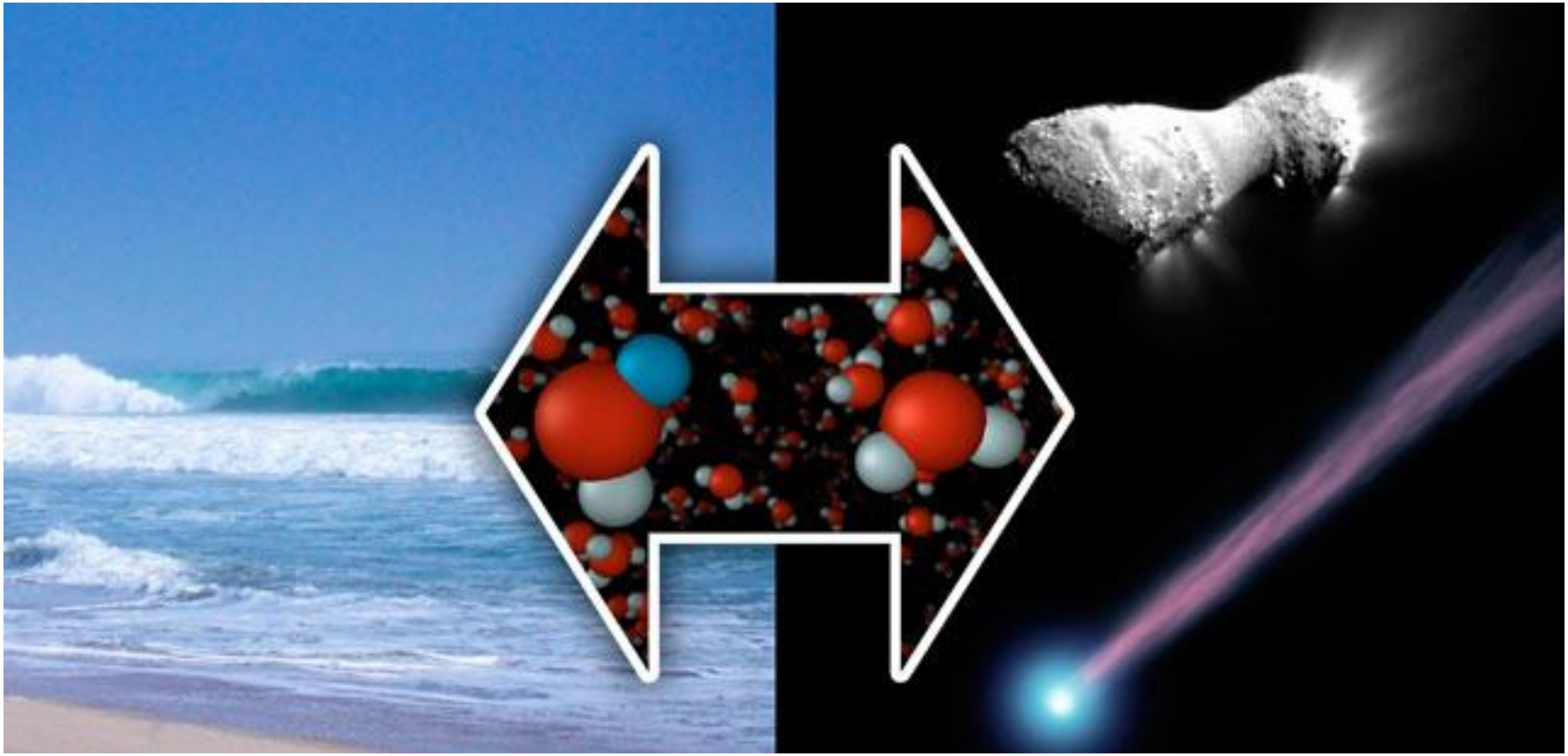
Moisture, Clouds, and Atmospheric Stability

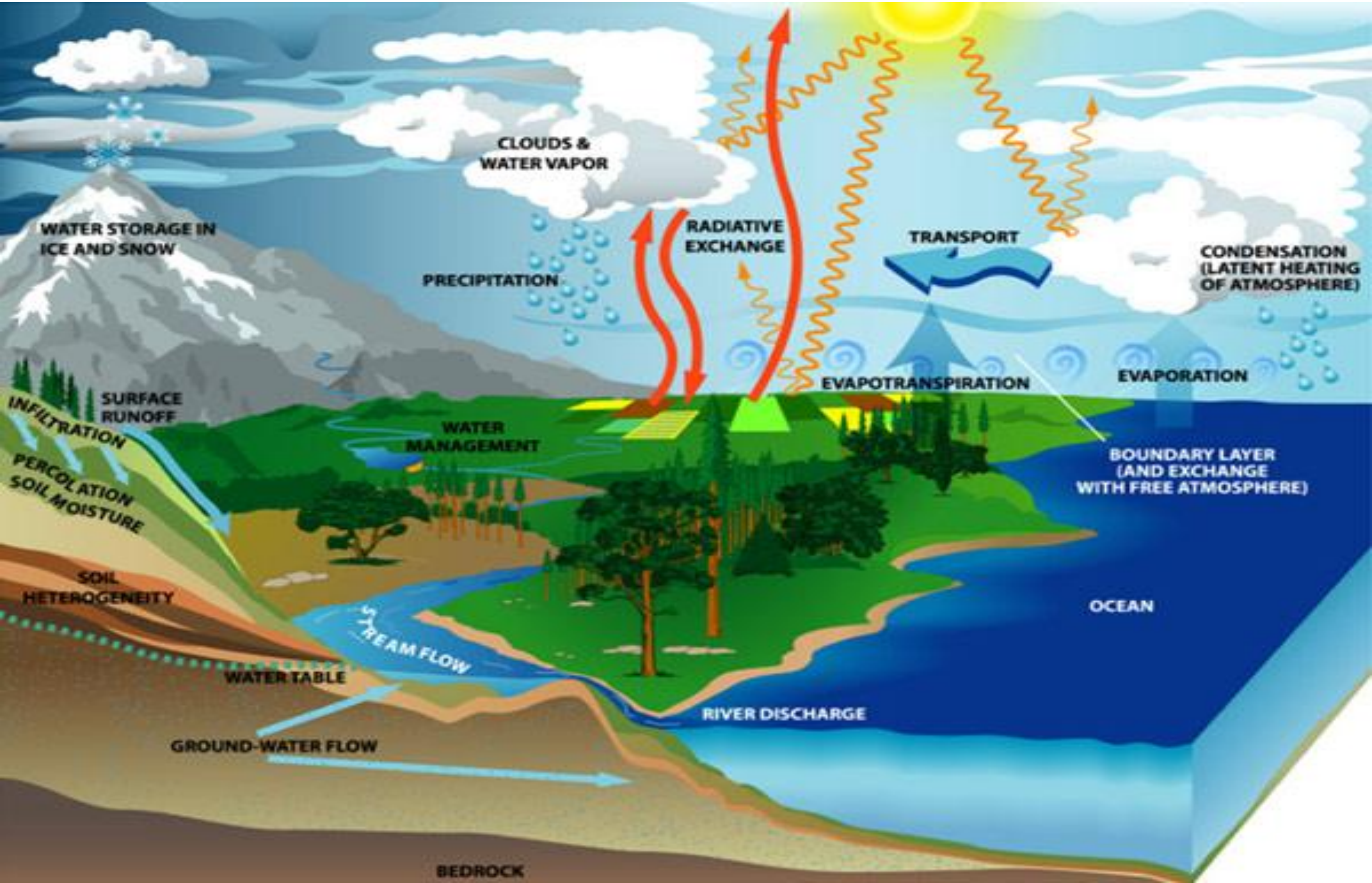
Analyzing the Formation of Clouds and Precipitation

The Origins of Water

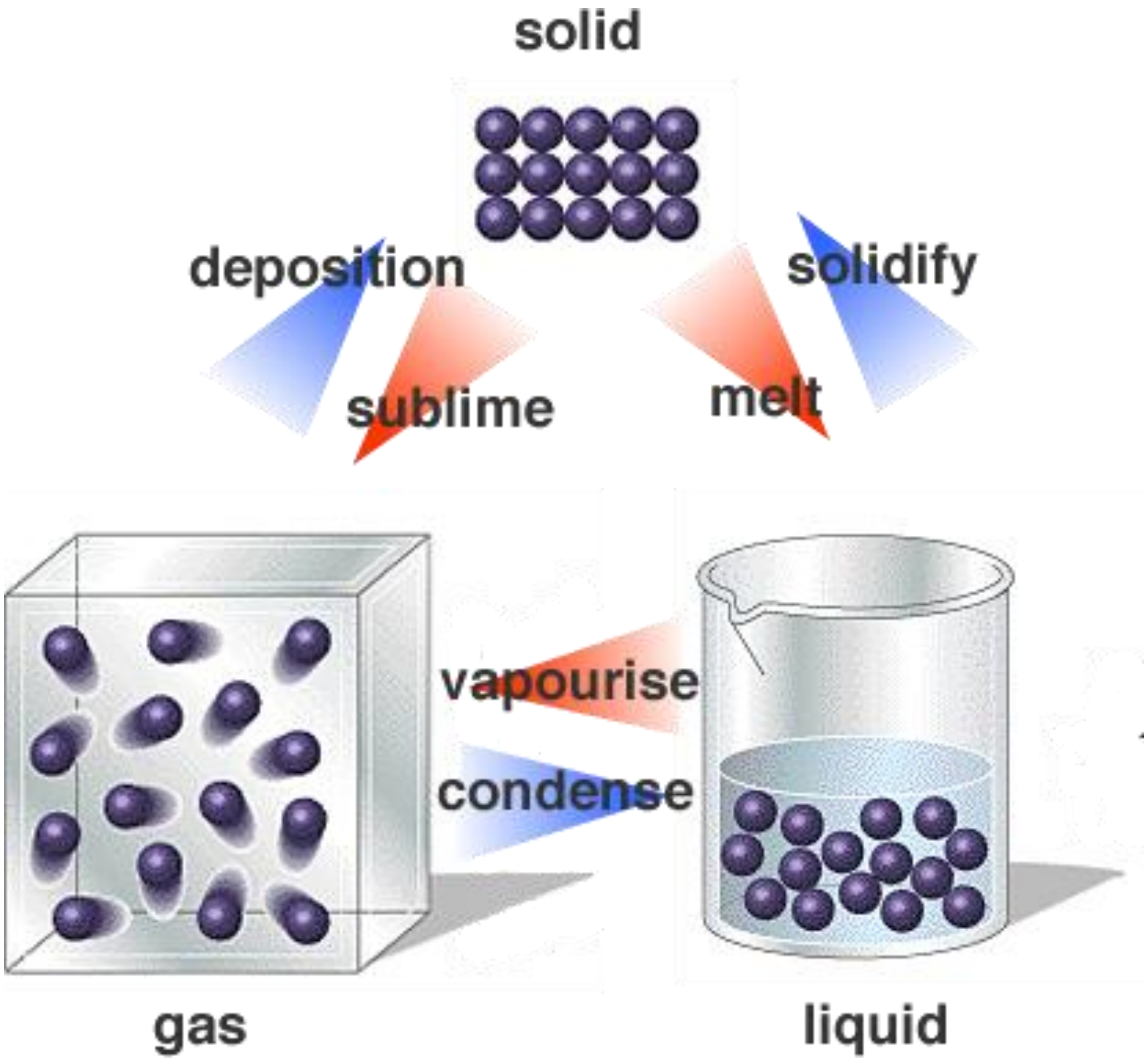


Volcanic eruptions spewed gases from Earth's interior to the atmosphere, a process called ***outgassing*** that continues today. Most of the gas was carbon dioxide and water vapor. ***The water vapor condensed to form part of Earth's oceans*** **as the surface cooled**. ***Comets may also have contributed water*** **and complex organic molecules to Earth's environments**.

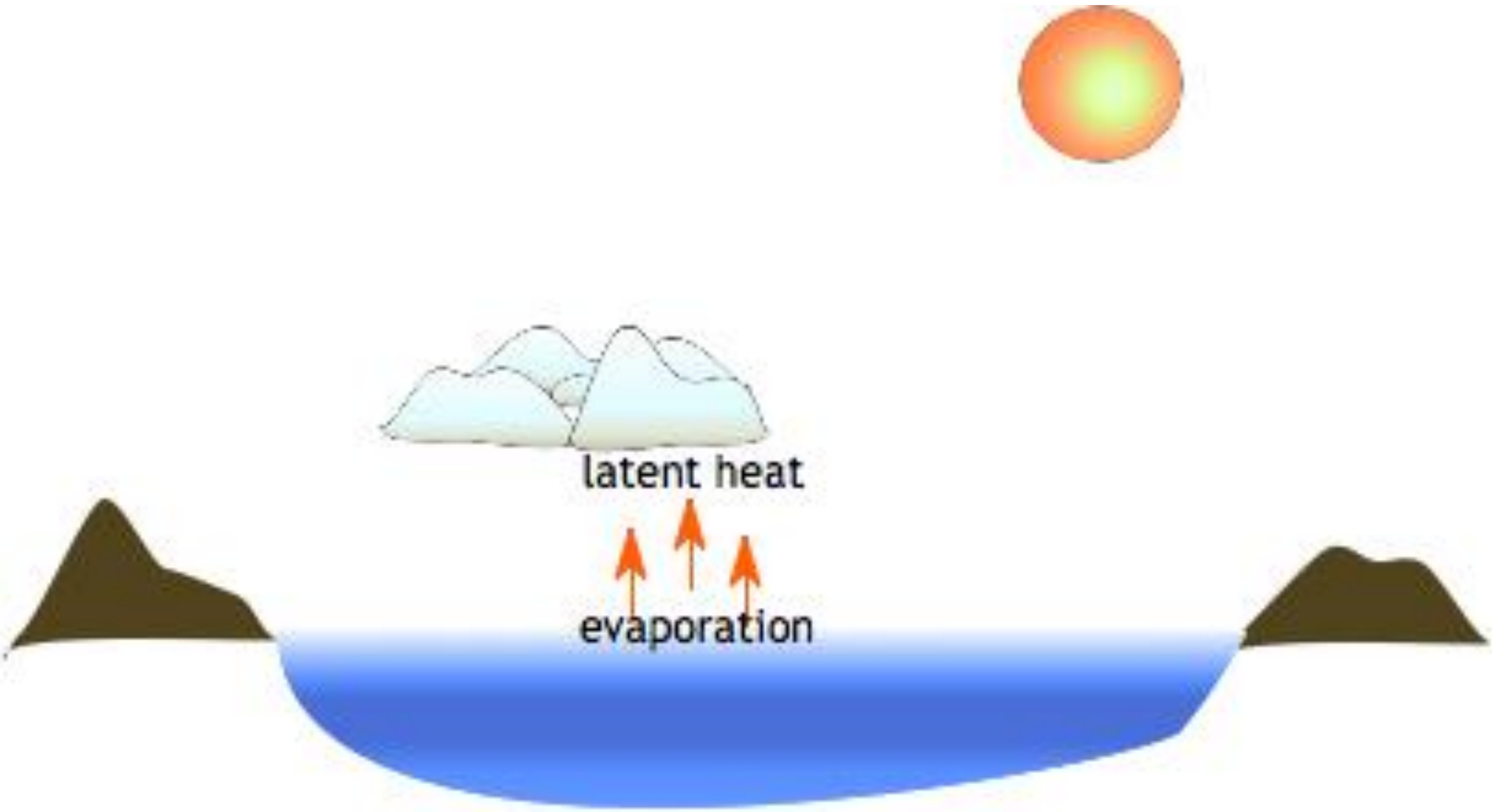
The Hydrologic Cycle



The Phases of Water

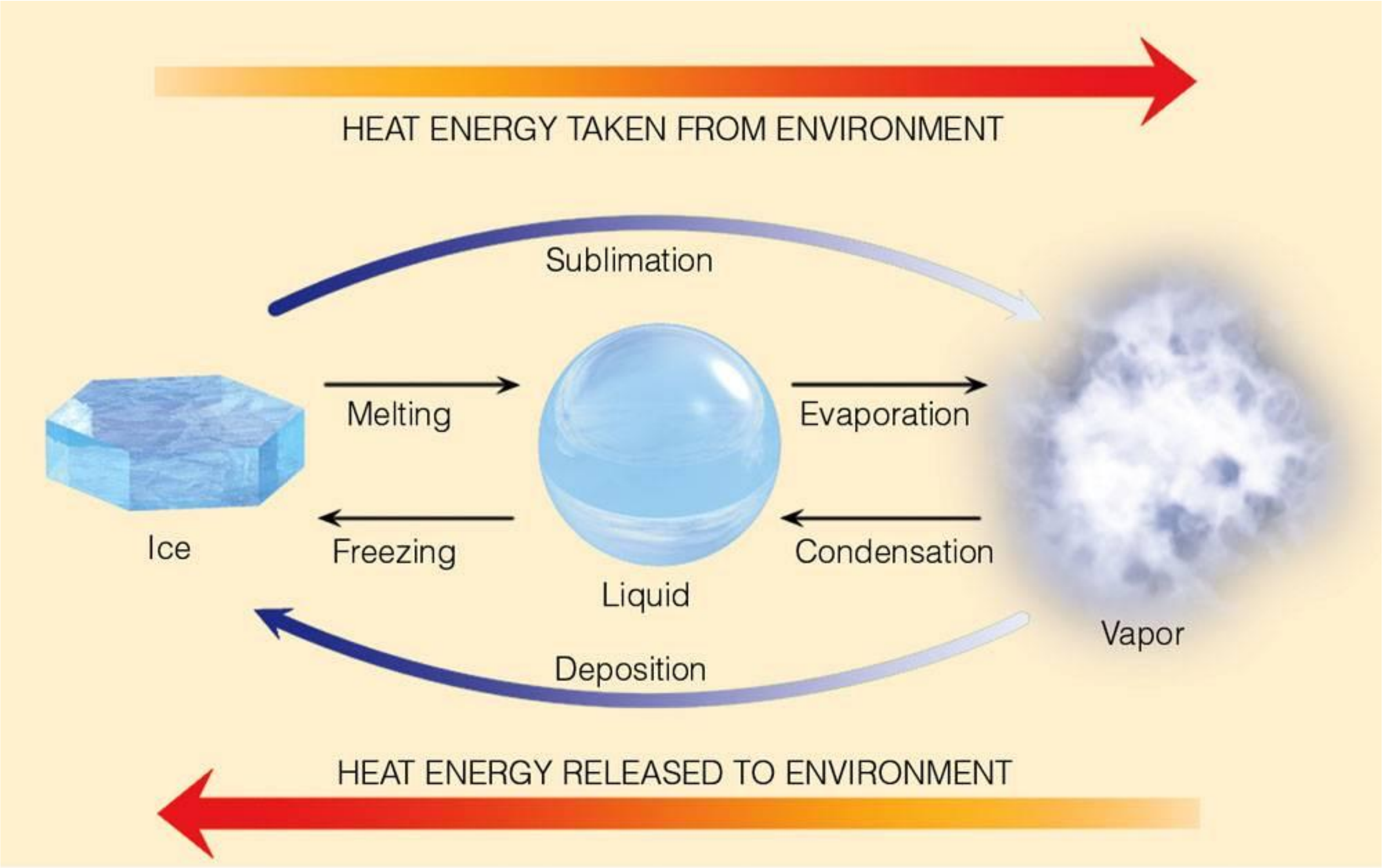


Latent Heat



Latent heat is the heat released or absorbed by a body or a thermodynamic system during a process that occurs <u>without a change in temperature</u>.

Latent Heat Exchanges

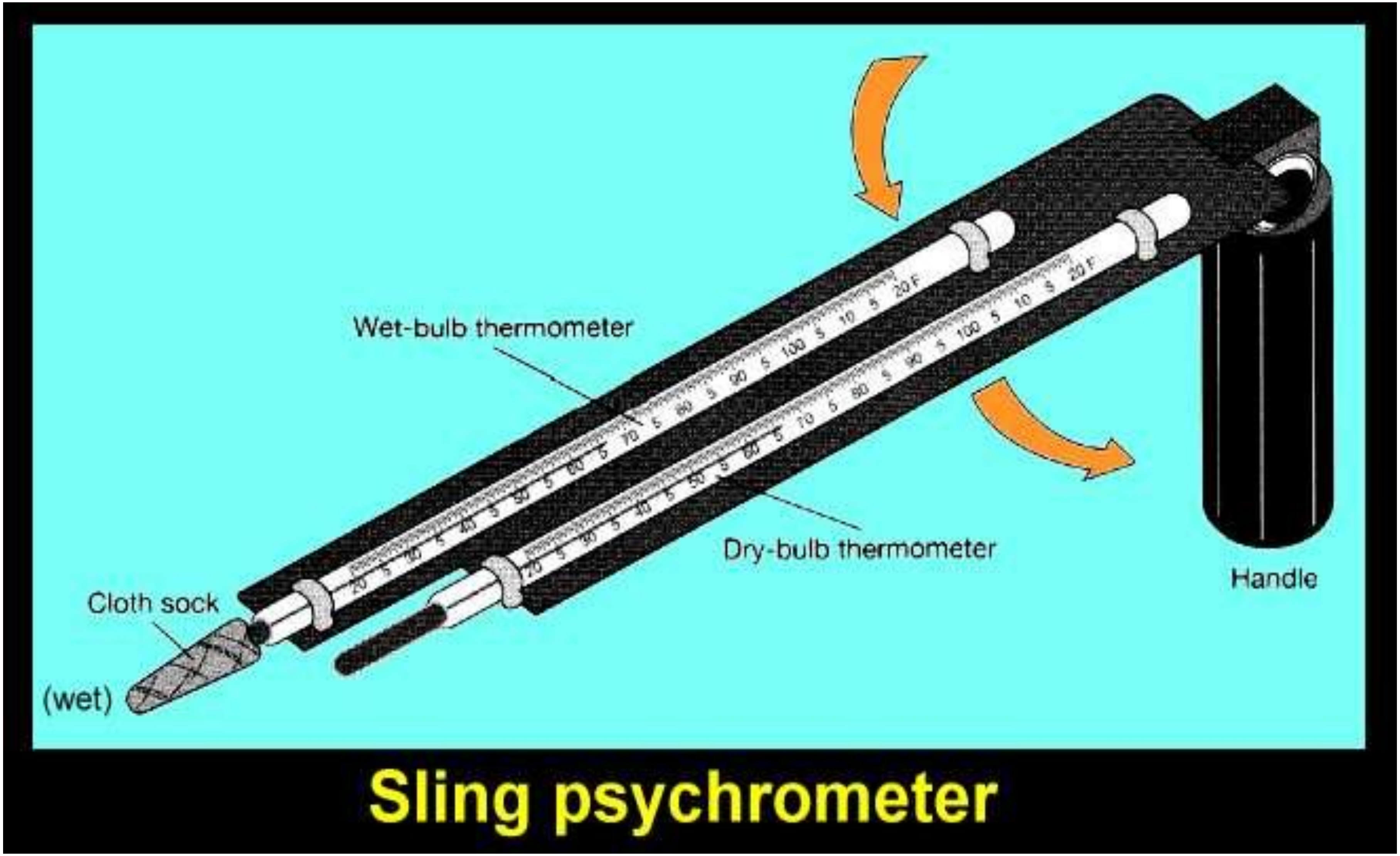


Moisture in the Atmosphere:
Relative Humidity and Dew Point

Relative Humidity

- **Relative Humidity**
  - ***the amount of water vapor in the atmosphere/ amount of water that air can hold at a specific temperature or pressure.*** Determined by the formula: Water vapor content/ water vapor capacity
  - Expressed as a %
  - Changed by
    - Adding water vapor
    - Changing the air temperature
  - Temperature/pressure dependant
  - Measured using a **Sling psychrometer or hygrometer**

Measuring the RH%: The Sling Psychrometer

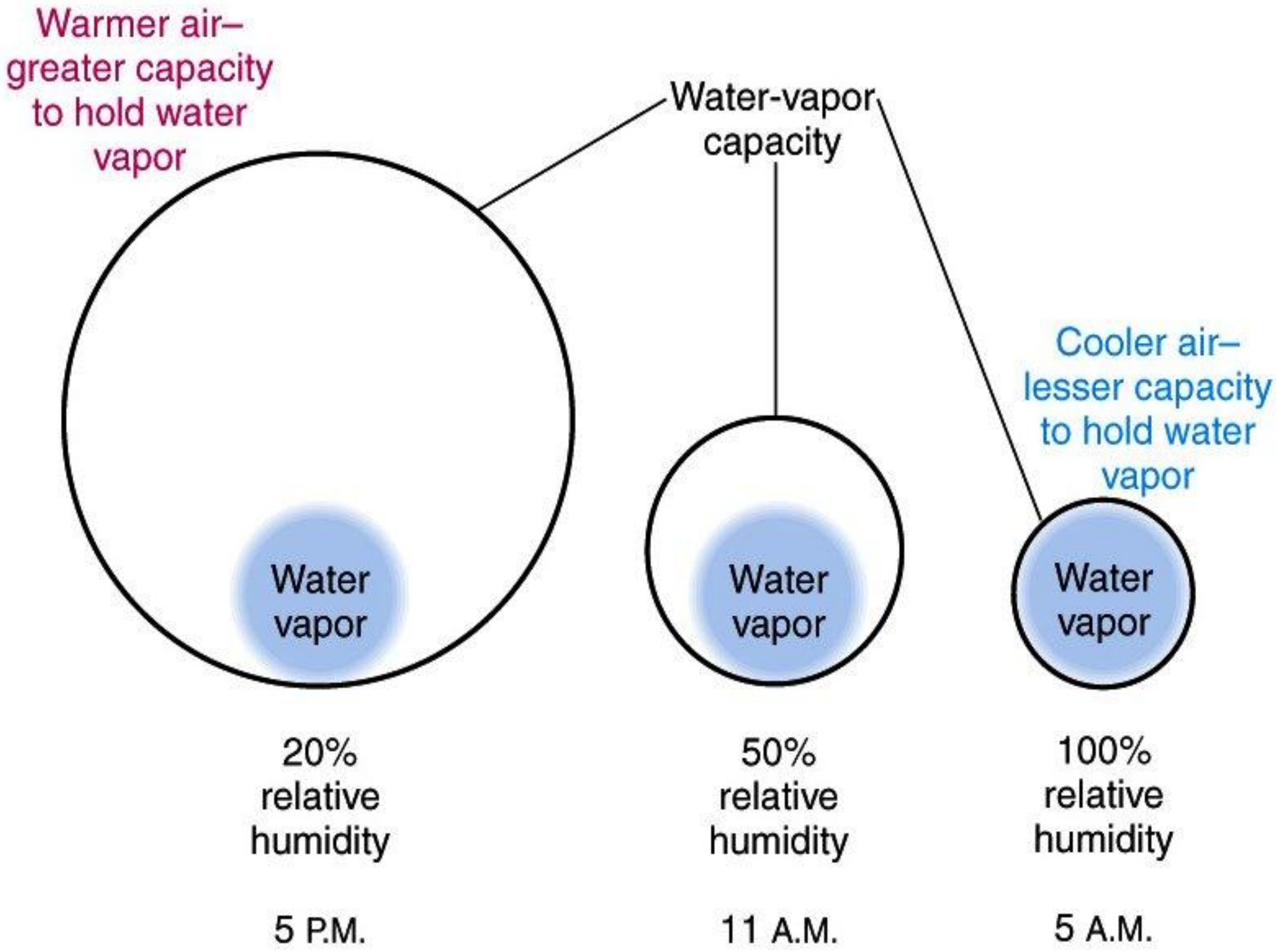


Determining Relative Humidity

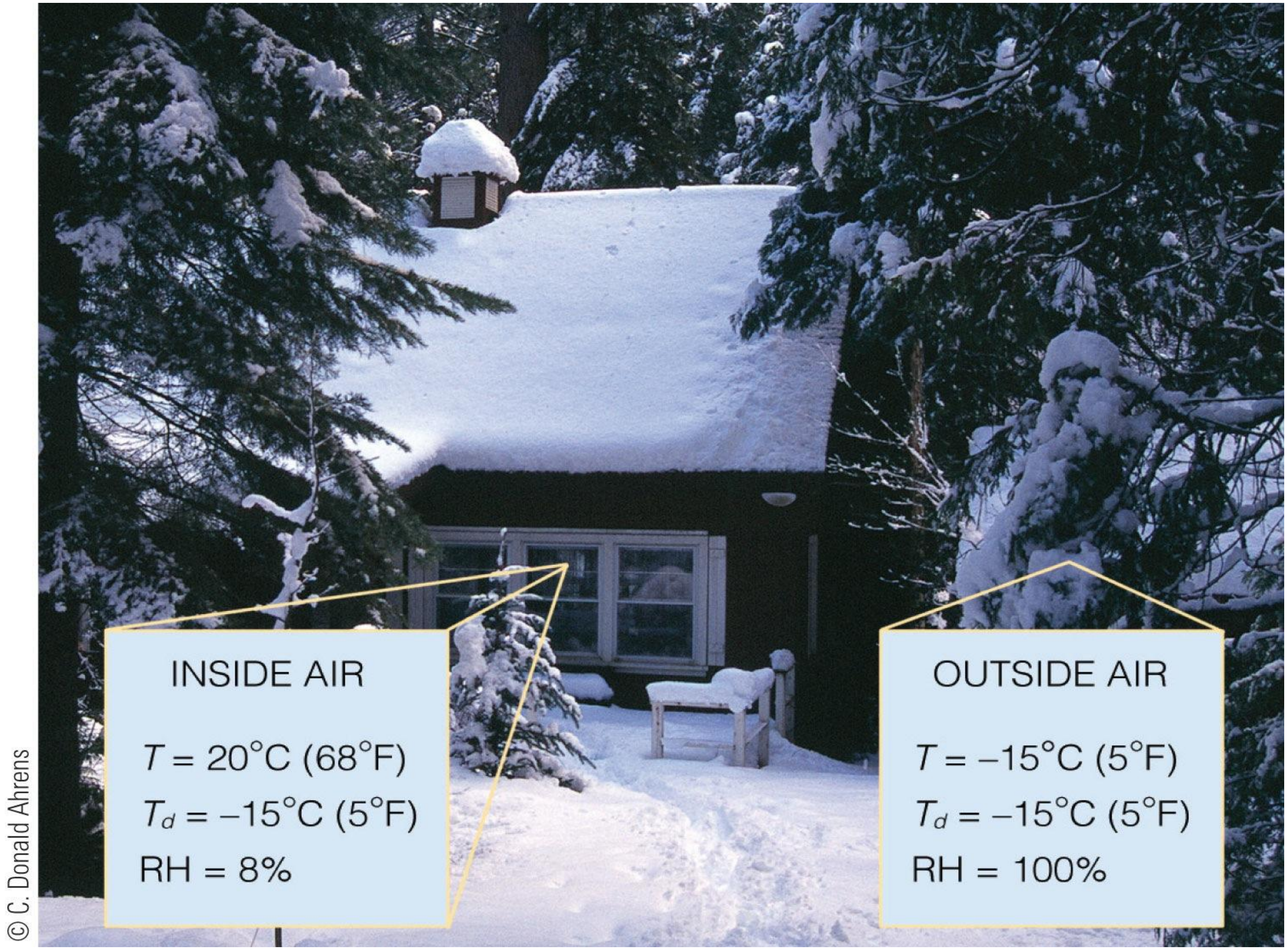
Relative Humidity (%)

Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
−20	100	28														
−18	100	40														
−16	100	48														
−14	100	55	11													
−12	100	61	23													
−10	100	66	33													
−8	100	71	41	13												
−6	100	73	48	20												
−4	100	77	54	32	11											
−2	100	79	58	37	20	1										
0	100	81	63	45	28	11										
2	100	83	67	51	36	20	6									
4	100	85	70	56	42	27	14									
6	100	86	72	59	46	35	22	10								
8	100	87	74	62	51	39	28	17	6							
10	100	88	76	65	54	43	33	24	13	4						
12	100	88	78	67	57	48	38	28	19	10	2					
14	100	89	79	69	60	50	41	33	25	16	8	1				
16	100	90	80	71	62	54	45	37	29	21	14	7	1			
18	100	91	81	72	64	56	48	40	33	26	19	12	6			
20	100	91	82	74	66	58	51	44	36	30	23	17	11	5		
22	100	92	83	75	68	60	53	46	40	33	27	21	15	10	4	
24	100	92	84	76	69	62	55	49	42	36	30	25	20	14	9	4
26	100	92	85	77	70	64	57	51	45	39	34	28	23	18	13	9
28	100	93	86	78	71	65	59	53	47	42	36	31	26	21	17	12
30	100	93	86	79	72	66	61	55	49	44	39	34	29	25	20	16

Relative Humidity and Temperature



Relative Humidity and Temperature



When outside air with an air temperature–15C (5˚ F) is brought indoors and heated to a temperature of 20C (68˚ F) (without adding water vapor to the air), the relative humidity drops to 8 percent, placing adverse stress on plants, animals, and humans living inside. (T represents temperature; Td, dew point; and RH, relative humidity.)

Relative Humidity and Human Discomfort

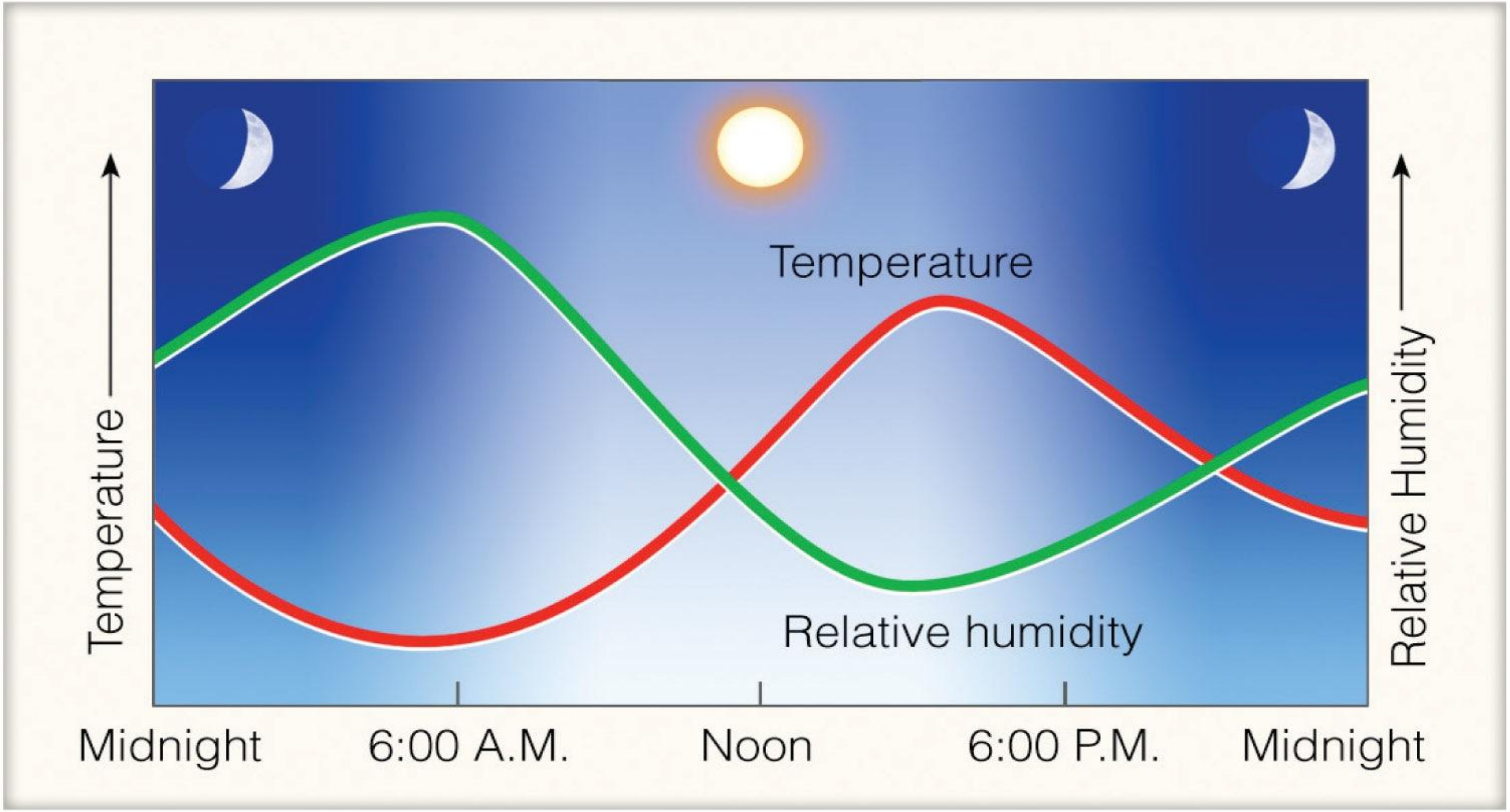
Relative humidity (%)

Temperature (°F)	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
120	130	138	148														
118	126	134	142														
116	122	129	137	146													
114	119	125	132	140	148												
112	116	121	127	134	142	150											
110	112	117	122	129	136	143											
108	109	113	118	123	130	137	144										
106	106	109	114	119	124	130	137	145									
104	103	106	110	114	119	124	131	137	145								
102	100	103	106	110	114	119	124	130	137	144							
100	97	100	102	106	109	114	118	124	129	136	143	150					
98	95	97	99	102	105	109	113	117	123	128	134	141	148				
96	93	94	96	98	101	104	108	112	116	121	126	132	138	145			
94	90	91	93	95	97	100	103	106	110	114	119	124	129	135	141	148	
92	88	89	90	92	94	96	99	101	105	108	112	116	121	126	131	137	143
90	86	87	88	89	91	92	95	97	100	103	106	109	113	117	122	127	132
88	85	85	86	87	88	89	91	93	95	98	100	103	106	110	113	117	121
86	83	83	84	85	85	87	88	89	91	93	95	97	100	102	105	109	112
84	81	82	82	83	83	84	85	86	88	89	90	92	94	96	98	101	104
82	80	80	80	81	81	82	83	84	84	85	86	88	89	90	92	94	96
80	79	79	79	80	80	80	81	81	82	82	83	84	84	85	86	88	89

Possible heat-related risks
Extreme danger Heatstroke or sunstroke highly likely
Danger Sunstroke muscle cramps and/or heat exhaustion likely
Extreme Caution Sunstroke muscle cramps and/or heat exhaustion possible
Caution Fatigue possible

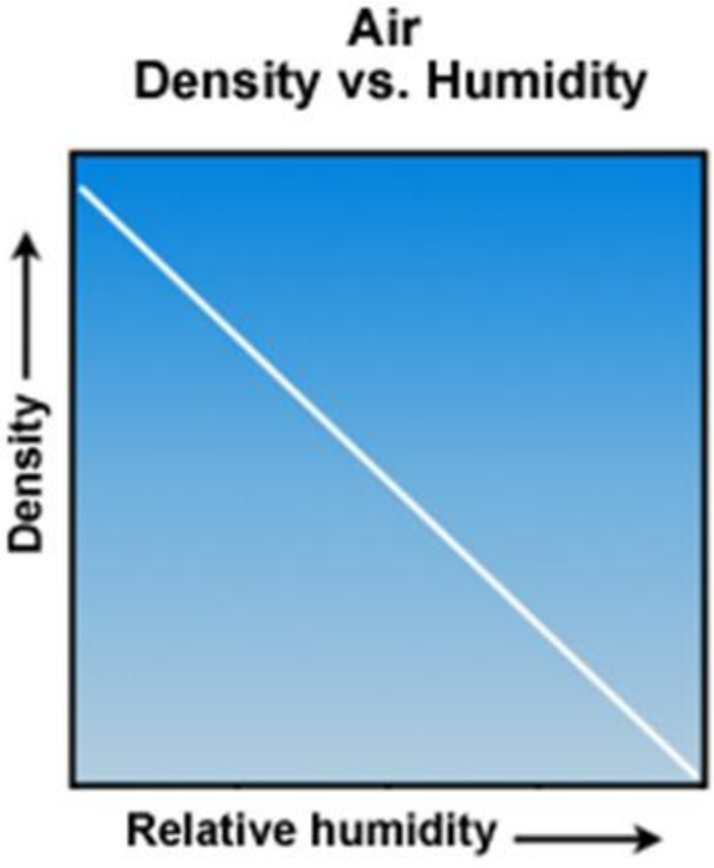
Air temperature (˚ F) and relative humidity are combined to determine an apparent temperature or heat index (HI). An air temperature of 96˚ F with a relative humidity of 55 percent produces an apparent temperature (HI) of 112˚ F.

The Daily Cycle of Humidity



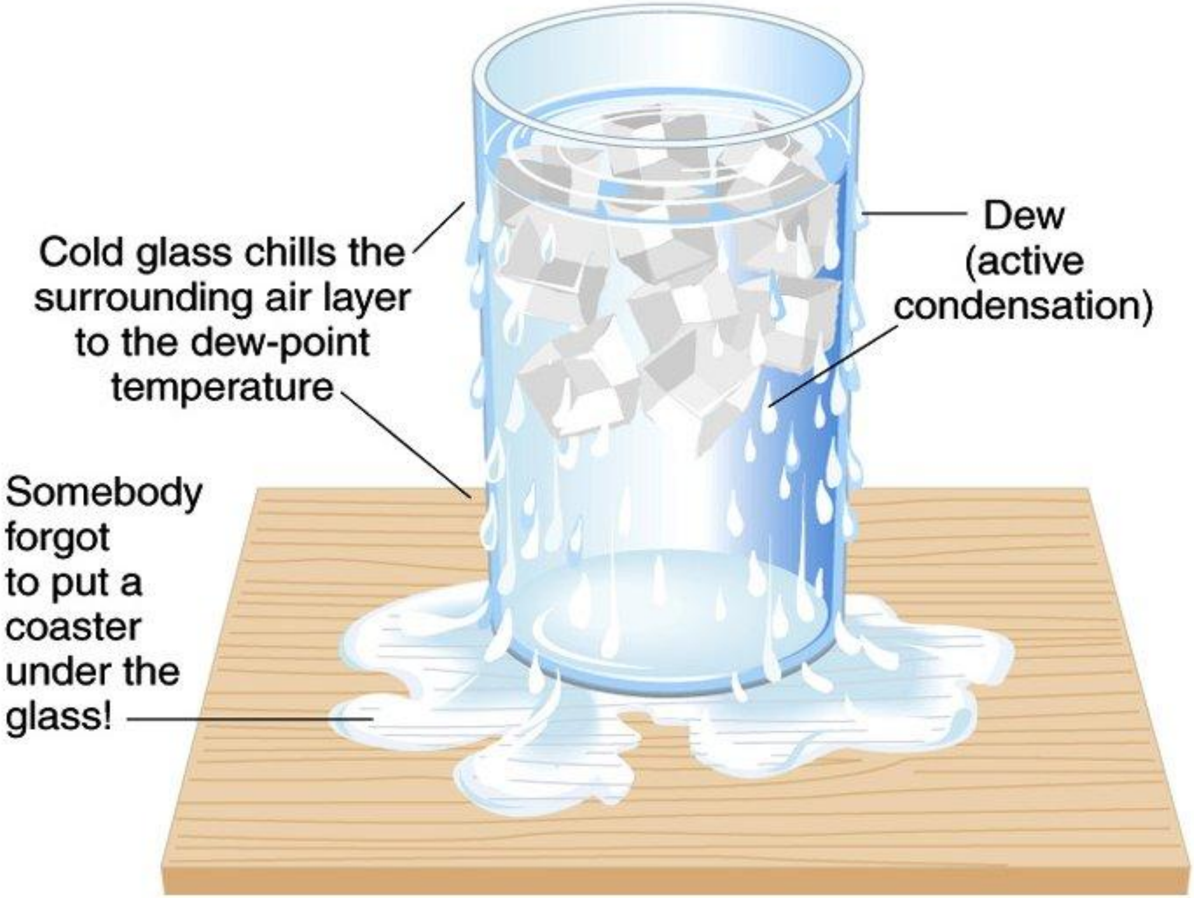
When the air is cool (morning), the relative humidity is high. When the air is warm (afternoon), the relative humidity is low. These conditions exist in clear weather when the air is calm or of constant wind speed.

Air Density and Humidity



As the humidity increases in a parcel of air, the density decreases making the parcel more bouyant and wanting to rise.

The Dew Point Temperature



-expressed as a temperature (T_d)

- ***represents the temperature at which air would have to be cooled (with no change in pressure or moisture content) for saturation to occur and water vapor to condense***

-Temperature/Pressure dependant as well

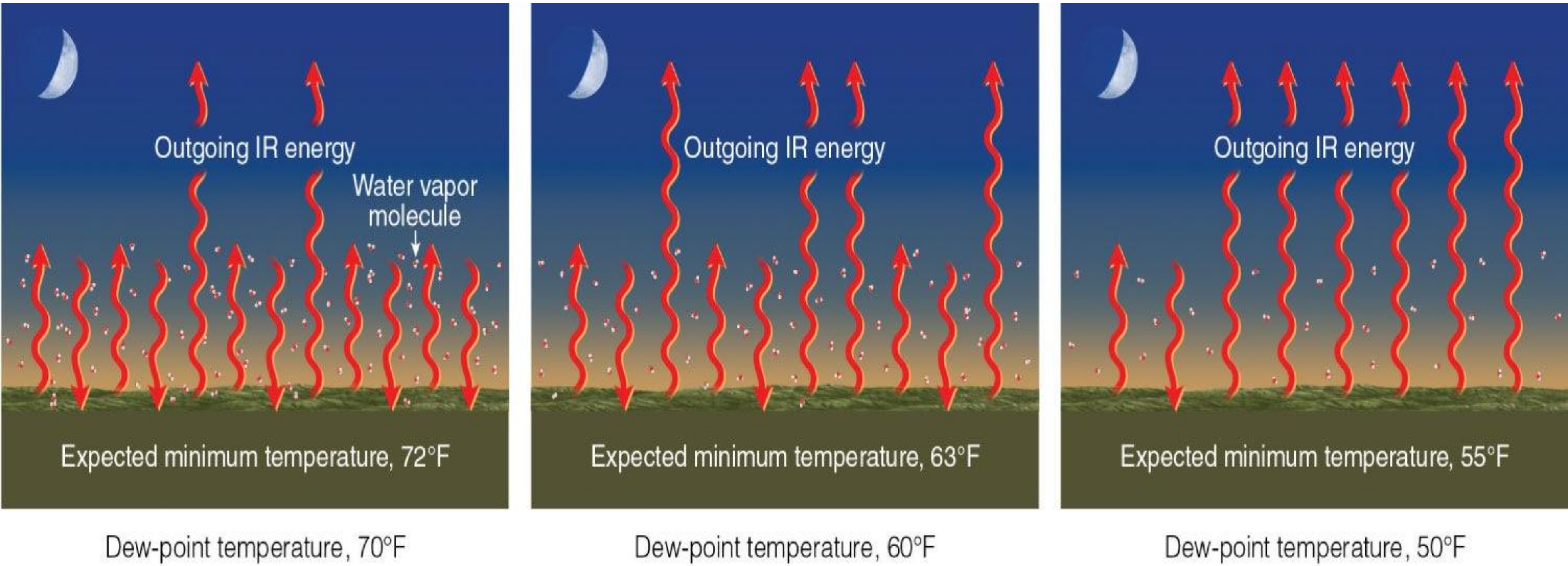
-Also measured using a sling psychrometer or hydrometer

Determining Dew Point

Dewpoint Temperatures (°C)

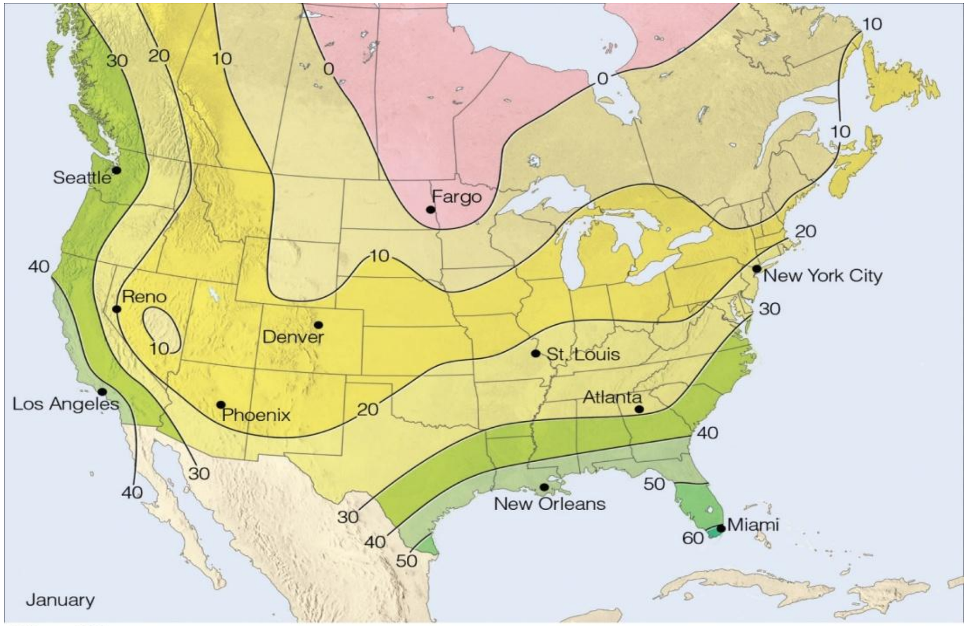
Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
−20	−20	−33														
−18	−18	−28														
−16	−16	−24														
−14	−14	−21	−36													
−12	−12	−18	−28													
−10	−10	−14	−22													
−8	−8	−12	−18	−29												
−6	−6	−10	−14	−22												
−4	−4	−7	−12	−17	−29											
−2	−2	−5	−8	−13	−20											
0	0	−3	−6	−9	−15	−24										
2	2	−1	−3	−6	−11	−17										
4	4	1	−1	−4	−7	−11	−19									
6	6	4	1	−1	−4	−7	−13	−21								
8	8	6	3	1	−2	−5	−9	−14								
10	10	8	6	4	1	−2	−5	−9	−14	−28						
12	12	10	8	6	4	1	−2	−5	−9	−16						
14	14	12	11	9	6	4	1	−2	−5	−10	−17					
16	16	14	13	11	9	7	4	1	−1	−6	−10	−17				
18	18	16	15	13	11	9	7	4	2	−2	−5	−10	−19			
20	20	19	17	15	14	12	10	7	4	2	−2	−5	−10	−19		
22	22	21	19	17	16	14	12	10	8	5	3	−1	−5	−10	−19	
24	24	23	21	20	18	16	14	12	10	8	6	2	−1	−5	−10	−18
26	26	25	23	22	20	18	17	15	13	11	9	6	3	0	−4	−9
28	28	27	25	24	22	21	19	17	16	14	11	9	7	4	1	−3
30	30	29	27	26	24	23	21	19	18	16	14	12	10	8	5	1

Dew Points and Nighttime Temperatures



On a calm, clear night, the lower the dew-point temperature, the lower the expected minimum temperature. With the same initial evening air temperature (80ºF) and with no change in weather conditions during the night, as the dew point lowers, the expected mini-mum temperature lowers. This situation occurs because a lower dew point means that there is less water vapor in the air to absorb and radiate infrared energy back to the surface. More infrared energy from the surface is able to escape into space, producing more rapid radiational cooling at the surface. (Dots in each diagram represent the amount of water vapor in the air. Red wavy arrows represent infrared (IR) radiation.)

Isodrosotherms



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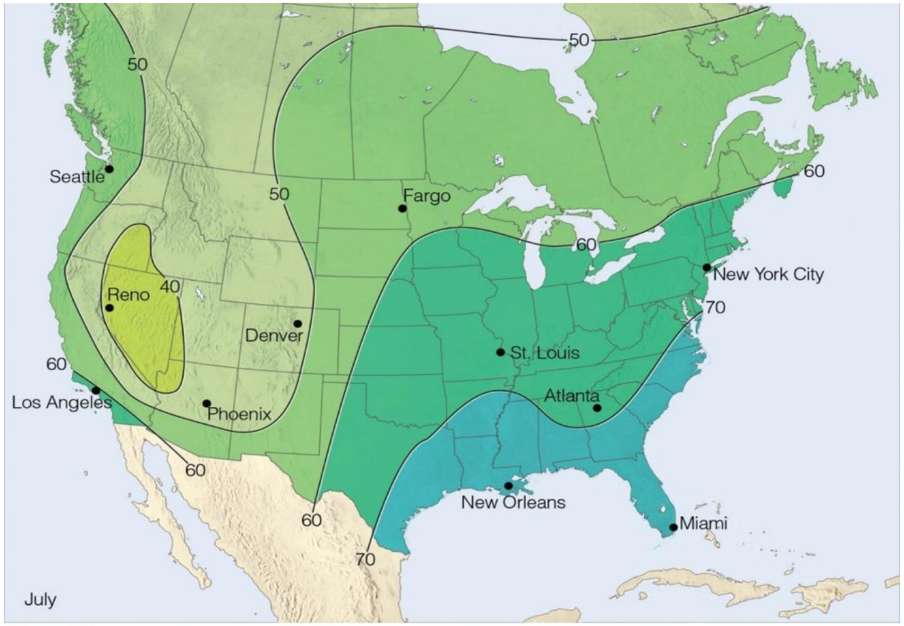

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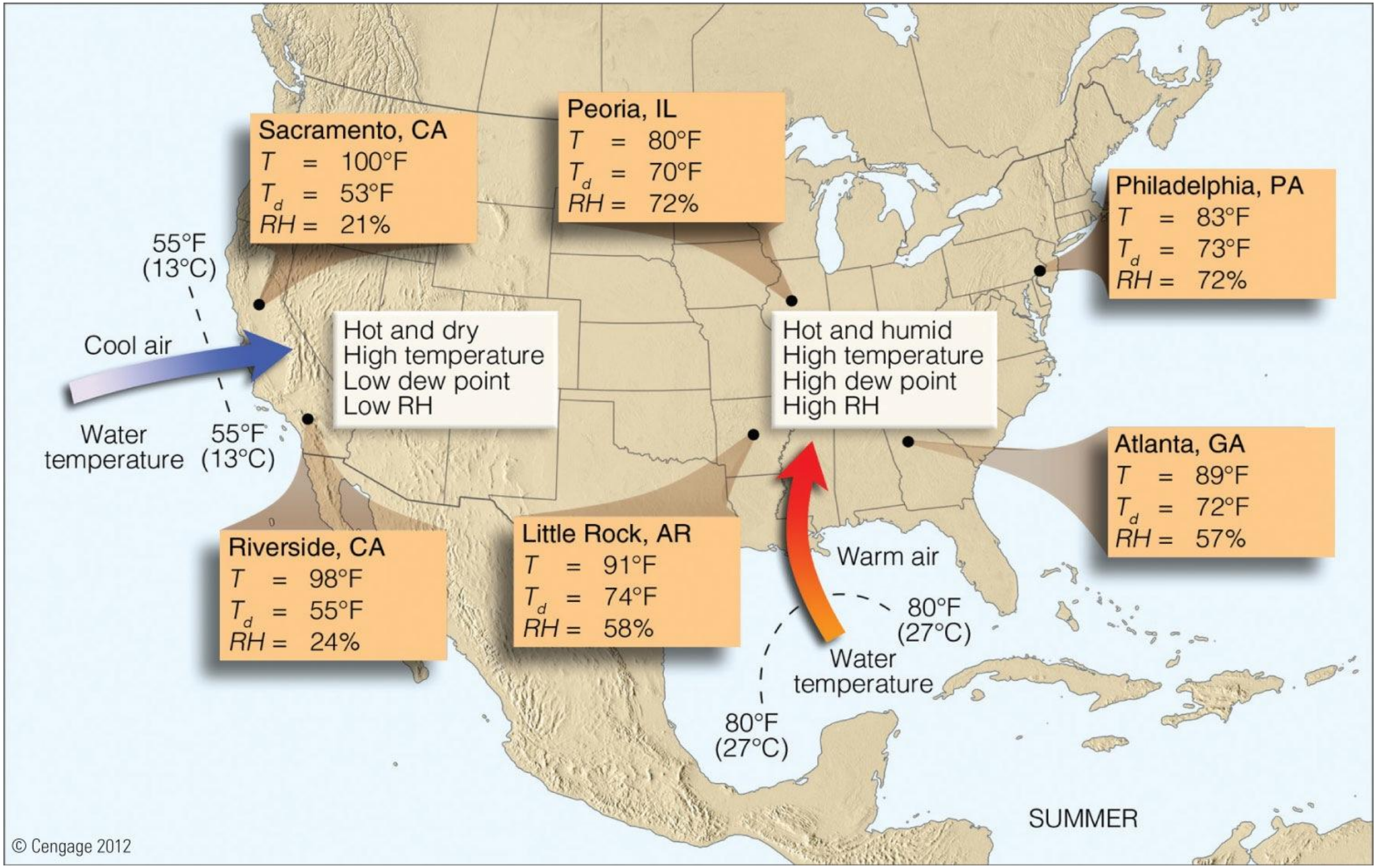
Average surface dew-point temperatures (ºF) across the United States and Canada for January.

