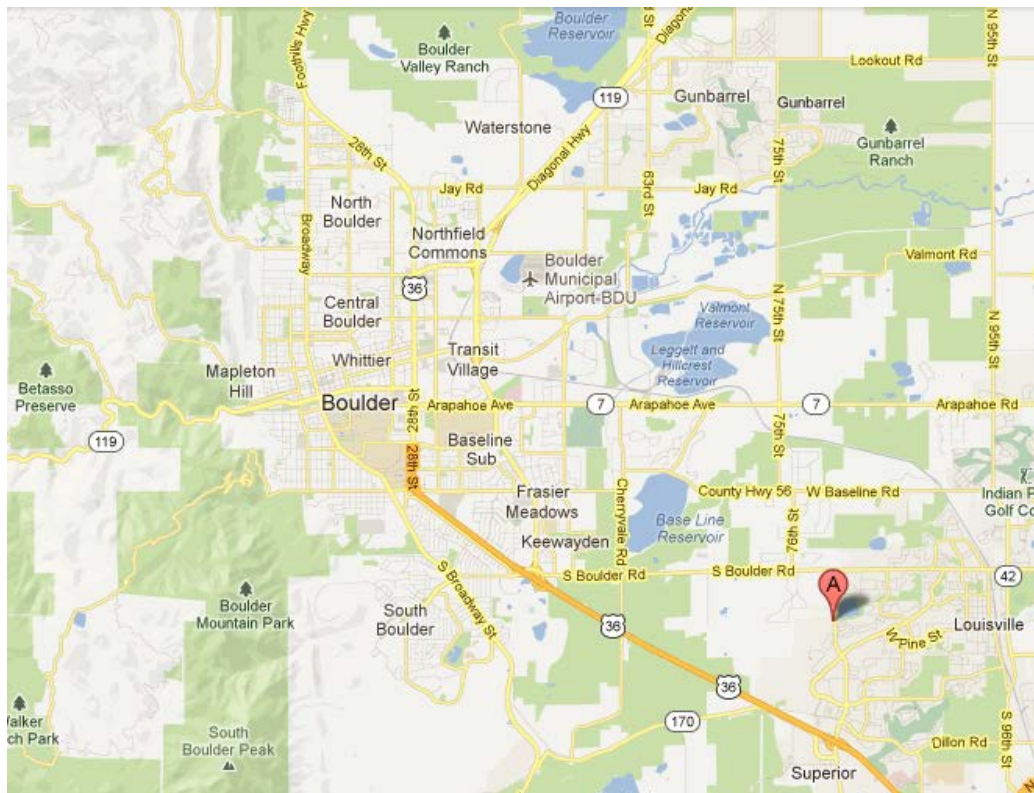


## Clouds – Sunset Struggles

Though in most parts of the world clouds are an ever-present phenomenon, they are usually overlooked. In Oregon, where I spent most of my life, the clouds are nearly constant – predictable in their nature and presence. Here in Boulder the sky is often open blue vastness. However rare the clouds here may be, when they appear they can be startlingly impressive. The second personal project in the Flow Visualization course is to capture an image of clouds. Though I only spent one evening photographing, I spent many of the days before hand observing the clouds.

On the evening of February 17<sup>th</sup> I was lucky enough to be on the plateau in Louisville at sunset, looking out toward the foothills of the majestic Rockies. I stopped at the Davidson Mesa Trailhead, shown with respect to Boulder in Figure 1.



**Figure 1. Map of Photograph Location<sup>[1]</sup>**

I stopped at about 5:45 pm and took photographs for the next twenty minutes or so, catching most stages of the sunset. Though I played around with camera angle and direction, my chosen image was taken with the camera nearly horizontal and facing slightly north of west. I wanted to catch the bulk of the sunset over the mountains, and propped my camera on a fence post to keep it stable. The unedited image can be seen in Figure 2.



**Figure 2. Unedited Cloud Image**

The Skew-T diagram, seen in Figure 3, gives us a little insight into the atmospheric conditions present at the time of the photograph. Firstly, the diagram tells us that the lower atmosphere was unstable. This is reinforced by the visual presence of cumulus clouds in the image. Cumulus clouds are present in unstable atmospheres and tend to reside between five and ten thousand feet elevation. This is approximately one to two miles in elevation. This is evidenced by the relative closeness in elevation between the tops of the foothills and the clouds. Boulder sits at slightly above one mile in elevation, so the cumulus clouds should be relatively close to the ground. Above these cumulus clouds, and more in the background of this image, we see clear streaks of cirrus. The cirrus clouds sit quite high in elevation, nearer to seven or eight miles, and are present in stable atmospheres. Though this contradicts the cumulus clouds, as one is present in a stable atmosphere and one in an unstable atmosphere, both make sense. The Skew-T suggests that the lower elevations may be unstable, but this can be independent of the high elevations.

