


Weather Dynamics



ions as of 3:52 PM PDT

82 °F
30.15 in and falling
36 %
10 mi
53 °F
NW 10 mph
3
Moderate
6:54 AM
7:28 PM

83°
High: 73° Low: 51°

- » Detailed Forecast
- » Records and Averages
- » Get Yahoo! Weather on your desktop

WEATHER MAN

The only job where you can be wrong consistently, and still have a job.

Outcomes:

S2-4-01 Illustrate the composition and organization of the hydrosphere and the atmosphere.

Weather introduction...

What Is Weather?

- **WEATHER** is defined as the general condition of the atmosphere (the air that surrounds us) at a **PARTICULAR TIME** and **PLACE**.
- **WEATHER** is what you **SEE** when you **LOOK** out of a window in your home.
- **METEOROLOGY** is the study of **WEATHER**, weather **PHENOMENA**, and weather **FORECASTING**.

Example:

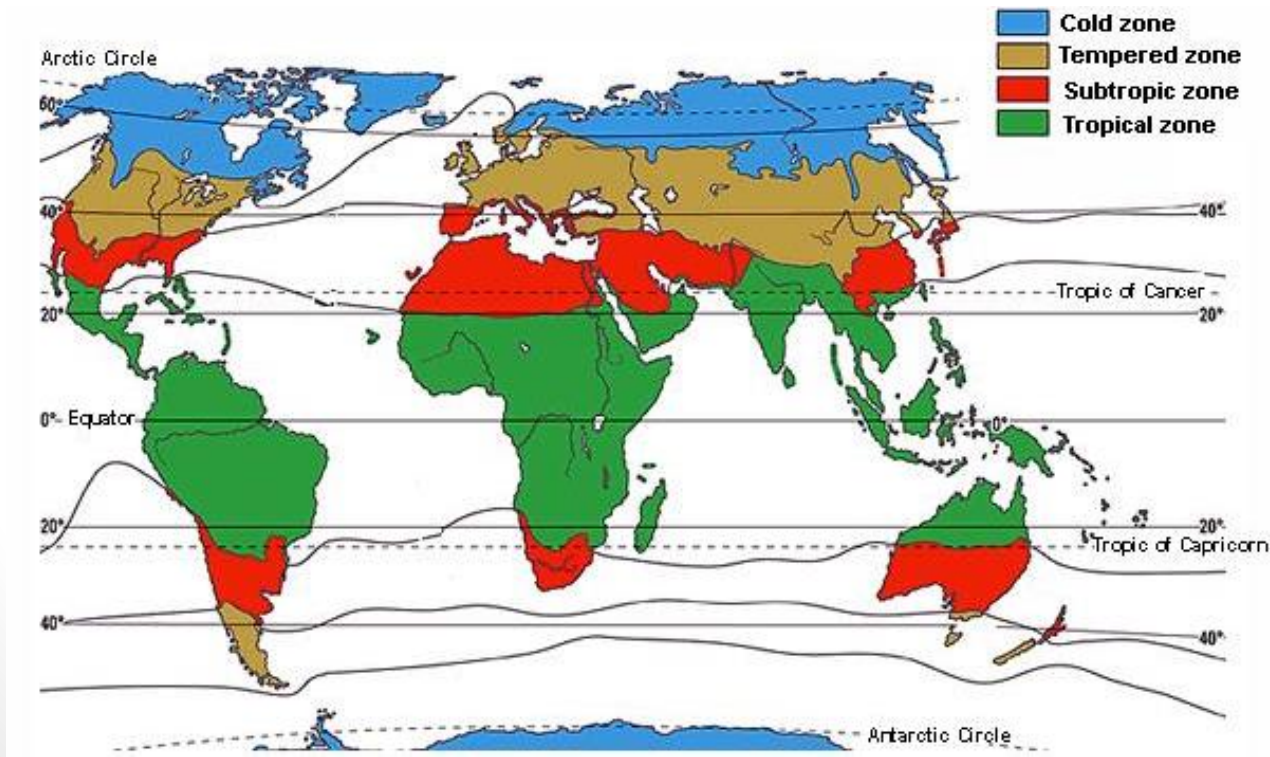
“Today in Winnipeg there are clear skies, light winds with a temperature of 15°C.”



Weather introduction...

What Is Climate?

- **CLIMATE** is a **LONG-TERM, AREA-SPECIFIC** idea.
- **CLIMATE** is the set of **PREVAILING** or **AVERAGE** weather conditions of a place **OVER TIME**, as determined by **MANY YEARS** (decades usually) of meteorological observations or data.
- **WEATHER CHANGES** all the time, but **CLIMATES** tend to be **MORE CONSTANT**, in spite of variations year to year.