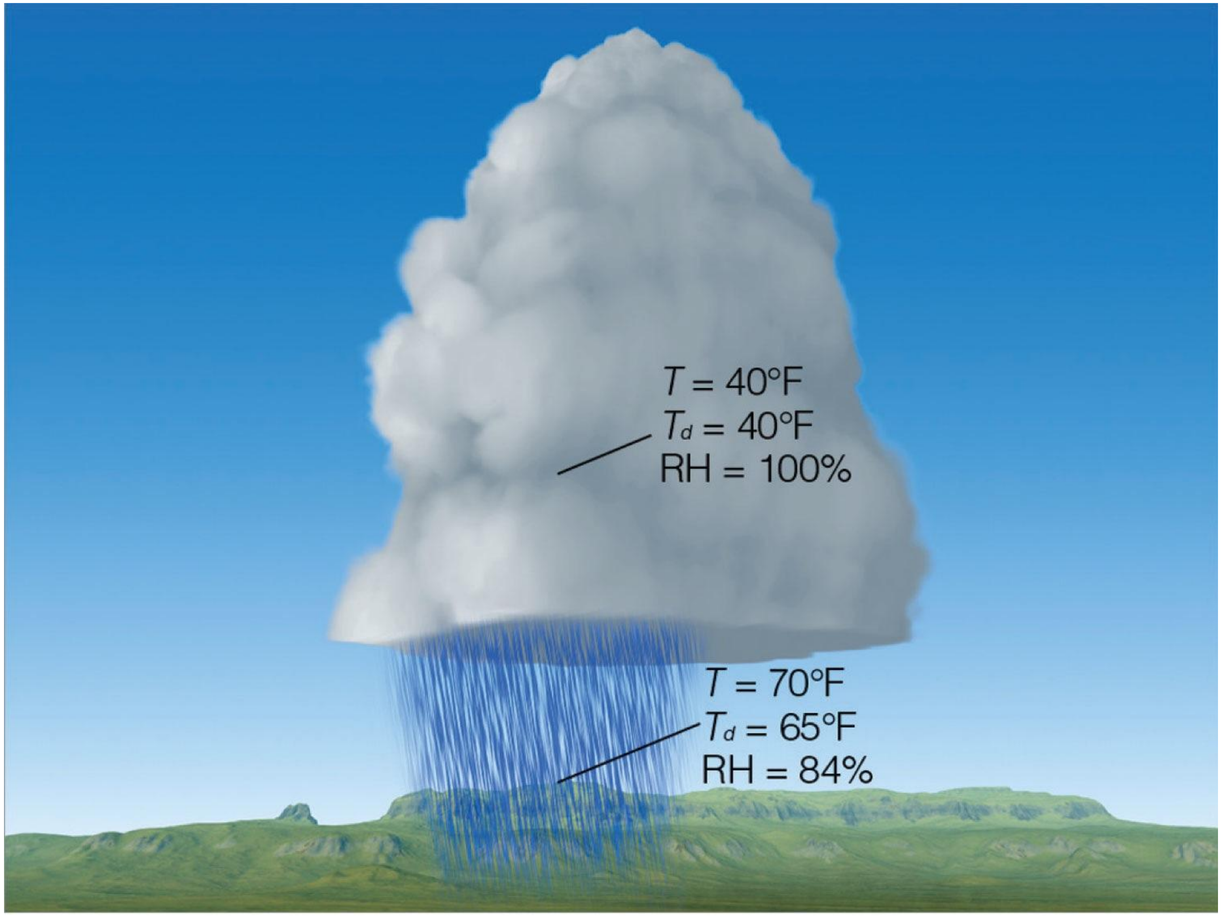
Average surface dew-point temperatures across the United States and Canada (° F) for July.

Relative Humidity, Dew Points, and the Station Model



Air from the Pacific Ocean is hot and dry over land, whereas air from the Gulf of Mexico is hot and muggy over land. For each city, T represents the air tempera-ture, Td the dew point, and RH the relative humidity. (All data represent conditions during a July afternoon at 3 p.m. local time.)

Relative Humidity, Dew Point, and Precipitation



Inside the cloud the air temperature (T) and dew point (Td) are the same, the air is saturated, and the relative humidity (RH) is 100 percent. However, at the surface where the air temperature and dew point are not the same, the air is not saturated (even though it is raining), and the relative humidity is considerably less than 100 percent.

Dew and Frost

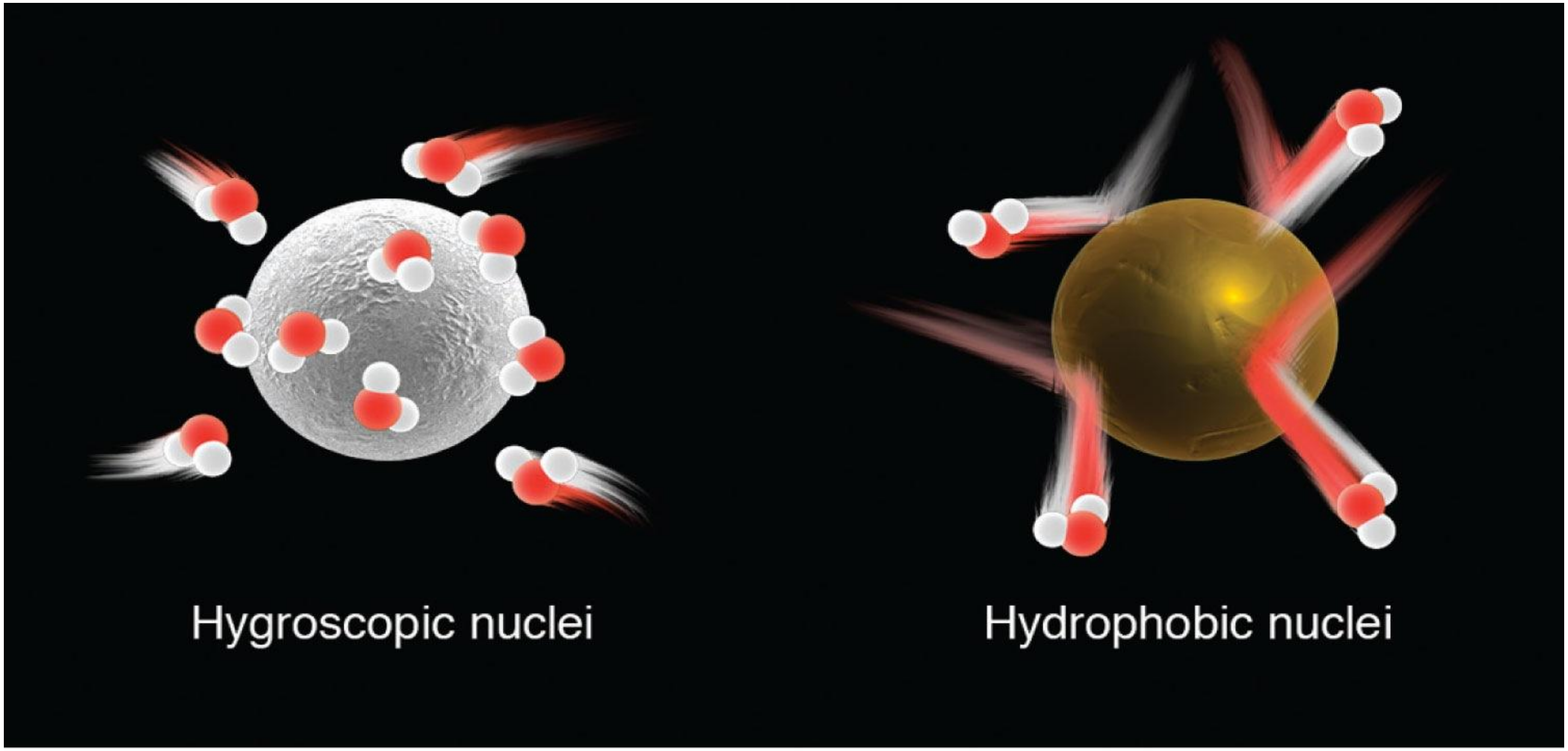
- ***Dew*** forms on objects near the ground surface when they cool below the dew point temperature.
  - More likely on clear nights due to increased radiative cooling
- ***White frost*** forms when temperature cools below the dew point and the dew point is below 0° C

The Basics of Cloud Formation

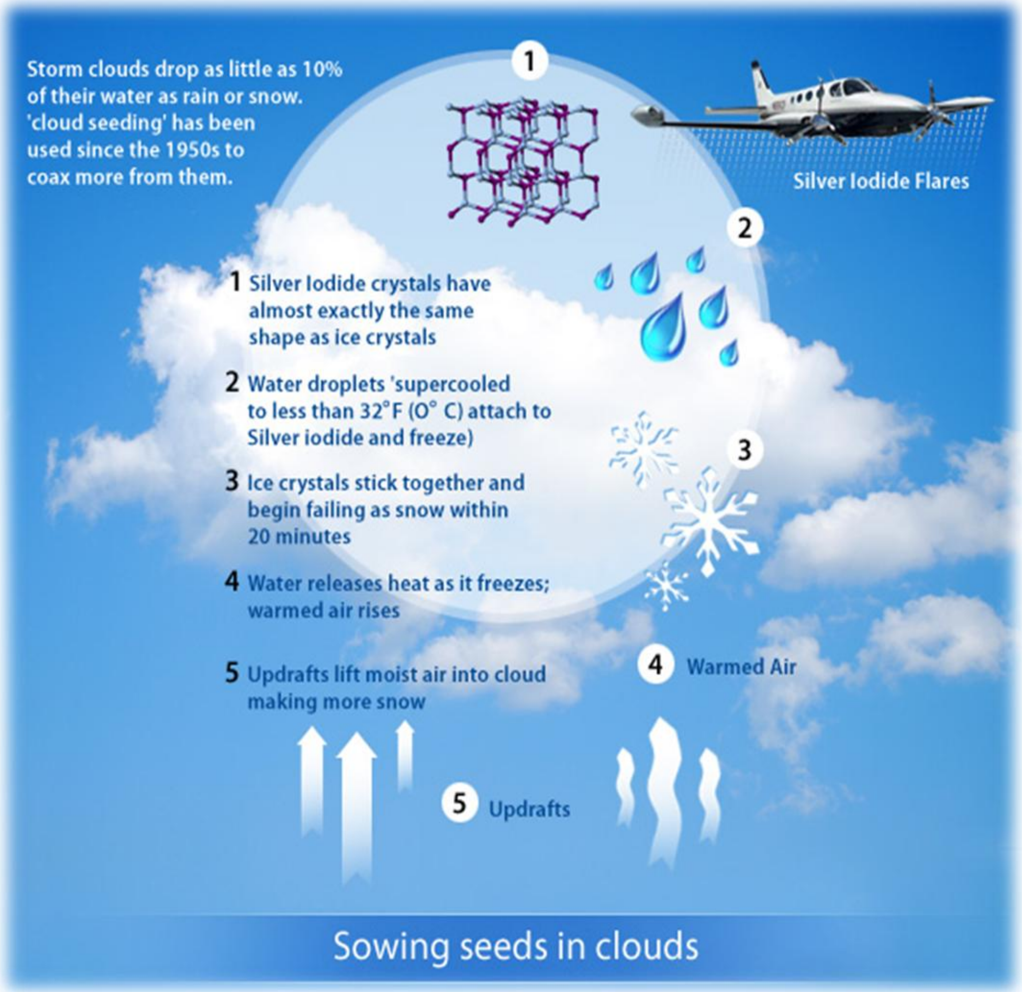
Conditions for Cloud Formation

for clouds to form there are three (3) criteria necessary…
a) ***Moist air*** b) ***a condensation nuclei*** and c) a ***lifting mechanism***

Condensation Nuclei



Hygroscopic nuclei are "water-seeking," and water vapor rapidly condenses on their surfaces. Hydrophobic nuclei are "water-repelling" and resist condensation.

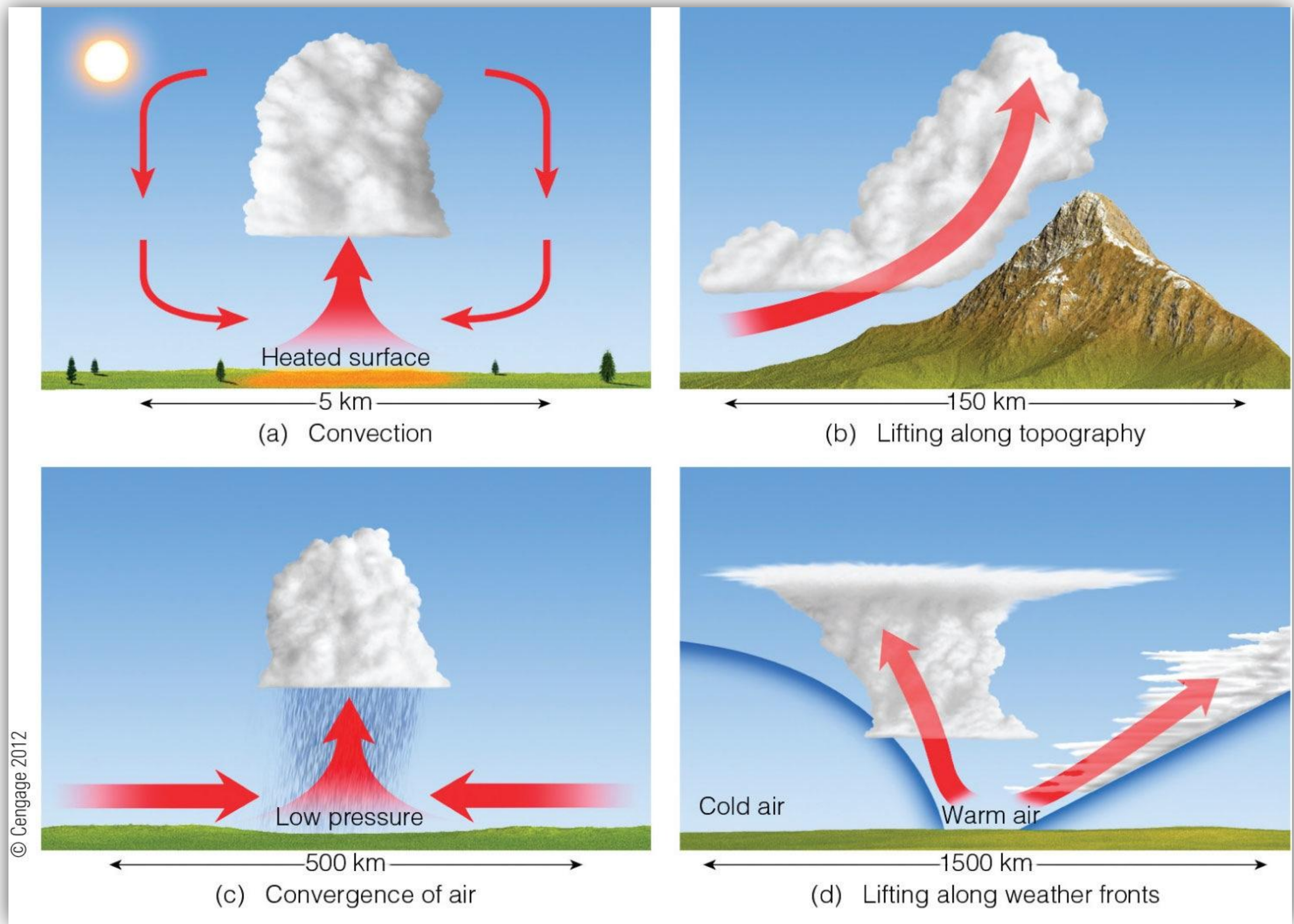


Cloud Seeding/Dispersion of silver iodide

Nearly a century ago it was discovered that the atmosphere contains particles that have an affinity for water. These serve as centers for condensation. They are called **Cloud Condensation Nuclei (CCN).** With CCN, we need much smaller supersaturations (RH >100%). In nature we find supersaturations on the order of 1.5%.The atmosphere has plenty of CCN: Dust, Salt Spray from Oceans, Volcanoes, Sulfate Particles from Phytoplankton, Forest Fires Trees, Anthropogenic Origins

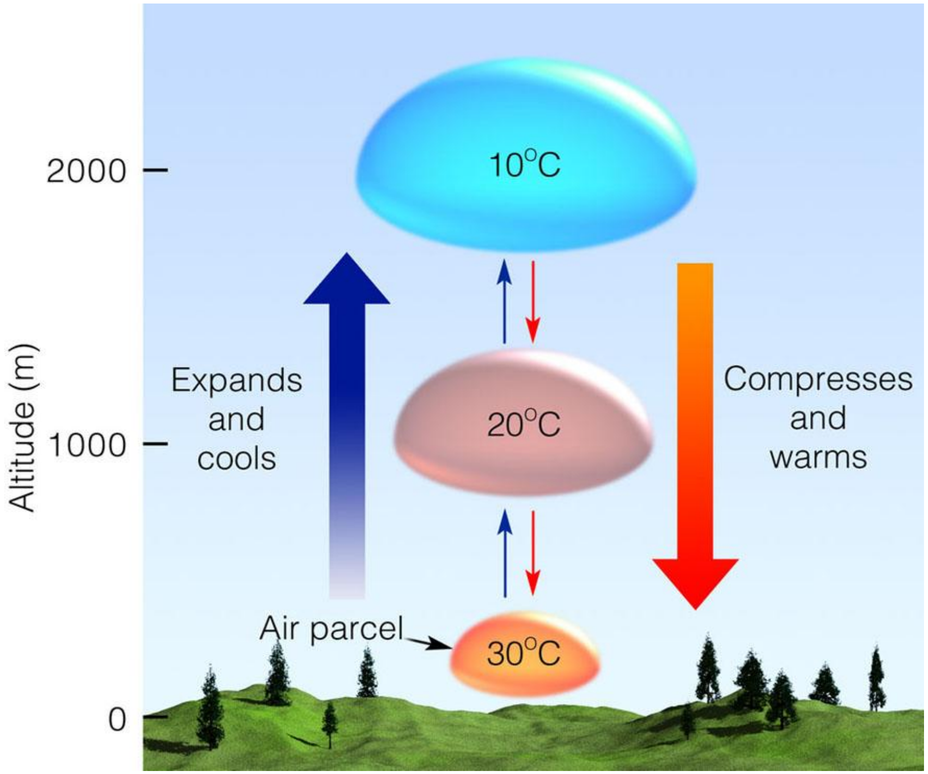
Cloud Formation Mechanisms- Lifting Mechanisms

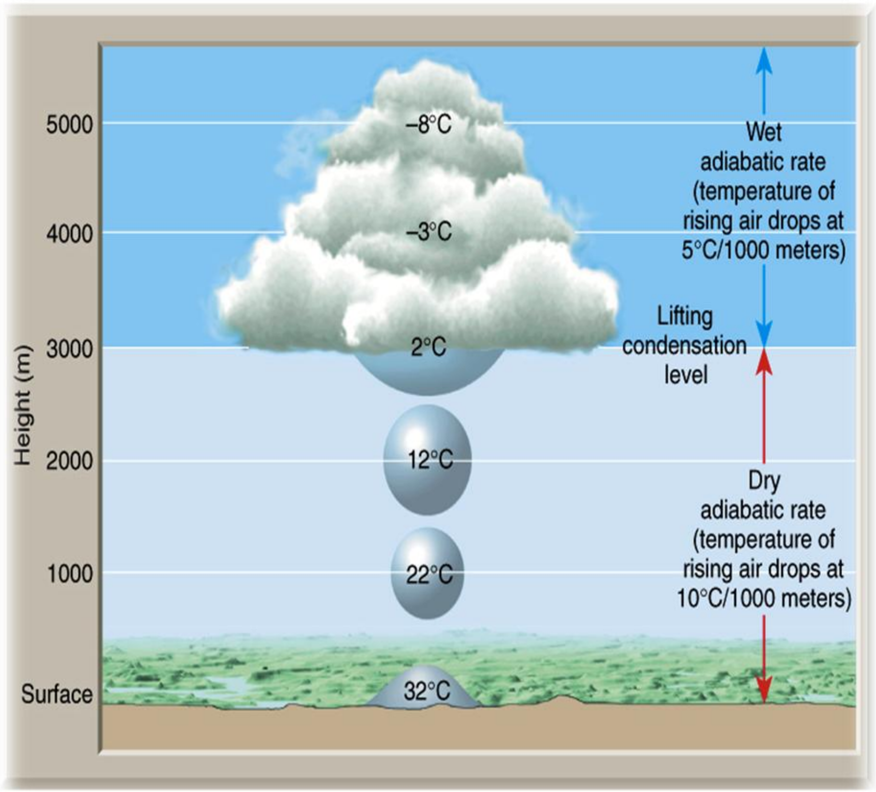
……can be anything that lifts air to cause condensation occur.



Cloud Formation Mechanisms- Adiabatic Lapse Rates

An **adiabatic process** is any process occurring without gain or loss of heat within a system (i.e. during the process the system is thermodynamically isolated- there is no heat transfer with the surroundings).





As air ascends upwards through the atmosphere, pressure decreases and therefore, temperature decreases at the following rates:

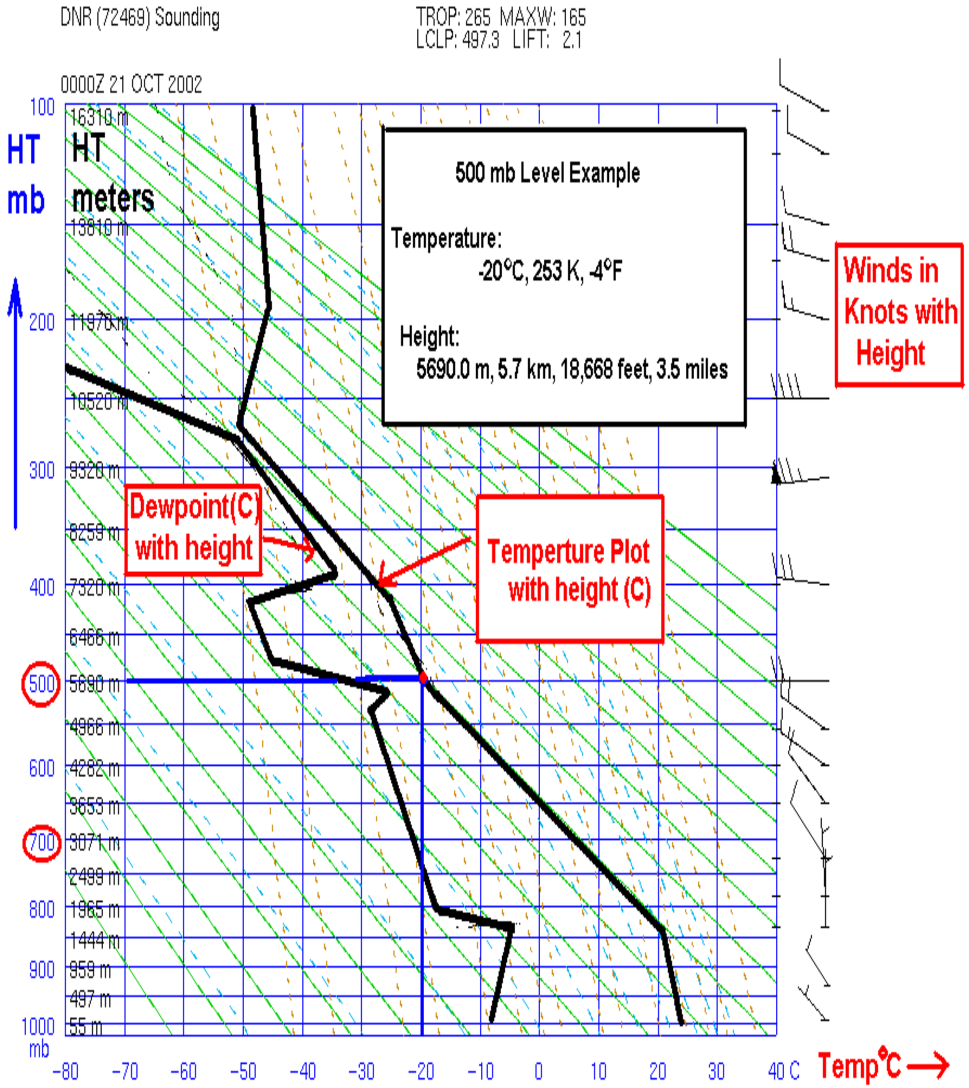
Dry Adiab. Rate (DAR)- 10C/km

Wet Adiab. Rate (WAR)-5-9C/km

Dew pt. Lapse Rate (DLR)- 2C/km

Enviro. Lapse Rate (ELR)- 6.5C/km

Obtaining Upper Atmospheric Data



Stuve diagrams are charts used to analyze upper atmospheric conditions

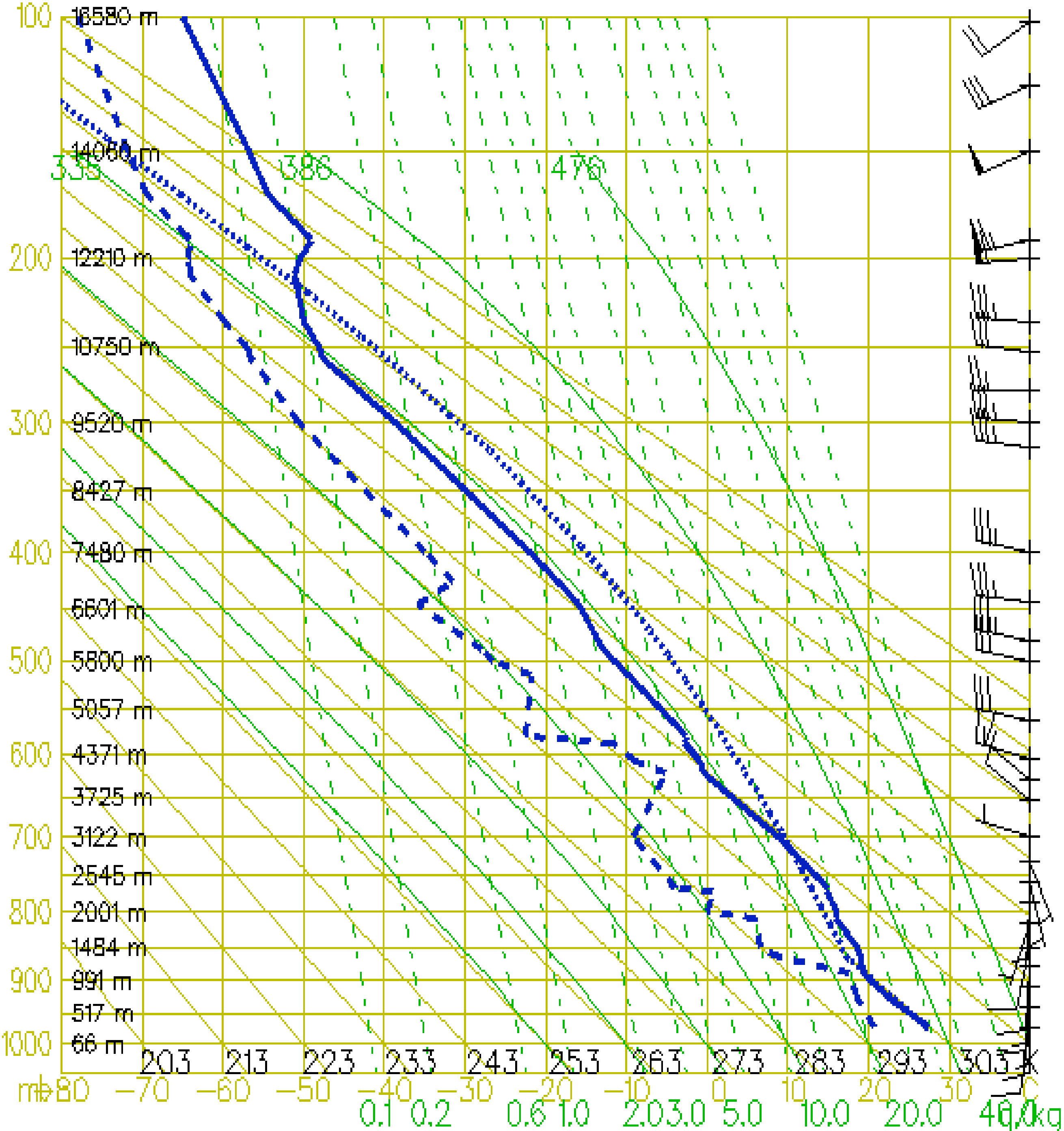


Figure 6.1. Sounding. The solid line represents the environmental temperature and the dotted line represents the parcel temperature. The dashed line represents the dew point temperature

