

Weather & Atmospheric Variables Review

Words that are bold, italicized and/or underlined are vocabulary you must KNOW!

A) Atmospheric variables:

a) **Temperature** as it relates to:

- 1) duration of insolation.....longer day = higher temp.
- 2) time of day.....afternoon (2-3 PM) = highest temp.
- 3) season of year.....late summer = highest temp
- 4) **altitude** (in **troposphere**)..... higher = lower temp
- 5) latitude.....equator (0° lat) = highest temp
- 6) cloud cover..... more clouds = lower temp.
- 7) **aerosols** and **particulates** (smoke).....more 'stuff' in the air = lower temp.
- 8) absorptive qualities of land/water.....land gets hotter faster and
land cools off faster.

b) **Pressure** as it relates to:

- 1) altitude.....higher = lower pressure
- 2) temperature.....higher temp = lower pressure
- 3) moisture in air (**humidity**).....more moisture = lower pressure
- 4) highest pressure.....cold/dry air = high pressure
- 5) lowest pressure.....warm/moist air = low pressure

6) pressure measurement - pressure measured w/**barometer**
measured in:

- 1) **millibars**
- 2) **inches of Hg**
- 3) **atm (atmospheres)** - pressure at sea level = 1 atm

c) **Humidity** (moisture content of air)

- 1) **Absolute humidity** - amount of water vapor in the air
- 2) **Relative humidity** - amount of water vapor in the air as compared to
the maximum capacity of the air at a given temp.

affected by

- a) temperature - warmer air can hold more water vapor
- b) actual water content of air

d) **Dew point** - The temperature at which:

- a) air is **saturated**
- b) relative humidity is 100%
- c) **evaporation** effectively stops
- d) **wet bulb temp** = dry bulb temp
- e) water vapor will **condense***

* If the dew point is < freezing point then water vapor **sublimates** into ice/snow

B) **Cloud formation**

- a) Air rises, cools to dew point, **condensation** occurs
- b) Releases heat into air (540 cal/g)
- c) Water must **condense** onto nuclei (**condensation nuclei** - pollen, dust, etc)
- d) If **dewpoint** < 0°C, then ice crystals **sublimate**.
- e) **Clouds** are **aerosols** - droplets or ice
- f) **Droplets** remain suspended until heavy enough to fall
 - 1) **Rain & Hail** - frozen rain (both begin as liquids)
 - 2) **Snow** - (vapor to solid) - only form of precipitation that begins as solid
- g) The **cloud base** is the altitude at which the air temperature is at the **dew point**.

C) **Convection in the atmosphere**

- a) Depends on **density differences**
 - 1) Least dense air (warm and moist) rises:
 - 2) As the air rises it expands and cools* becoming more dense.
- * if the air is cooled to the **dew point**, **condensation** occurs. This removes moisture from the air which is now not only cooler but also dryer. Cool, dry air is the most dense air.
- 3) Now this more dense air sinks completing the convection current
- b) Convection currents are caused by unequal heating of Earth's surface
 - 1) Land = low sp. heat = heats & cools quickly
 - 2) Water = high sp. heat = heats & cools slowly
 - 3) Different surface characteristics
Rough/dark or smooth/light
 - 4) Different cloud cover
Clouds reflect light keeping the surface beneath them cool.
 - 5) Different latitudes
Poles cold. Equator warm.

D) **How does air move?**

- a) From high pressure to low pressure
- b) From cool and dry to warm and moist
- c) **Coriolis effect**
 - 1) counterclockwise INTO a low = "**cyclone**"
 - 2) clockwise OUT OF a high = "**anticyclone**"
- e) Wind speed dependent on pressure gradient*

***The greater the difference (gradient, slope) between the high and the low pressure systems, the faster the winds blow.**

E) **Air mass characteristics:**

- a) Depends on the surface over which they formed:
 - 1) over ocean = moist (maritime) - m
 - 2) over land = dry (continental) - c
 - 3) warm region = tropical - T
 - 4) cold region = polar - P = cold
arctic - A = coldest

- b) Air masses are described by their temperature and moisture content:
 - 1) *cP or cA = cold and dry = high pressure*
 - 2) *mT = warm and moist = low pressure*

- F) **Fronts: interface** between two air masses (know where to find symbols on reference tables)
- a) cold front
 - b) warm front
 - c) *stationary* front
 - d) *occluded* front (cold overtakes warm)

Know which way the front is moving. Understand that the air mass is behind the front.

G) **Reading weather maps**

- b) *Isobars* - connect points of equal pressure.
 - Usually look like *concentric* circles (more or less)
 - If pressure is decreasing towards the center it's a LOW
 - If pressure is increasing towards the center it's a HIGH
- c) *isotherms* - connect points of equal temperature.
 - Usually look like roughly parallel lines
 - dip south when away from water - central part of U.S.
- d) precipitation will usually occur **just behind cold front** or possibly just ahead of a warm front.
 - e) air mass BEHIND front

G) **Reading station models** (know how to use the example on your reference table)

- a) Know how to convert *millibars* to abbreviated form.
- b) Know how to convert *millibars* \leftrightarrow *inches Hg*.
- b) relate barometric *trend* to previous/future pres.
- c) airmass symbols

Important stuff to remember:

- > Whether you are looking at numbers, reading a graph, or looking at a picture of a sling psychrometer, always remember that *the closer together the wet and dry bulb temperatures are, the higher the relative humidity and therefore, the greater the chance or precipitation.*
If wet bulb temp. = dry bulb temp. then RH = 100%
- > Heat is distributed around the planet by winds in the atmosphere (see "planetary winds and moisture belts" map on page 14 of your reference tables) AND by currents in the ocean (see Surface Ocean Currents" map on page 4 of your reference tables).

