Review

- Absolute Humidity – Mass WV / Vol Air (g/m^3)
- Specific Humidity – Mass WV / Mass Air (g/kg)
- Mixing Ratio – Mass WV / Mass Dry Air (g/kg)
  - 1 kg = 1000 g
- Sat. Mixing Ratio – Mass of WV in Sat. Environment / Mass of Dry Air (g/kg)
- Relative Humidity – Mass of WV / Mass of WV in a Sat. Environment.

Vapor Pressure

- Water Vapor in air is a collection of water molecules which all have kinetic energy, and therefore temperature.
- Since all the molecules move, they all exert a pressure.
- So, the more the molecules of wv per volume…the higher the vapor pressure!

Vapor Pressure cont..

- Obeys the idea gas law
  - $e=\rho RT$
- Molecular weight of dry air
  - 29
- Molecular weight of water
  - 18
- Dry air is more dense than water vapor!
- Why the air feel more heavy when humid?
  - A physiology thing…

Evaporative Cooling

- Sweat – Heat extracted from sweat, less heat in sweat means sweat cools, making us cooler.
  - Does this process work as efficiently in a more humid environment. (overhead drawing)
- Same process cools ocean…how?

Dew Point Temperature

- Temp a parcel of moist air must reach in order to become saturated
  - evaporation = condensation
- Good indicator of moisture in the air
- Large difference between T and Td means dry air
- See video
- Skew-T

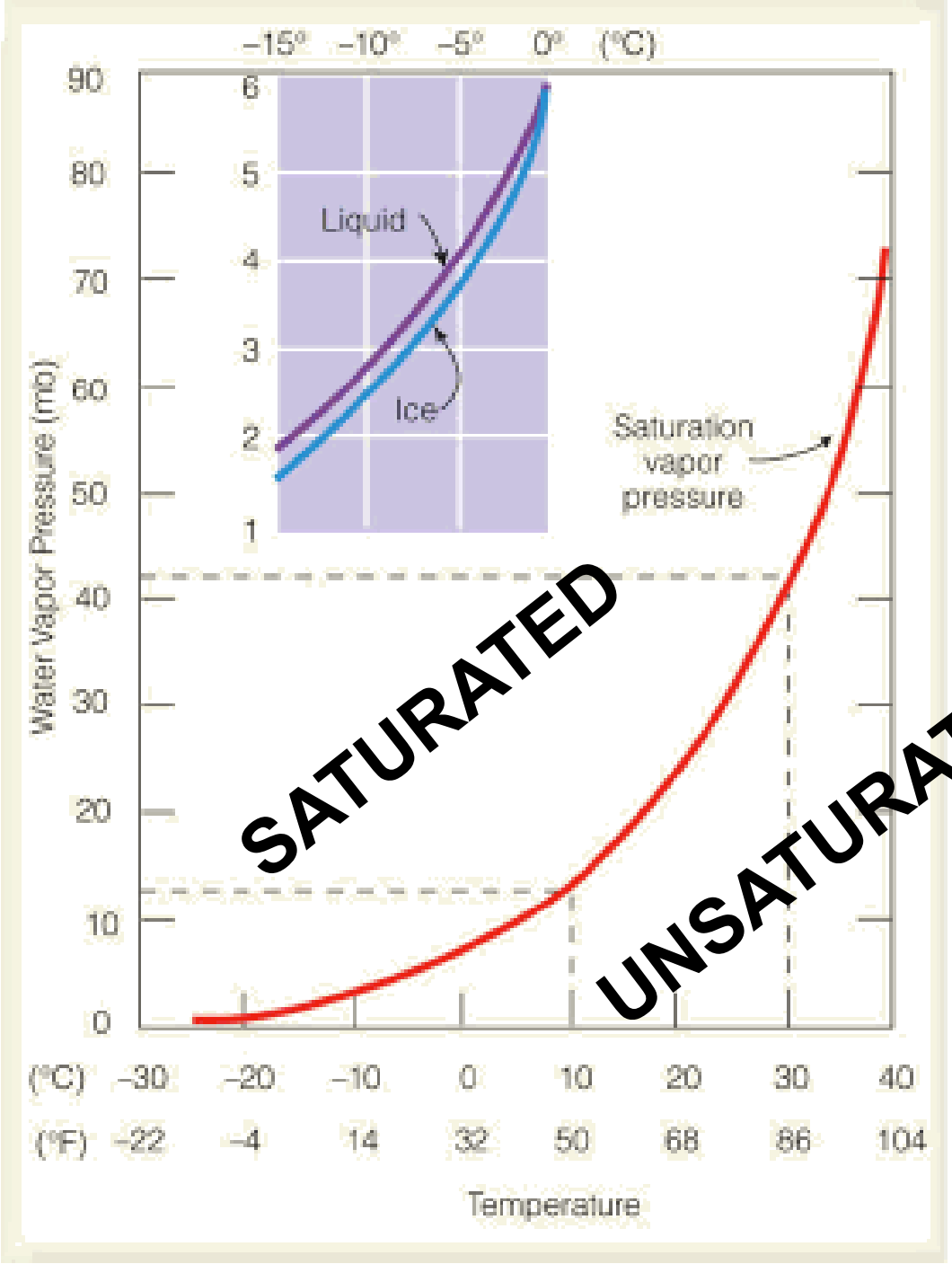


Fig. 4-10, p. 91

Dew →

T<0ºC

How does dew and frost form?