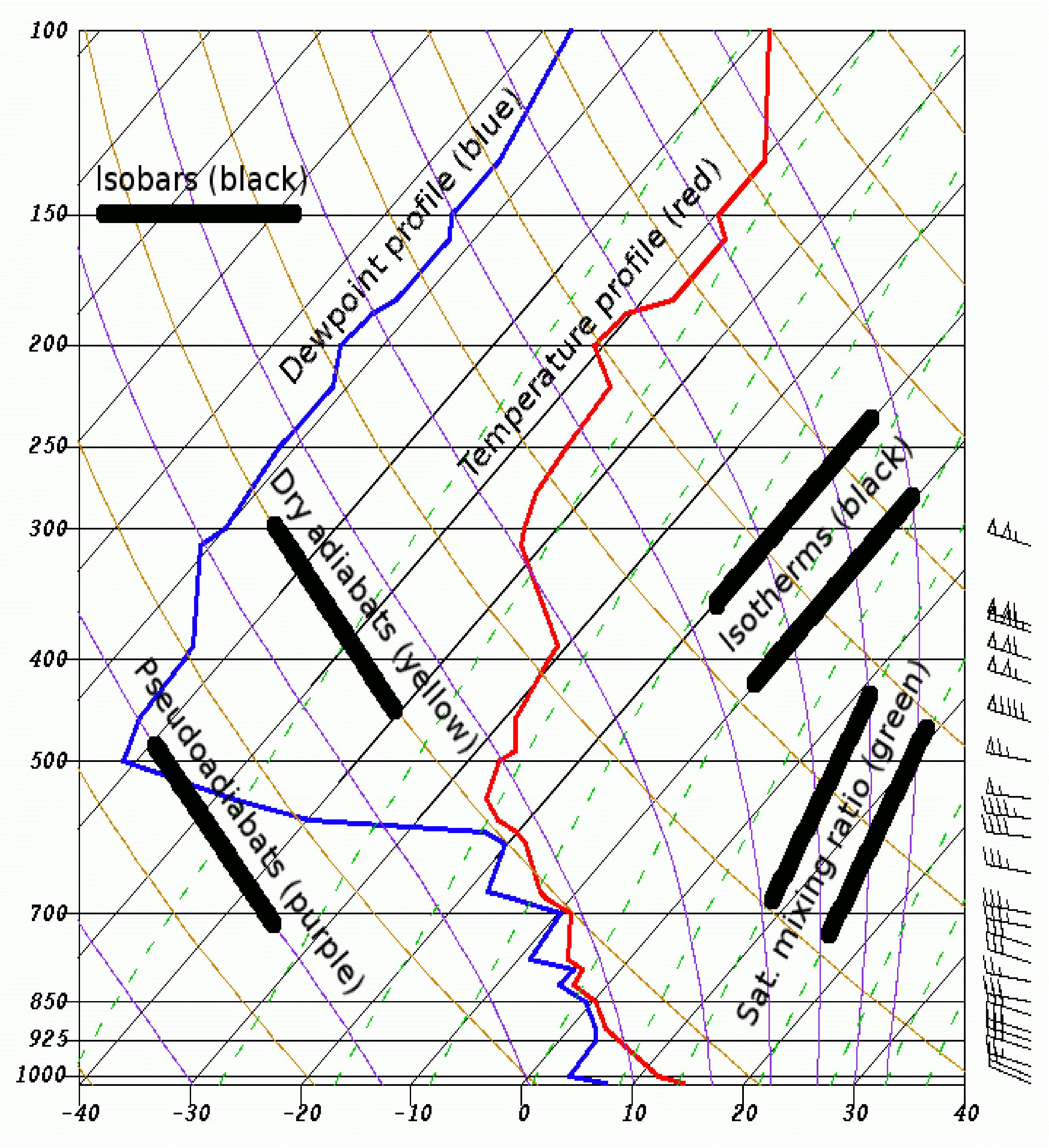
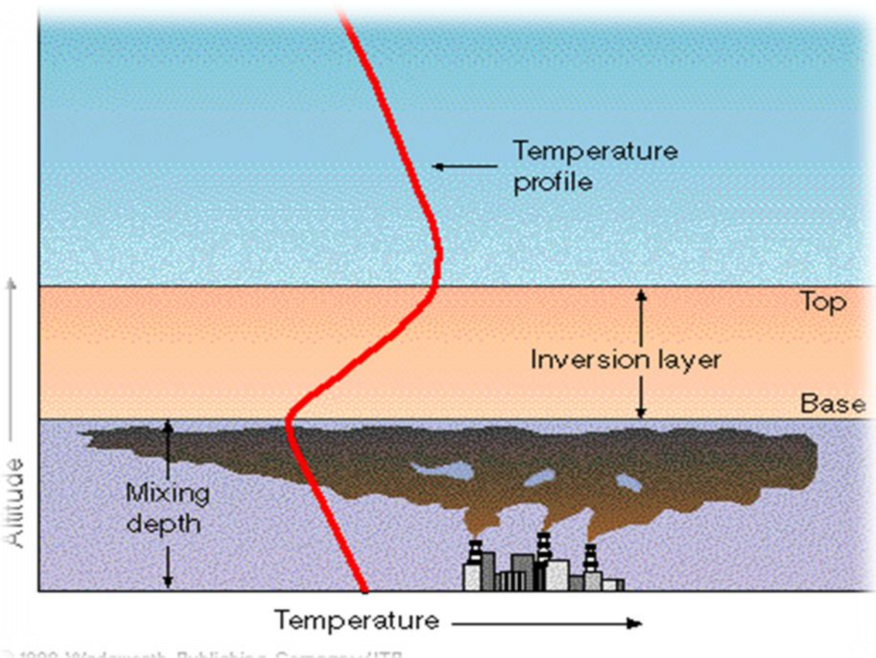
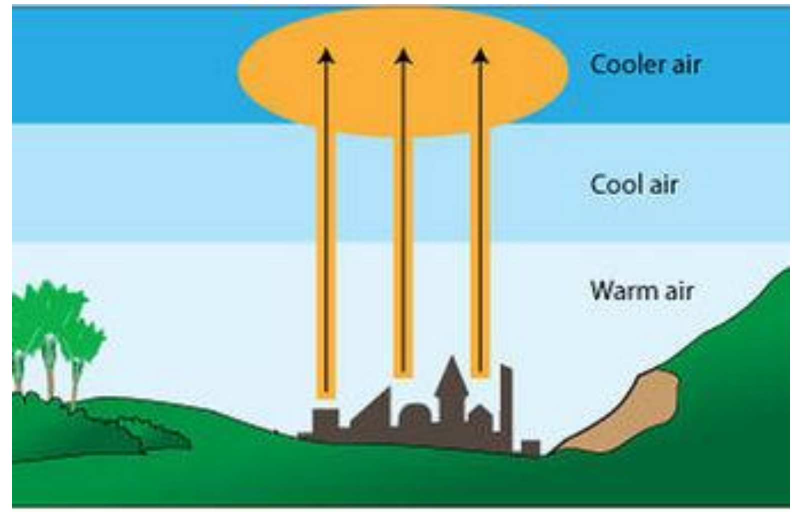


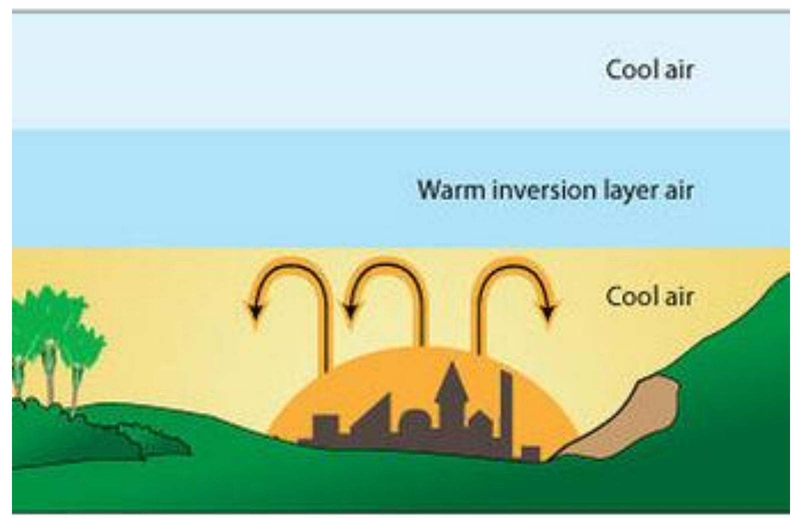
Figure 6.2. Skew-T Sounding. The solid line represents the environmental temperature and the dotted line represents the parcel temperature. The dashed line represents the dew point temperature. Observe that instead of vertical temperature (isotherm) lines like the Stuve, these lines are slanted.

Temperature Inversions



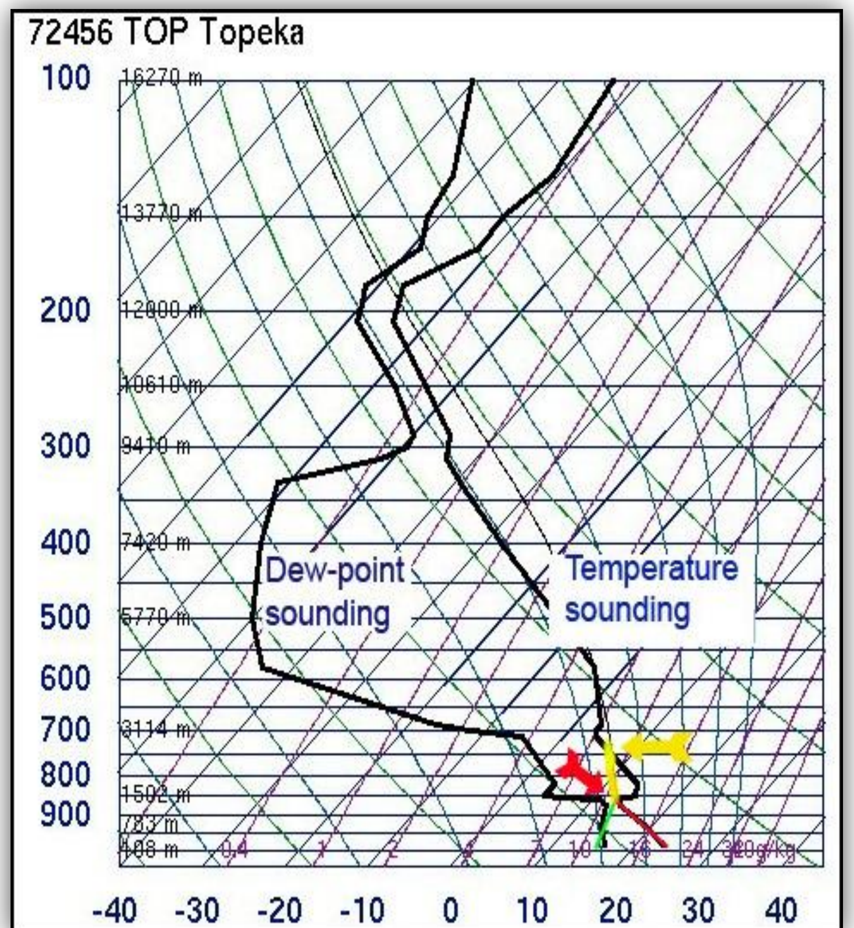


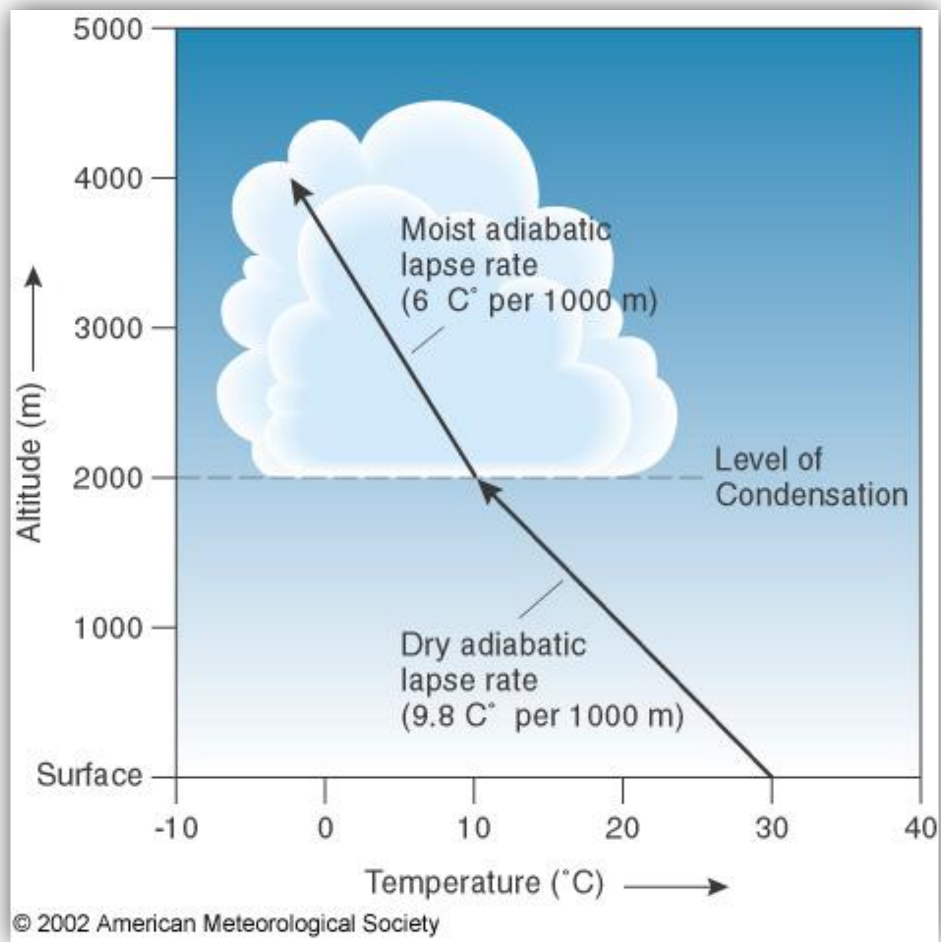
Normal pattern



Thermal inversion

The Lifting Condensation Level (LCL)

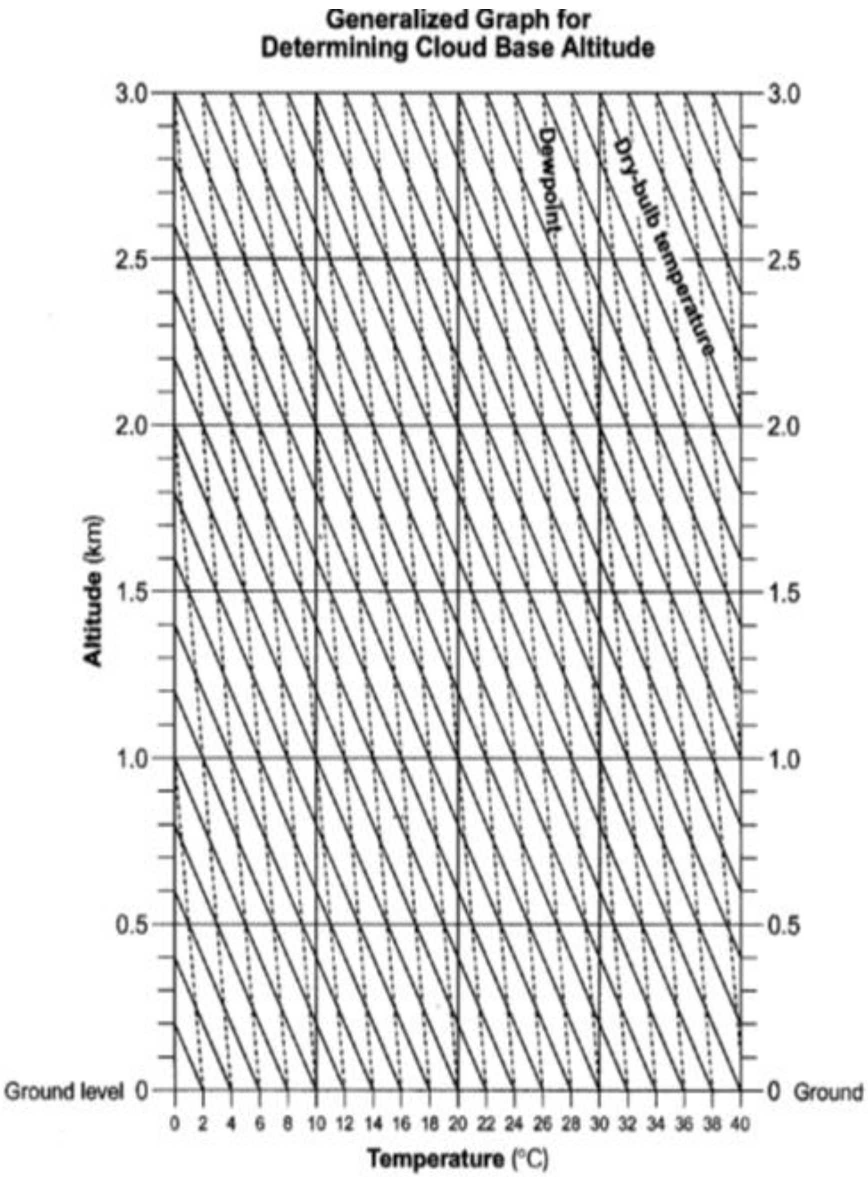


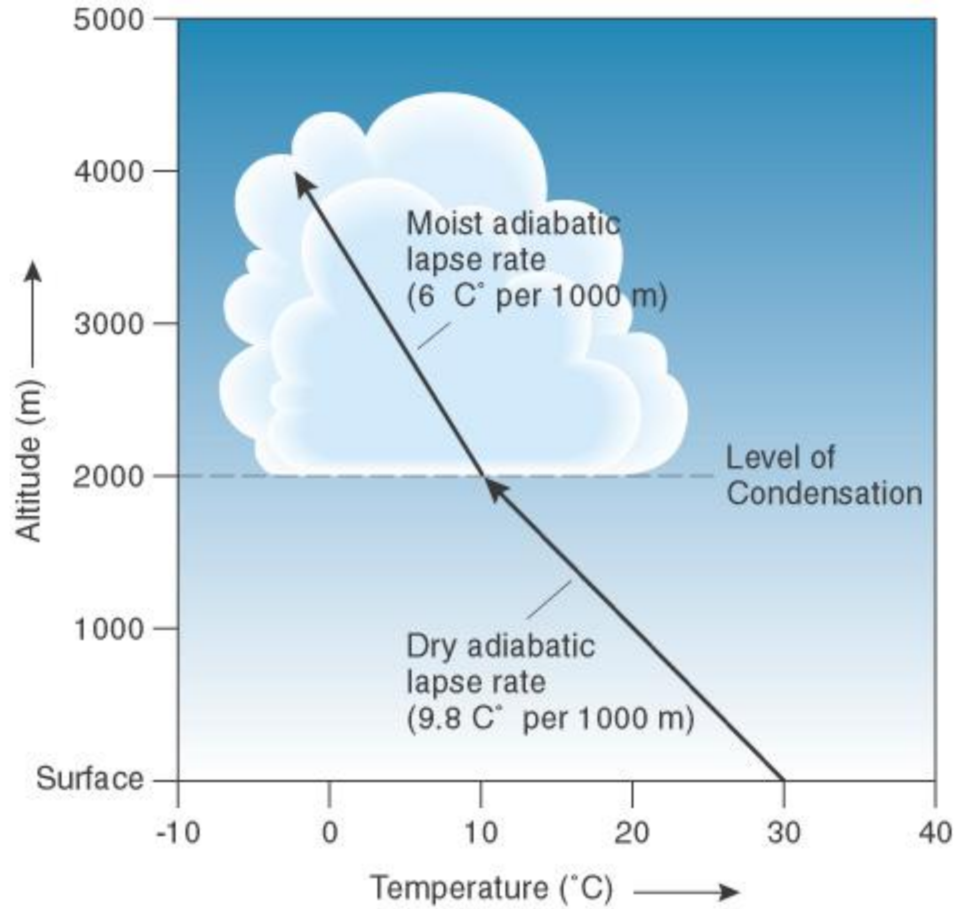


The height in the atmosphere in which condensation occurs due to adiabatic cooling.

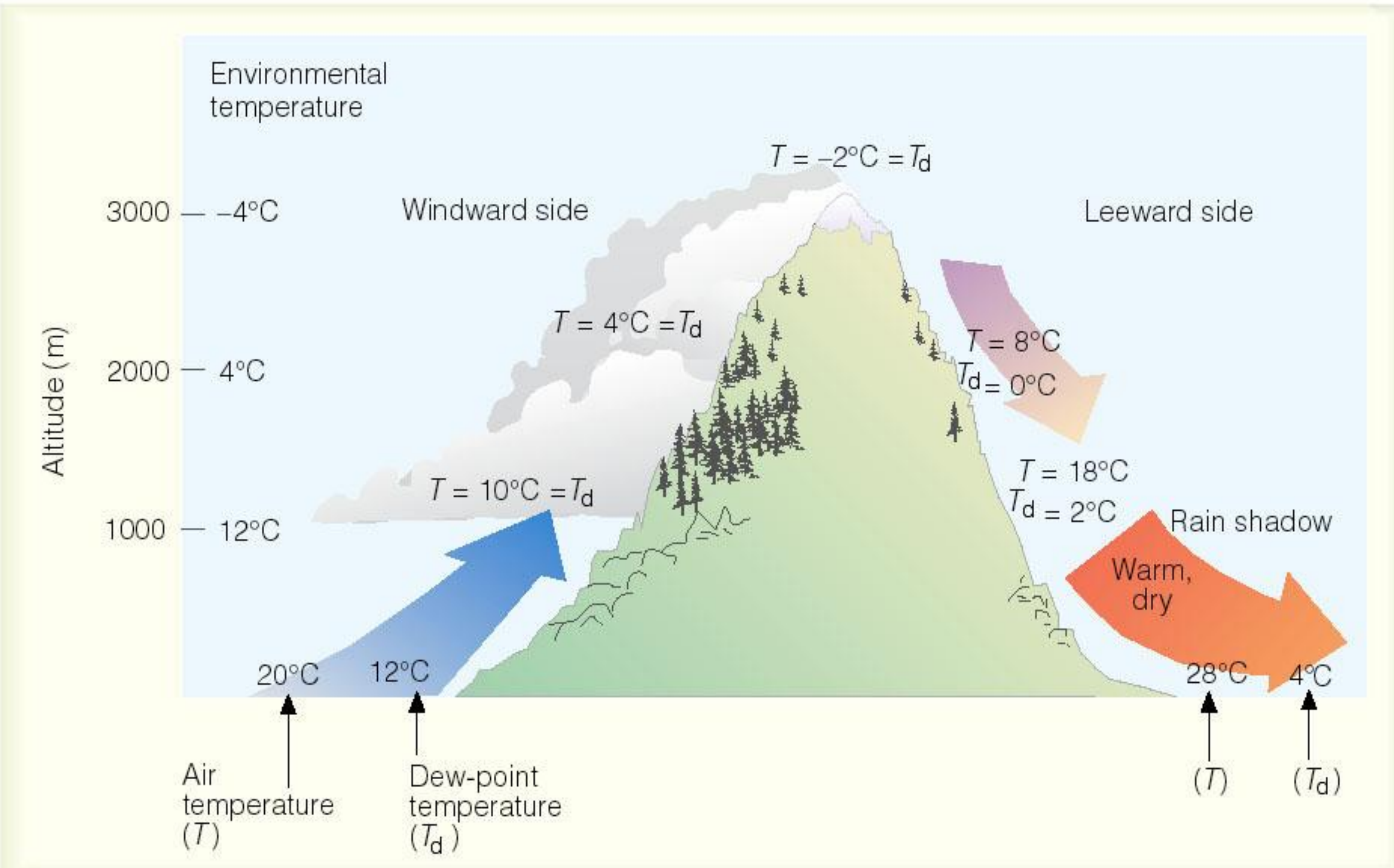
Knowing the LCL is important for forecasting the weather. By knowing the height in which the clouds will form and how high they will grow allows meteorologists to predict the severity of the storm.