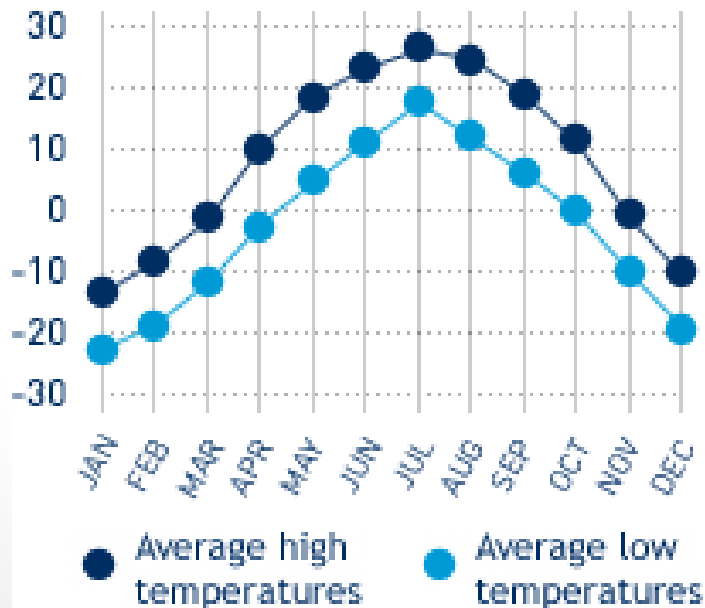


Weather introduction...

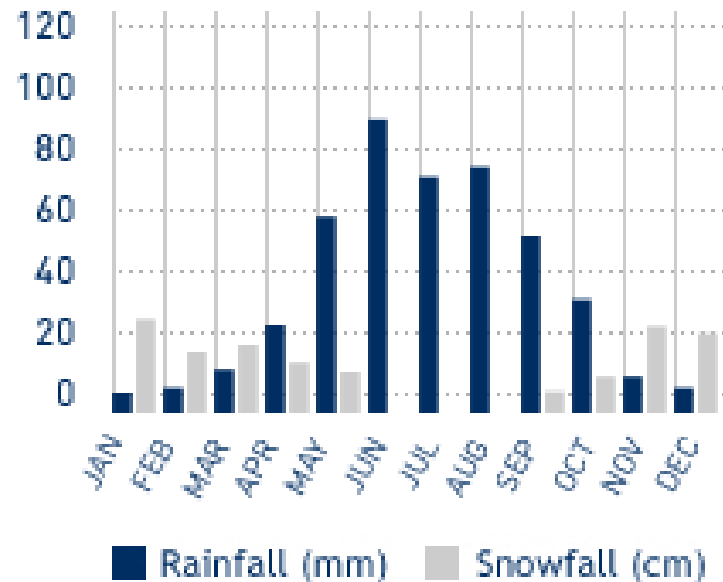
Example:

Winnipeg has what is often called a **CONTINENTAL** climate, with relatively **DRY**, **COLD WINTERS** from November to March and relatively **MOIST, WARM** **SUMMERS** from May to September; other areas in Manitoba will have varying climatic conditions

Average temperatures

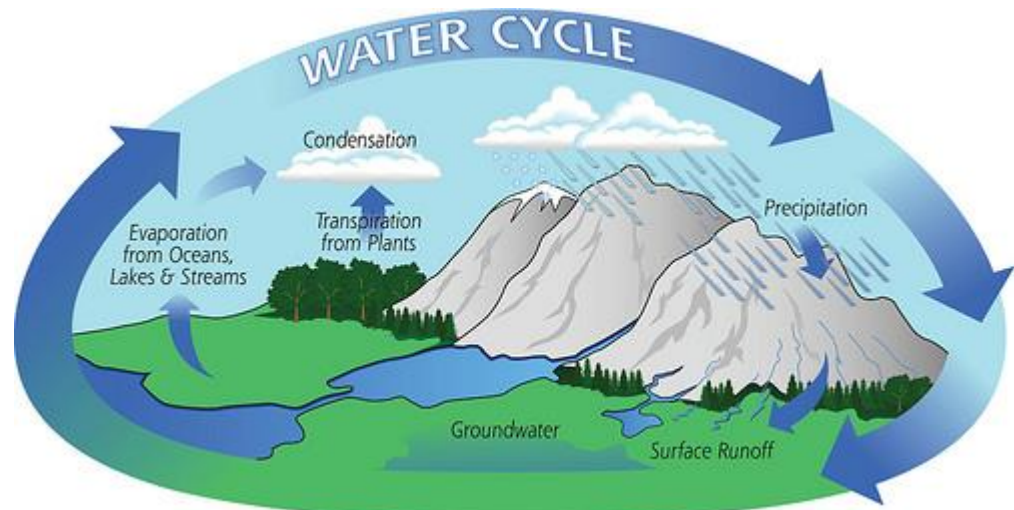
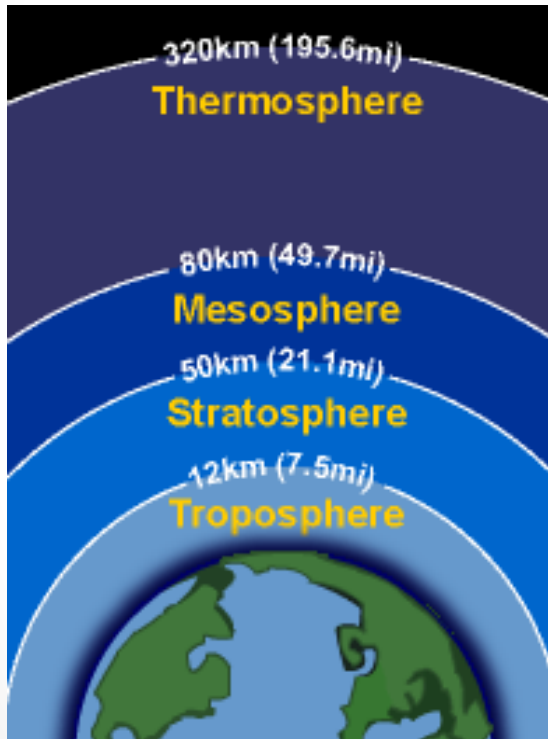