These clouds are fairly common in the Boulder area, and were not part of an exiting or entering precipitation system – the weather was consistently calm around this time. The sky looking east was also cloudy, though it looked very different. There were some undulating clouds and some large clouds, some

of which appeared to be altocumulus or altostratus, though my experience in cloud identification is limited. These clouds were large and darker, though they were easterly and the sun was setting.

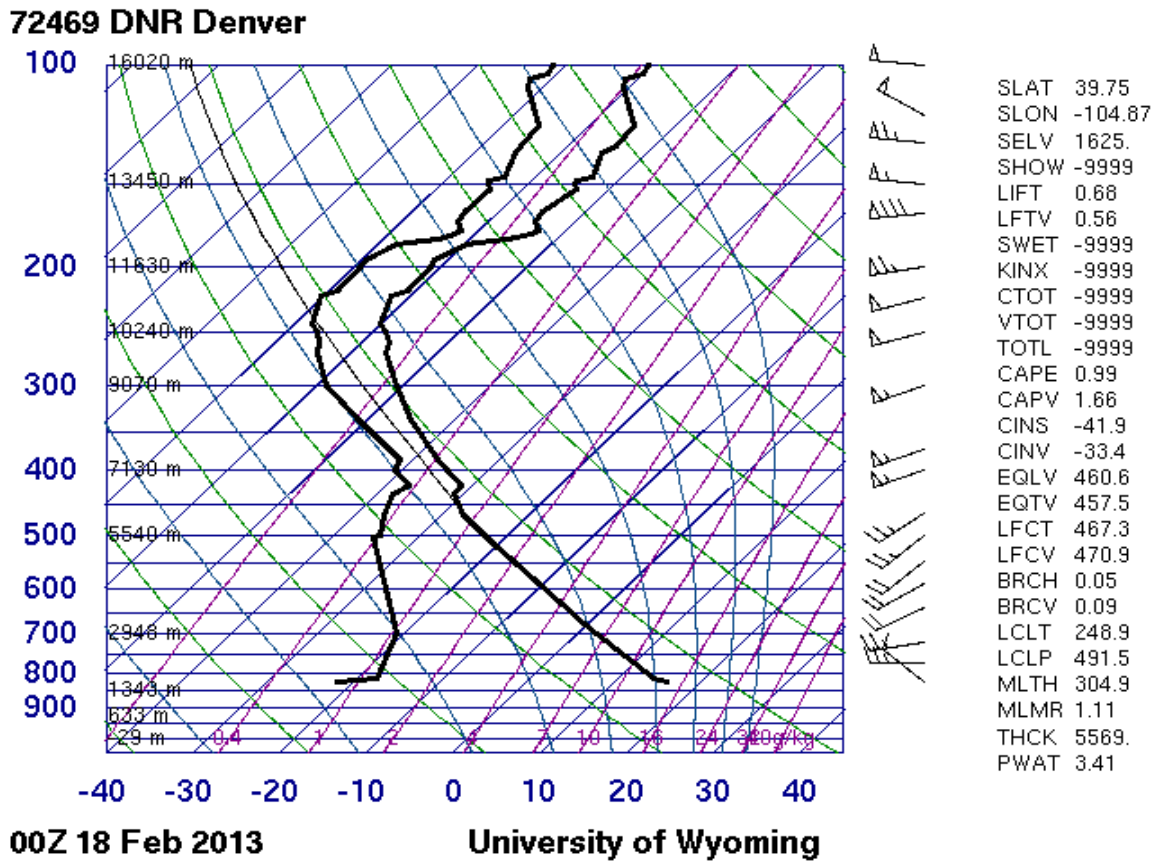


Figure 3. Skew-T Diagram for Evening, 2/17, Denver, CO<sup>[2]</sup>

I struggled initially with correctly setting the aperture and shutter speed of the camera. I could not seem to get the camera to actually show the details within the illuminated clouds. I switched settings for a while, eventually putting in on auto. Though I did not like those pictures as much, I examined the settings that auto had chosen, switched my manual settings to the same, then adjusted until I found something I liked. It was difficult to capture the large field of view with only certain parts of the image illuminated, and those very strongly so. The final settings for the image were the following.

