

# Clouds 2<sup>1</sup>

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April 19, 2006

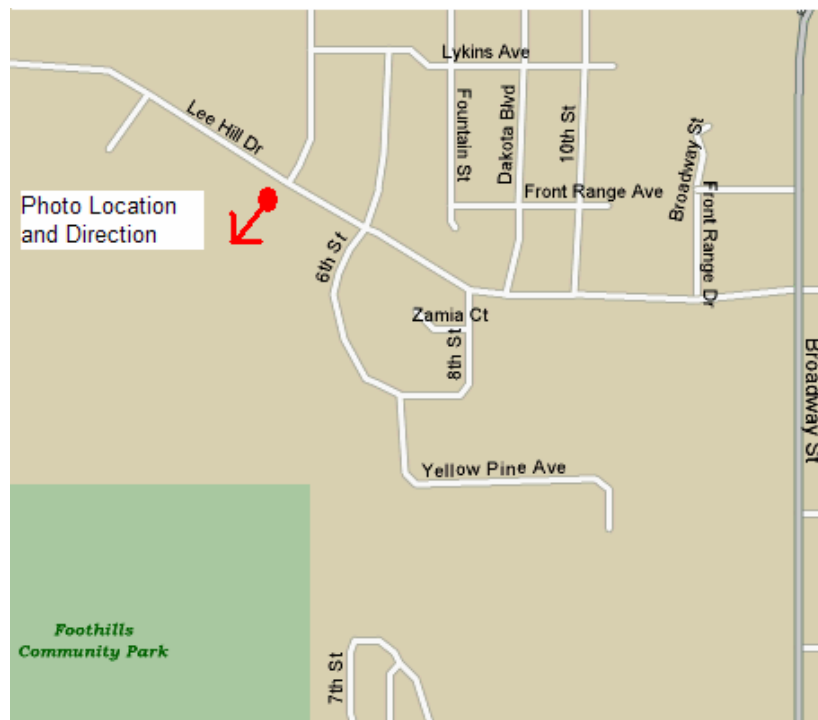
A cloud photographed on February 14<sup>th</sup> is analyzed using basic atmospheric physics in order to determine the possible meteorological phenomenon that may have created it. The cloud are the stratus uncinus formations that represent a relatively advanced stage of stratiform cloud development and give evidence that the cloud is slowly evaporating while being swept away by the wind.

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<sup>1</sup> This paper is submitted in partial fulfillment of the requirements of MCEN 5228-010, Flow Visualization: The Physics and Art of Fluid Flow

Imaging atmospheric phenomenon is inherently difficult because the medium that makes up the Earth's atmosphere, air, is largely invisible to the naked eye. The one major exception is when water moisture condenses into clouds and allows us to use clues from the clouds to infer the state of the local atmosphere at that time. The intent of this specific image is to do just that; the Boulder area clouds are known for demonstrating the effects of highly interesting atmospheric effects that are a direct result of the foothills on the western edge of town.

This photo was taken at approximately 11:15 a.m. on Tuesday, February 14<sup>th</sup>, 2006. It was taken in the Foothills Community Park parking lot just west of the Broadway and Lee Hill Dr. intersection. The field of view for the photo is approximately one and a half miles horizontally by one half mile vertically and was taken while facing in a WSW direction.