Average rainfall and snowfall



The Atmosphere & Hydrosphere...

The **ATMOSPHERE** and **HYDROSPHERE** (**AIR** and **WATER** spheres) of our planet are among its most unique and important features. Without them, biological **LIFE** as we understand it would be impossible.



It is no surprise that weather is highly dependent on the conditions in the **ATMOSPHERE** (after all, that's where weather occurs!), but it also **DEPENDS** greatly on interactions with water in the **HYDROSPHERE**.

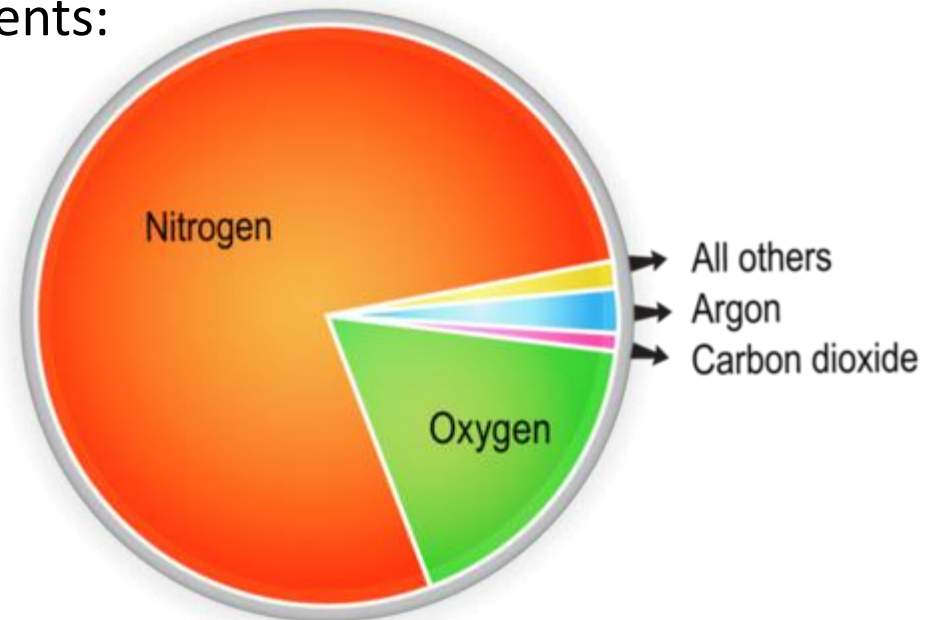
The Atmosphere...

The atmosphere is a **GASEOUS** blanket of **AIR** that covers the surface of the Earth.

Air is composed of three components:

1. **PERMANENT** gases

- Nitrogen (N_2) **78%**,
- Oxygen (O_2) **21%**,
- Argon (Ar) **1%**,
- Carbon Dioxide (CO_2) **0.035%**
- Minor amounts of Ne, Kr, Xe, He, H, methane (CH_4), and ozone (O_3).



The Atmosphere...

