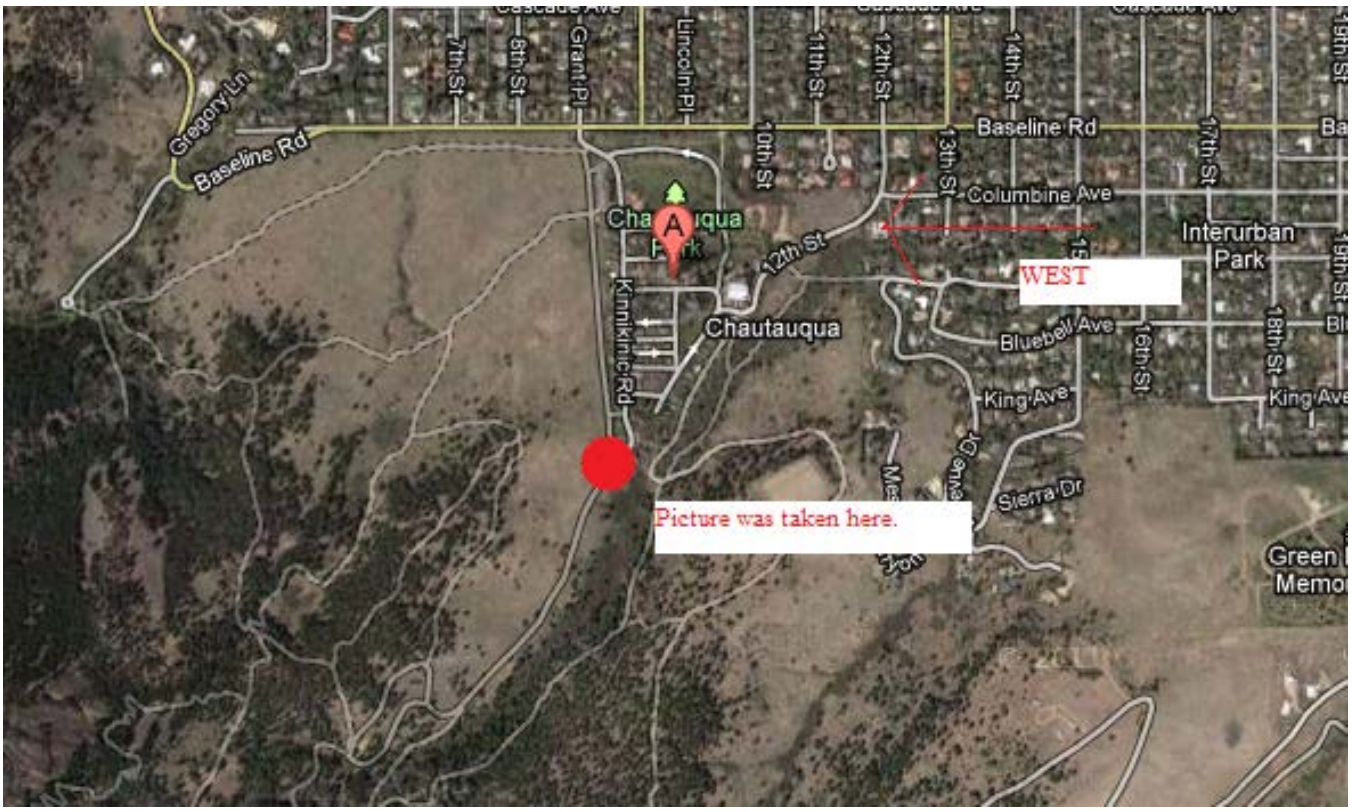
Nick Shearon
MCEN 4151 Flow Visualization
Professor Jean Hertzberg
February 23, 2012

Clouds 1

The purpose of this image was to capture fluid flow and phenomena in clouds. I personally wanted to capture the dynamics of fluid flow around the flatirons and mountains that we have in our backyard here in Boulder. I experimented with sunrise and sunset shots to make the colors of the clouds more appealing to the viewer, but upon initial review, I found that these pictures lacked a little bit in some way. I found success when I set up my camera on the very windy afternoon of Wednesday the 22nd of February. I set up my shot at Chautauqua to catch the immense scale of a weather system moving through. Even with the flatirons and the Front Range as my backdrop, I still wasn't getting the scale I desired. I finally set upon making a panoramic shot that encompassed the entirety of the weather pattern that could be seen from my vantage point.