-Radiational Cooling at night
-Air above cold surface cooled by conduction
-Once temperature cools to the dew point, water vapor in air condenses on surfaces

Frost →

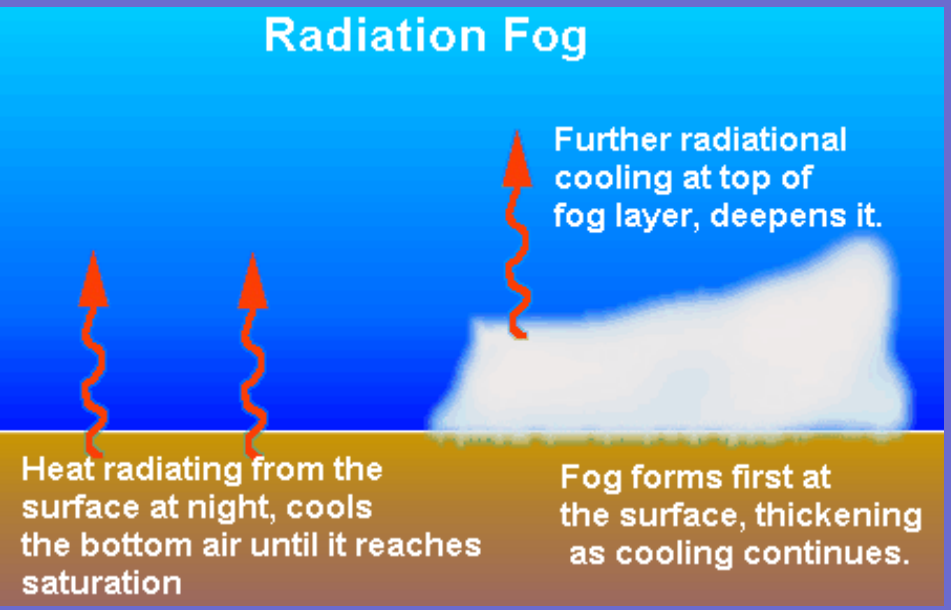
T<0ºC

Fog

- What is fog?

- Varieties of Fog
  - Radiation fog
  - Advection fog
  - Upslope fog
  - Valley fog
  - Evaporation fog

