

GEOL 117, Class 21

## ATMOSPHERE

Composition

- review
- human impact

Pressure

Zones

Vertical motion

Global wind patterns -- causes

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### **Why study the atmosphere?**

O<sub>2</sub> and CO<sub>2</sub> for life processes

Greenhouse effect

Filters harmful UV radiation

Ocean-atm. interactions

**\*\*Heat, moisture exchange\*\***

**\*\*Winds drive ocean currents\*\* (most important)**

### **COMPOSITION (mostly review)**

1) Dry atmosphere (ignoring water vapor)

- N<sub>2</sub> 78%
- O<sub>2</sub> 21%
- Ar 1%
- CO<sub>2</sub> 0.036%
- All other gases....(He, H<sub>2</sub>, etc) < 0.002%

2) Variable constituents

- Gases: ozone (O<sub>3</sub>), CO, CH<sub>4</sub>, N+O gases, S+O gases
- Aerosols: dust, pollen, water droplets
- Water vapor

### **Human modification**

CO<sub>2</sub> release -- fossil-fuel burning, deforestation

- Enhanced greenhouse effect
- Predicted global warming = 2-4°C

Ozone destruction in stratosphere by CFC compounds (e.g., freon)

- Increased UV penetration -- skin diseases
- Possible reduction in global photosynthesis

The global CO<sub>2</sub> Cycle: Carbon transferred between oceans, biomass on the continents (e.g., forests) and the atmosphere.

But the biggest holder of this carbon, by far, is the oceans.

Atmosphere has a relatively small amount (thus, easily changed)

## ATMOSPHERIC PRESSURE

Weight of overlying atmos. creates pressure

We don't notice – pushes on us in all directions

Variations in pressure:

Decreases with altitude, of course (no big issue there)

**Pressure at Earth's surface -- varies.... (this is important- know this)**

- **high pressure = descending air**
- **low pressure = ascending air**

## ATMOSPHERIC ZONES

### 1) Troposphere -- 0-12 km

- Heated at its base (earth's surface) --
- Convection, turbulent motion (this is where the action is, in terms of our weather)
- Warmed at bottom --> **warm air rises**
- Also: **Humid air tends to rise** (lighter than dry air)

### 2) Stratosphere -- 12-50 km

- Stratified -- little vertical mixing
- "Lid" on the turbulent troposphere
- Ozone absorbs UV radiation

## GLOBAL WIND SYSTEM (very important)

Prevailing wind "belts"

1. **Trade Winds:** Low latitudes, E --> W
2. **Westerlies:** Mid latitudes, W --> E
3. **Polar Easterlies:** High latitudes, E --> W

What causes this pattern?

- 1) Convection- Temperature difference -- Low vs. High Lat.
- 2) Coriolis effect

### 1) Convection:

- Equatorial zone: Hot, Humid --> **rising air** masses
- Polar zones (and elsewhere- more later) --> **sinking air** masses.
- Result:
  - Global convection cells
  - Global Wind Patterns at surface (Note: Local convection cells exist too; more on that later).
  - Fig. 6-7: If the earth were NOT rotating, convection cells in the atmosphere would look like this.

### 2) Coriolis Effect: (preview, see next class for full presentation)

Practical result: Things moving long distances on earth tends to be deflected by Coriolis "force"

- Deflection in N hemis.: RIGHT-HAND TURN
- Deflection in S hemis.: LEFT-HAND TURN

This causes the convection cells to break into 3 cells for each hemisphere.