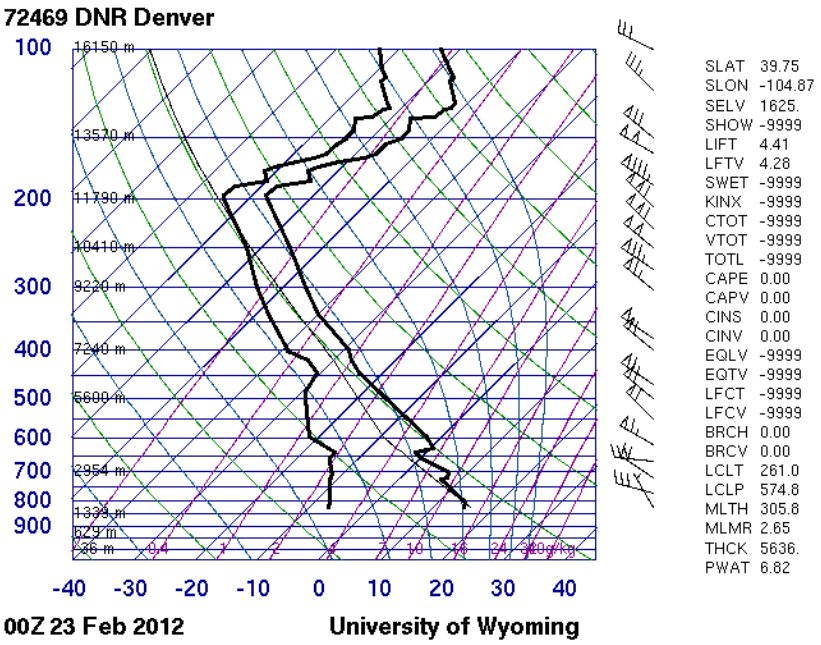
I was able to get the shot that I did because I could see the large weather system moving towards Boulder over the Flatirons. This photo was taken between 3:00pm and 4:00pm on Wednesday, February 22. I hiked about 200 yards up the Bluebell road, and set up my camera in a level position and took 5 photos of the weather pattern moving above the Flatirons in a manner that they could all be stitched together later on, I started with my first picture facing due West and then rotating to the South as I took the remainder of the photos.



The clouds seen in this photo are mountain wave clouds or altocumulus lenticularis and a Foehn cloud wall. According to Weatherspark the temperature was 57 degrees F with winds ranging from 50 to 60 miles per hour due West. These clouds are orographic clouds, or cloud formations due to topography. Altocumulus Lenticularis clouds are generally developed in relatively stable atmospheres when air “is forced up and over a topographic barrier that is oriented more or less perpendicular to the direction from which the upper-level wind is blowing. This deflection creates a gravity wave downwind of the topographic barrier not unlike a wave you might generate by throwing a pebble into a pond.” This means that when the air is forced up, it cools and sinks, but it hits the ground, heats back up and rises again causing the wave-like pattern described previously. “When sufficient moisture is present above mountain-top level, ACL clouds develop within the crest of these mountain waves where the air is rising. ACL clouds are

continually developing and dissipating in the vicinity of the wave's crest and immediately downwind of the crest, respectively. That is why they appear to remain stationary (hence the name) even though winds are swiftly (sometimes very swiftly) moving through the entire cloud. (NOAA) The Foehn cloud “results from the ascent of moist air up the windward slopes; as this air climbs, it expands and cools until it becomes saturated with water vapor, after which it cools more slowly because its moisture is condensing as rain or snow, releasing latent heat. By the time it reaches the peaks and stops climbing, the air is quite dry. As the air makes its leeward descent, it is compressed and warms rapidly all the way down slope because there is little water left to evaporate and absorb heat; thus, the air is warmer and drier when it reaches the foot of the leeward slope than when it begins its windward ascent.” (Britanica)

The rest of the sky that day was very clear and blue. There were a few fragments of the wave clouds near the edges of the cloud where the wind was tearing them up. As I mentioned earlier, the winds were very strong that day which lent itself to the formation of the wave clouds and the foehn. Below is the skew-t plot for the time of my picture; it along with the recorded CAPE of 0 further supports the mountain wave formations.



This photo was shot with the following specifications;

CAMERA	Olympus E 500
SHUTTER SPEED	1/200 sec
F-STOP	f/10
APERATURE VALUE	f/10
ISO	100
FOCAL LENGTH	14.0mm
LENS	14.0-45.0 mm f/3.5-5.6
PIXEL DIMENSIONS	8460 by 2495

The clouds were at approximately 20,000 ft in elevation when I photographed them.

I feel as thought this image really captures the mountain waves and foehn clouds in a way that really shows their magnitude as a weather pattern. The front range in the foreground really gives the viewer a sense of how large and powerful the fluid dynamics

above their heads truly are. I dislike the amount of distortion I am getting in the image, so if I replicate it, I will choose a further vantage point as to eliminate the curve of the image.

Here are my beginning images:

SOURCES

"Altocumulus Standing Lenticularis Clouds." *NWS Albuquerque*. NOAA, January 5th 2011 9:29 PM. Web. 24 Feb 2012. <http://www.srh.noaa.gov/abq/?n=features_acsl>.

"Atmosheric Sounding." . University of Wyoming, February 24, 2012. Web. 24 Feb 2012. <http://weather.uwyo.edu/upperair/sounding.html>.

"Boulder Dashboard." *Weatherspark*. N.p., February 24, 2012. Web. 24 Feb 2012. < http://weatherspark.com/

"foehn." *Encyclopædia Britannica. Encyclopædia Britannica Online Academic Edition*. Encyclopædia Britannica Inc., 2012. Web. 04 Mar. 2012. <http://www.britannica.com/EBchecked/topic/211886/foehn>.