Radiation Fog

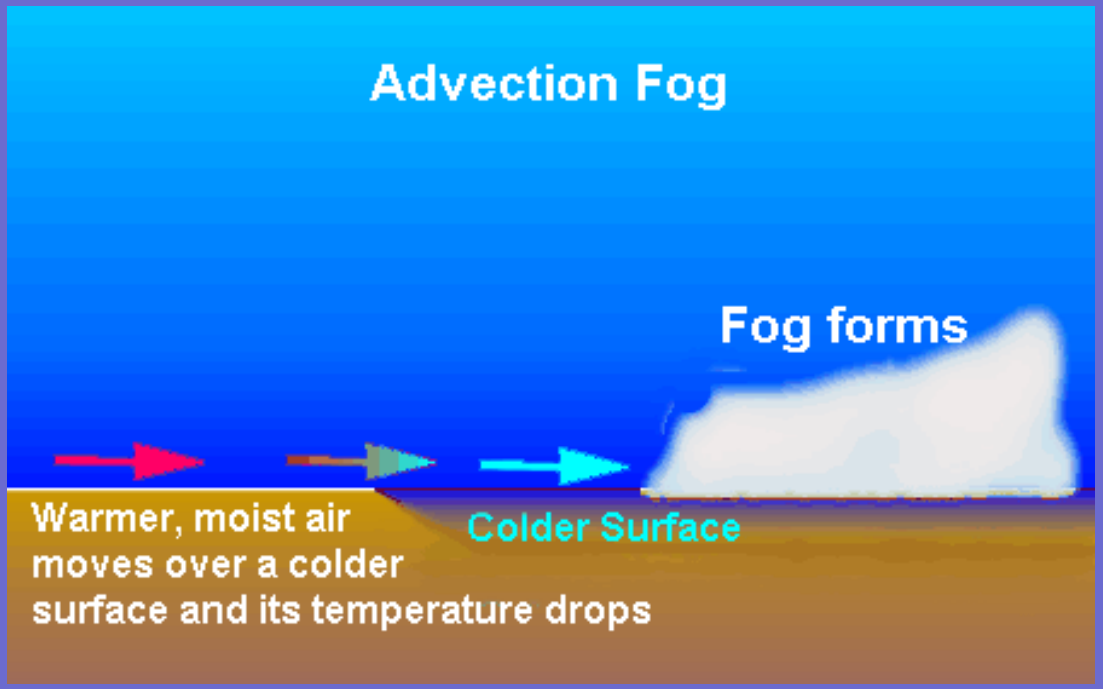


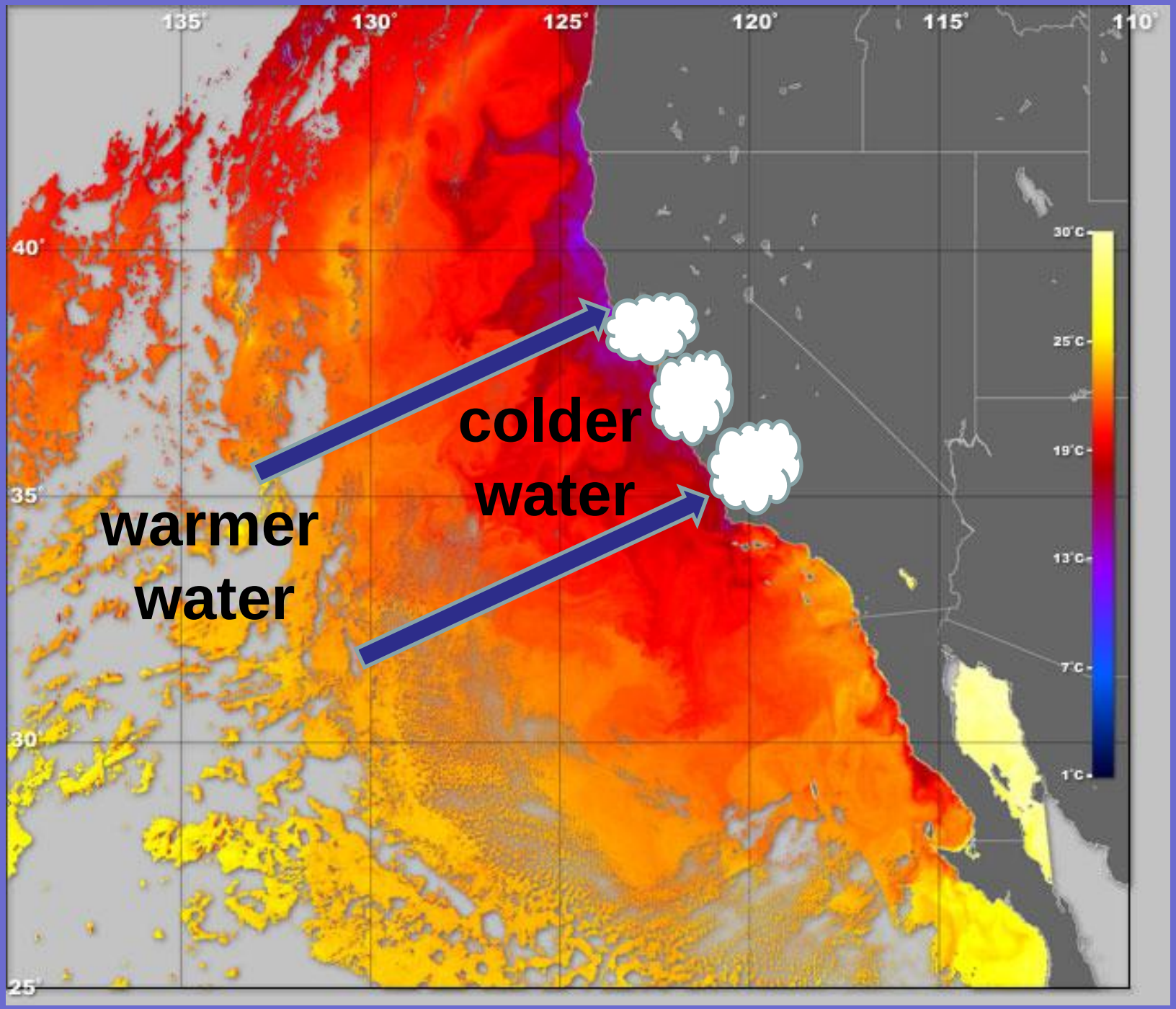
Ingredients:
-nighttime radiative cooling
-moist air
-calm winds