Determining the Lifting Condensation Level (LCL)





Orographic Lifting , Cloud Base, and the "Rainshadow"

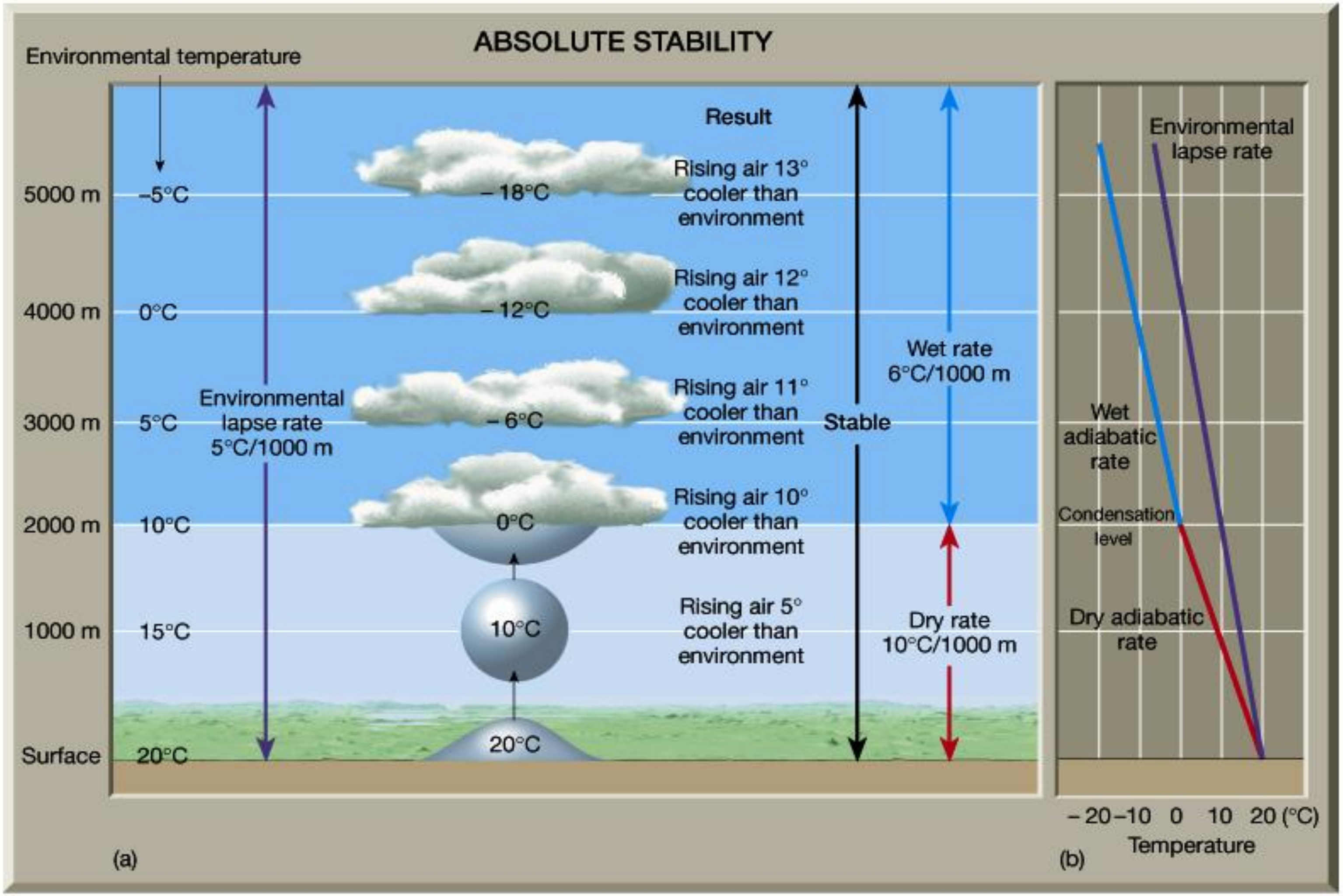


Atmospheric Stability and Cloud Formation

Atmospheric Stability

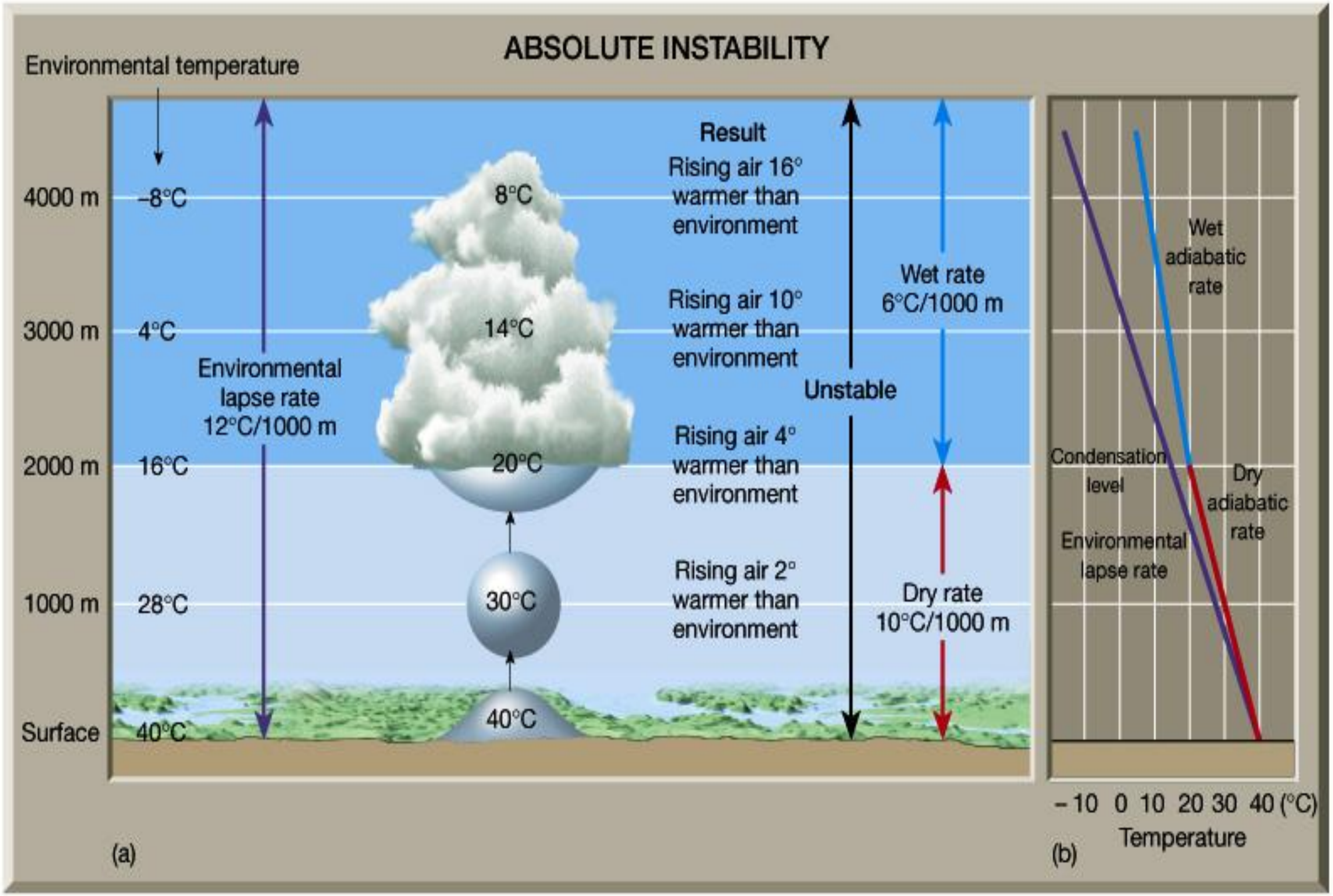
- A ***Stable*** atmosphere is one in which air resists vertical lifting
- An ***Unstable*** atmosphere is one in which the air will want to continue to rise. For this to happen: ***Cold air must be above warm air!!!!***

Absolute Stability (Stable)



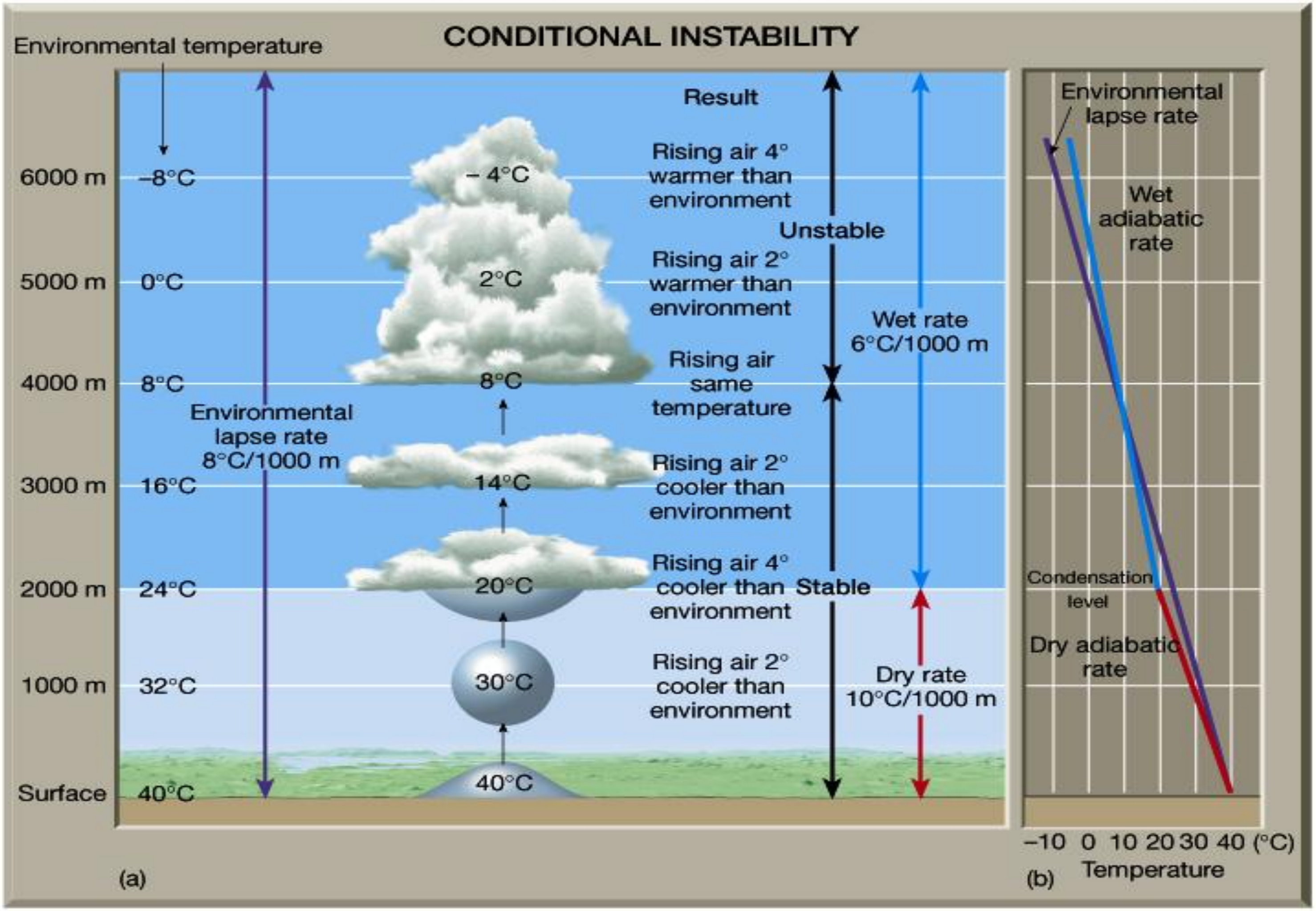
If the environmental lapse rate (temperature change of the level) is less than the Wet adiabatic rate (5C/km) then the atmosphere is ABSOLUTELY STABLE and air will resist rising.

Absolute Instability (Unstable)



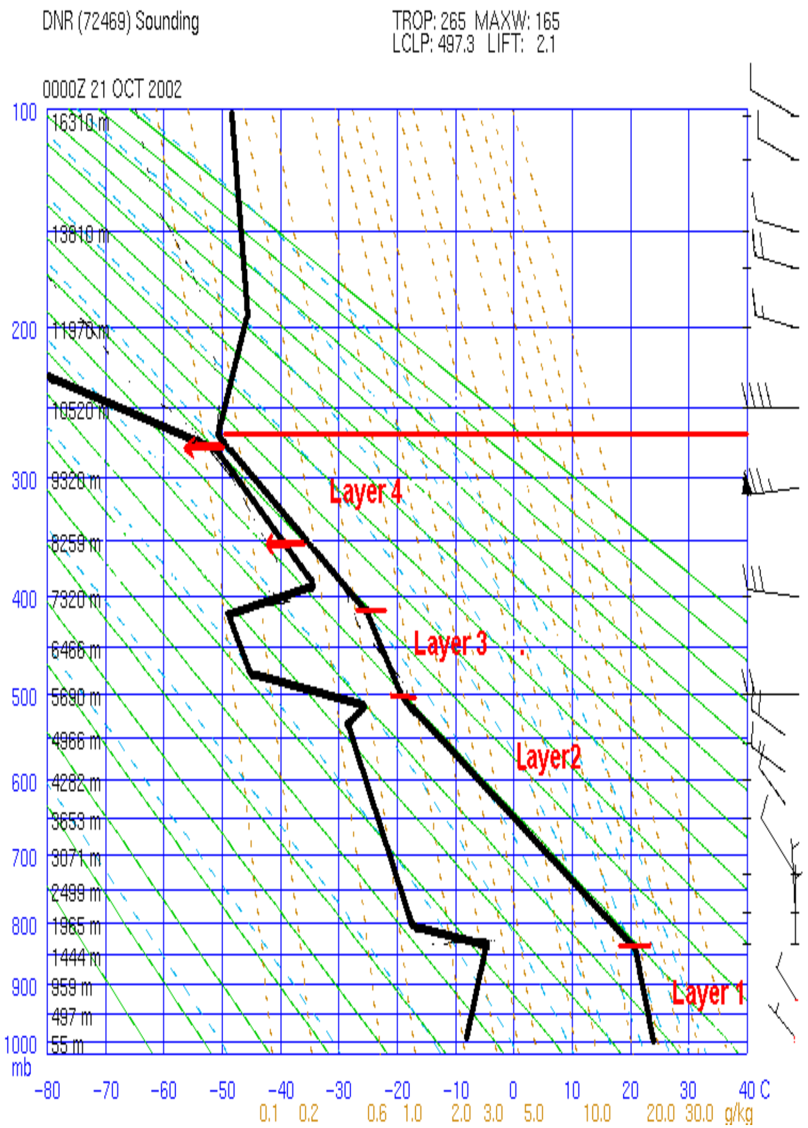
If the environmental lapse rate (temperature change with height) is greater than the Dry Adiabatic Rate (10C/km) then the atmosphere is considered UNSTABLE and this promotes air to rise.

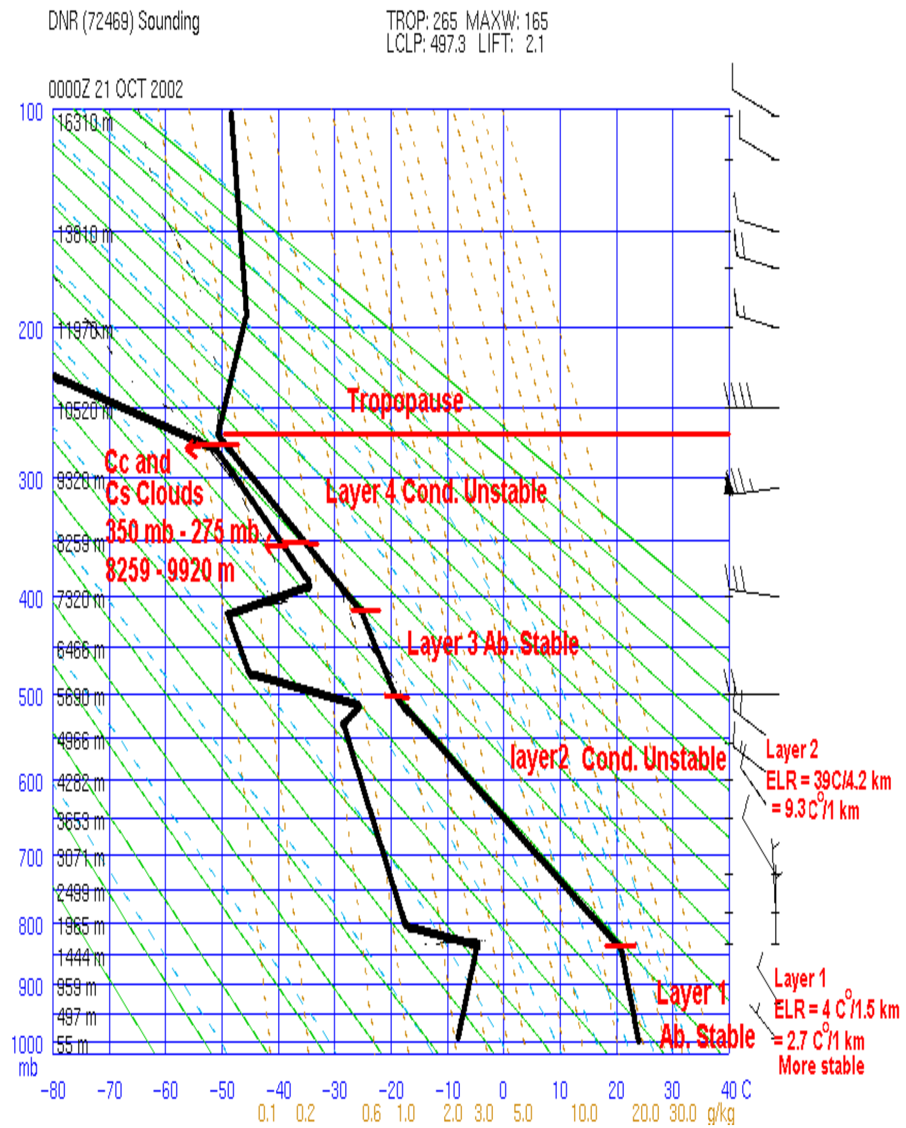
Conditional Instability (Conditionally Unstable)



If the environmental lapse rate (temperature change with height) is between the DAR (10C/km) and the WAR (5C/km) then the air is considered to be CONDITIONALLY UNSTABLE and air will only rise if forced (frontal, orographic, etc…)

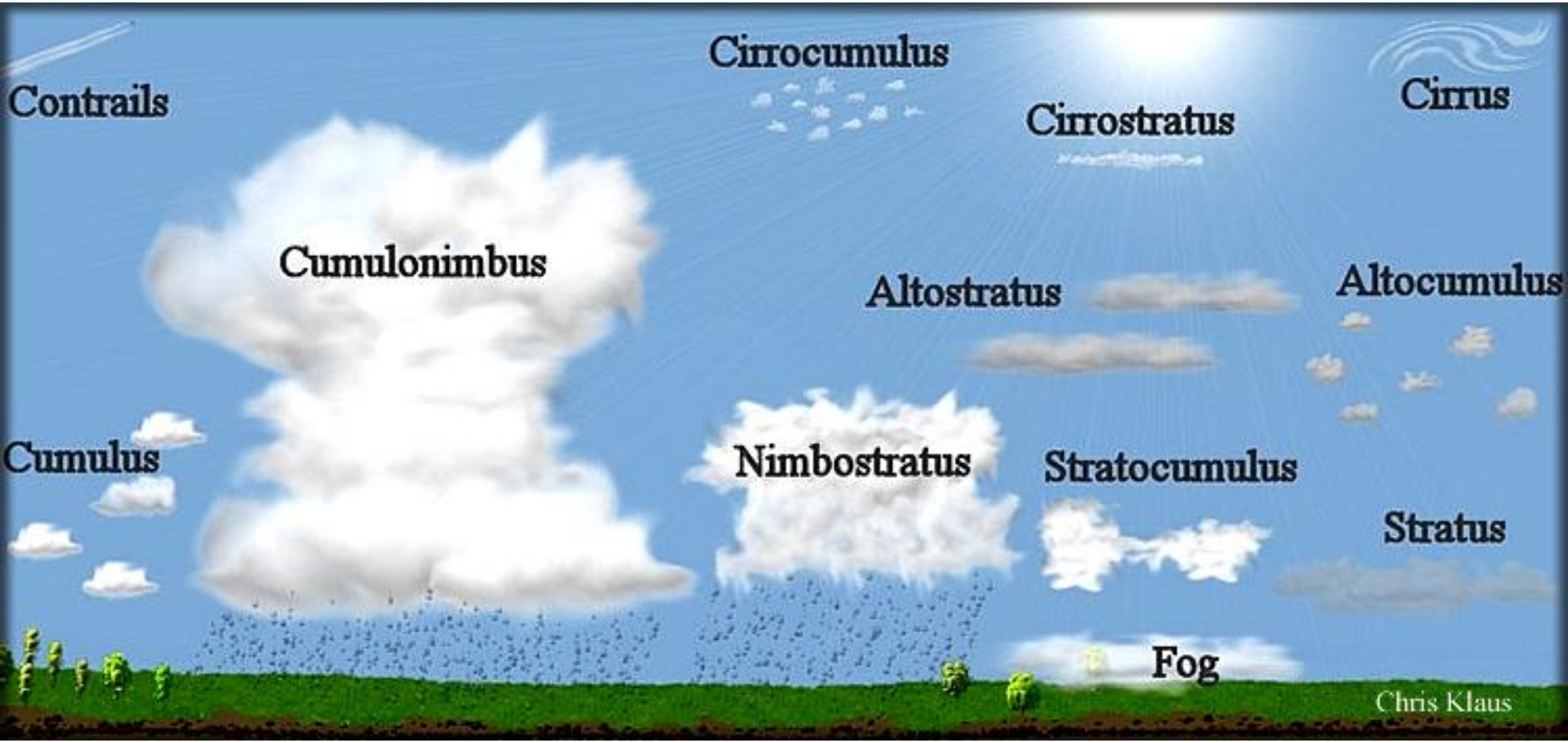
Analyzing Atmospheric Stability





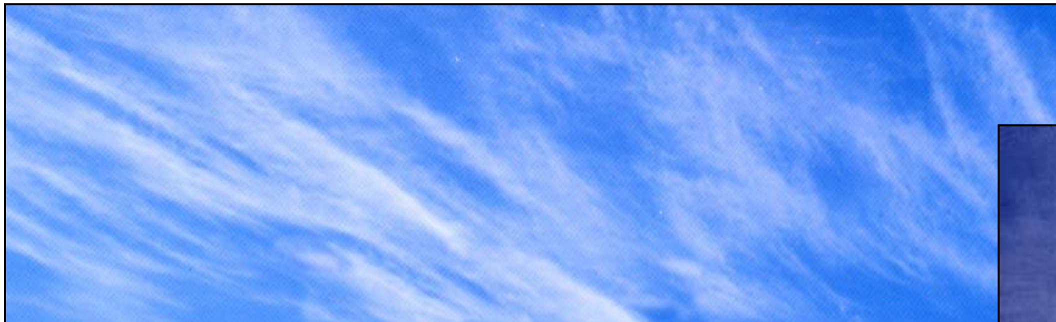
CLASSIFYING CLOUDS AND FOG

Cloud Classification Scheme



Cloud Classification is based upon 1) height and 2) structure

High Level Clouds



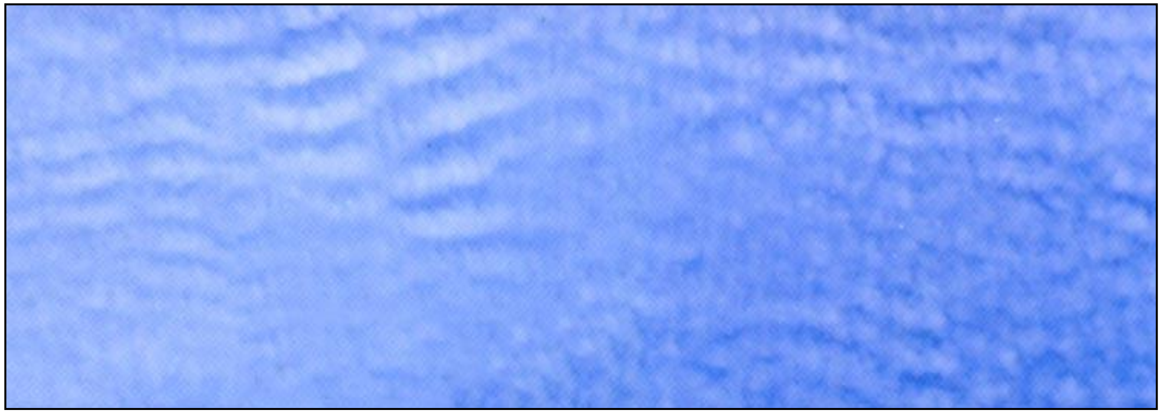
Cirrus (Ci): White, delicate, fibrous in appearance. Forms in patches or narrow bands. May for comma-shaped streaks or “mare’s tails” (cirrus uncinus)

Cirrus clouds are formed entirely of ice crystals. These grow and evaporate slowly, leading to soft edges to clouds.


Cirrus

Cirrostratus (Cs): Thin, transparent sheet or veil; sun clearly visible & casting shadows at surface. A halo may be seen around the sun (or moon). Sheets of cirrostratus may cover entire sky, and be up to several 1000m deep.


Cirrostratus



Cirrocumulus (Cc): Thin white patch or sheet of cloud; appears dappled or rippled. Dappling results from convective overturning within the cloud, ripples from gravity waves.

Aircraft contrails: condensation from aircraft exhaust. May dissipate quickly, or be very long-lived depending on conditions.

Cirrocumulus


1. 26. 2001
Photo by Louis Nguyen


Nacreous Cloud
(Stratosphere)

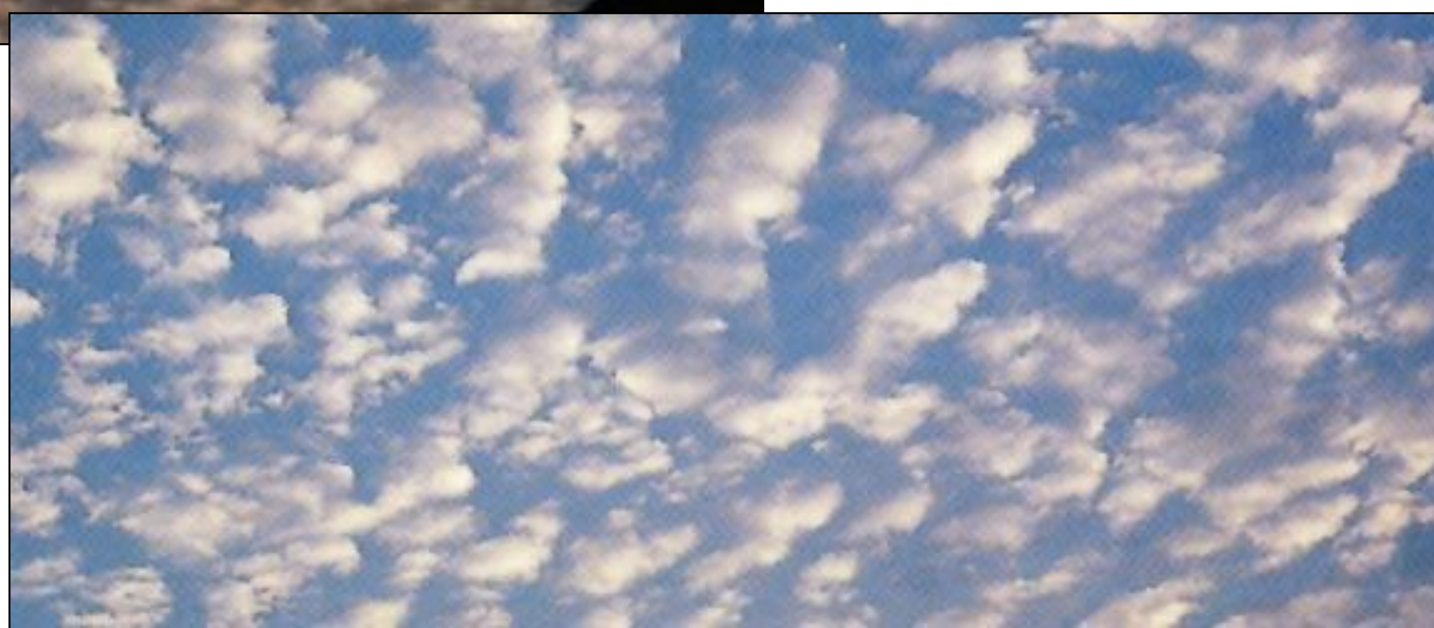
Mid- Level Clouds

Altostratus (As): A greyish sheet of cloud, may be fibrous or uniform in appearance. Thin enough in parts to make out the sun, but no halo.

Altostratus Clouds

Altocumulus (Ac): white or grey patches arranged in sheets. Shape and texture are variable.

