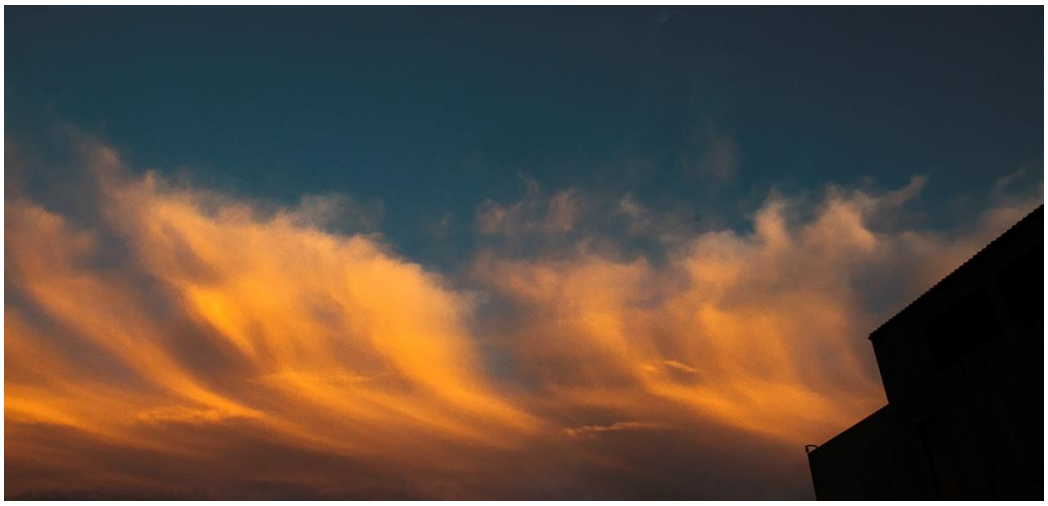
Campus Evening Waves



Cloud Second Report

MCEN 5151

12/04/2019

Aaron Zetley

Introduction:

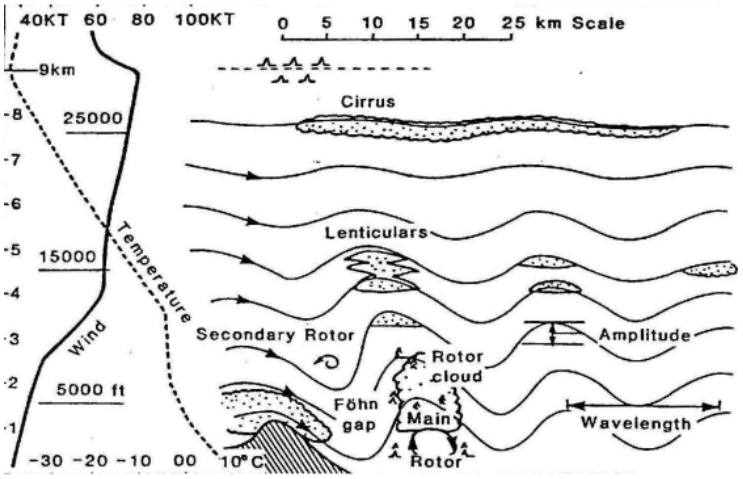
The cloud image above was taken on the sidewalk north of the engineering center as I biked back from classes of the evening of October 17th. As the sun was setting, I became mesmerized by the bright and dramatic colors in the clouds and their contrast with the darkening blue sky above it. Seeming dramatically close to the ground from my position on the side walk it almost felt like the clouds could be touched above me. The building was left in the image to leave a sense of perspective and scale for the image. I think the image helps portray my feelings at the time of trying to enjoy the lapse glimpses of sunshine by witnessing the sunset after working inside all day.

Cloud Explanation and Description:

When looking at the contextual clues of the image, the skew-T plot, and the weather for the day it was determined that the clouds were altostratus clouds with lenticular qualities via mountain wave effects. Although looking like wispy like Cirrus clouds when viewing images from other classmates of the same cloud which show the entirety of the cloud (see below) it can be concluded that the clouds are more likely to be altostratus clouds with mountain wave effects.