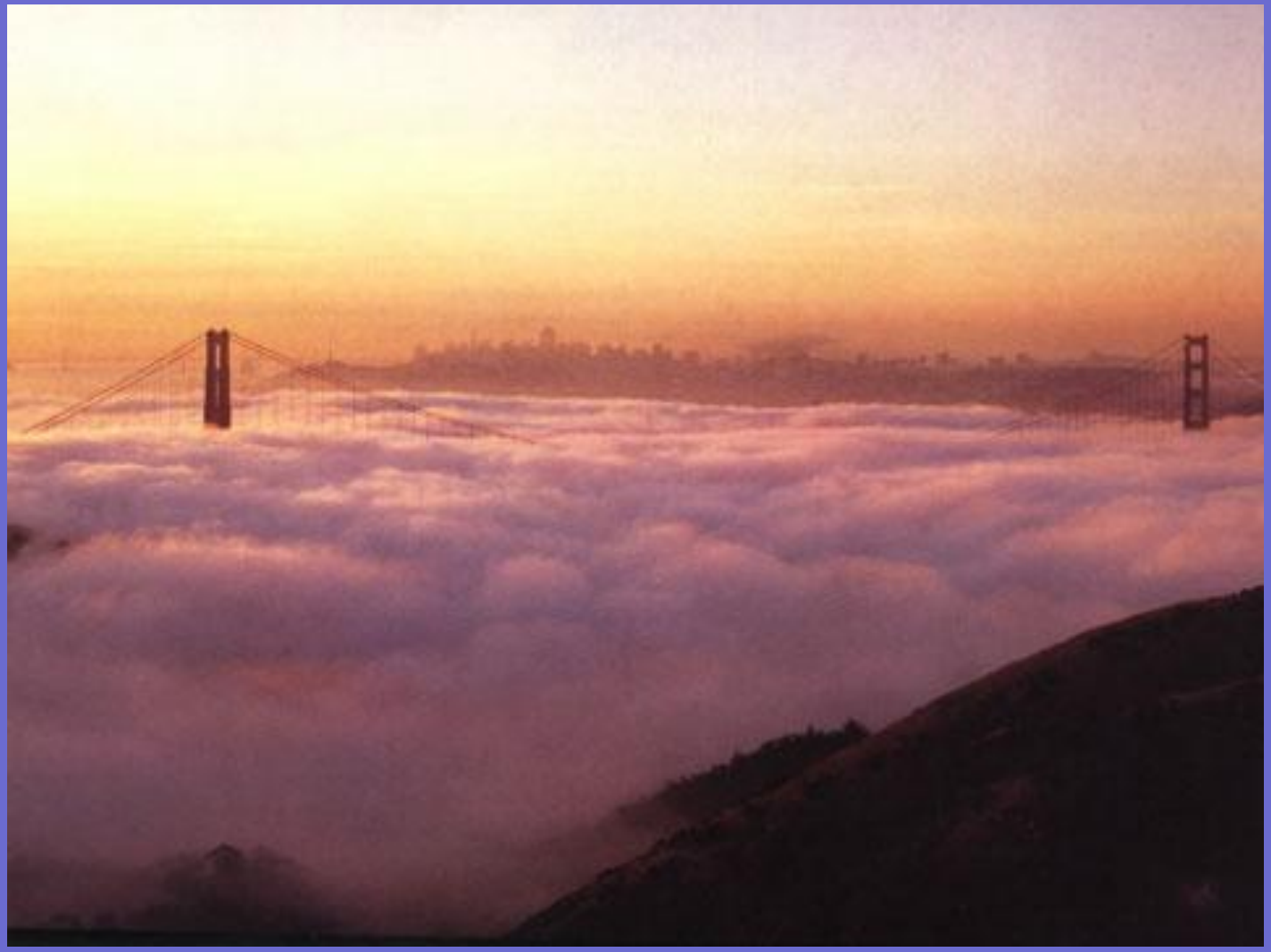
Air cools to dew point → condensation of water vapor on cloud condensation nuclei in atmosphere