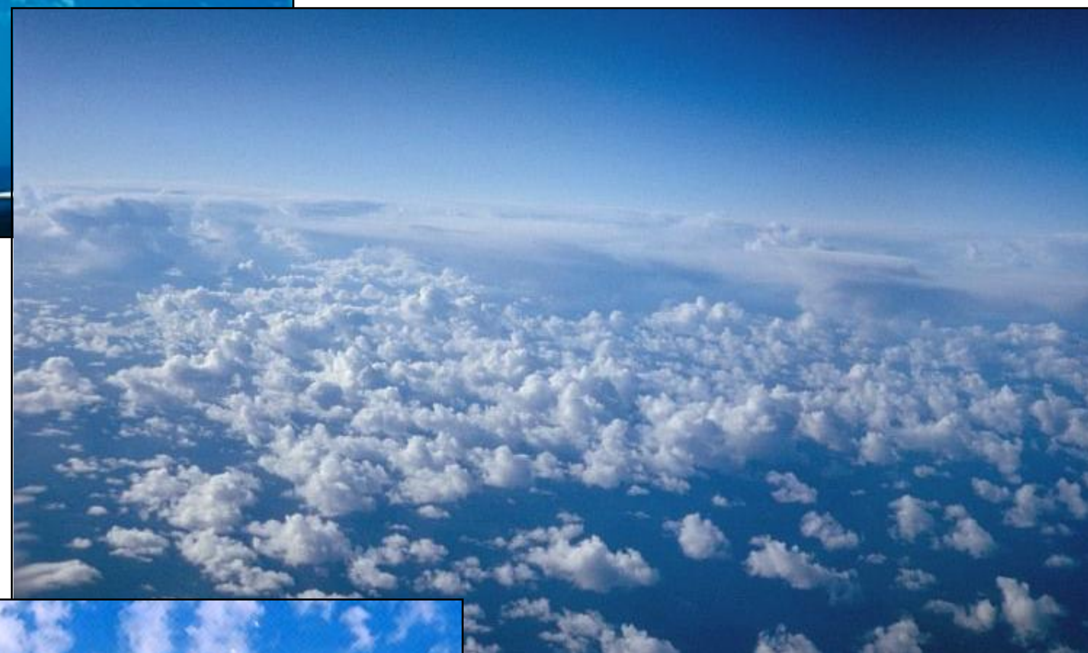
There are several distinct sub-classes of altocumulus

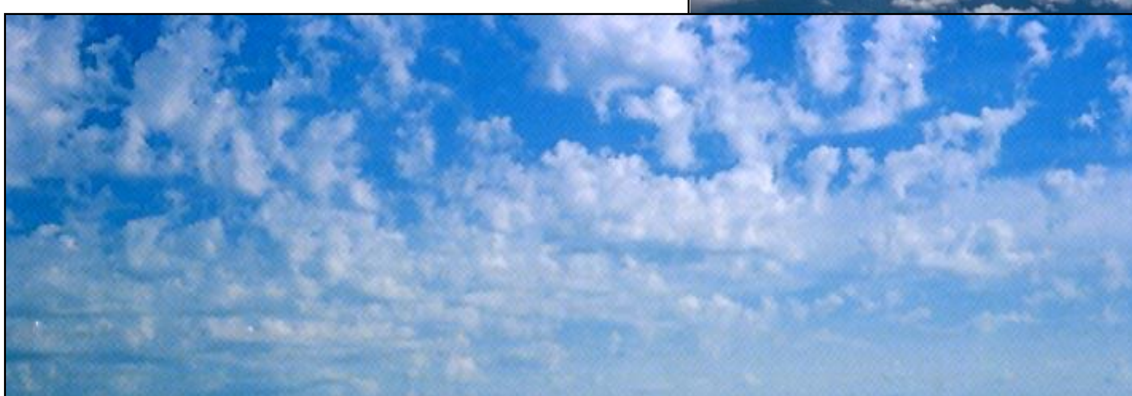



Altocumulus

Altocumulus lenticularis (Ac len): white or grey lenticular (lens shaped) clouds formed by the lifting of air over a topographic barrier.

Altocumulus castellanus (Ac cas): white or grey, broken cumulus-like clouds; upper part appearing castle-like. Sometimes arranged in lines.





Altocumulus undulatus (Ac und): white or grey patches or sheets of cloud with an undulating or rippled appearance.

Low- Level Clouds

Cumulus (Cu): Brilliant white to grey, dense detached clouds. Forms clumped or heaped (cauliflower-like) shapes, usually with sharp outlines and flat base. Field of Cu often have bases all at same (lifting condensation) level.

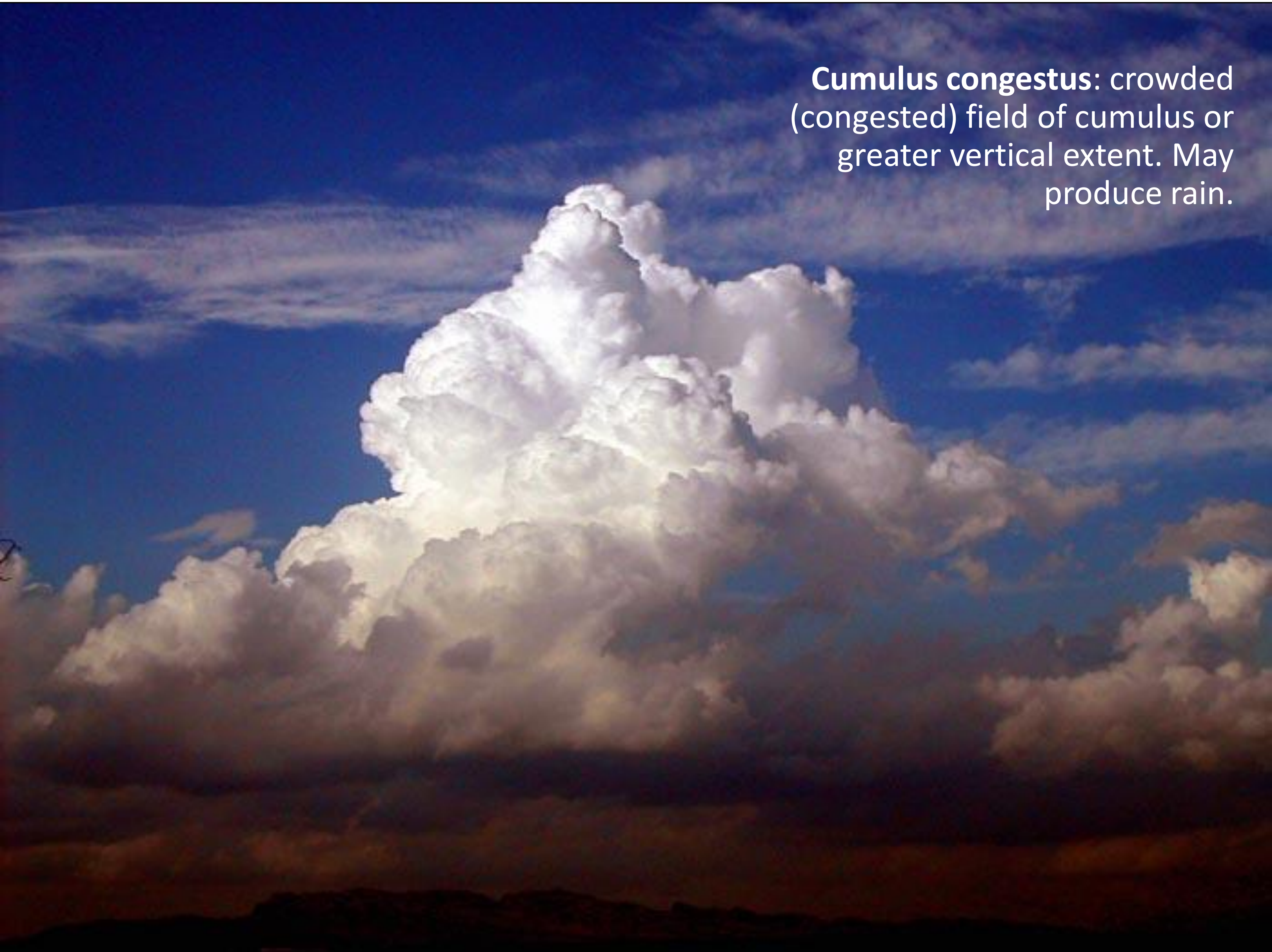
Cumulus humilis (Cu hum): small cumulus, of limited vertical extent, may have a flattened appearance. Also called fair-weather cumulus

Cumulus Humulis


Cumulus Fractus
broken up by wind


Cumulus mediocris : cumulus, of
moderate vertical extent.

Cumulus congestus: crowded (congested) field of cumulus or greater vertical extent. May produce rain.




Stratocumulus

Stratocumulus with *virga* – hair-like strands of falling rain, which evaporate below cloud before reaching the surface

Stratus (St) : grey featureless layer of cloud with a uniform base. Often associated with drizzle or snow.


http://australiasevereweather.com/


Stratus


Scud Clouds
Scud Clouds
www.stormdude.com

Pileus : cap clouds that form above large cumulus as the upward motion of the convective cloud distorts the layer of air above (pileus is latin for skull-cap)


Inflow band

Sylvan Hills
First Baptist Church

June 3, 2009 Cedar Rapids Iowa: Possible New cloud type?

Undulatus Asperatus

The Lowest Level Clouds- Haze

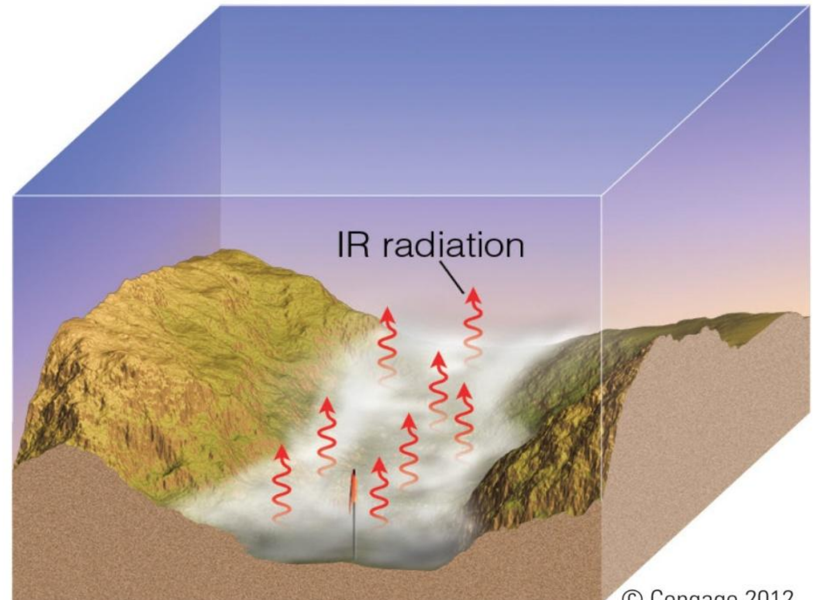
© C. Donald Ahrens

- Dry condensation nuclei (above dew point) reflect and scatter sunlight creating blueish haze.
- Wet condensation nuclei (75% relative humidity) reflect and scatter sunlight creating grayish or white haze.

The Formation of Fog

- Saturation reached condensation forms a cloud near the ground
- Radiation fog: ground cools through conduction and radiation; ground fog
  - Valley fog created by cold air drainage
  - High inversion fog

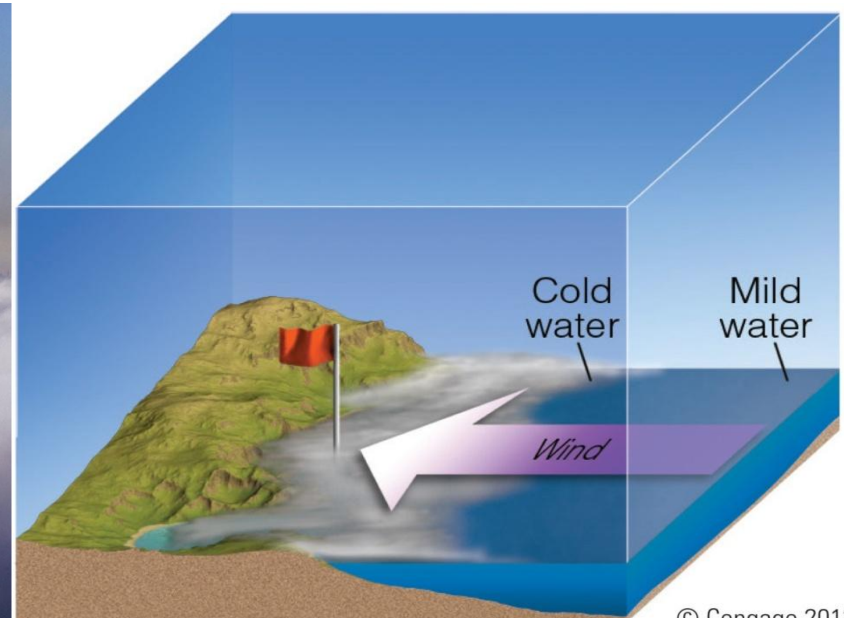
Radiational (ground) Fog



(a) Radiation fog

Radiation fog tends to form on clear, relatively calm nights when cool, moist surface air is overlain by drier air and rapid radiational cooling occurs

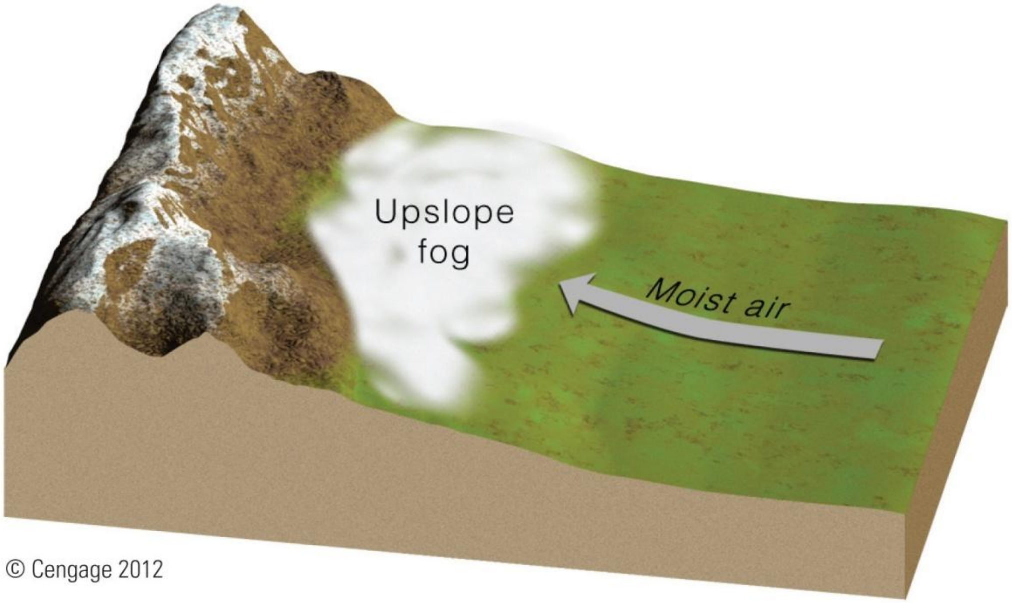
Advectional Fog



(b) Advection fog

Advection fog forms when the wind moves moist air over a cold surface and the moist air cools to its dew point.. Here advection fog, having formed over the cold, coastal water of the Pacific Ocean, is rolling inland past the Golden Gate Bridge in San Francisco. As fog moves inland, the air warms and the fog lifts above the surface. Eventually, the air becomes warm enough to totally evaporate the fog.

Upslope Fog



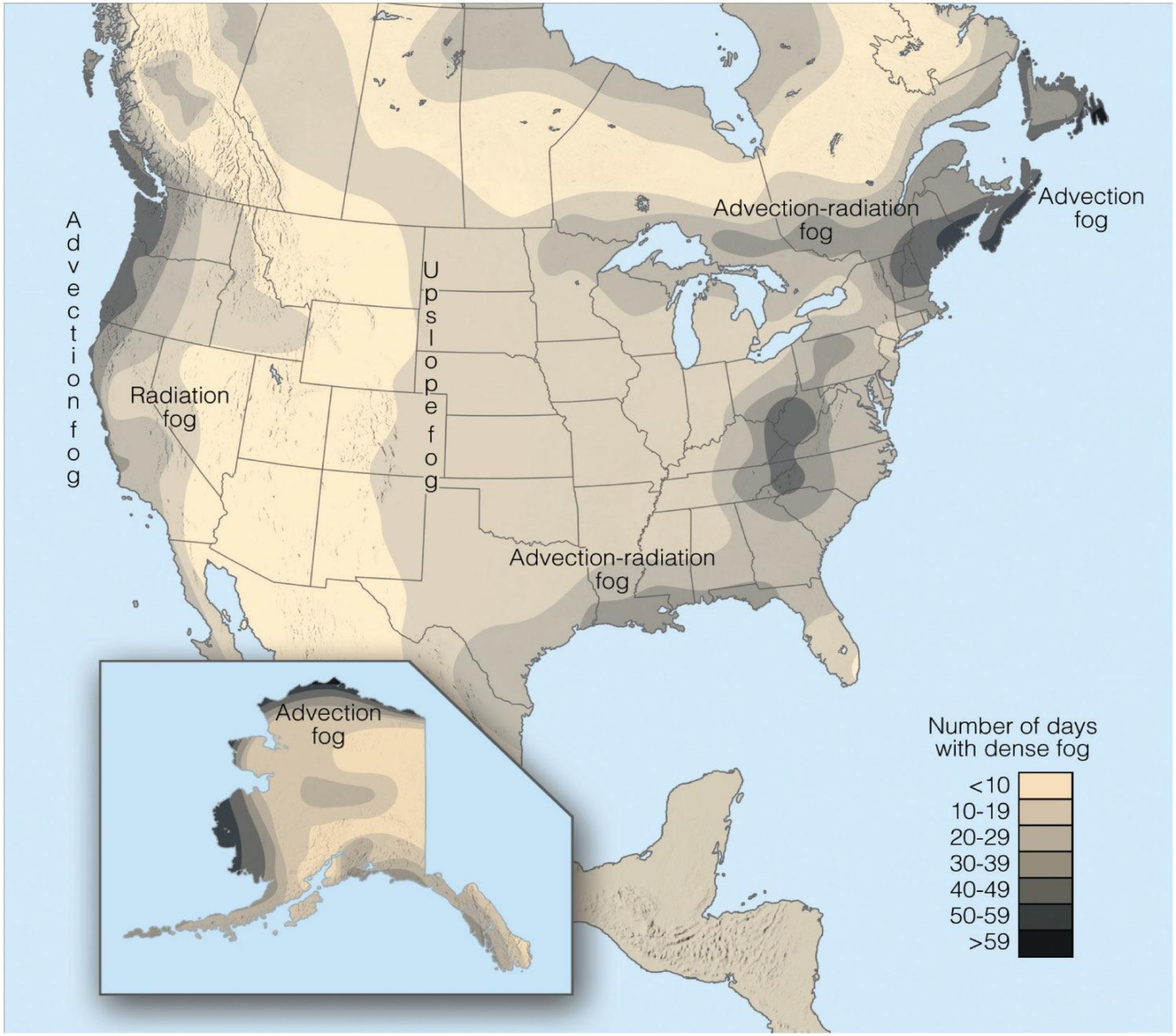
Upslope fog forms as moist air slowly rises, cools, and condenses over elevated terrain

Evaporation (Mixing) Fog

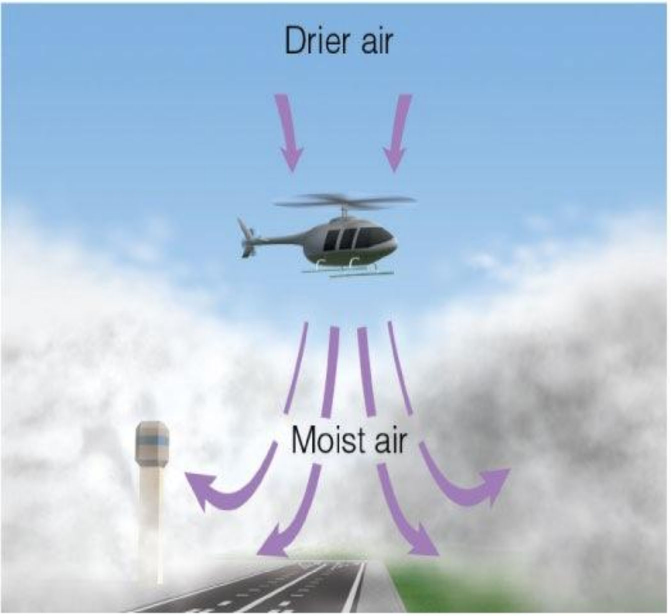
On a cold day, moist air from your mouth mixes with the cold air outside. The air becomes saturated and produces a tiny cloud.

Steam fog occurs when cold air moves over a warm body of water.

Fog Occurrence



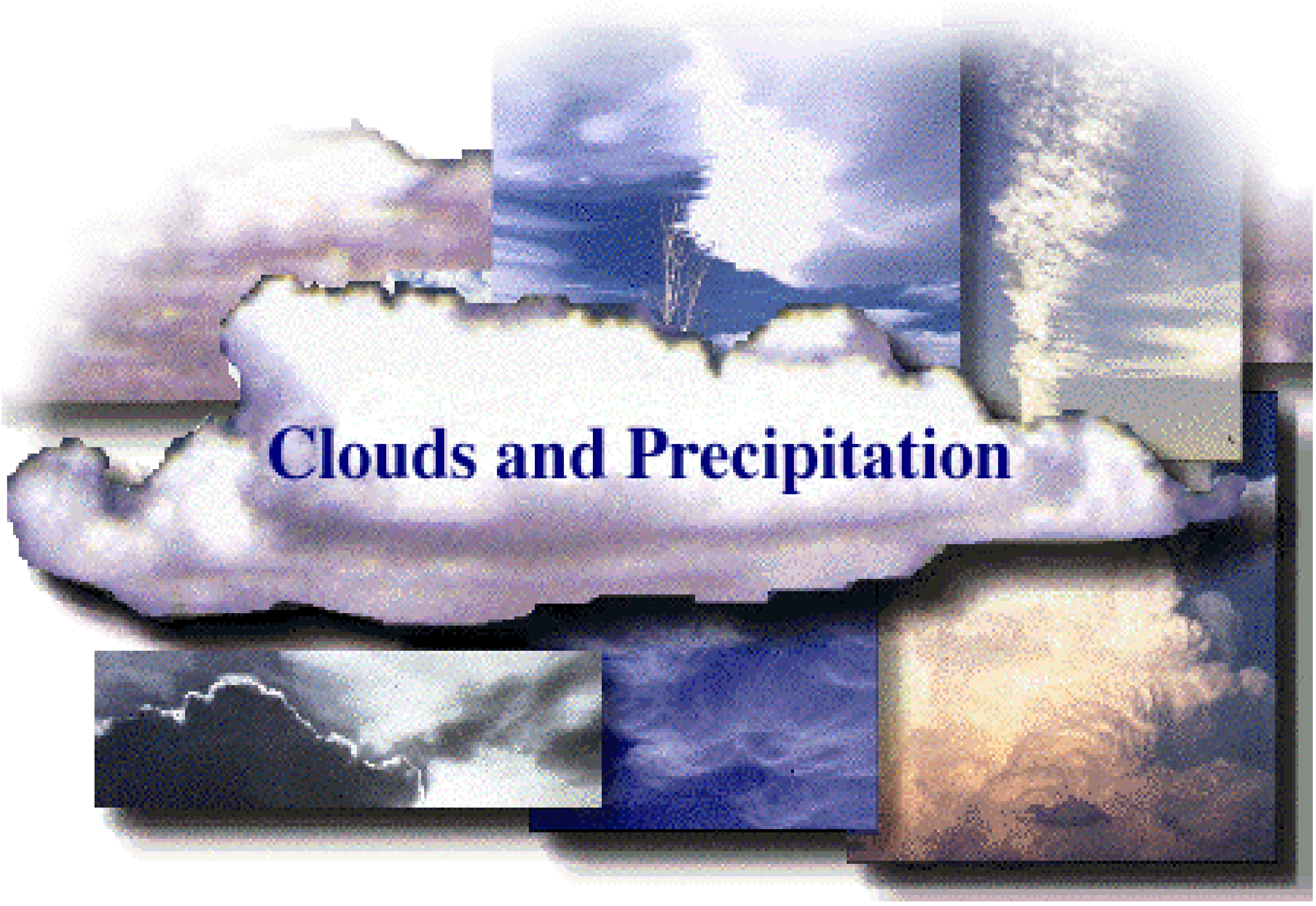
Fog Dispersal



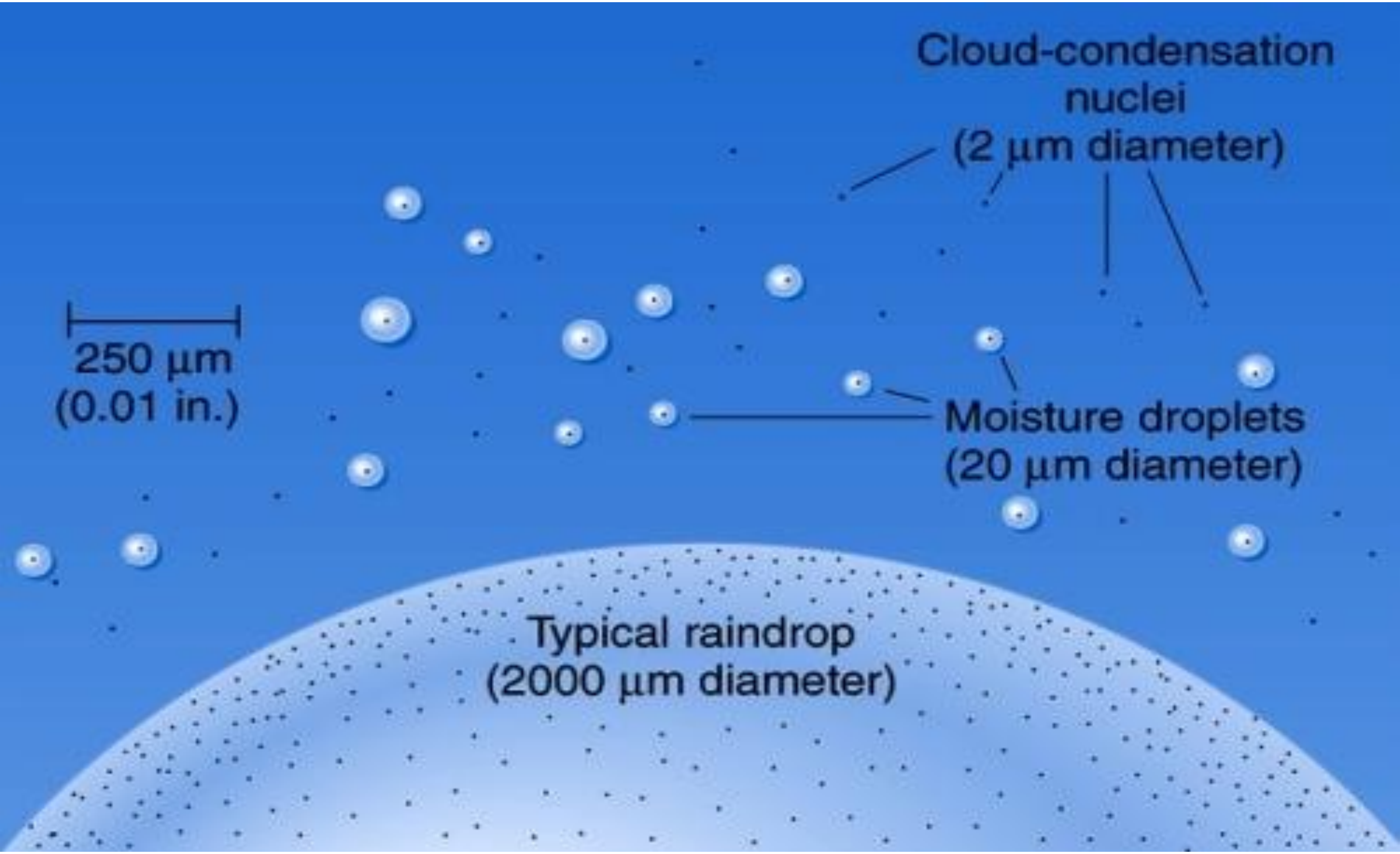
Helicopters hovering above an area of shallow fog (left) can produce a clear area (right) by mixing the drier air into the foggy air below.

“Burning off” the Fog

Sunlight penetrates the fog, warming the ground, causing the temperature to increase. This causes evaporation to occur and the fog “burns off.”