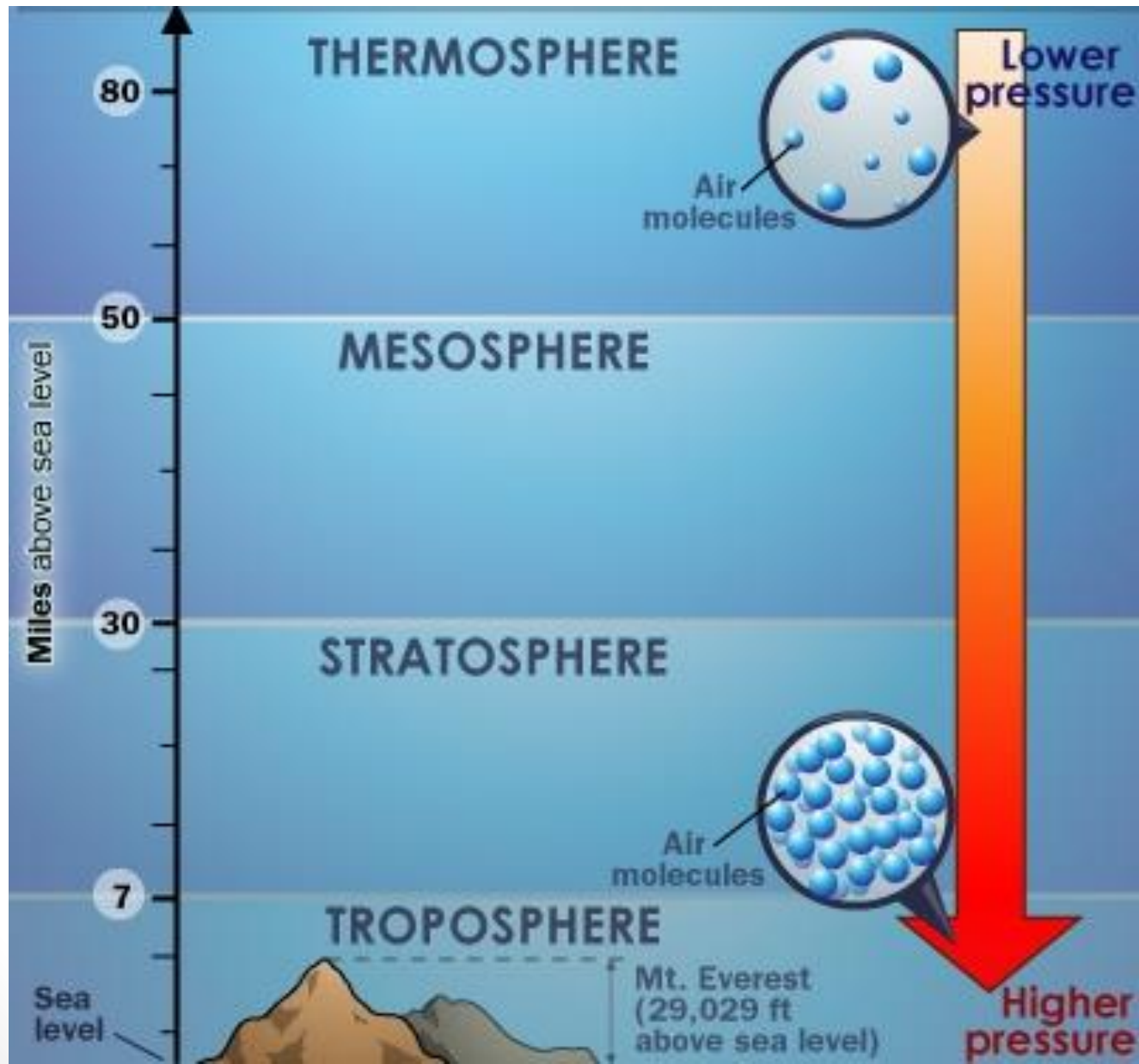
2. VARIABLE gases

- gases that do **NOT EXIST** in **FIXED** amounts (the amounts of these gases constantly change).
- Example:
 - **WATER VAPOUR** –
 - Can make up between **0 AND 7%** of the particles in air
 - Water vapour has a **MAJOR INFLUENCE** on **WEATHER**.
- Other variable gases in the atmosphere occur as a result of various natural phenomena (volcanoes) or human technology (car exhaust).

3. SOLID-LIQUID PARTICLES

- These particles, sometimes called **AEROSOLS**, are combined into the air by ocean waves (**SALTS**), volcanic eruptions (**ASH/DUST**) and by plants (**POLLEN**).
- Smog is a mixture of polluting gases and aerosols.

Layers of The Atmosphere...



The Atmosphere...

Troposphere (Tropo in Greek means “to mix”)