Advection Fog

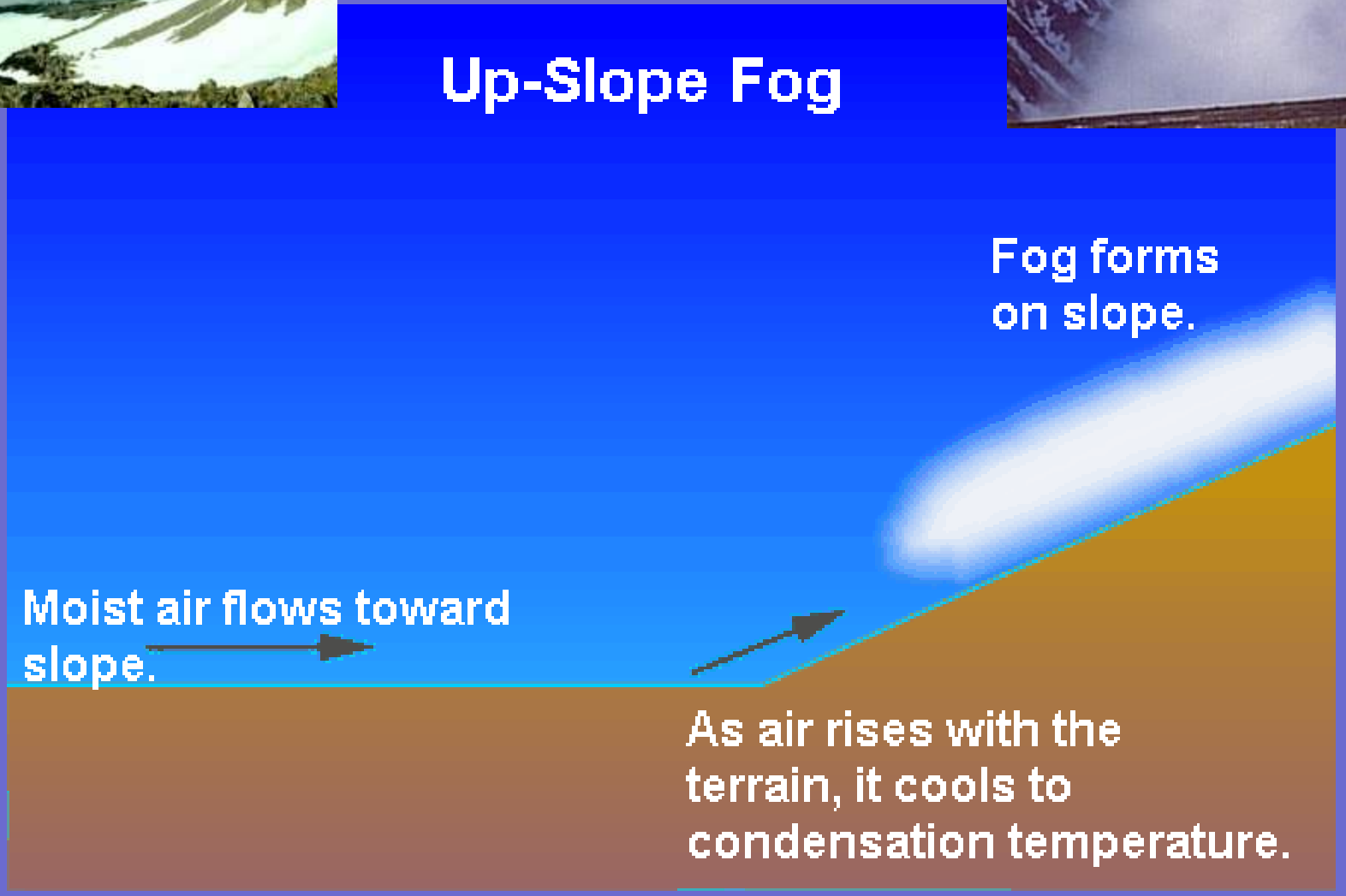
- Warm air moving over cold surface is cooled to saturation
  - What season is best for this?



