Jonathan Cook

Cloud Image #1

Image Taken on October 1, 2015 at 11:50am

The goal of flow visualization is to capture the physics of a system in such a way that we are provided a better understanding of what the system is doing. Clouds are a magnificent example of this process. Clouds tell us about how our atmosphere is behaving and can give insight into the coming weather. The purpose of this first cloud image project was to capture a picture of any cloud and then combine the picture with atmospheric sounding data to come to and understanding of the state of the atmosphere.

My image was taken on October 1, 2015 at 11:50 am. The picture was taken from the west end of the CU Boulder campus, facing SWW. The camera was pointed just high enough above the horizon to capture the very peak of the mountains, I would estimate about 20^{o} above the horizontal.

The large cloud in the center of the image is cumulostratus cloud and is the subject of the image. Given that the rest of the sky was fairly clear and stable, this cloud was probably an orographic cloud caused by the change in elevation in the Front Range. As the air is forced upwards an unstable region is created and a cloud forms. As the front exits the mountain range it is heavier than the air it meets and sinks back down [2].

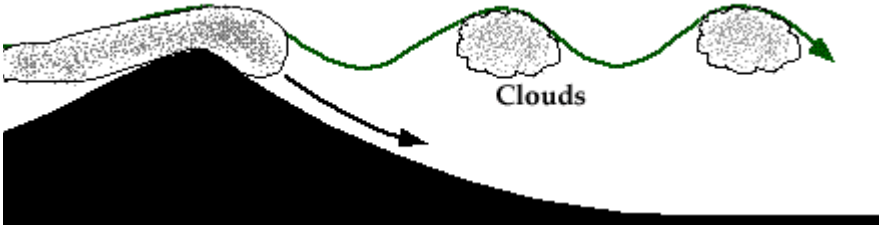

Figure 1: Graphical Representation of an Orographic Cloud Forming

The elevation of the cloud is probably only about 1000 feet above the tops of the mountains. I chose to use the skew-T plot from the Denver airport at 6am that day (pictured below), which shows a very stable atmosphere with a cape of 0.00 [1]. The plot was collected from the University of Wyoming's Department of Atmospheric Science. It is important to note that the sounding data was collected 6 hours before the image was taken. Even though my photo was taken 6 hours later, the atmosphere still appeared stable everywhere besides directly over the mountains. This image was taken only a couple days before a large week long storm moved in to town.

Skew-T Plot from DEN Airport at 6am on Oct 1

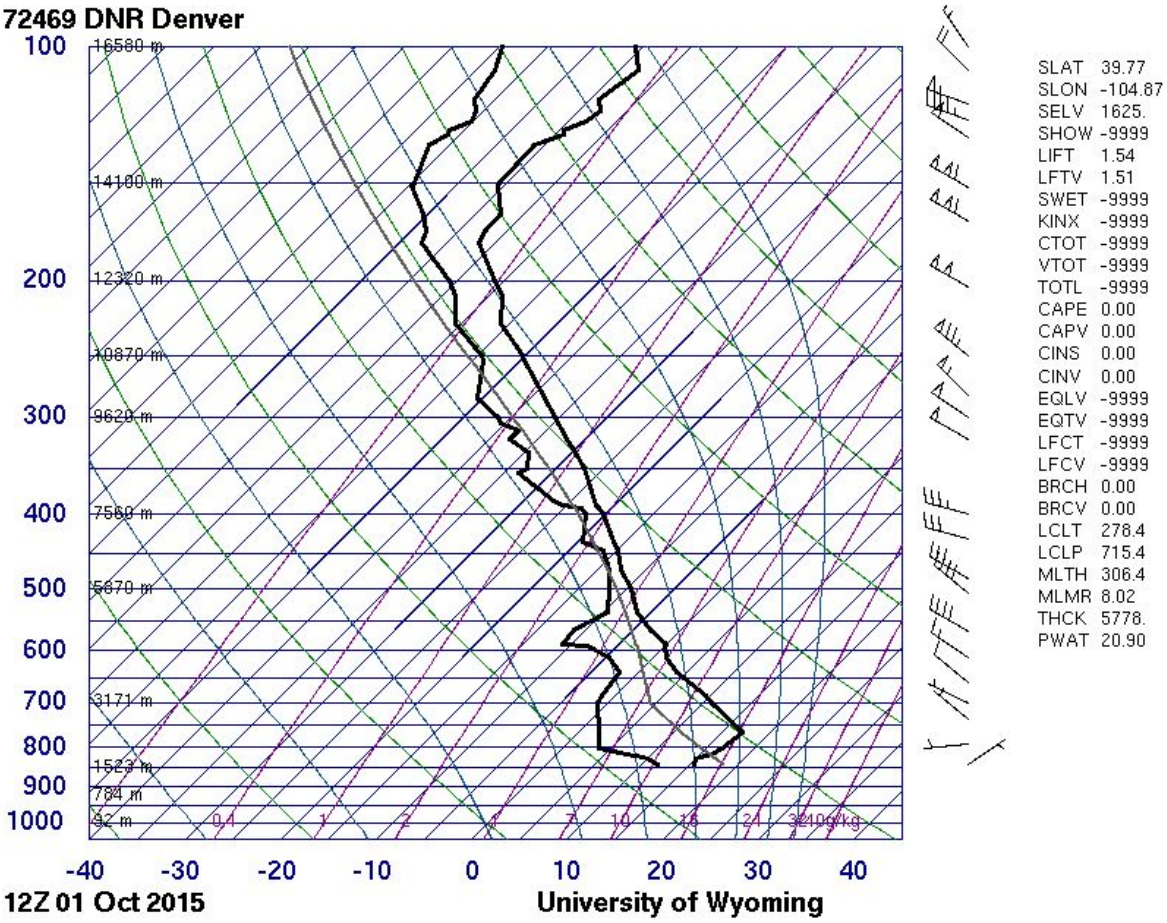

Figure 2: Skew-T diagram for 6am on October 1, 2015

The picture was taken using a Nikon Coolpix P520 digital camera. The image that I chose to use was taken with the shutter speed set to 1/1000 sec. The lower shutter speeds were over-exposed due to how bright the sun was that day. I manually focused the camera at infinity and took the picture. The camera selected settings were an aperture setting of f/5.2 and a sensitivity of ISO-80. Focal length of the lens is 10 mm. The original image was 4896 pixels in width and 3672 pixels in height.

Figure 3: Raw, Unedited Image

Once the image was uploaded to a computer it was post-processed in GIMP. First the image was cropped on the top and bottom, resulting in new dimensions of 4896 pixels in width and 1992 pixels in height. This was done to highlight the cloud that I was attempting to capture. Next the color tool Curves was used to black out the foreground and increase contrast in the image. Curves was also used to bring out the intensity of the blues in the image.

I think that the image does a good job of capturing an orographic cloud hovering over the edge of the Front Range. The contrast of light and shadow in the cloud highlights the physics of the cumulostratus cloud. I want to continue to practice using the Levels tool and other color tools to improve my images. I see examples that seem to lose less quality than mine in post-processing while still improving color range and contrast, and while my pictures are improving there is still more to learn.

References

[1] “Atmospheric Soundings.” Accessed December 14, 2015. http://weather.uwyo.edu/upperair/sounding.html.

[2] “Orographic Clouds: Forced by the Earth’s Topography.” Accessed December 14, 2015. http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/cld/cldtyp/oth/org.rxml.