Cloud Report 1

Flow Visualization

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2/3/2010

Introduction

The image above was taken for the first cloud assignment in the Flow Visualization course. The objective of the assignment was just that, to take an image of any cloud and to be able to describe the genus and type of cloud as well as other physical properties of the weather or cloud that contributed to the image. The intent of the image above was to photograph clouds at night. Because the image was to be taken at night there was very limited light. Because the moon is the primary light source at night the picture was taken near the time of a full moon which along with a long exposure time provided enough light to be able to clearly distinguish the cloud. A mix of shutter speeds were tried however if it were too long there was too much motion blur and if too short then wasn't enough light. The key to this photo was finding the correct shutter speed at the maximum aperture and highest allowed ISO that would not make the picture too grainy.

Location and Environment

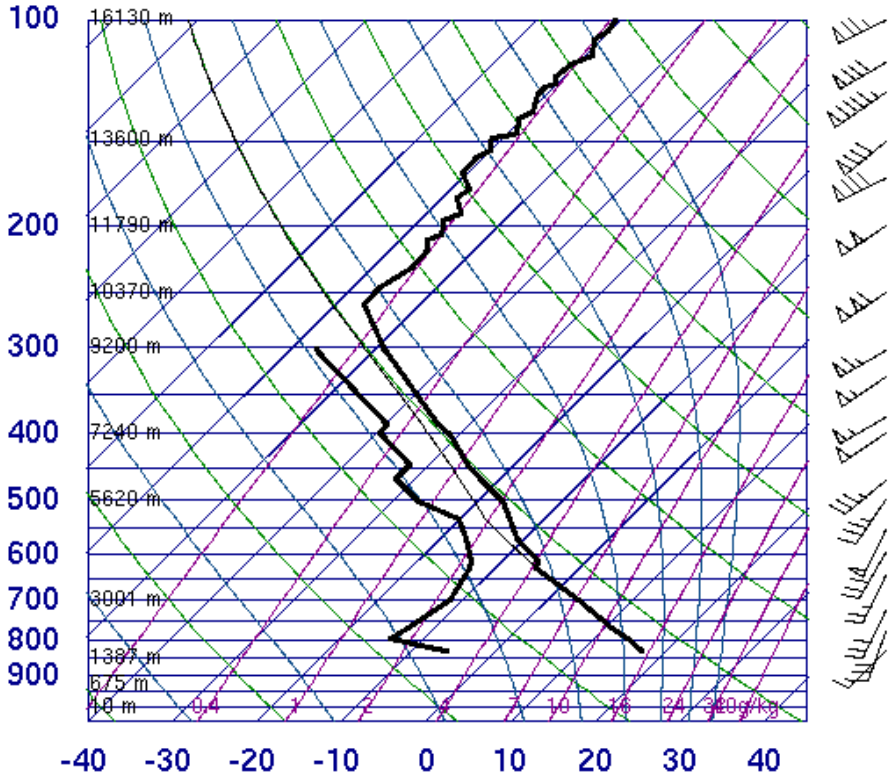
The photo was shot on the night of February 19th, 2011 around 11 pm. This was just one night after the full moon with approximately 94% of the moon illuminated at the time of the shot []. The shot was taken facing east from Nederland CO at approximately 2500 meters []. The camera was pointed several degrees up from the plane of the earth. The weather in Nederland at the time of the photo was clear, calm, and approximately -1 C^{o}. However, the clouds were not in Nederland they were east most likely above Boulder, CO. In Boulder there were light winds blowing north and a temperature of around 4 C^{o} consequently causing the clouds to move northward [].

Cloud discussion

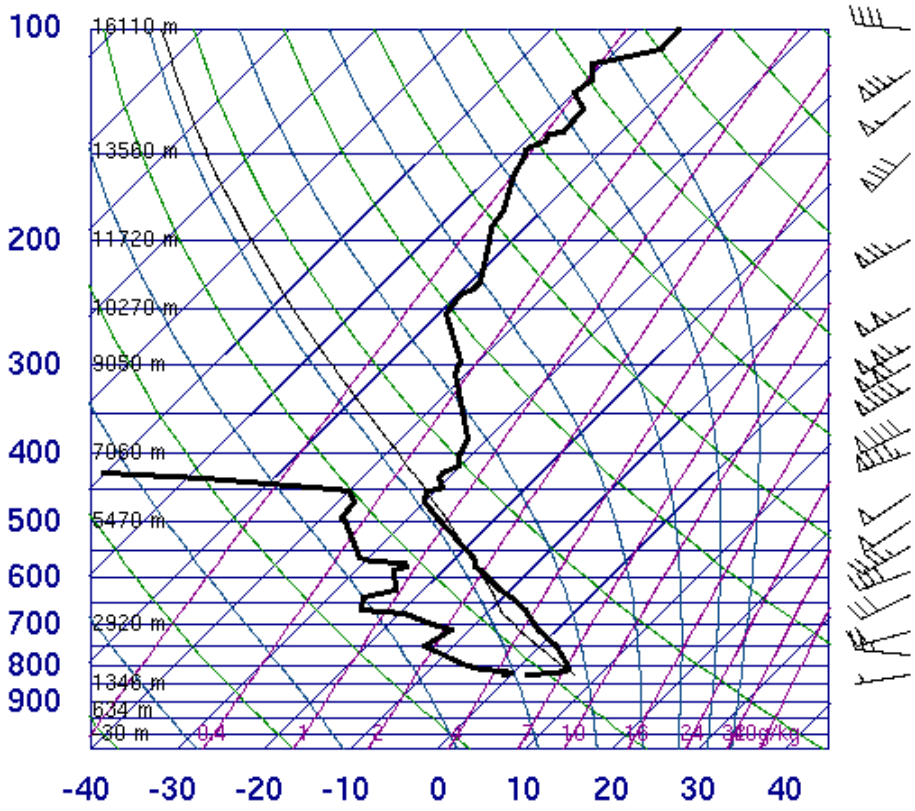
The clouds in this photo are Stratocumulus Stratiformis and fall under several different varieties including Opacus, Translucidus, Perlucidus, Duplicatus, and Lacunosus. Stratocumulus clouds are low altitude clouds ranging in elevation from 600 to 2000 meters. They are usually associated with layers and patches of clouds. However, how the layers and patches are formed varies. Depending on the formation of the patches of the Stratoformis cloud there can be gaps between the patches allowing light to pass through or the clouds can be packed close together forming a smooth layer on the bottom.