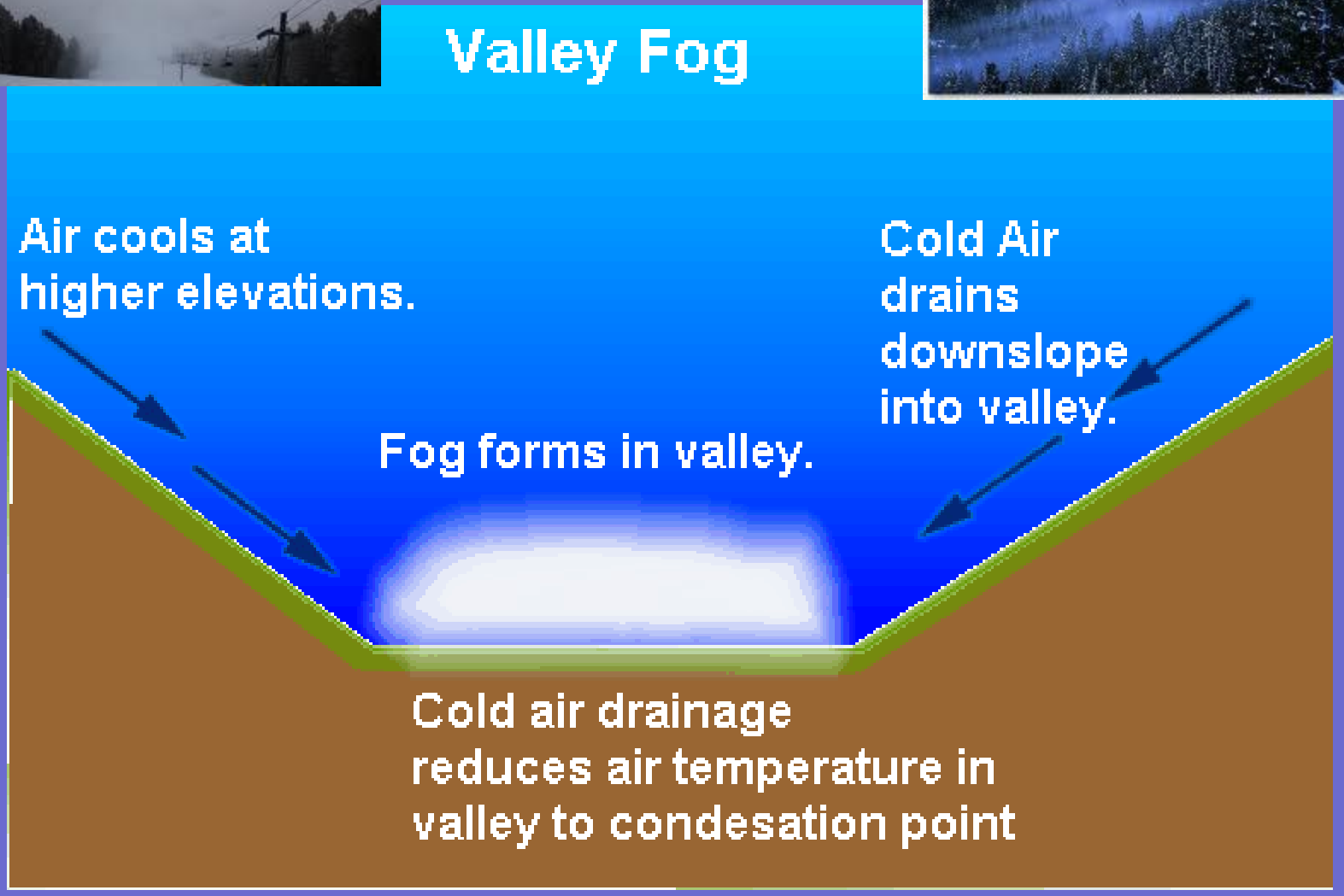

135°
130°
125°
120°
115°
110°
40°
35°
30°
25°
30°C
25°C
19°C
13°C
7°C
1°C
warmer water
colder water



Upslope Fog


Up-Slope Fog
Fog forms on slope.
Moist air flows toward slope.
As air rises with the terrain, it cools to condensation temperature.

Valley Fog


Valley Fog
Air cools at higher elevations.
Cold Air drains downslope into valley.
Fog forms in valley.
Cold air drainage reduces air temperature in valley to condesation point

Steam Fog

-cold, dry air over warm surface

-vapor added to air

-air becomes saturated if mixed and rises

Haze

- Vapor condenses onto condensation nuclei (soot, clay etc.) when relative humidity ~ 75%

- Haze scatters white light

Clouds!!!

