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"Clouds – Part 1"

John Lubbock once wrote, "Rest is not idleness, and to lie sometimes on the grass under the trees on a summer's day, listening to the murmur of water, or watching the clouds float across the sky, is by no means a waste of time." [1] We all have found ourselves gazing and pondering into the daytime sky mesmerized by the clouds that pass above us. Clouds can bring a sense of tranquility and peacefulness into our, at time, chaotic lives. Hence, capturing the wonder and marvel of clouds on paper is exciting and noteworthy.

In the Assignment "Clouds – Part 1," I was trying to capture the dynamics of clouds and, at the same time, provide a lasting image to be enjoyed by many. In ***FIGURE 1***, I believe I accomplished these two goals by offering a lasting image that is dynamic in content and memorable in photographic composition.

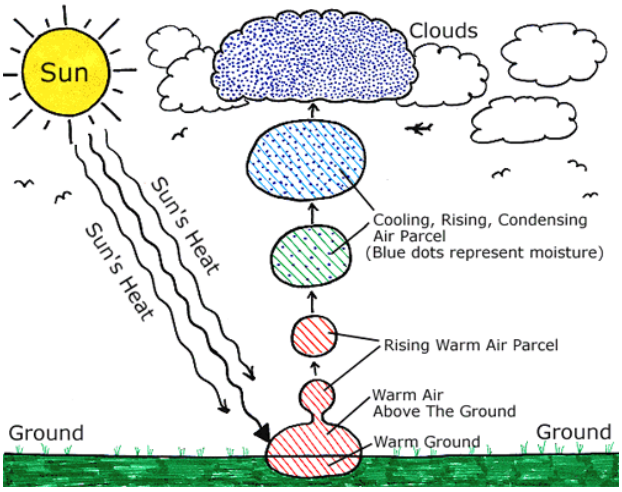
FIGURE 1: Cumulus Clouds (original unedited picture)

CLOUD FORMATION

First, to understand clouds, we must understand the physics behind clouds. In general, "cloud development is linked closely with the concept of *stability,* i.e., the tendency of air to rise. Although several factors determine whether or not clouds will form, the stability of the atmosphere is far and away the single greatest indicator of cloud formation. As the surface of the earth heats up due to incoming solar radiation,

warm bubbles of air (thermals) develop and begin to rise. When these thermals reach a height known as the *condensation level,* cumulus clouds begin to form. Cooler air surrounding the clouds sinks to replace the warm air rising from the surface. The subsidence outside of the cumulus clouds suppresses cloud formation in the area surrounding the clouds. This is why one normally sees lots of blue sky surrounding fair-weather cumulus clouds. Eventually, a growing cumulus cloud cuts off the ground from the sun's rays, reducing surface heating and convection. The cloud begins to dissipate and the process may start again. Fair weather cumulus clouds are often characterized by level bases (at the condensation level), moderate vertical development, and lots of blue sky in between." [2]

FIGURE 2: Cloud Formation Cycle



A simplified schematic of cloud formation is noted by ***FIGURE 2***. [9] It is important to note all energy provide in cloud formation is fueled by energy supplied by the sun. The sun drives warm air parcels rising through the atmosphere via a environmental temperature gradient. These rising parcels of warm air contain H2O moisture. As a result, the subsequent formation of clouds is due to these moisture laden warm air parcels gradually cooling and condensing as they rise in altitude through the atmosphere. Hence, a cloud is essentially a collection of these condensed water molecules suspended in the atmosphere. As an aside, cumulus means, "heap, a pile, an accumulation."