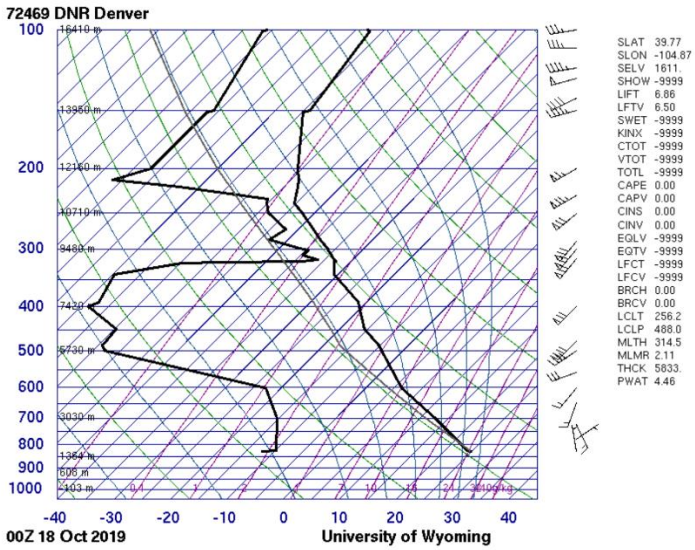
Image of full shape of same mountain wave cloud taken by Peter Rosenthal one hour before cloud report image

In this case the waving wispiness formed on the tips of the cloud was created by mountain wave effects. Mountain waves are oscillating pressure waves that from typically on the lee side of mountains forming pockets of unstable and stable are that on known uniform in elevation as the pressure fields continues past the mountain. When formed in stable atmosphere, mountain waves form when stable air above a mountain is pushed by the wind and geography into less stable air above it, while more stable air remains below the mountain range on its lee side. This creates variable the pockets of stable and unstable air that form creating oscillating wind currents creating turbulence and intriguing cloud shapes like the image above. This cloud technically is considered a leeside lenticular mountain wave cloud formed by the wind being pushed upward by the mountain ridges.



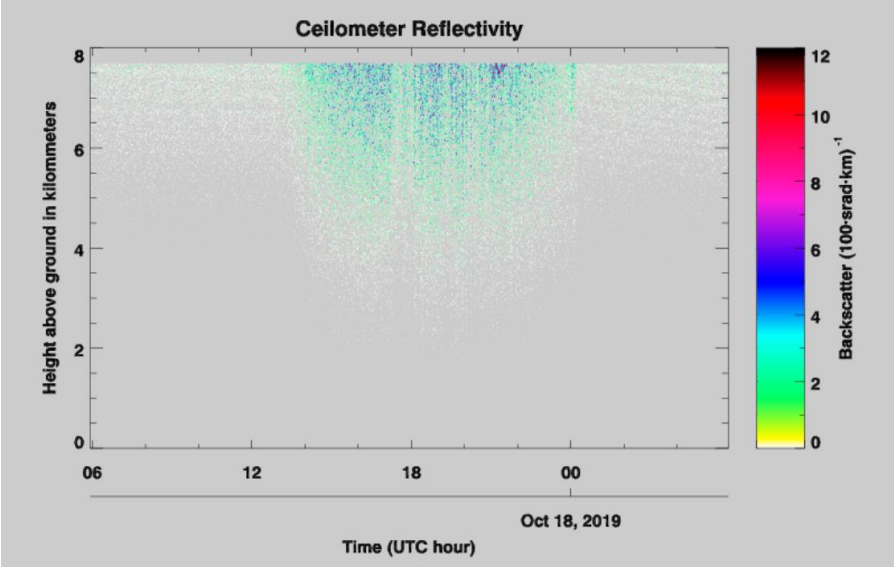
Overview of Mountain Wave Cloud Formation and Wind Oscillations

One issue with this determination is then when looking at the Skew T Plot the clouds layers seemed to lie between 9000 and 12000 meters (29,000 and 40000 feet). This elevation fits more within the elevation range of cirrus clouds not altostratus Although it is highly unlikely that altostratus clouds are this high in the atmosphere when looking at the ceilometer data for Boulder (seen below) for the October 17th it seems like there is also cloud density in areas between 5000 and 8,000 meters which is more likely possible for high altostratus clouds. Although the Skew-T Plot may not agree, I think with the visual, geography and environmental indicators along with the ceilometer data provide enough evidence to conclude that this is a lenticular altostratus clouds affected by mountain waves.