**Original Image Specifications**

Width (pixels)	4608
Height (pixels)	3456
F-stop	f/8
Exposure	1/2000 s
ISO	ISO-200
Focal Length	29 mm

The chosen photograph was taken using a Canon Powershot SX160 IS camera, and then edited slightly in photoshop. Only two things were performed in photoshop. The first was cropping – the original image contained a large portion of the mountains. I chose to crop the bulk of these out, as well as some of the empty sky at the top, to create a naturally framed image of the clouds. I wanted the mountain line to be a silhouette that brought out the clouds instead of drawing the focus. The second alteration was done using curves in photoshop. I adjusted the curves slightly to distinguish the colors a little more. The final image has the same width as the original image, though the final height in pixels was only 1680, which is less than half the original. The edited image can be seen in Figure 4.



**Figure 4. Final Edited Image**

I am unsure even now how I feel about the edited version. I think I was reluctant to move away from the sunset and really explore the clouds. Looking back that seems like a mistake. I think even in this image of the sunset I could have highlighted specific clouds, bringing the focus to the interesting details in them instead of drawing the attention to the mountain line and brightness of the sun. That being said, since my focus when photographing the clouds was ensnared by the sunset, the focus would be more difficult to transfer to the clouds.

## References

- <sup>[1]</sup> "Davidson Mesa Trail Head." *Google Maps*. Google, n.d. Web. 05 Mar. 2013.
- <sup>[2]</sup> "Atmospheric Soundings." *Atmospheric Soundings*. University of Wyoming, College of Engineering, n.d. Web. 05 Mar. 2013.
- <sup>[3]</sup> Hertzberg, Jean. "D8. Clouds 2." *Flow Visualization - Course Lectures*. MCEN Colorado, n.d. Web.
- <sup>[4]</sup> "History for Broomfield, CO." *Wunderground.com*. N.p., n.d. Web. 05 Mar. 2013.

**Image Assessment Form**  
**Flow Visualization**  
**Spring 2013**

Hannah Schumaker - Cloud Assignment #1 – Due 3/5/13

Scale: +, ! = excellent √ = meets expectations; good. ~ = Ok, could be better. X = needs work.  
 NA = not applicable

<b>Art</b>	Your assessment	Comments
Intent was realized	√	I feel that I accomplished most of what I wished and that the image conveys that. The cropping especially enhanced the image, and removed the distracting elements.
Effective	√	
Impact	√	
Interesting	!	
Beautiful	√	
Dramatic	!	
Feel/texture	!	
No distracting elements	√	
Framing/cropping enhances image	!	

<b>Flow</b>	Your assessment	Comments
Clearly illustrates phenomena	√	The version of my edited image that was shown in class appeared super grainy and wasn't very pleasant, but the image on my computer does not show that at all.
Flow is understandable	√	
Physics revealed	√	
Details visible	√	
Flow is reproducible	N/A	
Flow is controlled	N/A	
Creative flow or technique	N/A	
Publishable quality	√	

<b>Photographic/video technique</b>	Your assessment	Comments
Exposure: highlights detailed	√	I spent time adjusting the settings on my camera to get an image I was pleased with and I think that showed. The post-processing was successful in enhancing the image intent, but perhaps not the image quality
Exposure: shadows detailed	!	
Full contrast range	!	
Focus	√	
Depth of field	√	
Time resolved	N/A	
Spatially resolved	N/A	
Photoshop/ post-processing enhances intent	!	
Photoshop/ post-processing does not decrease important information	√	

Report		Your assessment	Comments
Collaborators acknowledged		N/A	Most of the categories in the "report" section of this evaluation seem to be yes/no questions. Most of which I included in my report, giving myself a !, as they were completed.
Describes intent	Artistic	√	
	Scientific	√	
Describes fluid phenomena		N/A	
Estimates appropriate scales	Reynolds number etc.	N/A	
Calculation of time resolution etc.	How far did flow move during exposure?	N/A	
References:	Web level	√	
	Refereed journal level	N/A	
Clearly written		!	
Information is organized		!	
Good spelling and grammar		!	
Professional language (publishable)		√	
Provides information needed for reproducing flow	Fluid data, flow rates	N/A	
	geometry	N/A	
	timing	N/A	
Provides information needed for reproducing vis technique	Method	√	
	dilution	N/A	
	injection speed	N/A	
	settings	√	
lighting type	(strobe/tungsten, watts, number)	√	
	light position, distance	N/A	
Provides information for reproducing image	Camera type and model	!	
	Camera-subject distance	√	
	Field of view	!	
	Focal length	!	
	aperture	!	
	shutter speed	!	
	Frame rate, playback rate	N/A	
	ISO setting	!	
	# pixels (width X ht)	!	
	Photoshop and post-processing techniques	√	
"before" Photoshop image	!		