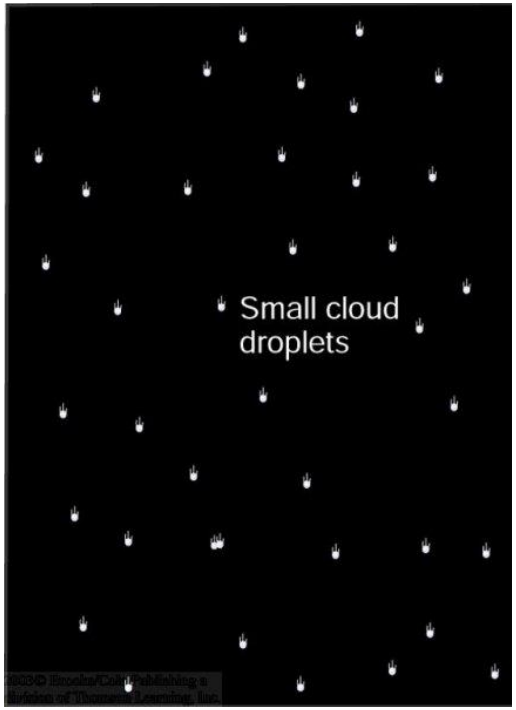

Clouds and Precipitation

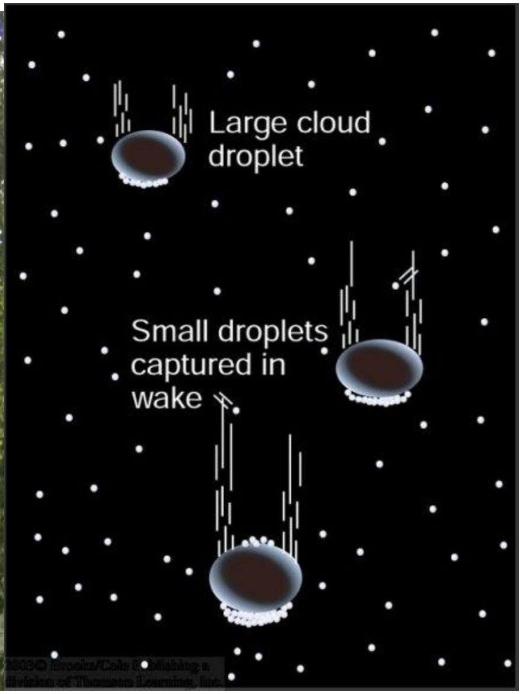
The Sizes of a Raindrop



Collision-Coalescence Process

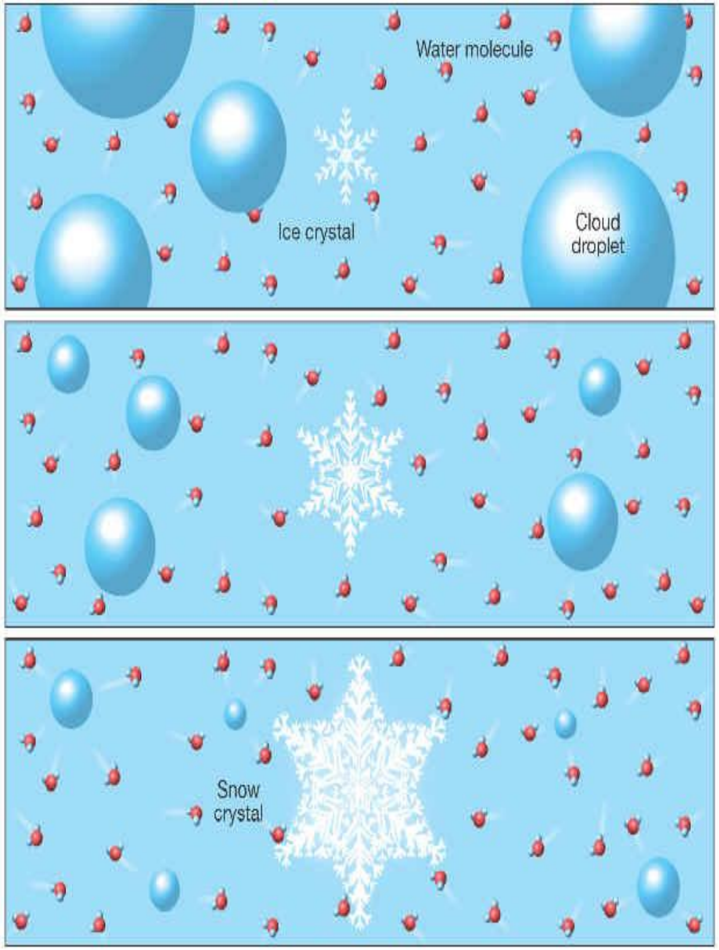
In a warm cloud composed only of small cloud droplets of uniform size, the droplets are less likely to collide as they all fall very slowly at about the same speed. Those droplets that do collide, frequently do not coalesce because of the strong surface tension that holds together each tiny droplet.

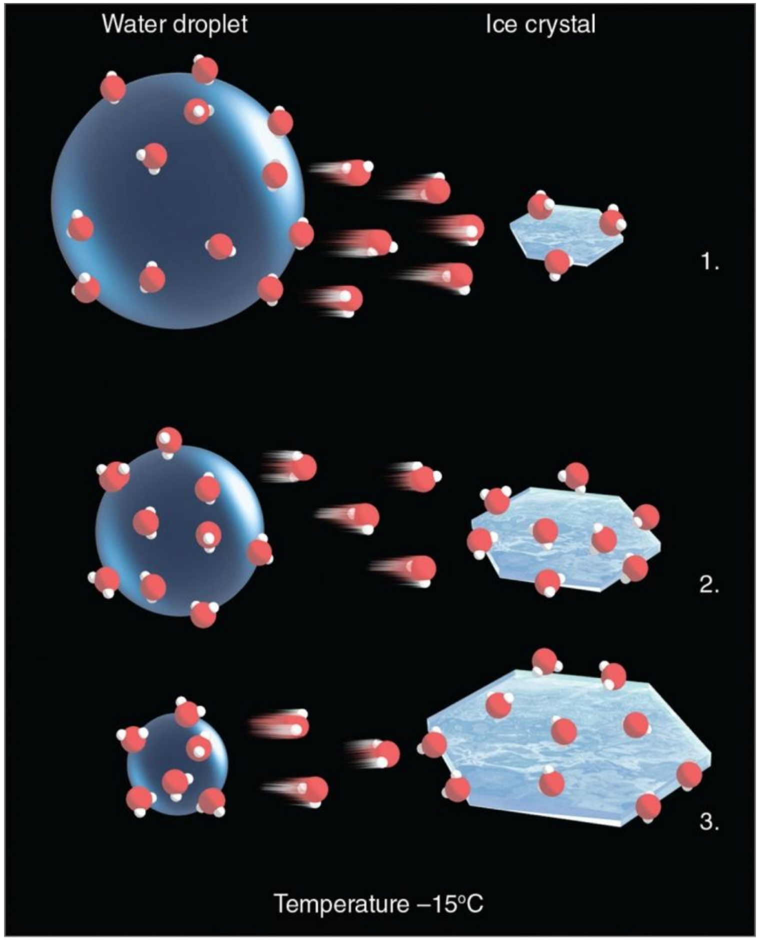




In a cloud composed of different size droplets, larger droplets fall faster than smaller droplets. Although some tiny droplets are swept aside, some collect on the larger droplet's forward edge, while others (captured in the wake of the larger droplet) coalesce on the droplet's backside.

Ice Crystal (Bergeron) Process





(1) The greater number of water vapor molecules around the liquid droplet causes water molecules to diffuse from the liquid droplet toward the ice crystal. (2) The ice crystal absorbs the water vapor and grows larger, while (3) the water droplet grows smaller

The Formation of Precipitation

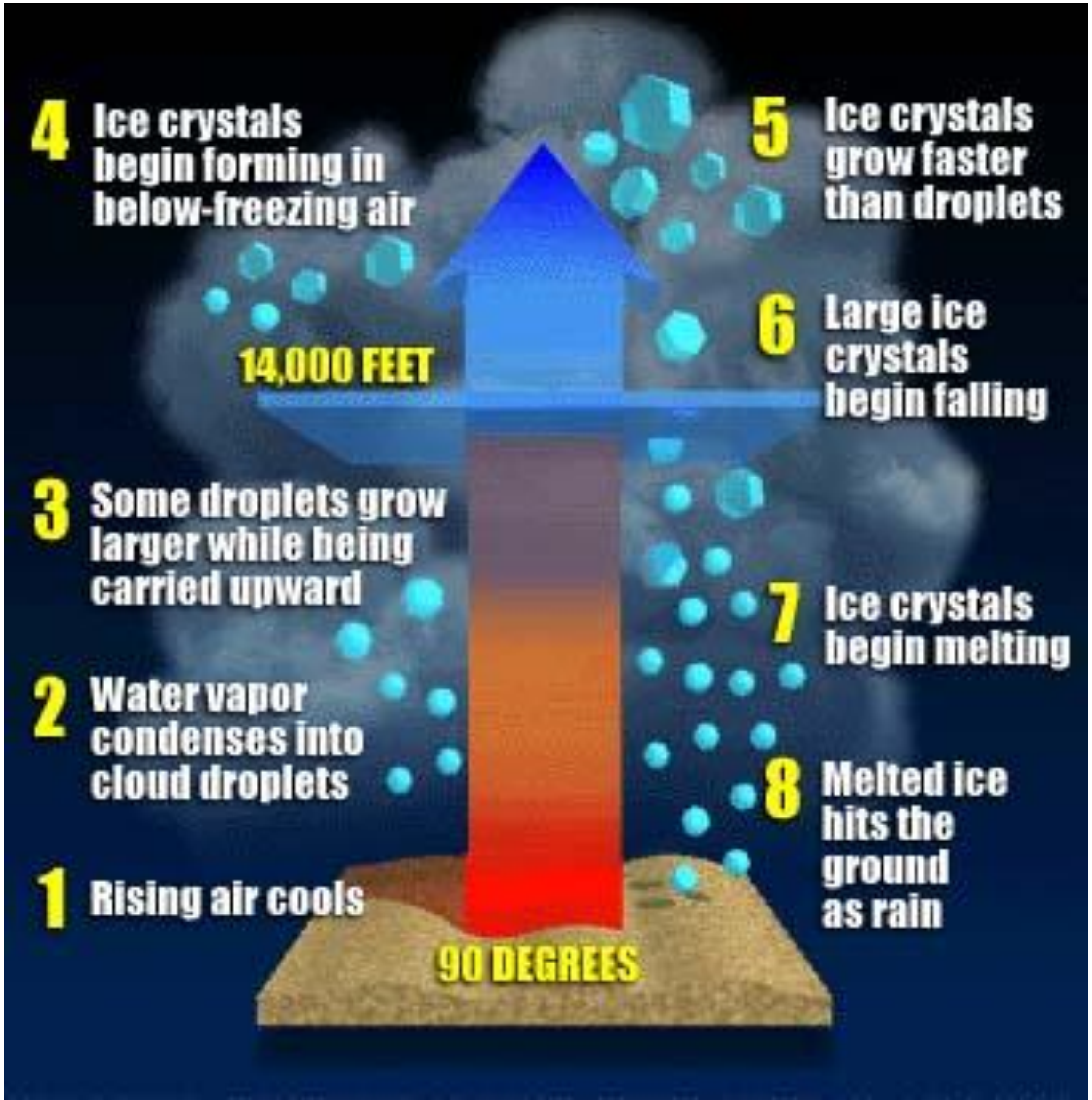


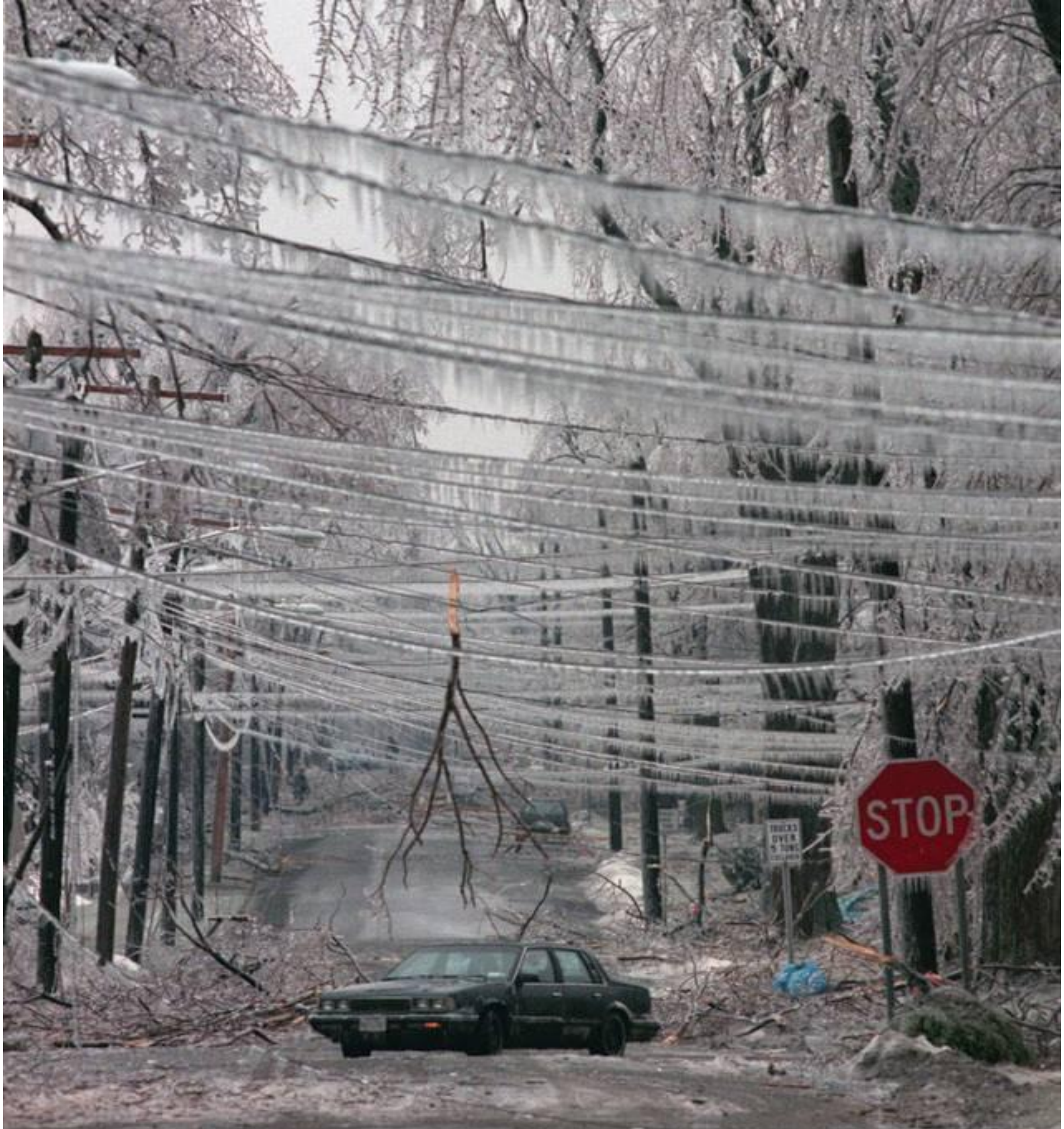
Table 5–4 Types of precipitation

Type	Approximate Size	State of Water	Description
Mist	0.005 to 0.05 mm	Liquid	Droplets large enough to be felt on the face when air is moving 1 meter/second. Associated with stratus clouds.
Drizzle	Less than 0.5 mm	Liquid	Small uniform drops that fall from stratus clouds, generally for several hours.
Rain	0.5 to 5 mm	Liquid	Generally produced by nimbostratus or cumulonimbus clouds. When heavy, size can be highly variable from one place to another.
Sleet	0.5 to 5 mm	Solid	Small, spherical to lumpy ice particles that form when raindrops freeze while falling through a layer of subfreezing air. Because the ice particles are small, any damage is generally minor. Sleet can make travel hazardous.
Glaze	Layers 1 mm to 2 cm thick	Solid	Produced when supercooled raindrops freeze on contact with solid objects. Glaze can form a thick coating of ice having sufficient weight to seriously damage trees and power lines.
Rime	Variable accumulations	Solid	Deposits usually consisting of ice feathers that point into the wind. These delicate frostlike accumulations form as supercooled cloud or fog droplets encounter objects and freeze on contact.
Snow	1 mm to 2 cm	Solid	The crystalline nature of snow allows it to assume many shapes, including six-sided crystals, plates, and needles. Produced in supercooled clouds where water vapor is deposited as ice crystals that remain frozen during their descent.
Hail	5 mm to 10 cm or larger	Solid	Precipitation in the form of hard, rounded pellets or irregular lumps of ice. Produced in large convective, cumulonimbus clouds, where frozen ice particles and supercooled water coexist.
Graupel	2 mm to 5 mm	Solid	Sometimes called “soft hail,” graupel forms as rime collects on snow crystals to produce irregular masses of “soft” ice. Because these particles are softer than hailstones, they normally flatten out upon impact.

DRIZZLE: *Drops with diameter smaller than .02 inch falling close together.*

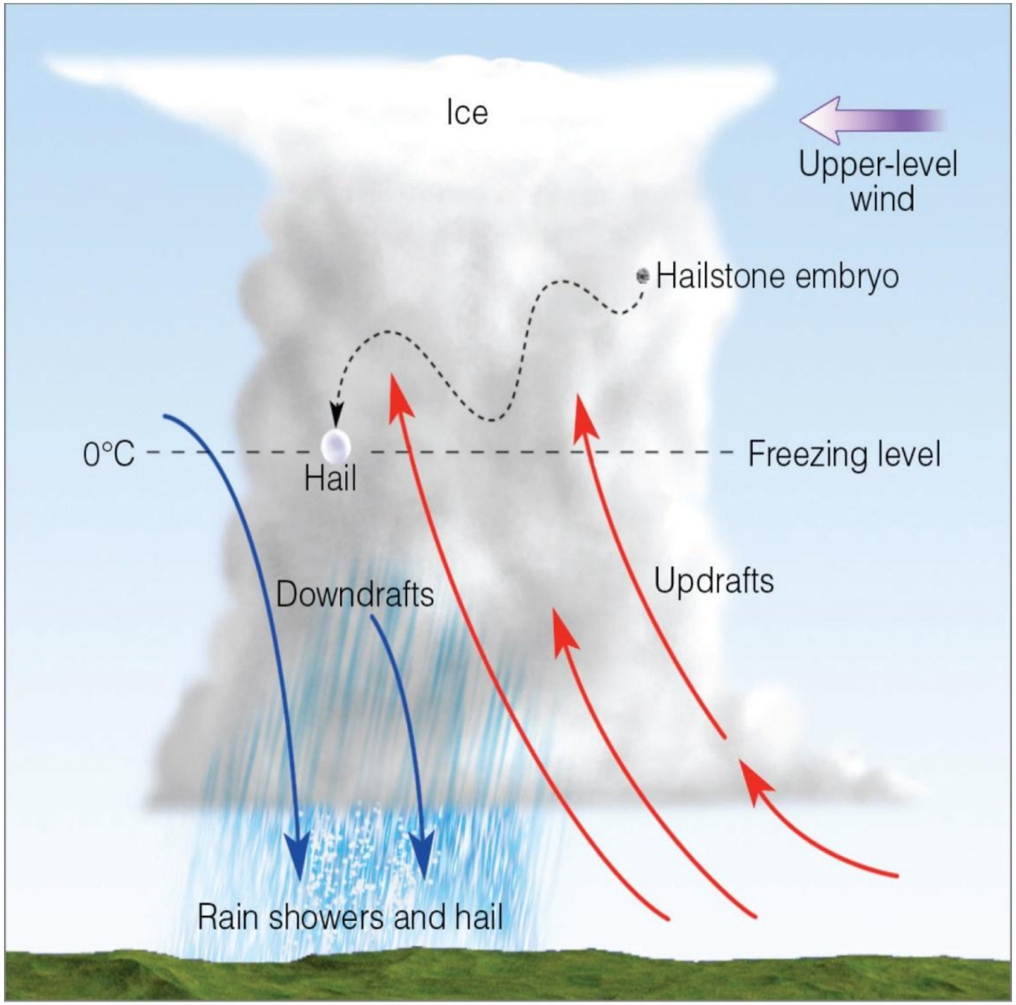
RAIN: *Drops with diameter larger than .02 inch or smaller drops, widely separated.*

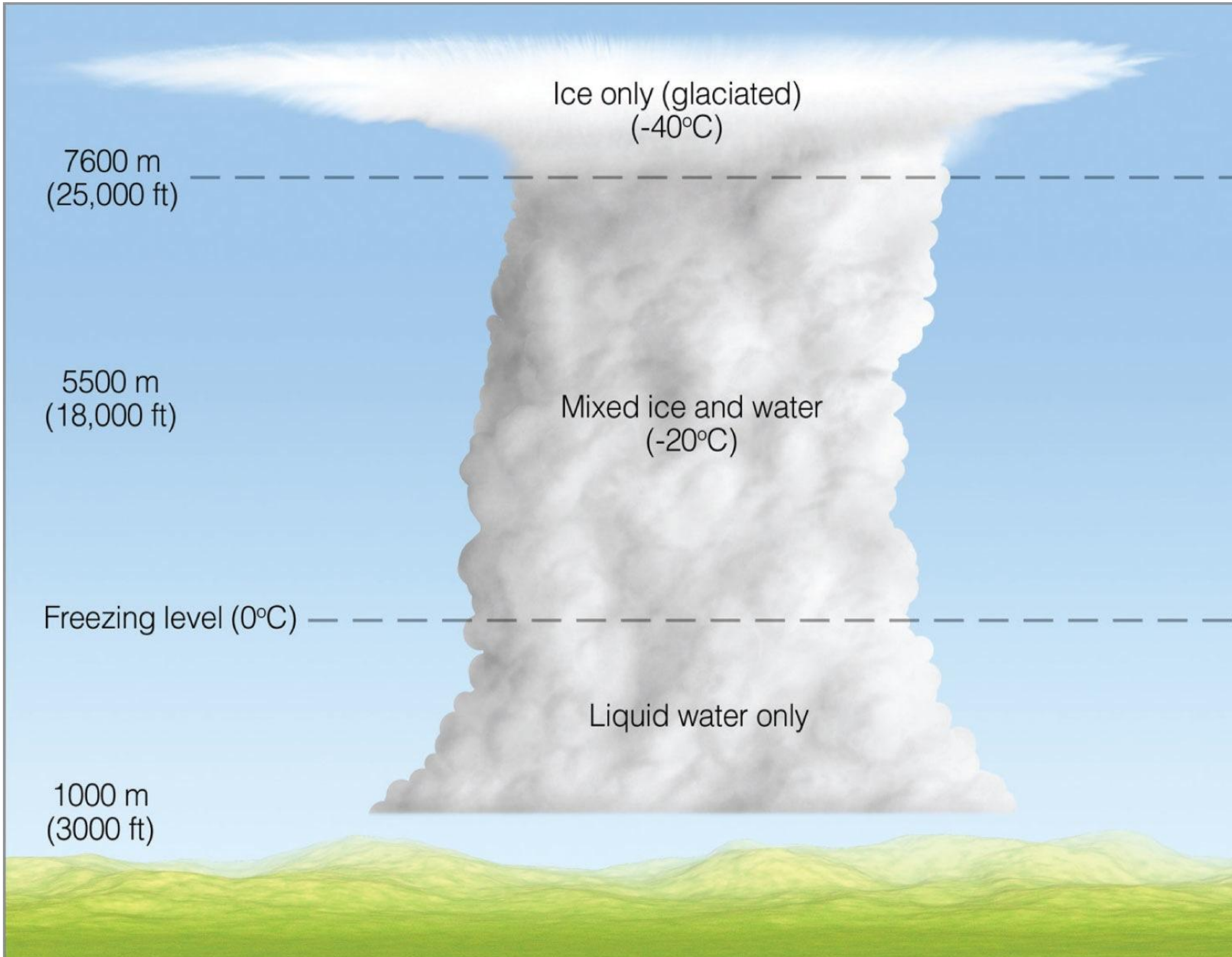
Light drizzle	Moderate drizzle	Heavy drizzle	Light rain	Moderate rain	Heavy rain
Visibility more than 1/2 mile.	*Visibility from 1/2 to 1/4 mile.*	*Visibility less than 1/4 mile.*	*0.1 inch or less in an hour*	*.11 to .30 inches per hour*	*More than .30 inches per hour.*


STOP

Hail

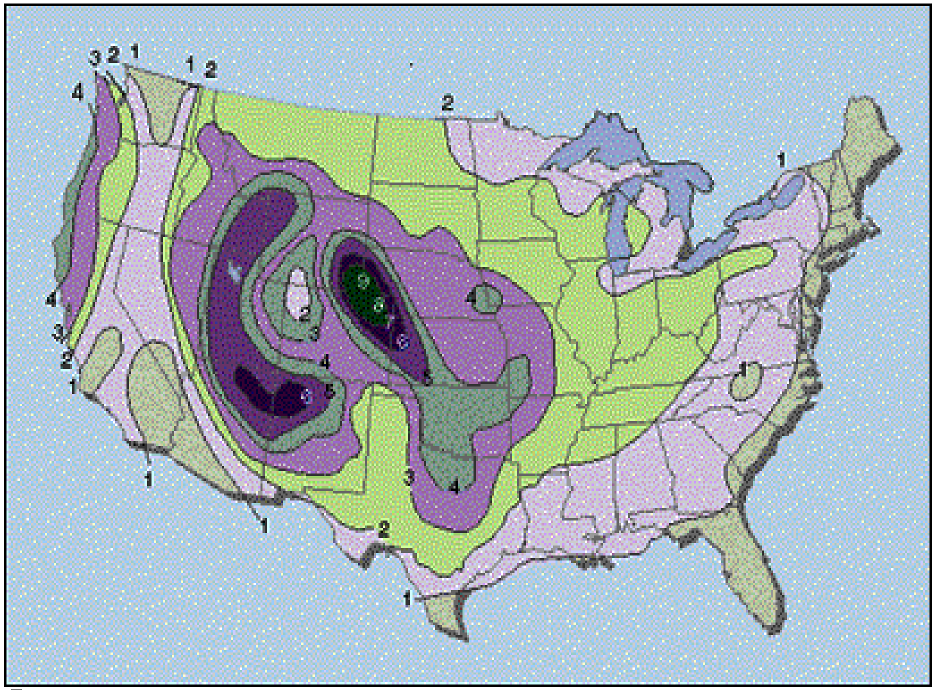
Hail is a thunderstorm precipitation only. It forms as ice particles circulate above and below the freezing level in a thunderstorm.

