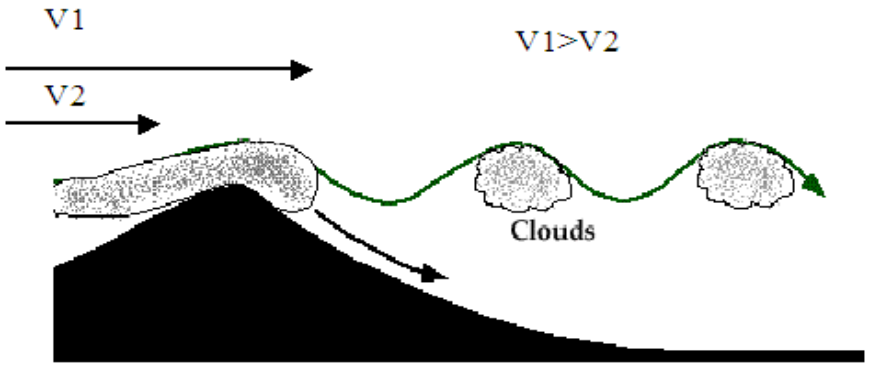
CLOUDS PROJECT 2

Context & Purpose:
The goal was to show a different Orographic cloud effect than the one discussed in 'Cloud Project 1.' It seams to have become an obsession of mine to take high contrast images of Orographic Clouds with a dark silhouette of the mountains. The above images display an unsteady Orographic formation in a steady environment. This particular photo was chosen because it seams as though you are staring onto another planet in orbit around the earth.

Description of Flow and Apparatus:
By examination of the main photograph (left), the cloud formation can be described as mostly Cumulus or Stratocumulus, and likely includes: Cumulus Fractus, Humiilis & Mediocris. Interpretation of the Skew T shows a stable climate up to ~4500m and a moderately stable climate between 4500m and 10620m [2]. The Skew T also reveals a sudden change in wind velocity between 4500m and 3000m. The Orographic lift will force clouds from the lower (slower) elevation to the higher (faster) elevation. This sudden change in velocity will cause shear between the faster-higher layers of the atmosphere and the slower-lower layers. Thus the flow of atmospheric particles to become UN-steady (more turbulent). The shear breaks Fractus clouds from the larger Cumulus/Stratocumulus formations. The Fractus clouds bring and irregular and ragged texture to the pictured cloud formation. Below is a picture and brief notation describing Orographic lift.



Orographic clouds as a result of Earth's surface topography. [2] **Link**

Orographic lift occurs when air is forced from a low elevation to a higher elevation as it moves over rising terrain, such as mountains. The air expands and cools as it gains altitude. At high altitude the air can not hold moisture as effectively, thus causing clouds to form. As the air moves past the elevated terrain it descends and warms. Now the flowing air mass is lighter than the surround air, it then rises until stabilization. The motion can be described as following the waveform of an under-damped system.

Visualization Technique and Lighting:

To heighten contrast and lighten depth of field, a fast shutter speed was used with a large aperture. Using a fast shutter speed helped blacken the silhouette of the mountains. The clouds were back light by the sun, visibility was up to 40miles (see appendix A.1). No photo editing modifications were made to the main image. The negative was taken of a duplicate image in an atempt to make it look more 'earthly' with more blue white and tan. The negative was taken for anesthetics.

Photographic Information:

Date:	11/16/2007 16:42:24
Field of view:	~3 miles
Depth of field:	20 miles
Distance from object to lens:	~3 miles
Lens focal length:	55mm
Camera:	Digital 8.1 Mega Pixels Canon EOS
Shutter Speed:	1/100 sec.
Aperture Value:	F5.6
ISO Speed:	100
White balance:	Sun
Image Processing:	None

Conclusion:

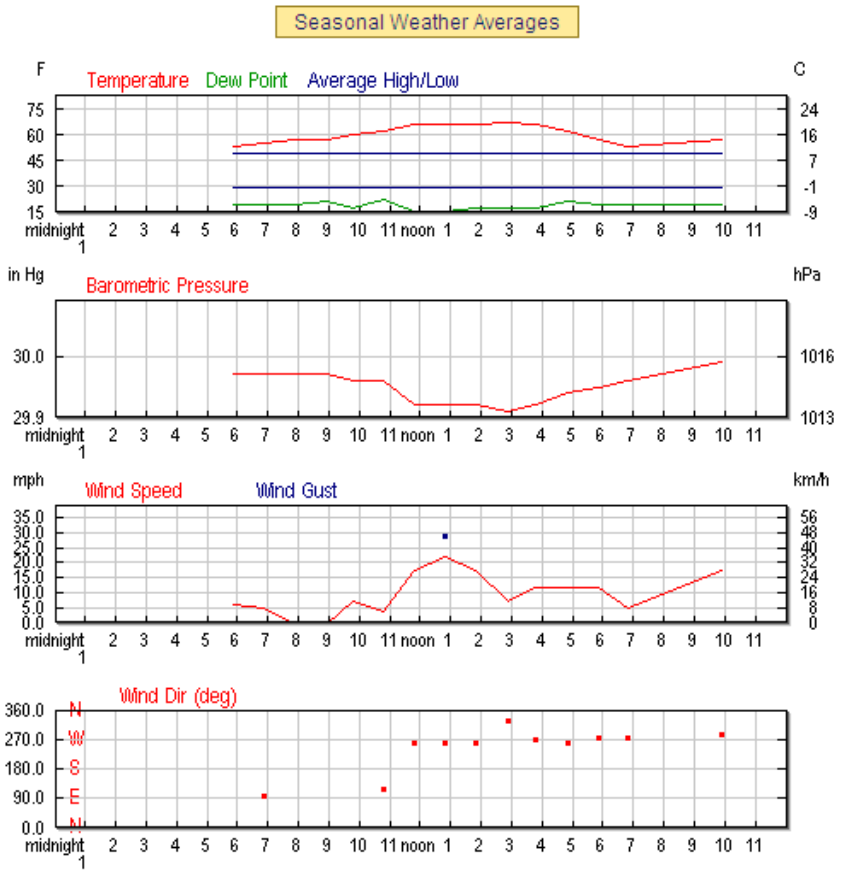
Looking back at Project 1's image, this image shows that a slight change in atmosphere can cause a drastic difference in Orographic cloud formation. With available data and knowledge, this formation could be predicted without visual aid. It is expected that air particles will rise and condense in an Orographic situation. With the velocity varying with elevation it can also be expected that the formation will be unsteady and Fractus. The image well supports atmospheric data. This particular photo was chosen because for its 'earthly' like appearance. In the future I would like to study Orographic formations further with different exposures and profile views of mountain ranges.

Appendix:

A.1) Atmospheric Conditions as provided by Weather Underground

Daily | Weekly | Monthly | Custom

	Actual:	Average :	Record :
Temperature:			
Mean Temperature	60 °F / 15 °C	-	
Max Temperature	68 °F / 20 °C	50 °F / 9 °C	75 °F / 23 °C (1999)
Min Temperature	53 °F / 11 °C	30 °F / -1 °C	8 °F / -13 °C (1996)
Degree Days:			
Heating Degree Days	4		
Growing Degree Days	10 (Base 50)		
Moisture:			
Dew Point	19 °F / -7 °C		
Average Humidity	20		
Maximum Humidity	26		
Minimum Humidity	14		
Precipitation:			
Precipitation	0.00 in / 0.00 cm	-	- ()
Sea Level Pressure:			
Sea Level Pressure	29.95 in / 1014 hPa		
Wind:			
Wind Speed	7 mph / 11 km/h (West)		
Max Wind Speed	22 mph / 35 km/h		
Max Gust Speed	29 mph / 47 km/h		
Visibility	20 miles / 32 kilometers		



A.2)

72469 DNR Denver Observations at 12Z 16 Nov 2007

PRES hPa	HGHT m	TEMP C	DWPT C	RELH %	MIXR g/kg	DRCT deg	SKNT knot	THTA K	THTE K	THTV K
1000.0	93									
925.0	757									
850.0	1468									
836.0	1625	6.4	-7.6	36	2.59	180	4	294.2	302.2	294.7
829.0	1694	15.0	-6.0	23	2.96	204	7	304.0	313.4	304.6
826.0	1724	15.6	-6.4	21	2.88	214	8	305.0	314.2	305.5
815.5	1829	14.8	-6.9	22	2.80	250	12	305.3	314.2	305.8
785.8	2134	12.6	-8.5	22	2.57	270	11	306.1	314.4	306.6
757.2	2438	10.3	-10.1	23	2.36	280	14	306.9	314.6	307.4
729.6	2743	8.1	-11.7	23	2.16	285	16	307.8	314.9	308.2
700.0	3083	5.6	-13.4	24	1.95	295	22	308.6	315.1	309.0
651.5	3658	1.9	-19.1	19	1.30	305	32	310.9	315.4	311.2
627.2	3962	0.0	-22.1	17	1.04	310	29	312.1	315.8	312.3

