Jeff Byrne

MCEN 4151: Flow Visualization

Professor Hertzberg

February 29, 2012

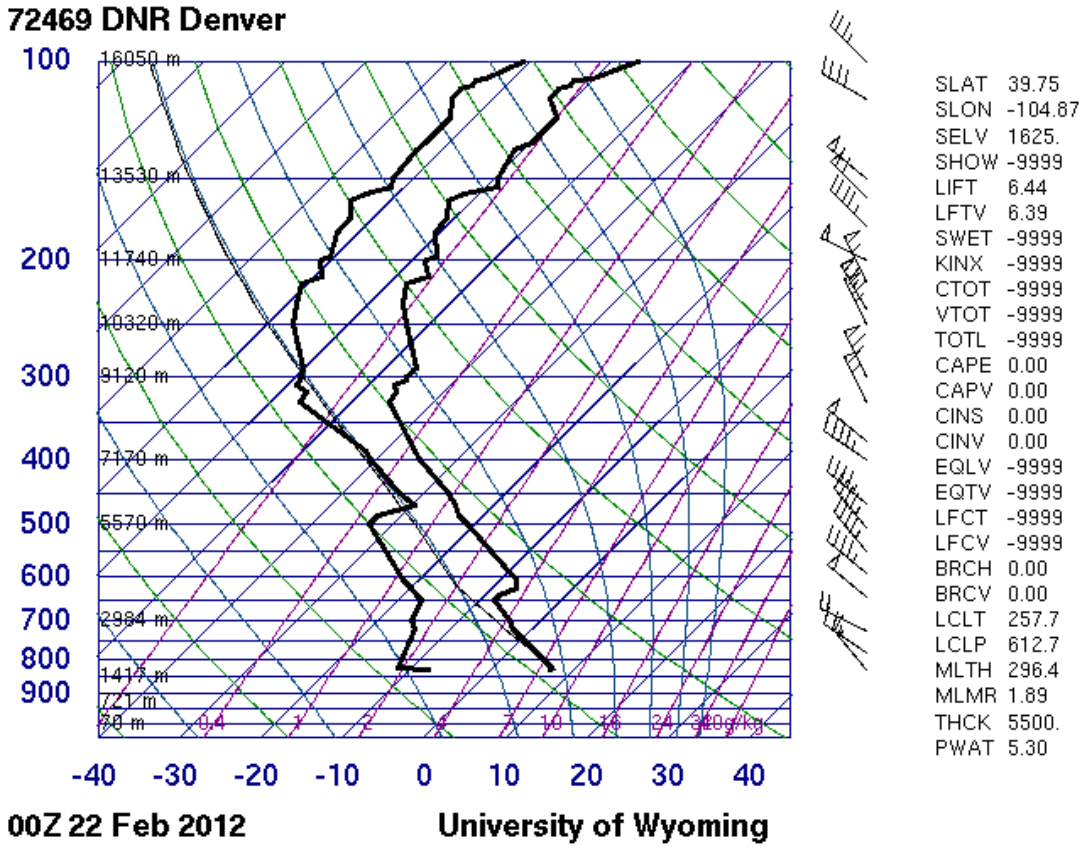
Clouds Assignment #1: February 21, 2012

Raw "Before" Image

Post-Photoshop "Final" Image

This image was taken to fulfill the requirements of the Clouds #1 assignment in the Flow Visualization class offered at the University of Colorado in Boulder. I attempted to capture the beauty of a cloud formation illuminated by the color spectrum of the sunset. After capturing the image I wanted to alter the colors and edit the photo so as to enhance the features of the atmospheric phenomenon and contrast the cloud from the background.

This cloud was photographed from the south end of Franklin Field on the University of Colorado campus in Boulder, at the intersection of Folsom and Colorado. The camera was directed north at approximately 15^{o} from the horizon. The image was taken at 5:31PM (Mountain Standard Time) on the 21^{st} of February in 2012. The clouds in the image seemed to be moving from east to west, reaching towards the mountains. The following Skew-T plot[3] of the atmosphere in Denver at 6:00PM MST was made available through the use of weather balloon sounding by the University of Wyoming.



From the data presented on the right, we see a CAPE value of zero, which indicates a stable atmosphere. The plot also shows steep temperature slopes at approximately 3000 meters, then intermittent steep slopes between 8500 and 12000 meter altitudes, which indicate potential cloud conditions. Also, the dry and moist adiabatic lines both cross the dew-point between the 5800 and 7300 meter altitudes which indicates cloud formation due to the vertical motion of water particles in this slightly unstable part of the atmosphere. This is confirmed by what was caught in the image. At the bottom of the lower-right quadrant of the picture we see what looks very much like a stratocumulus, which occur near 3000 meter altitudes. The clouds immediately above this stratocumulus in the image appear much darker, a characteristic of altostratus which form at around 6000 meters. Above the altostratus we can also see some brighter sections of the sky which is characteristic of the cirrostratus clouds that occur between 8500 and 11000 meters. Finally, we see the streaky cirrus clouds at the top of the atmosphere between 11000 and 12000 meters[1].

The day before had more cloud cover and was cooler on average, but overnight there was no cloud coverage and then the temperature then increased 14 degrees from sunrise to noon. The sky immediately overhead from the picture location was 90% cloudy[2]. The stratocumulus cloud seen in the image confirms that a warm front had moved in, as indicated by the temperature increase that day.

The camera used to capture this image was a Nikon D50 DSLR. A focal length of 46 mm, exposure time of 1/40 second, F-stop of f/14 and an ISO of 400 were used to capture the image. A low ISO was chosen to prevent a “grainy” image, and then the shutter speed was adjusted to allow for

sufficient pixel saturation. The focal length and F-stop allowed for an acceptable depth of field to capture as much of the clouds as possible. In the raw (.NEF) image the field of view is 2000 by 3008 pixels. Based on the cloud height of a stratocumulus (3000 meters), and the fact that it is at about 10 degrees off of the atmosphere, we can use trigonometry to estimate that this cloud is approximately 17 km away.

Photoshop was used to create the final image. The raw image was left un-cropped so as not to lose any of the cloud formations. The contrast was enhanced slightly, as well as the brightness. The most obvious change was the increase in temperature, which greatly enhanced the oranges in the photo. I also increased the blacks in the picture as much as Photoshop would allow which gives the more ominous dark section of the picture in the lower right corner. Vibrancy and brightness were then increased and the tone curve was adjusted to amplify contrast, enhancing the "sunset" effect.

The image does an excellent job at showing the many layers of clouds in the stable atmosphere. I like the orange-blue contrast as well as the ominously dark lower right section of the photo. The cirrus and stratocumulus were well captured, but I had originally wanted to catch an entire large cloud in one frame. I am a little curious as to why these clouds appear so puffy at higher altitudes (a characteristic of instability), when the atmosphere is supposedly completely stable. It may be possible to catch better, more discernible individual clouds during the summer months.

Citations:

[1] http://cloudappreciationsociety.org/collecting/

[2] www.weatherspark.com

[3] http://weather.uwyo.edu/cgi-bin/sounding?region=naconf&TYPE=GIF%3ASKEWT&YEAR=2012&MONTH=02&FROM=2112&TO=2200&STNM=72469&REPLOT=1