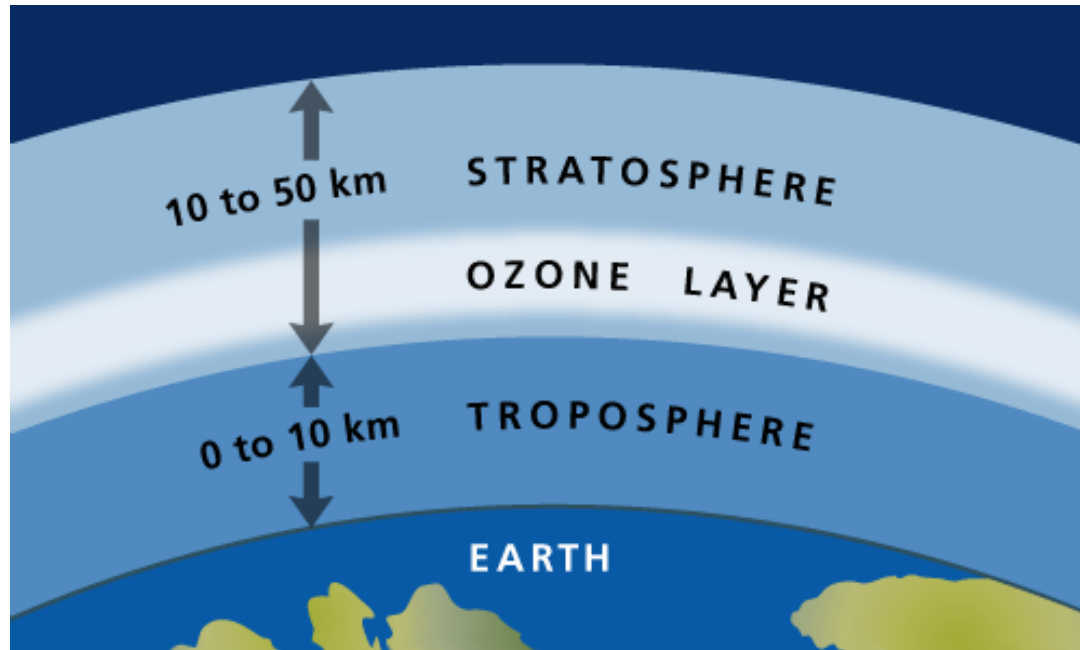
- Layer **CLOSEST** to Earth (ground to **8-14 KM** upward)
- **WEATHER** events **OCCUR** mainly in this **LAYER**.
- Temperature varies from **17°C TO -52°C**.
- **TEMPERATURE** and **AIR PRESSURE DROP** as you **RISE** through this layer.
- Contains **75%** of the total **AIR MASS** on Earth.
- **CLOUDS** and dry **GASES** combine to **SHIELD** living things from most of the high-energy radiation that comes from the Sun.



The Atmosphere...

Stratosphere

- DRY layer from 14 KM TO 50 KM above the Earth.
- Contains the OZONE layer (O₃ gas) that shields Earth from UV RADIATION, near the TOP of the stratosphere.
- TEMPERATURE INCREASES from -52°C TO -3°C because the UV radiation is absorbed by ozone molecules.
- HIGHEST clouds will occur in the LOWER stratosphere.
- Contains 24% of the Earth's air.



The TROPOSPHERE and the STRATOSPHERE contain 99% of the planet's atmospheric AIR MASS.

The Atmosphere...

Mesosphere

- Extends from 50 KM TO 85 KM above the Earth's surface.
- Temperature drops to -93°C
- Meteors are often observed burning up in the mesosphere



The Atmosphere...