-Condensation occurs away from surface

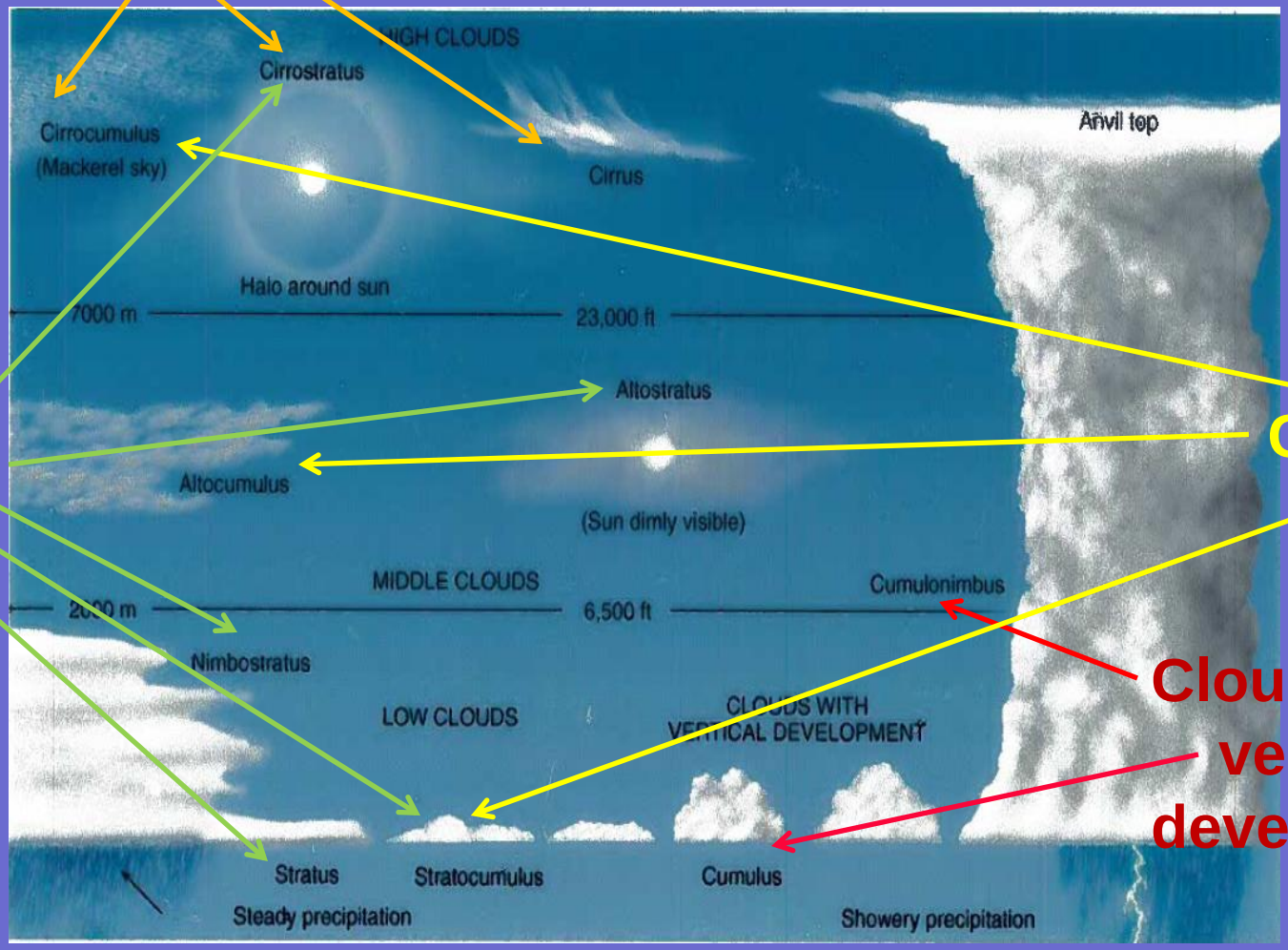
-10 major types of clouds

Determined by:

-form/composition

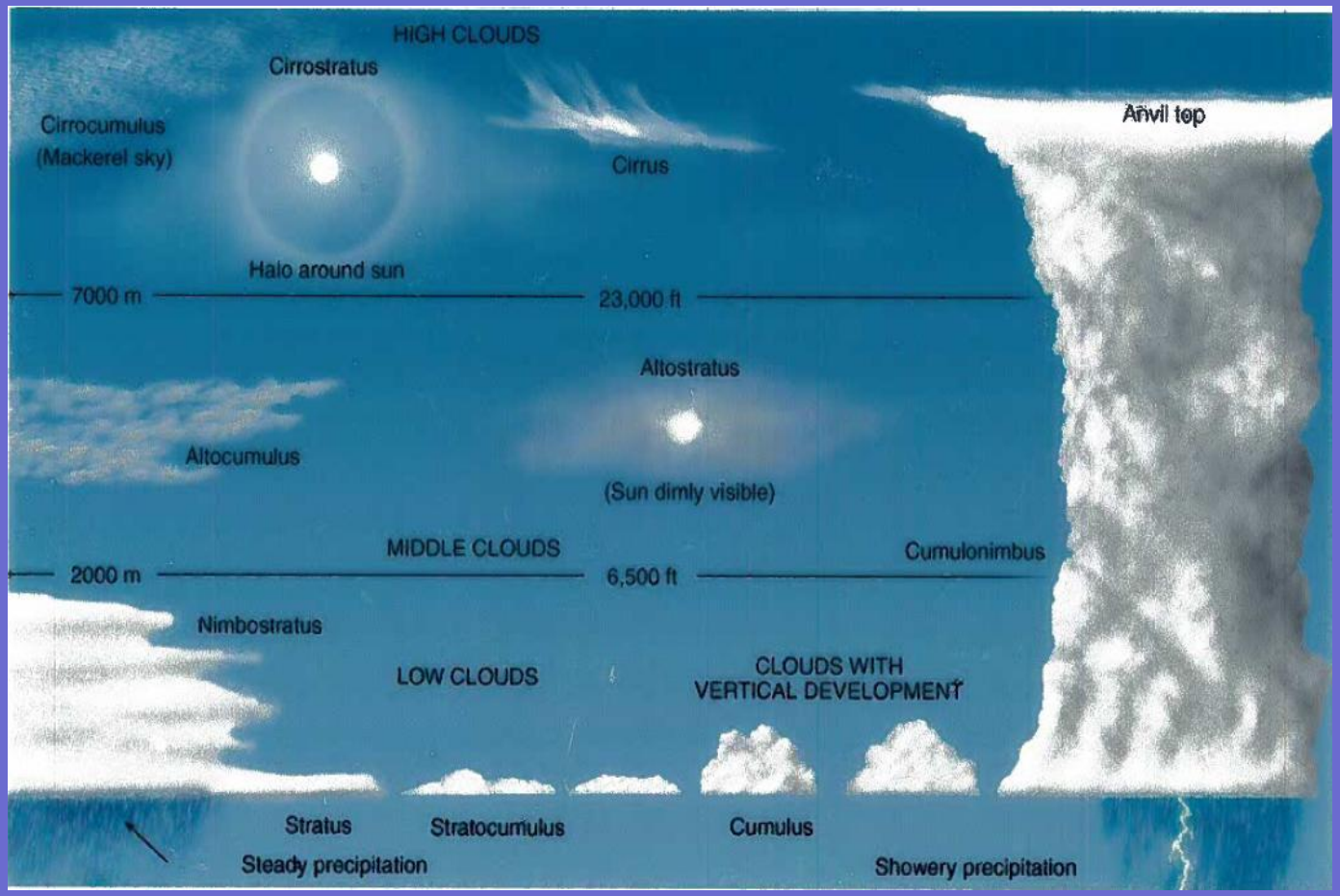
-cloud base height

Major Cloud Types



Cirrus – wispy, fibrous Stratus- sheet-like Cumulus – puffy heaps

Cloud Types



High Clouds
-above 6km
-mostly ice
-thin clouds

Middle Clouds
- 2-6km
-‘alto’ prefix
-thicker clouds
-mix of ice, liquid

Low Clouds
-Below 2km
-water
-Sharp boundaries

Clouds with Vertical Development
-cumulus
-cumulonimbus

-Height of cloud base for low, mid, and high clouds varies between tropical, mid-latitude, and polar regions

