot for this image, my photographic technique was rather limited. The clouds were estimated to be about 1 mile away from the camera, resulting in a rather large field of view on the range of 1 mile. The lens focal length on my Nikon Coolpix S200 was 7.4mm and the original image had dimensions of 3072x2304 pixels. The exposure was not controllable on

my camera and was automatically set to 1/750. The f-stop was set at f/4.9 and the ISO was at 50. I did not use the camera's built in flash as the outside lighting was sufficient and the flash would have had no effect. In Photoshop, I initially adjusted curves to increase the blacks and create contrast out of the monotone grayness associated with the cloud formation. The brush tool was used to remove three power lines found in the lower right corner of the original image. The color scales were adjusted to better bring out contrast in the upper layers of cloud. After adjusting many different ways, I found the purple hue to be the best at bringing out definition in the upper left region. This purple color also gave the image a very interesting aesthetic and made it appear 'otherworldly'.

The image reveals that those typical grey, featureless and depressing days can be just as interesting as a dynamic mountain wave or cumulonimbus cloud formation; one just has to be patient and wait for the right moment. I really like how the purple color changes the feel of the image, giving a psychedelic and dreamy look, while still maintaining some natural blues and whites. I may have gone a bit overboard on the post-processing, but I really wanted to bring out as much detail from the original image as possible. If I could change anything I would have like to be able to better visualize the physics going on. The nimbostratus clouds are inherently featureless and it was difficult to bring out any sort of dynamic within the image. I think it would be interesting for future research, to capture this type of cloud formation from a higher elevation, possibly from the top of Bear Peak or Green Mountain. This higher vantage point might allow for a better image of the cloud layers and provide better visualization of the physics occurring.

References

[1] *Pretor-Pinney, G.* The Cloudspotter's Guide, The Science, History, and Culture of Clouds. *New York, NY: Perigee, 2007.*

[2] University of Wyoming, College of Engineering, Department of Atmospheric Science. *http://weather.uwyo.edu/upperair/sounding.html*