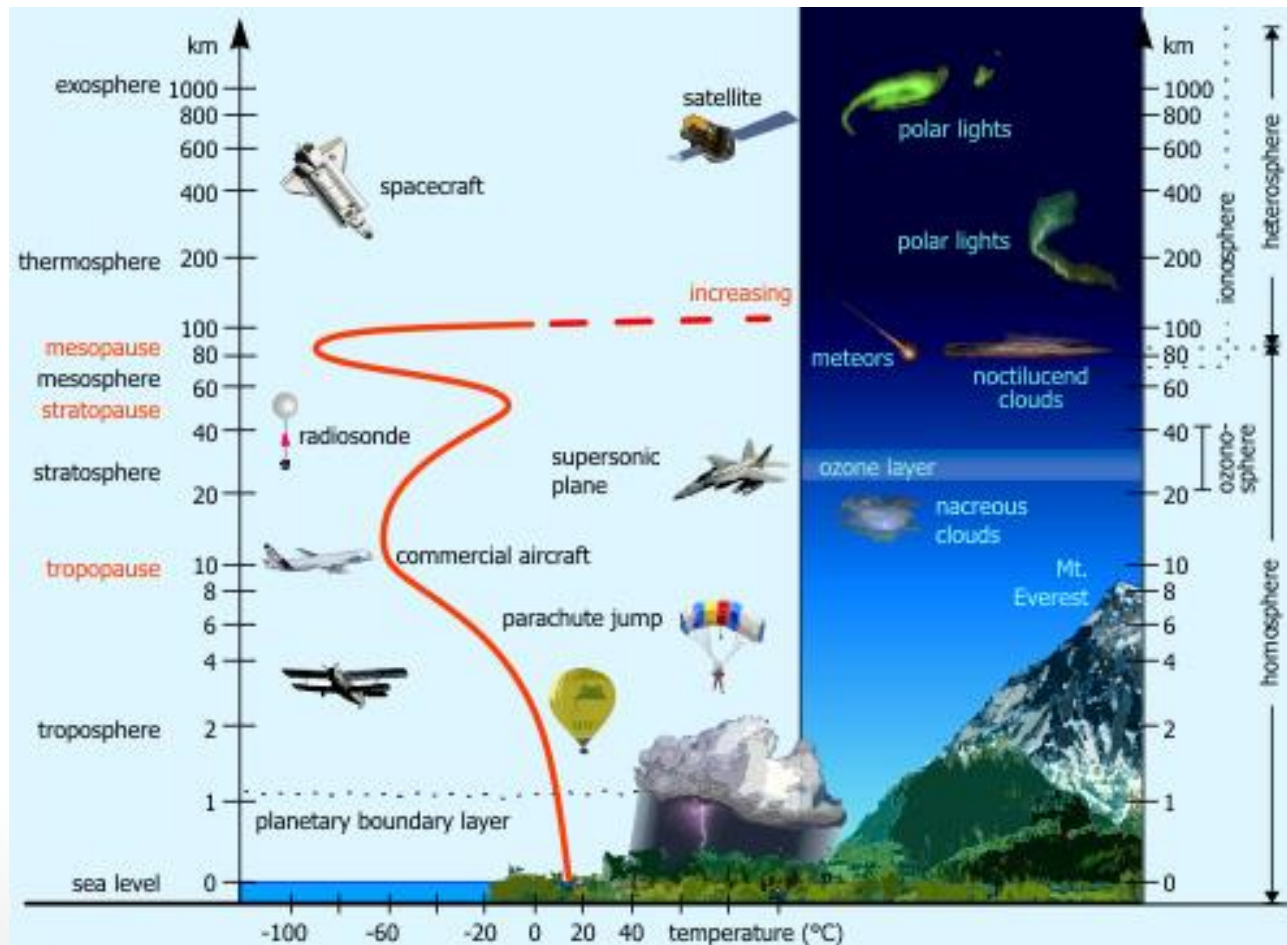
Thermosphere

- Extends 85 KM TO 560 KM above the Earth's surface.
- Temperature of individual molecules rises to due GAMMA radiation to +1700°C, but the density of the molecules is so low that objects in this layer “don't feel the HEAT”.
- Satellites, the Hubble Space Telescope, and the space shuttle orbit in this layer.



The Atmosphere...

Beyond the atmosphere is a region called the **EXOSPHERE**, which is a gradual **DISAPPEARANCE** of atmospheric **GASES** into the vacuum of space once they are **560 KM AWAY** from Earth. Molecules that end up in the exosphere are lost to outer space. Only hydrogen and helium are found in the exosphere



The Atmosphere...

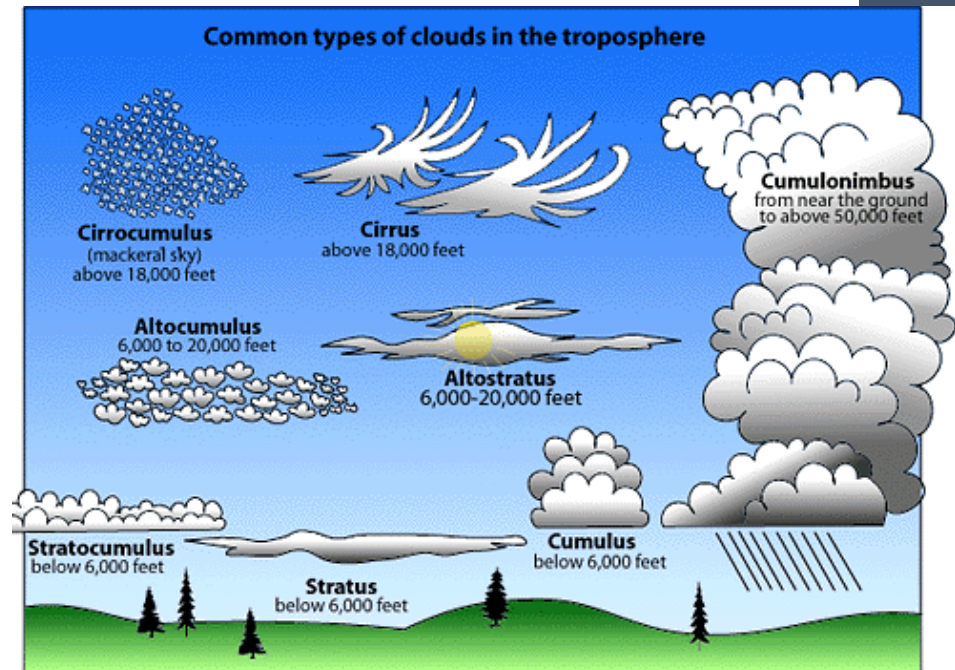
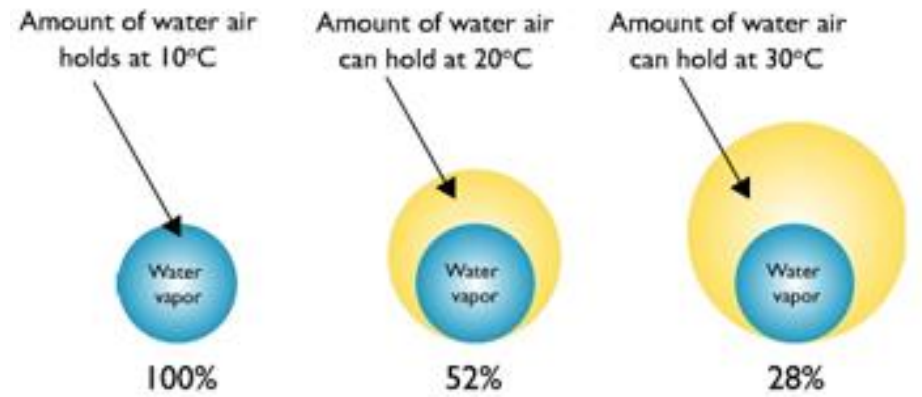
What are Humidity and Clouds?