The clouds observed this night were small and sporadic. Due to the wind clouds were moving from south to north and a given cloud would normally take no longer than several minutes to pass by. The rest of the sky that night, to the east and west of Boulder appeared mostly clear. Because of the light and varying cloud conditions the Skew-T plots shown below do not directly indicate that there were any clouds in the sky. This is also due to the time discrepencies between when the measurements for the Skew-T plots were taken and when the photo was taken. Because of the time discrepancy two Skew-T plots are shown below. The one on the top is from 6 PM on February 19th and the one below is from 6

AM the following day[].



SLAT 39.75
SLON -104.87
SELV 1625.
SHOW -9999
LIFT 3.24
LFTV 3.14
SWET -9999
KINX -9999
CTOT -9999
VTOT -9999
TOTL -9999
CAPE 0.00
CAPV 0.00
CINS 0.00
CINV 0.00
EQLV -9999
EQTV -9999
LFCT -9999
LFCV -9999
BRCH 0.00
BRCV 0.00
LCLT 256.8
LCLP 539.2
MLTH 306.4
MLMR 2.04
THCK 5610.
PWAT 7.23



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LIFT -1.01
LFTV -1.11
SWET -9999
KINX -9999
CTOT -9999
VTOT -9999
TOTL -9999
CAPE 40.51
CAPV 48.43
CINS -146.
CINV -127.
EQLV 452.9
EQTV 452.7
LFCT 581.7
LFCV 583.3
BRCH 0.43
BRCV 0.51
LCLT 265.4
LCLP 680.4
MLTH 296.3
MLMR 3.24
THCK 5500.
PWAT 4.90

The Skew-T plots do not tell us much about the location of the clouds seen on the night of February the 19th. However they do tell us that the atmosphere is stable before and after the photo was taken. The stability of the atmosphere helps confirm the clouds seen in the photo. This is because a stable atmosphere prevents air pockets from continuously rising. That is because in a stable atmosphere the air temperature does not cool with altitude as quickly as would a dry adiabatic particle taken from one elevation to another. In the case of a temperature inversion the temperature of the air either stays the same or grows warmer with altitude and this is the sign of a very stable atmosphere. In summary air will want to rise in an unstable atmosphere and be stationary in a stable atmosphere.

In the case of clouds, an air particle will often rise, cool and condense in an unstable atmosphere; however, once the condensed air particle reaches a stable atmosphere it will stop rising. If enough condensed air particles form at the same elevation they will form a cloud layer. Due to the stable atmosphere the cloud will stay at a specific elevation. This is often the formation of Stratocumulus clouds which consist of thin patches and layers of clouds at low elevation.

This type of cloud formation is likely given the Skew-T plot above. In the first plot the atmosphere is barely stable near the ground with increasing stability with elevation. It is likely that at the time of the photo there was instability in the atmosphere near the ground which grew stable at the elevation of the clouds. The first plot also shows the air temperature nearing the dew point at the same elevation at which the atmosphere becomes more stable. The Skew-T plots were formed from data taken in Denver, CO with the data from the first plot occurring 5 hours before the clouds seen were seen further west in Boulder, CO. Therefore, the plots can only be used as a guide to obtain information about the clouds photographed. It can be inferred then that above Boulder the air temperature did meet the dew point at

In the case of this photo it is difficult to discern what the bottom of the cloud looked like because the photo was taken from the side of the cloud rather than below. However from that angle the layers of the Stratiformus cloud are easily discernible. The different layers of the cloud exhibit multiple varieties as mentioned above. The definition of each variety mentioned is listed below.

Opacus: Layer is thick enough to mask sun or moon

Translucidus: When it is thin enough to show

Perlucidus:

Duplicatus:

Lacunosus:

The Skew-T plots for boulder, shown below, also do not give up much information about the cloud because the temperature plot never intersects the dew point plot.

References

[] : http://www.timeanddate.com/worldclock/astronomy.html?n=75&month=2&year=2011&obj=moon&afl=-11&day=1

[] : http://geonames.usgs.gov/pls/gnispublic/f?p=154:3:323264340459534::NO:3:P3_FID,P3_TITLE:204702,Nederland

[] : http://www.wunderground.com/weatherstation/WXDailyHistory.asp?ID=KCOBOULD54&month=2&day=19&year=2011

[] : http://weather.uwyo.edu/upperair/sounding.html