Clouds First

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Flow Visualization Fall 2016

Introduction and Context

The purpose of this project was to extend our techniques of visualizing flows from classic fluids, to everyday flows; clouds. Clouds are an interesting photography subject due to the way they are constantly changing, and that interesting cloud physics are not always present. My submission is of cumulus clouds developing from behind a mountain range in an unstable atmosphere.

This image was taken from the basin of the Fraser Valley in Middle Park, near Tabernash CO. The time of the photo was approximately 4:30 in the afternoon on September 16th, 2016. This image is taken facing East South-East. The mountain pass in the foreground is the Continental Divide. The day in the mountains had been calm and sunny all day. Meanwhile, in the Denver-Boulder region, an unstable atmosphere was giving rise to cumulus clouds and thunderstorm conditions. Seeing the clouds develop behind the pass was a striking scene, as the pure white clouds contrasted beautifully against the brown mountains and the blue sky. The driver of the car I was in said that it looked like a "nuclear explosion".

Cloud Physics

These cumulus clouds are a common instance of mountain wave clouds. In this case, a cold front moving west struck the mountains and forced the cold air upwards. When the colder air mixed with the warmer air above, the warm, moisture rich air developed clouds in the mid to upper atmosphere. These clouds are likely at 9,000-15,000 feet. To provide a frame of reference, the ridge in the foreground peaks at around 12,000 feet of elevation. This is an indicator that the clouds are cumulus type, as that is the area they are likely to be found. Shown below is the Skew-T plot for the day, at the noon sounding in Denver,

approximately 4 hours earlier than the image-capture time. (University of Wyoming 2016)

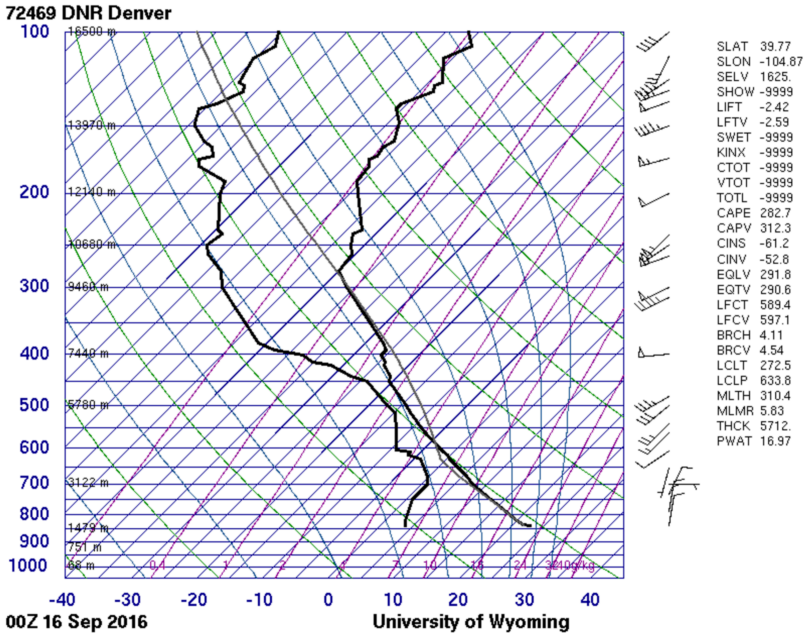

Figure 1: Skew T

The cape value for the day is 282.7, which is a fairly moderate value. It indicates a slightly unstable atmosphere for the day, but not unstable enough to be seeing thunderstorms. I suspect that the atmospheric increased in instability as the afternoon went on, as these clouds were not at all visible at noon, when the skew T was taken.

Photographic Technique

I took this photo on the highway, out of my friend's sunroof. The photo was taken on a DSLR Canon T3i, with a Tamron telephoto lens. I switched to the telephoto lens because the subject was so far away, and zoomed in the telephoto all the way. The camera was on "landscape mode" but all of the other settings were automatic. The settings are listed below.

Distance to Subject	25 – 45 miles
Focal Range	5 miles
ISO	100
Shutter Speed	1/500th sec
Aperture	F4.8
Focal length	300mm

Table 1: Camera settings

Post processing mostly included increasing the contrast, cropping down the photo, and adjusting the color levels to more closely replicate the pure white clouds that were actually present that day.

Conclusion

I am relatively happy with the results of this photo. I do think that I failed to capture the spectacular scene that I could see with my eyes. The size of the clouds with respect to the foreground could not be accurately captured by any of the lenses I had, and in order to see detail in the clouds I had to zoom in so far that the sense of place and foreground was lost. I think that a higher vantage point might have helped a lot, as it would have made for a more interesting foreground and a more expansive view of the clouds. I enjoy taking pictures of these clouds though, because unlike our other subjects, they cannot be maniupulate to suit my needs. Instead, the challenge becomes a photographic one, trying to make your gear capture the scene how you'd like it. I really love solving these photographic puzzles.

References

Hertzberg, Jean. "Clouds 1". N.p., 11 Jan. 2011. Web

University of Wyoming, 24 Sept. 2016. Web.