High Clouds

Cirrus

Cirrostratus

Cirrocumulus

- Cirrus- thin, mares' tails, move from west to east across sky
- Cirrostratus- thin, sheetlike, can cover sky, produce halos
- Cirrocumulus- small white puffs, can occur in rows

Middle Clouds

Altocumulus

Altostratus

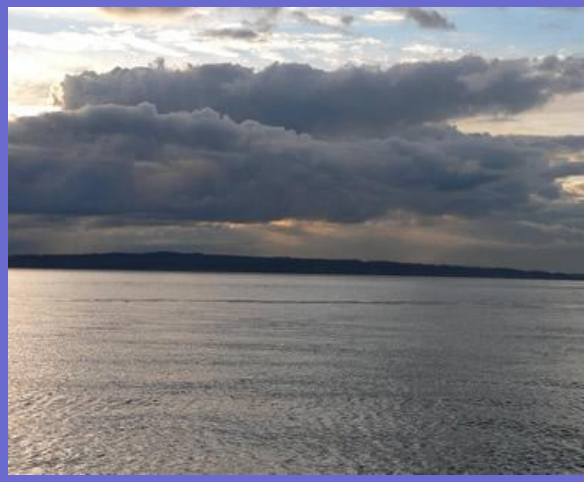
- Altocumulus- gray, puffy , wavy, may indicate thunderstorms
- Altostratus- gray, blue-gray, covers sky, sun dimly visible

Low Clouds

Nimbostratus

Stratus

Stratocumulus



- Nimbostratus- dark gray, light-moderate precipitation
- Stratus- uniform gray, covers sky, possibly mist or drizzle
- Stratocumulus- lumpy, in rows or patches, light to dark gray

Clouds with Vertical Development

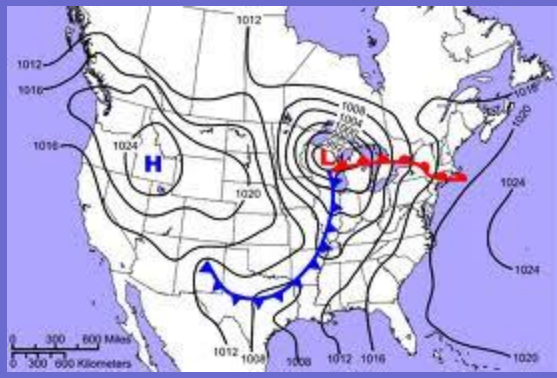
Cumulus

Cumulonimbus

- Cumulus- cotton puff, flat base, lots of blue sky between
  - Fair weather cumulus, towering cumulus (showers)
- Cumulonimbus- thunderstorm cloud
  - Updrafts, anvil, hailstones, ice, rain, lightning, thunder, tornadoes

On weather maps..

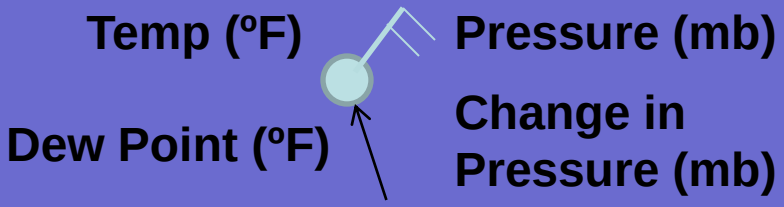
- Isobar - line of constant pressure
- Isoheight/Isohypse – line of constant height
- Isotherm – line of constant temperature
- Isotach – line of constant wind speed

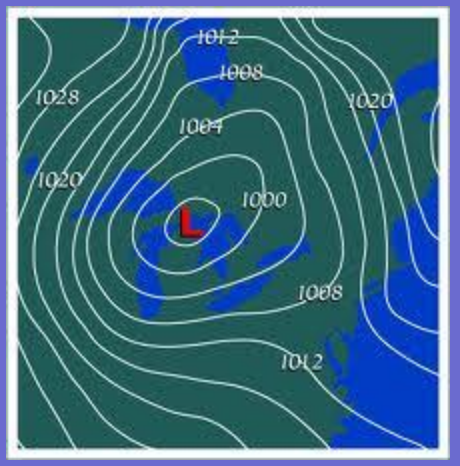


Isodrosotherm?

Isochalaz?

Surface Station Plot





Atmospheric pressure provided with leading 9 or 10 omitted.
ex) If pressure 999.8 mb, plotted as 998……If pressure 1002.4 mb, plotted as 024

Use the number (9 or 10) that will give value closest to 1000 mb.