Skew-T for Afternoon of October 17th 2019

(Time based on UCT-Time on Plot not Mountain Standard Time)



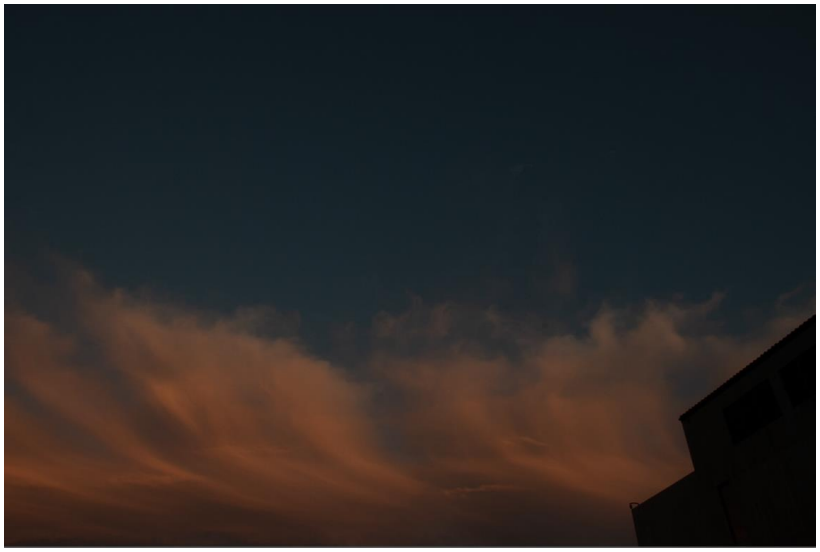
Ceilometer plot University of Colorado Skywatch Observatory October 17th 2019

Visual Technique

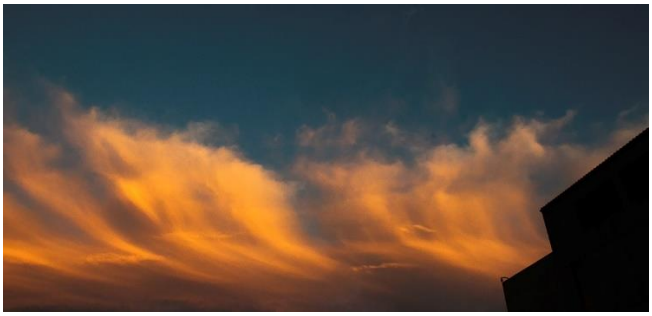
Camera Settings	
Property	Value
Type	Nikon D5500

Shutter Speed	1/50 sec
F-Stop	F/18
ISO	640
Focal Length	18mm
Image Size	4000 X 6000 px
Flash Used	No
Cropped?	Yes 6000 X 2857

This image was taken using my Nikon d5500 DSLR camera pointed up towards the sky at around 30 degrees. The settings on camera are in the table above. As the image was taking during sunset, a longer exposure was used to capture the clouds and their unique colors. As a large amount of light was being reflective in the clouds it enabled me to use a high f-stop (F/18) with a relatily low ISO of 640. These design choices led to strong shadow elements on the building in the image but led to bright colors in the clouds. I used a high f-stop for the image to be able to capture the entirety of the subject, in this case the clouds at varying distances. As seen below the image was rather dull and colorless in its original state. Luckily, with the data available within the Raw image file, I was able to the brighten the colors and hues present in the clouds by editing the image in Adobe Lightroom. First as the image was originally incredibly dark I increasing the highlights and exposure in lightroom, pulling out the beautiful features and colors in the cloud that could have been seen by the naked eye that evening. To gain even more color and texture in the image, I next edited the shadows, sharpness, and color hues. Finally, to better frame the image I cropped the photo slightly to focus more on the clouds itself.



Original Image



Edited Images

Self Reflection and Future Projects

This image in the general and the cloud at the time provided me with a feeling of relaxation and calm. As it was taken after a long day of staring at my computer inside it was a nice treat to get a nice glimpse of nature as I tried to decompress as I biked home. I would like to thank my classmate Peter Rosenthal for his insight into this cloud during his presentation and providing the images seen on his flow vis website post so one could better understand the shape of the cloud. In the future I would like to take more images of mountain wave clouds as I hike in the backcountry and in the Front Range itself. I would like to capture more in-depth and intriguingly shaped mountain clouds as they seem to occur often in the Colorado front range. I really enjoyed the technical challenge of trying to determine cloud type. Although at points it was confusing that some of the visual indicators and metrological data disagreed it forced me to dig deeper and learn more about how each helps determine which clouds are flying over us every day.

References:

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