HUMIDITY:

- Refers to the **WATER VAPOUR** contained in the **AIR**.
- The amount of water that **EVAPORATES** depends on the **PRESSURE** and **TEMPERATURE** of the **SURROUNDING AIR**.
- When the water vapour **COOLS** it can turn back into its **LIQUID** (or even solid) form, producing **RAIN**, **DRIZZLE**, **SNOW**, etc.

CLOUDS:

- Accumulations of **LIQUID WATER** that still remain suspended, as the water particles have not **COMBINED** enough to form drops, which could then fall from the sky



The Hydrosphere...

Fact: 71% of the Earth's surface is COVERED in WATER!

Fact: Your own body is composed of 93% water!

The HYDROSPHERE is global term meant to encompass all the Earth's SOLID, LIQUID, and GASEOUS WATER.

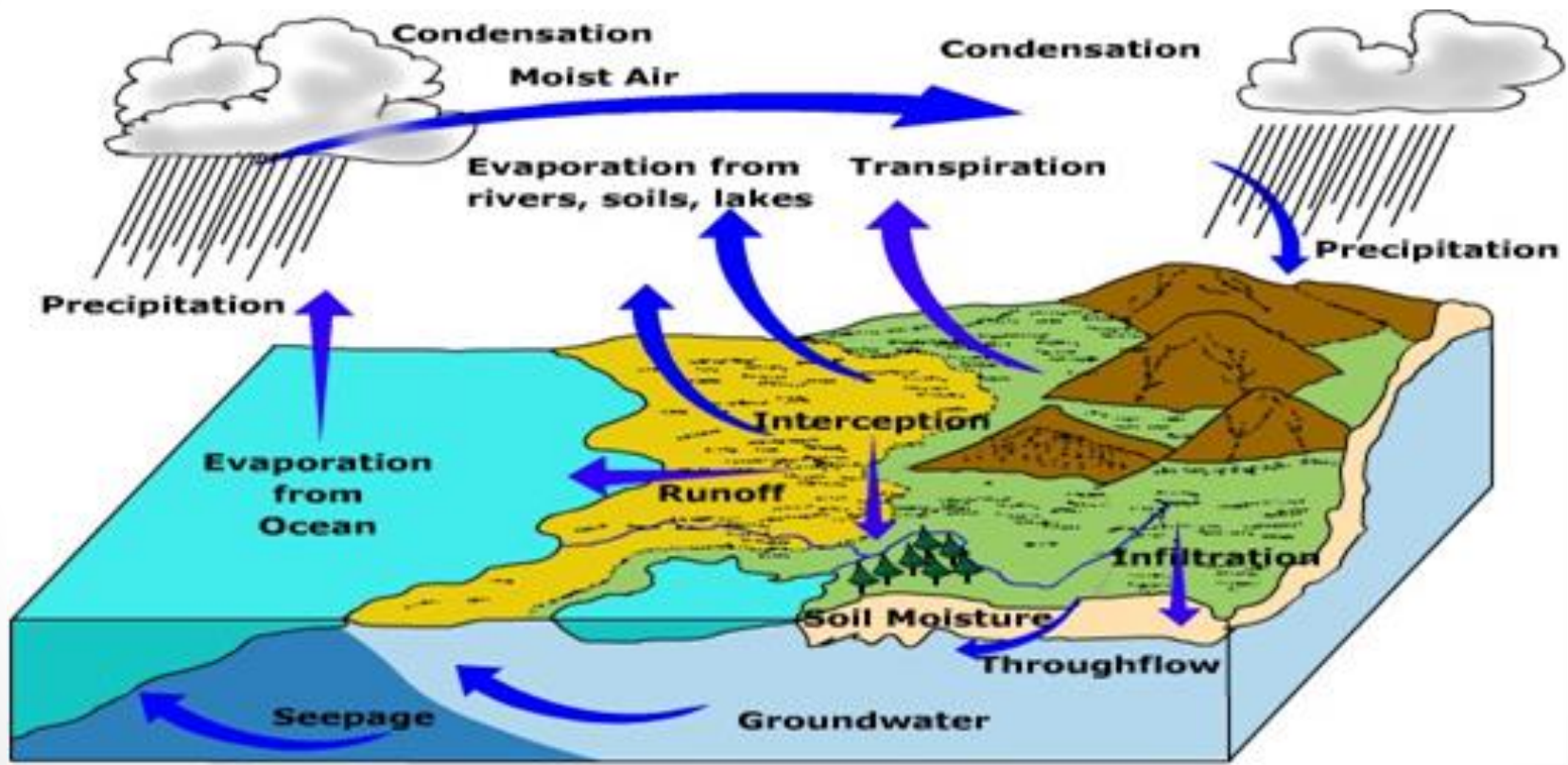
Hydrosphere Composition:

- 95.5 % of water in the hydrosphere is SALT water.
- 2.5% of water in the hydrosphere is FRESH water.
 - The majority (87%) of fresh water is found in GLACIERS and POLAR ICE.
 - 12% of fresh water is found in UNDERGROUND water.
 - 1% of the world's fresh water is found in LAKES and RIVERS.
- The REMAINDER of the hydrosphere is found in WATER VAPOUR form.

The hydrosphere's water is free to transform itself from one state to another through the water cycle:

The Hydrosphere...

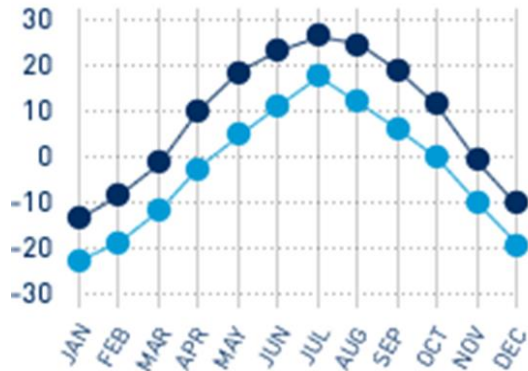
The hydrosphere's water is free to transform itself from one state to another through the water cycle:



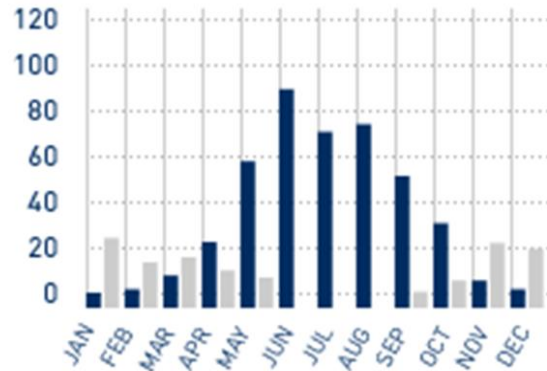
The Hydrosphere...

Water has a high **HEAT CAPACITY**. In other words, a volume of water can store much **MORE** heat energy than a similar volume of air. Therefore, water acts as a **BUFFER** against **EXTREME** temperature **FLUCTUATIONS** (can make winters less cold, and summers less hot).

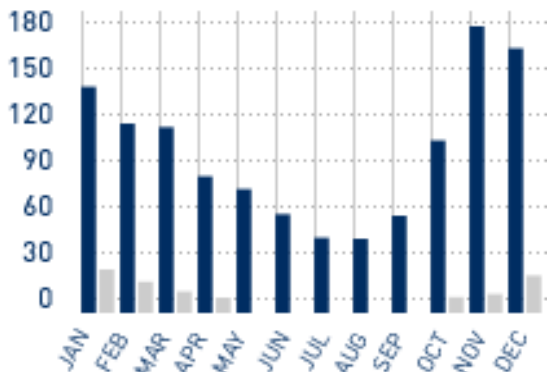
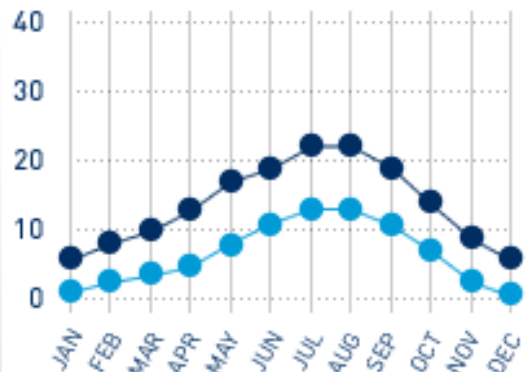
Average temperatures



Average rainfall and snowfall



Winnipeg, MB



Victoria, BC

● Average high temperatures ● Average low temperatures

■ Rainfall (mm) ■ Snowfall (cm)