WEATHER CONDITIONS

Image of alto-cumulus clouds was taken on February 27th, 2006 at 1:30 p.m. MST. Picture was captured at the United States Air Force Academy located in Colorado Springs, CO (Latitude: 38.99 N, Longitude: 104.86 W [3]) on a day with approximately 38% cloud cover and partly cloudy skies. Outdoor

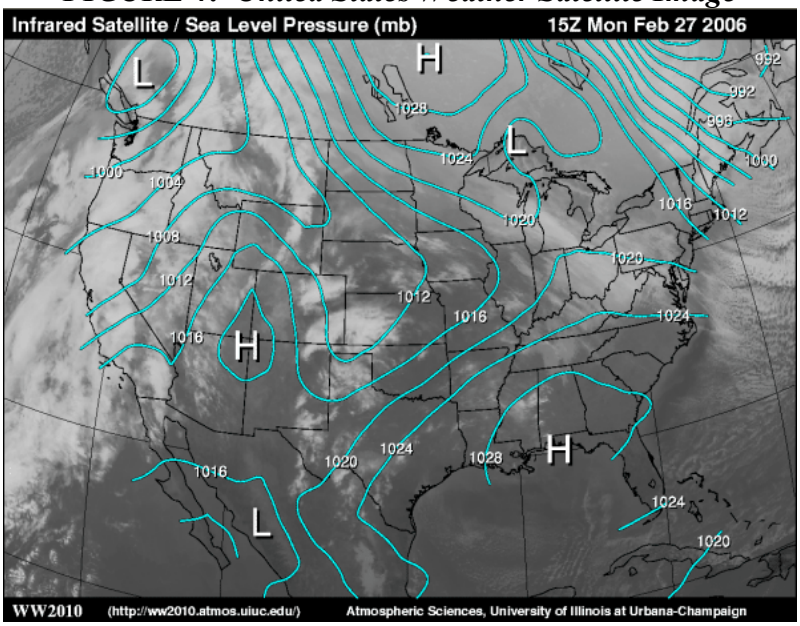
ground air temp was 65°F with a dew point temperature of 15°F. Humidity was 6% with winds out of the west at 8 mph. A summary of atmospheric weather conditions may be noted by ***FIGURE 3***. [4]

FIGURE 3: Weather Summary Data – Colorado Springs, CO

	2 AM	5 AM	8 AM	11 AM	2 PM	5 PM	8 PM	11 PM
Temperature / Dew Point (°F)	29 / 11	24 / 11	37 / 17	50 / 16	65 / 15	57 / 14	40 / 17	36 / 18
Humidity (%)	33%	44%	30%	14%	6%	9%	26%	34%
Wind (mph)	6 216° SW	6 220° SW	6 318° NW	8 196° SSW	8 264° West	7 176° South	4 18° NNE	7 354° North
Conditions	Partly Cloudy	Partly Cloudy	Partly Cloudy	Partly Cloudy	Partly Cloudy	Partly Cloudy	Partly Cloudy	Partly Cloudy
Probability of Precipitation (%)	0%	0%	0%	0%	0%	0%	0%	0%
Cloud Cover (%)	48%	48%	50%	50%	38%	38%	39%	39%

In addition, ***FIGURE 4*** [8] is a satellite image provided by the University of Illinois Urbana-Champaign weather website. The image provides additional information of cloud cover and sea level pressure in Colorado Springs, CO the day the image was photographed.

FIGURE 4: United States Weather Satellite Image



PHOTOGRAPHIC TECHNIQUE:

IMAGE SUMMARY:

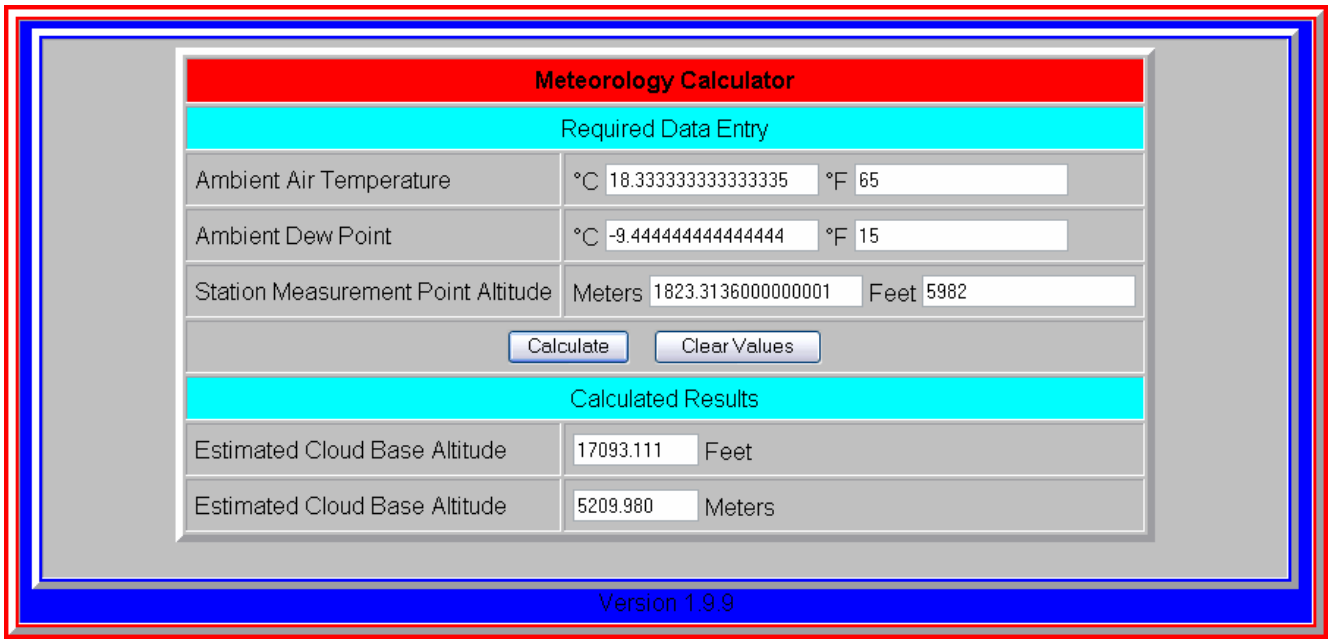
- Field of View: Infinity (∞)
- Distance from Object to Lens: ≈ 17,000 feet
- Lens Focal Length: 35 mm
- Type of Camera: Canon Elan 7E - 35 mm print film
- Exposure Specifications:
  - Shutter Speed: 1/1000 second
  - Aperture (f-stop): 11
- Film Type & Speed: Kodak Gold – 200 Speed
- Digital Manipulation: None
- Printing: Black & White (Photo Laboratory)

Image was originally taken in color and developed in black & white with the use of a red colored filter to increase contrast and increase whiteness of clouds. In addition, chapel was "burned" to decrease washout and correct for overexposure. "Burning" of chapel helped increase depth control and expose details in chapel image.

CLOUD DYNAMICS

Using a meteorology calculator [5], an estimated cloud base altitude was calculated at 17,093 feet (5,210 meters). A summary of calculated data may be noted by ***FIGURE 5***.