> This unit requires extensive knowledge and use of your reference tables. Here are the charts and tables along with pages with which you must be familiar:

- 1) Specific heats & properties of water (page 1)
- 2) Gradient, rate of change, and density equations (page 1)
- 3) Surface Ocean Currents (page 4)
- 4) Average Chemical Properties (page 11)
- 5) Dewpoint & Relative Humidity (page 12)
- 6) Temperature conversions (page 13)
- 7) Pressure conversions (page 13)
- 8) Weather Map Symbols (including station model) (page 13)
- 9) Properties of the Earth's Atmosphere (page 14)
- 10) Planetary Wind and Moisture Belts (page 14)

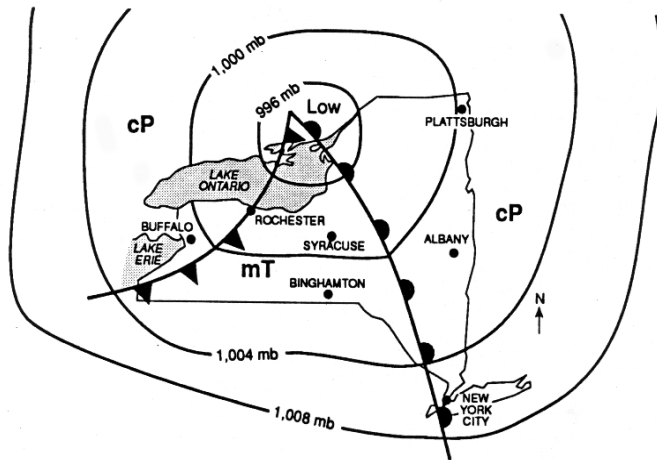
Remember, first you have to know where to look to find the information you need and then you must know how to use (interpret) the reference tables.

> Interpreting weather maps: When asked "Where is it most likely raining" this is what you should look for:

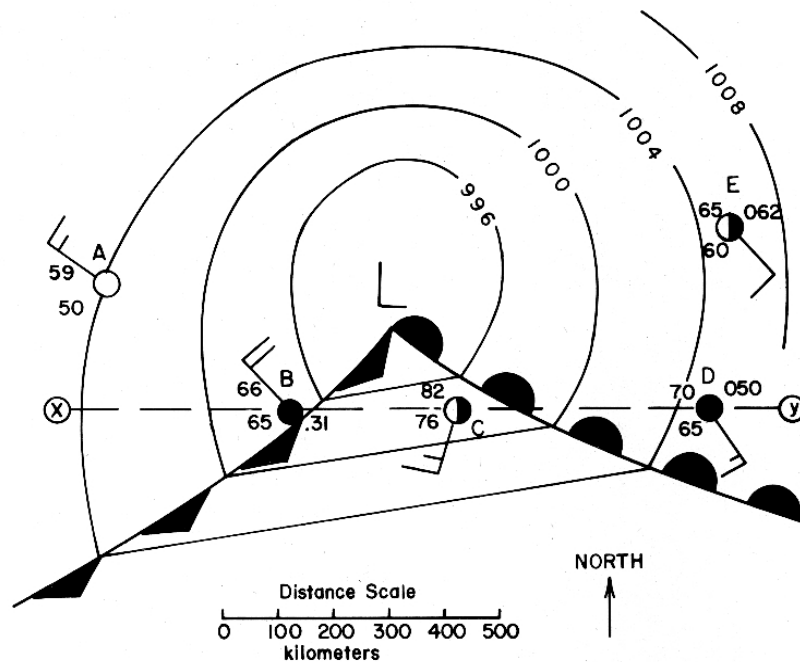
- 1) Look just **behind a cold front** or, if no choices are found there, look for a choice located at a warm front. It will be raining **at or near a front**.
- 2) Look for a location whose station model shows **100% cloud cover**.
- 3) Look for a location whose station model shows the **smallest difference between air temperature and dew point temperature**.

This is the "Classic Weather Map"

- > The lines are isobars
- > There is cold air behind the cold front and ahead of the warm front.
- > This shows a low pressure system. The pressure decreases towards the center.
- > Where is it most likely raining? Rochester.
- > What is the pressure at Albany? 1002 millibars (half way between 1000 and 1004 mb).
- > Which cities are in a warm air mass (experiencing the highest temperatures)? Binghamton and Syracuse.
- > What is the forecast for NYC? (notice that a warm front is about to pass over NYC) A slow, steady rain (as the front passes) followed by clearing skies and warmer temps.
- > At which city is the relative humidity probably greatest? Rochester (it's raining).



Yet another classic weather map.



Q: Where is it most likely raining?

A: City B because at city B.....

There is 100% cloud cover.

The air temperature is very close to the dew point temperature

It is located just behind a cold front.

Q: What is the pressure at city D in inches (of Hg)?

A: 29.68 in

Q: What is the pressure at city E in mb?

A: 1006.2 mb

Q: What is the temperature at city C?

A: 28°C

Q: What is the wind direction at city B?

A: NW (from the NW)

Q: Which city has the slowest wind speeds?

A: City E (10 knots)

If you don't understand any of these answers, PLEASE ask your teacher!