Station information and sounding indices

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                        Station identifier: DNR
                            Station number: 72469
                          Observation time: 071116/1200
                          Station latitude: 39.75
                         Station longitude: -104.87
                         Station elevation: 1625.0
                              Lifted index: 6.23
    LIFT computed using virtual temperature: 6.07
      Convective Available Potential Energy: 0.00
             CAPE using virtual temperature: 0.00
                       Convective Inhibition: 0.00
             CINS using virtual temperature: 0.00
                      Bulk Richardson Number: 0.00
          Bulk Richardson Number using CAPV: 0.00
  Temp [K] of the Lifted Condensation Level: 261.79
Pres [hPa] of the Lifted Condensation Level: 589.02
     Mean mixed layer potential temperature: 304.55
              Mean mixed layer mixing ratio: 2.75
              1000 hPa to 500 hPa thickness: 5647.00
Precipitable water [mm] for entire sounding: 6.02
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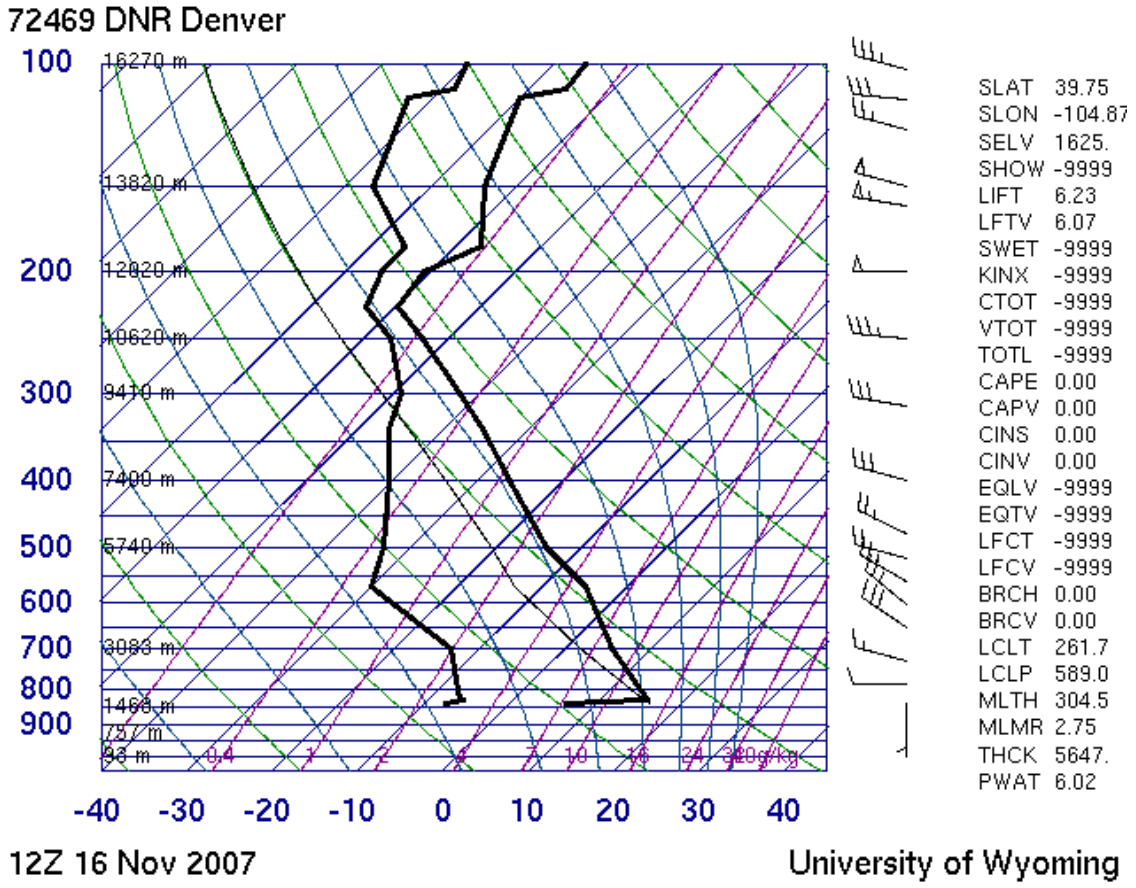
A.3)



References:

[1] World Meteorological Organization. "INTERNATIONAL CLOUD ATLAS." Abridge Atlas, 1969.

[2] The Kings School Worchester, "Orographic." Unknown. 10/10/07. http://atschool.eduweb.co.uk/kingworc/departments/geography/nottingham/atmosphere/pages/orographic.html

[3] Weather Underground, "History." Unknown. 10/10/07. http://www.wunderground.com/history/airport/KBJC/2007/10/4/DailyHistory.html?req_city=NA&req_state=NA&req_statename=NA

[4] Rutgers, The State University of NJ, "Cloud Photos." Unknown. 11/24/07. http://www.discoverscience.rutgers.edu/extras/weatherwise/clouds.html