FIGURE 5: Cumulus Cloud Base Calculator

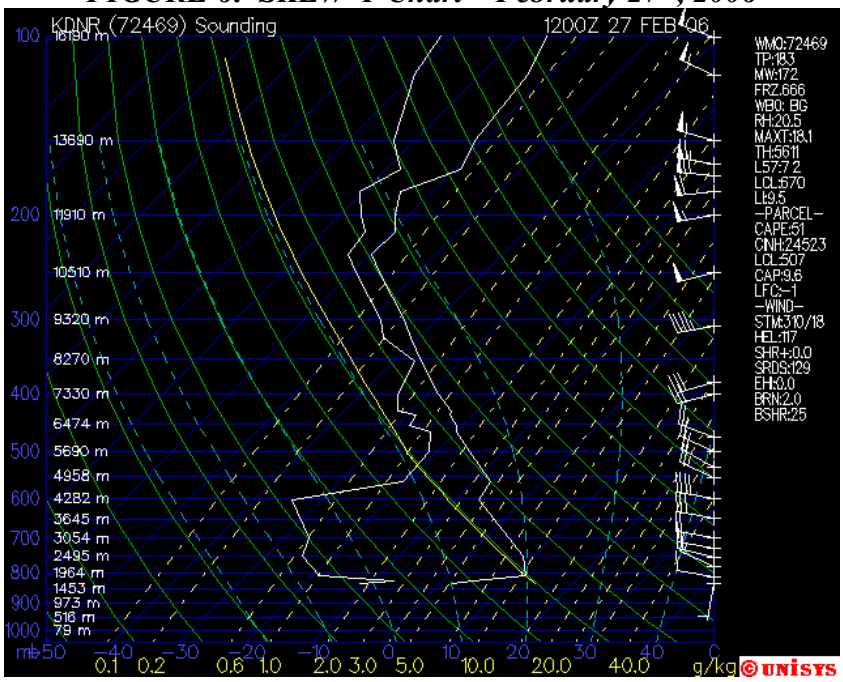


A SKEW-T Chart [6] (***FIGURE 6***) for appropriate date of image was read and interpreted. SKEW-T Chart parameters may be noted by the following:

> "A Skew T plot is a standard plot used by meteorologists to analyze data from a balloon sounding. This is a plot of temperature with height as denoted by pressure. The pressure lines are plotted horizontally in blue and are also on an inverse log scale. The concept of Skew T means that the temperature is not plotted vertically but angles off to the right at a 45 degree angle. The temperature lines of the Skew T are in blue. The green lines are called dry adiabats. The light blue dashed lines are saturation adiabats. The yellow dashed lines are lines of constant mixing ratio. The sounding is plotted as two white lines. The right line is the temperature profile. The left line is the dewpoint profile." [6]

At an altitude of approximately 5,210 meters, the SKEW-T Chart denotes an air temperature of approximately -20°C and a dew temperature of approximately 0°C. Winds were approximately 28-32 knots. In addition, the right white (Dew Point Temp) line slope is steeper (larger) than the yellow (Adiabatic Cooling Line) line. This signifies the atmospheric conditions were stable at an altitude of 5,210 meters. A stable atmospheric condition may be explained by the following: "A stable parcel will decelerate and eventually descend. This is the typical atmospheric condition and it the primary condition in high pressure areas. The descending air desaturates the atmosphere and leads to clearing skies and calm conditions. [7]

FIGURE 6: SKEW-T Chart – February 27th, 2006



In summary, *Clouds – Part 1* was an interesting assignment. More importantly, I gained an understanding of basic cloud formations and appreciation for the dynamics of cloud physics. I photographed a memorable image that will be enjoyed by myself and many others. As importantly, I believe I fulfilled the requirements for the assignment and will carry with me the knowledge gained into future assignments.

REFERENCES:

[1] http://en.thinkexist.com/quotes/with/keyword/clouds/3.html. Accessed: February 27, 2006

[2] http://imnh.isu.edu/digitalatlas/clima/imaging/clddev.htm. Accessed: February 27, 2006

[3] http://www.city-data.com/city/Air-Force-Academy-Colorado.html. Accessed: February 27, 2006

[4] http://www.wunderground.com/cgi-bin/findweather/. Accessed: February 27, 2006

[5] http://www.csgnetwork.com/estcloudbasecalc.html. Accessed: February 27, 2006

[6] http://weather.unisys.com/index.html. Accessed: February 27, 2006

[7] http://weather.unisys.com/upper_air/skew/details.html. Accessed: February 27, 2006

[8] http://www.atmos.uiuc.edu/weather/tree/viewer.pl?launch/irslp. Accessed: February 27, 2006

[9] http://www.vivoscuola.it/us/rsigpp3202/umidita/lezioni/form.htm. Accessed: February 27, 2006