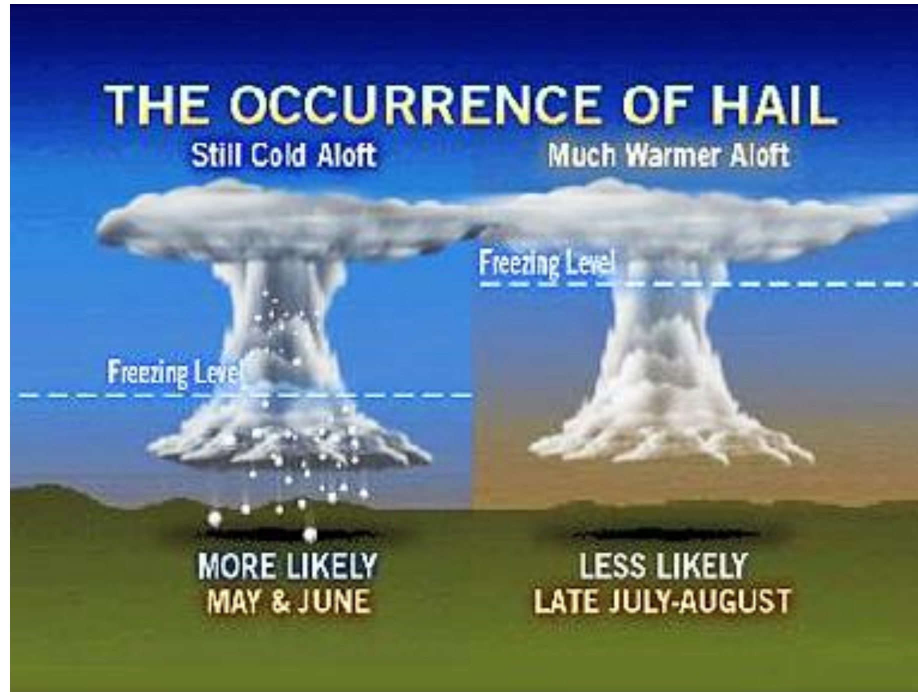




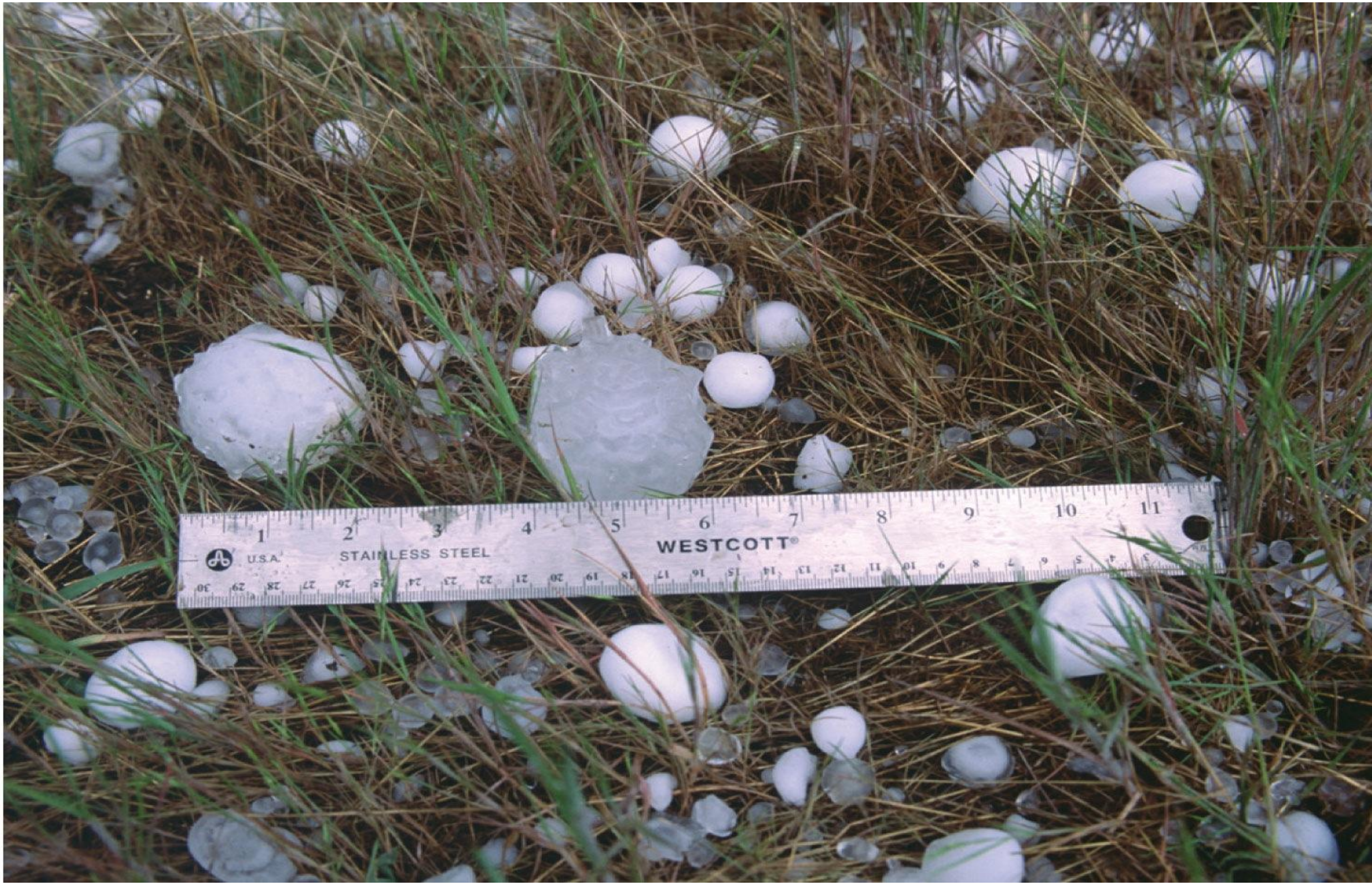
Ice only (glaciated)
(-40°C)
7600 m
(25,000 ft)
5500 m
(18,000 ft)
Mixed ice and water
(-20°C)
Freezing level (0°C)
Liquid water only
1000 m
(3000 ft)

Hail Occurrence





Though Florida has the most thunderstorms, Nebraska, Colorado, and Wyoming usually have the most hail storms. The area where these three states meet – "hail alley," averages seven to nine hail days per year. The reason why this area gets so much hail is that the freezing levels (the area of the atmosphere at 32 degrees or less) in the high plains are much closer to the ground than they are at sea level, where hail has plenty of time to melt before reaching the ground.



Hailstones of varying sizes fell over west Texas during an intense thunderstorm.

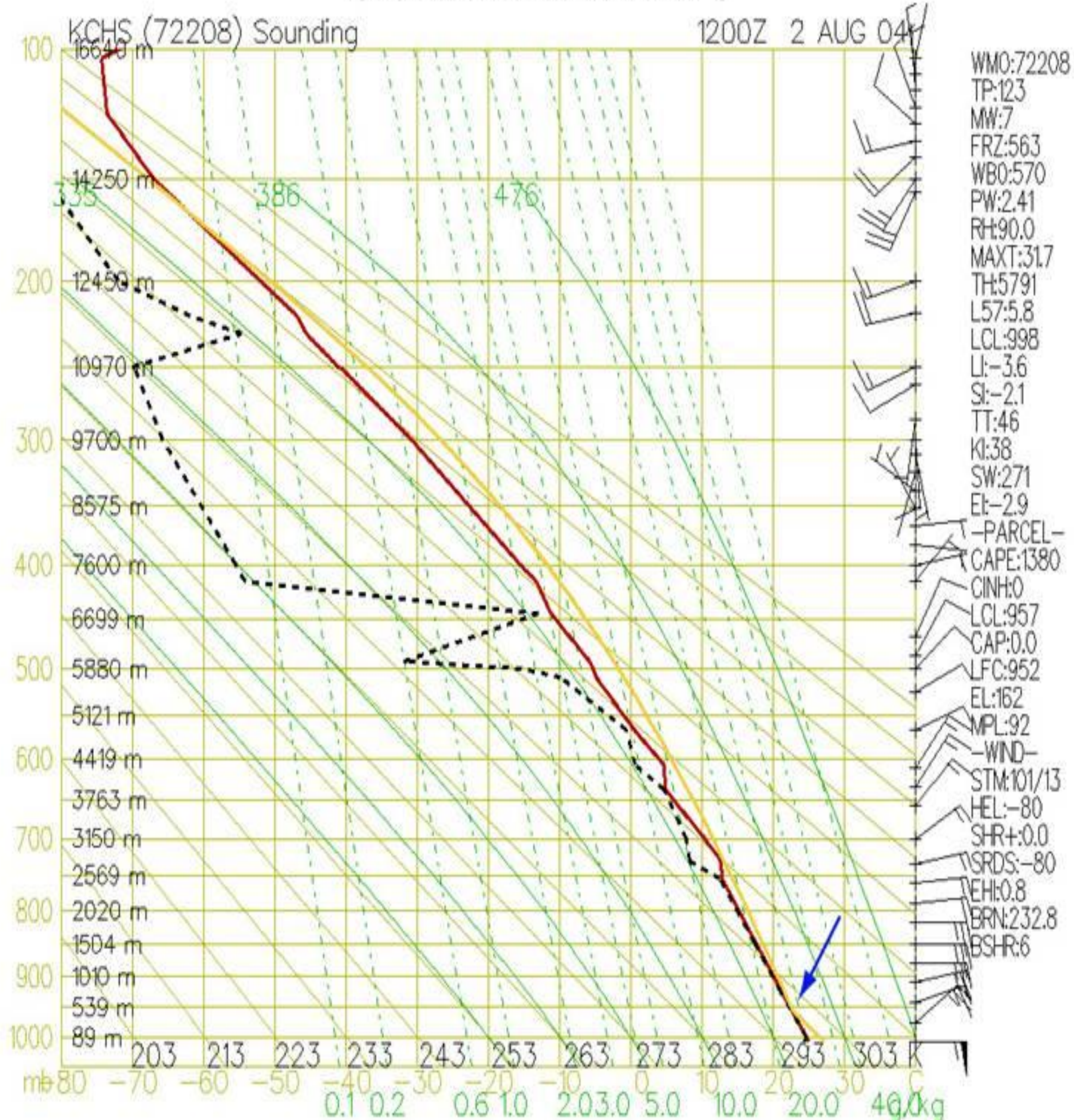
Hail Sizes

PEA
PENNY
QUARTER
GOLFBALL
BASEBALL
SOFTBALL
UPDRAFT REQUIRED
30mph
45mph
55mph
70mph
100mph
100+mph
FALL SPEED
20mph
40mph
50mph
60-70mph
75-100mph
100+mph

NOAA National Weather Service

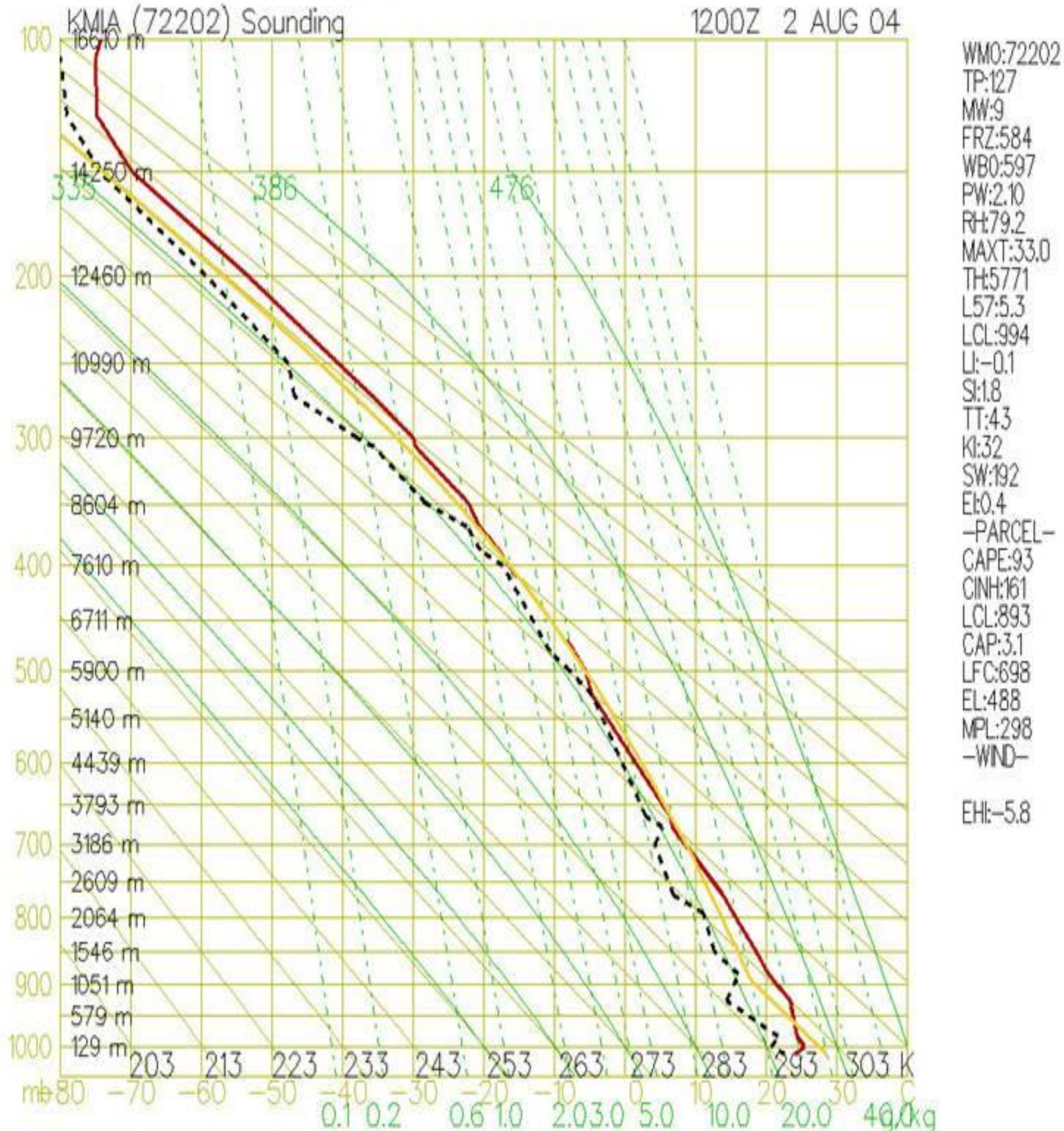
This whopping hailstone fell on Vivian, South Dakota, on July 23, 2010. It had a record diameter of 8 inches, weighed a record 1.94 pounds and had a circumference of 18.6 inches.

Forecasting Precipitation



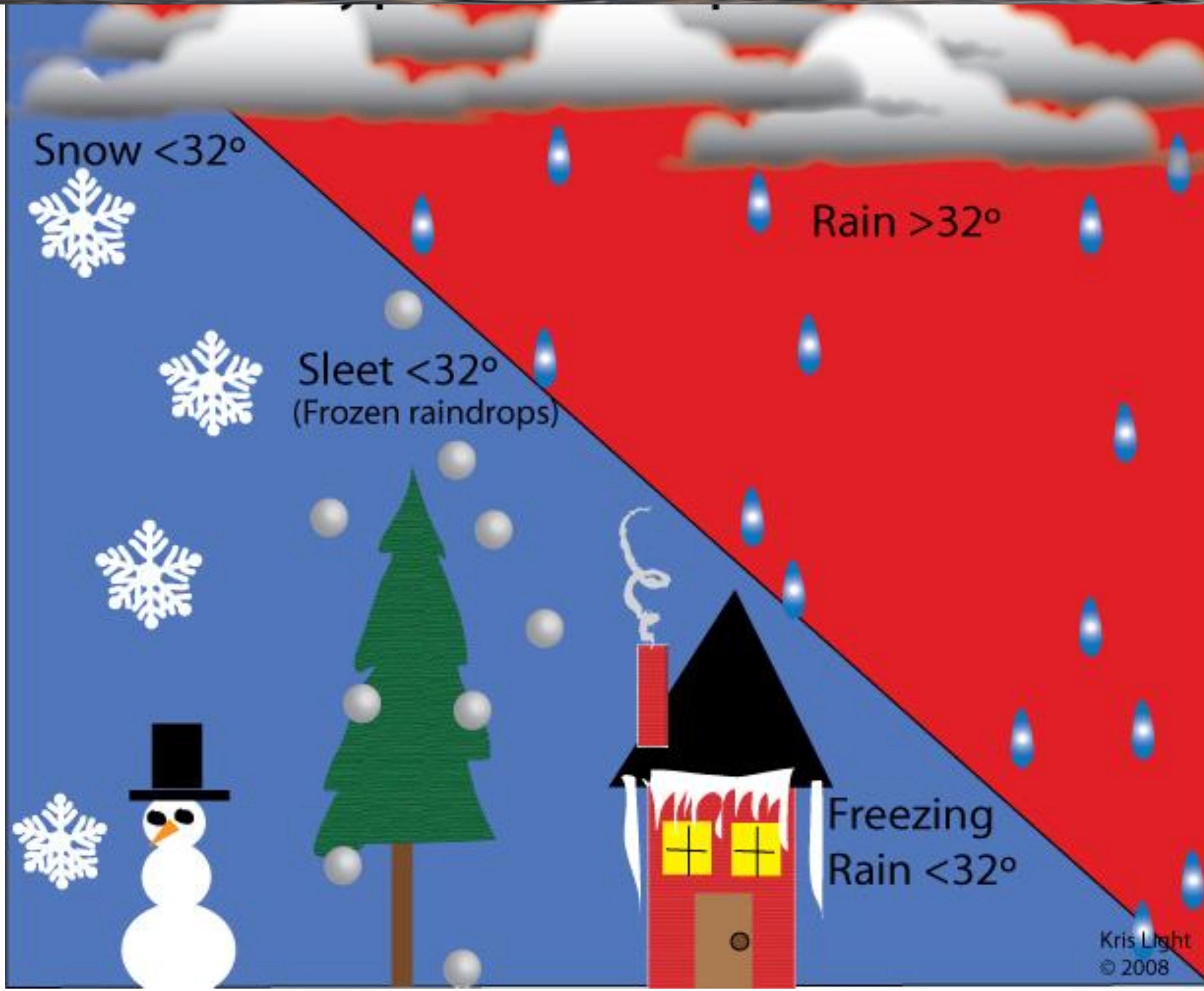
Stuve diagram for Charleston, South Carolina on the same day. Note that the air is virtually saturated at ground level and that the dew point is nearly equal to the air temperature! The mixing ratio is also about 20g H_20/kg. This is a very warm storm with very heavy rain. The LCL is 957 mb which is only a few hundred meters (see the arrow) off the ground. From the LCL on, the yellow line follows the saturated adiabatic lapse rate (note that it lies to the right of the red line). The air parcel rises not only because it is still warmer than the surrounding air, but also as a function of the latent heat that is released from the water vapor when it condenses (more warmth=continued rising). This cycle typically perpetuates itself until all available moisture in the system has condensed. Thus, cloud tops form once lifting ceases. Note that the cloud in Figure 7 is quite deep; it occupies nearly the entire troposphere!

Forecasting Precipitation

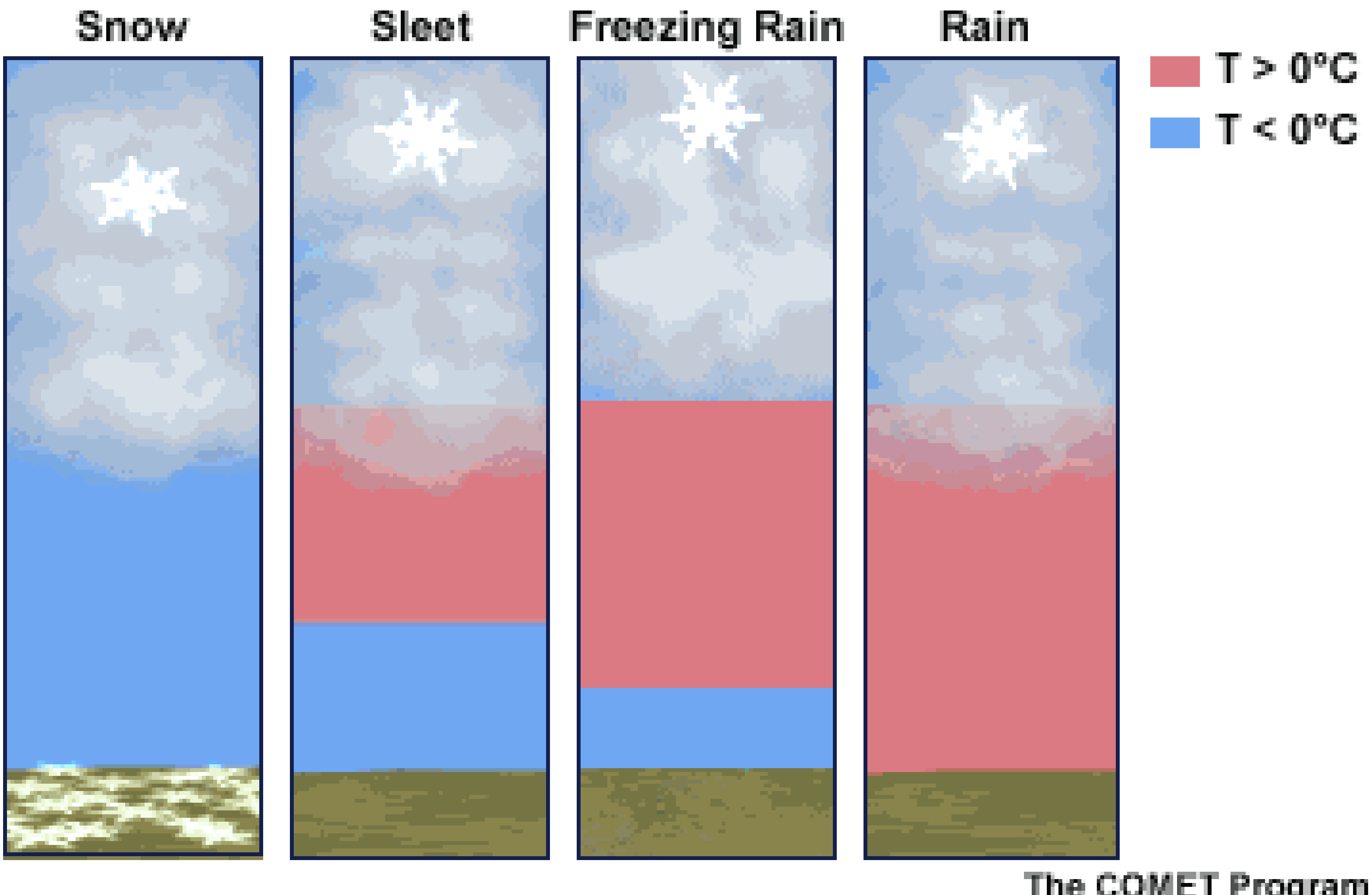


Stuve diagram for Miami on the same day. Here the cloud level is less deep, but as the air is still significantly moist, significant rain still results. The amount of rain an area receives is dependent on the cloud depth and the amount of moisture in the air.

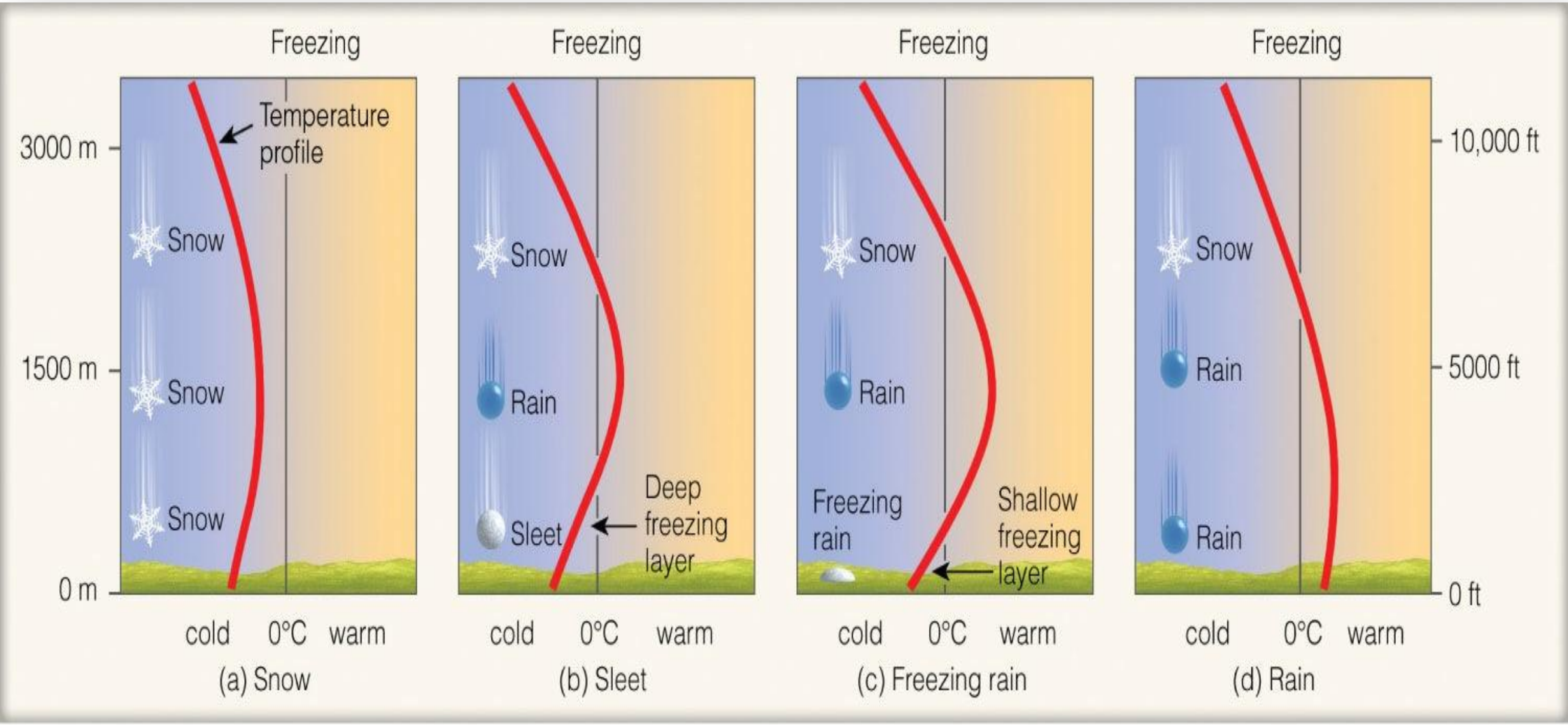
Types of Winter Precipitation



Forecasting Winter Precipitation



Forecasting Winter Precipitation



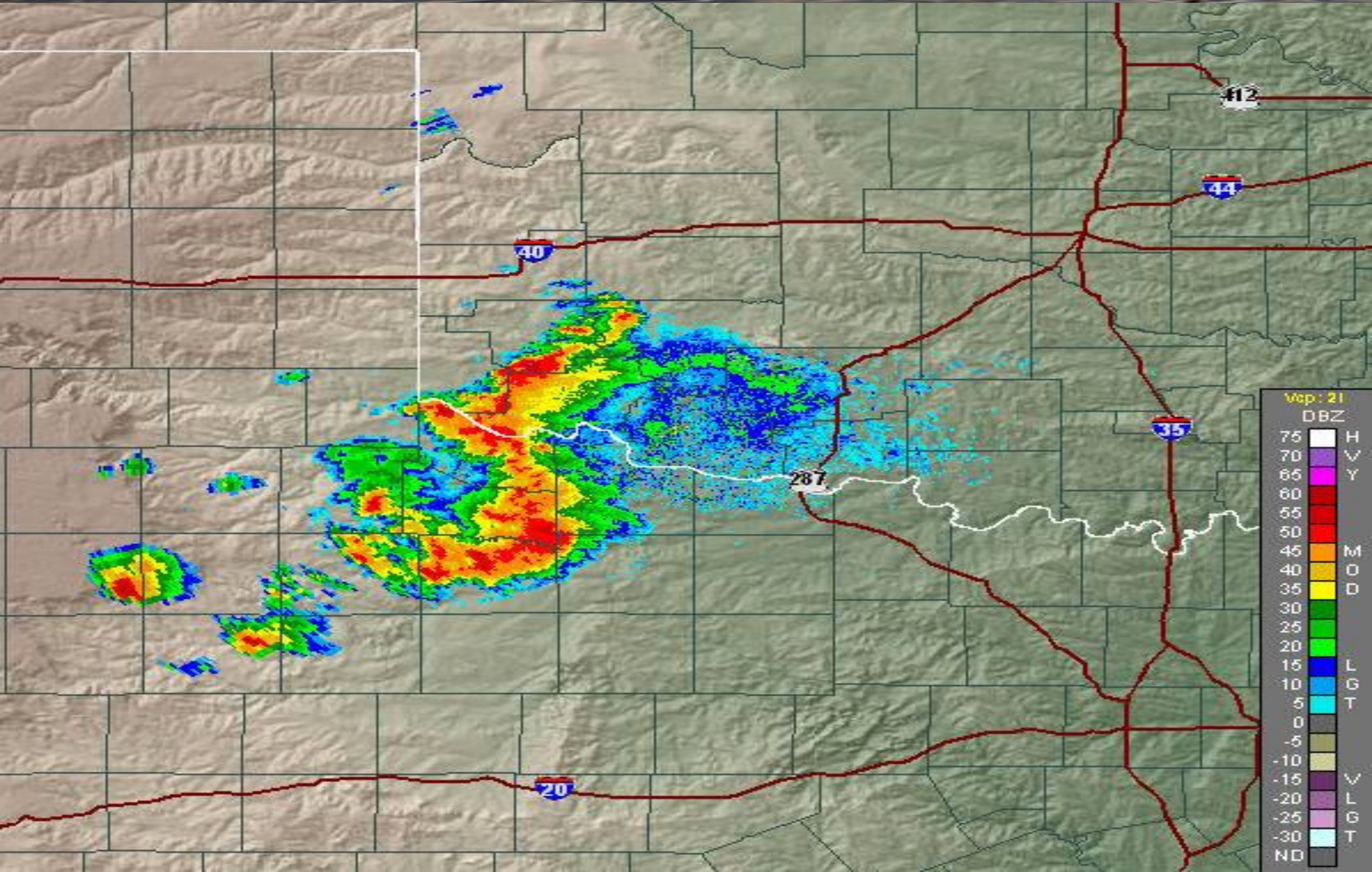
The type of precipitation that falls to Earth depends upon the surface temperatures.

Mistaken Precipitation

Fog, Dew, and Frost are often mistaken for types of precipitation.

Monitoring Precipitation

Monitoring Precipitation



This Concludes

Moisture, Clouds, Atmospheric Stability, and Precipitation