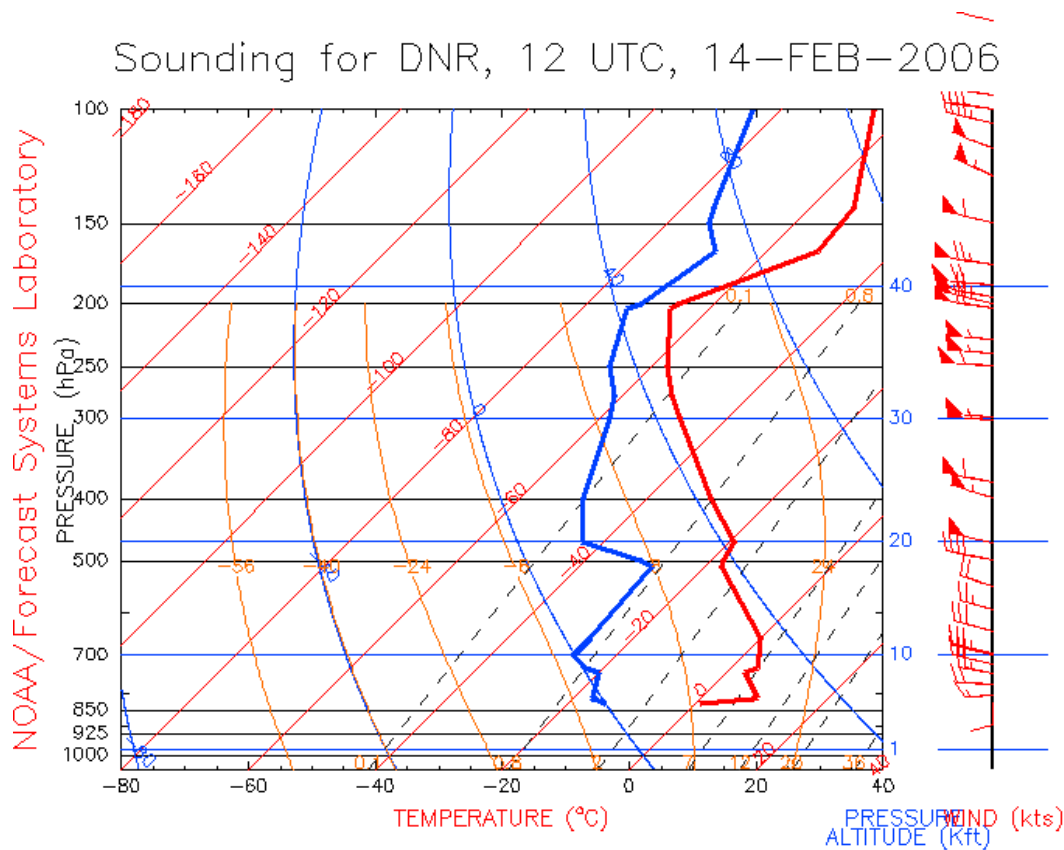
**Figure 1: Location of photo.**

The weather on the day of the photo was uncharacteristically warm for February; with a high temperature of 62° F that came within four degrees of the record. The low for the day was 32° F and the wind varied from 9-24 mph with a maximum gust of 37mph. I distinctly recall while at the dog park near where the photo was taken having to turn my back to the wind numerous times and deciding that despite the unseasonably warm weather, the wind still made the day rather inhospitable.

The clouds in this photo appeared along the entire range the foothills throughout the better part of the day. These were the only major clouds visible in the sky, there being no cloud activity to the east of the foothills. The clouds appear to be quite low level because the tails of cloud being pulled over the hilltops seem to almost touch. The classification of the cloud is hindered however because the “long strand of cirrus with a hook at their upwind ends ... are called cirrus uncinus (Houze, pp16).” Cirrus clouds however, occur at much higher altitudes than these particular clouds appear to reside so classification as cirriform is most likely incorrect.

The skew-T plot for the day shows evidence of large winds near approximately ten thousand feet. This layer of wind could be responsible for shearing the tops off of low level clouds trapped in the valley west of the foothills and blowing them over the plains where they begin to evaporate, supporting the hypothesis that these clouds are low level. Also, the skew-T plot shows a stable atmosphere in which parcels of air will rise until they lose momentum and then descend again. The warm weather from the day of the photograph will have warmed the ground, allowing parcels of air to rise gently and evaporate any wisps of clouds forced over the foothills by the

wind layer at 10,000 feet. Thus, the skew-T plot again supports the conclusion that low level clouds are responsible for the phenomenon observed in the photograph.



**Figure 2: Skew-T plot for Denver, CO on February 14th**

It would appear therefore that the clouds are the tops of stratiform clouds, possibly stratus, because stratiform clouds are “characterized by little or no vertical movement of air (Houze, pp 8)” consistent with our skew-T plot. The wisps of cloud evident in the left central portion of the image appear to rise slightly, possibly becoming entrained in the wind layer passing by just above the main cloud body. Thus, the white blanket of cloud visible in the right-hand portion of the image is evidence of the main body of a low lying stratus cloud from which wisps of ice or snow grains are being pulled away by the wind layer and evaporated by the warmer air rising

from the plains east of the foothills. Therefore, although it is a blend of two cloud names discussed so far, it would appear that these clouds should be classified as stratus uncinus.

The camera used for this image was a Pentax ZX-5N with a 28mm to 200mm lens set at about 75mm and the shutter speed was set at  $1/125^{\text{th}}$  of a second with an aperture of f/11 and the film used was 400speed Fuji Superia X-tra. The only post-processing done on the image was to crop a portion of the bottom of the image in order to remove some distracting elements such as trees and rooftops. Also, the upper portion of the image was cropped as well, eliminating a portion of the cloudless blue sky in order to make the image a narrow horizontal band that accentuates the left to right motion of the cloud's "tail". All of the colors are true to the original image and there was no use of any filters.

The final image is very satisfying partly because I have finally been able to use cropping to enhance my image rather than just using it to eliminate portions of my photographs that contain distracting elements. The dynamic appearance of the wisps of cloud helps give the observer the impression of a day that involved a large amount of wind and I admit that I cannot look at the image without recalling the somewhat miserable hour spent huddled in the wind at the dog park just prior to taking the photograph. The intent of this photograph was to image a cloud phenomenon much different from that in my first cloud project and I feel that I have accomplished this objective and increased my understanding of general atmospheric physics in the process.

Reference: Houze, Robert A. Jr. Cloud Dynamics, Academic Press, New York