The atmosphere of the Earth and the main polluting chemicals

Natural environment is a self-operating system:
- land
- sea
- air
- water
- all living thing

Built environment: everything made by people

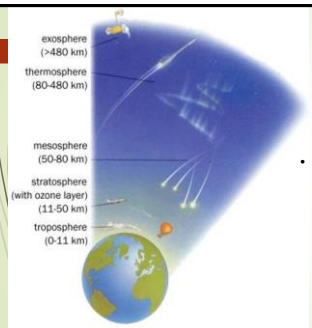
environmental elements

We have to take care of our environment, because the nature doesn't depend on us, but we do

- **weather** = day-to-day changes in atmospheric conditions. These conditions include:
  - temperature
  - air movements
  - moisture content
- **climate** = general weather conditions averaged over *many years*
  - one climatic period is 30 years by IPCC Intergovernmental Panel on Climate Change)
- **atmosphere** – consist of solids, gases and liquids

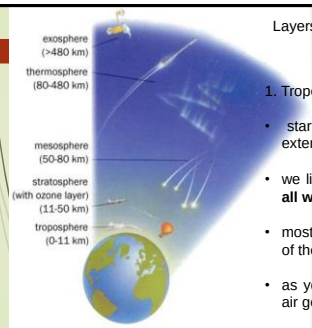
B A L A N C E

- **atmosphere**
  - allows all the plants and animals to survive. The atmosphere provides us with the air we breathe
  - helps **maintain** the temperature of the Earth
- **energy**
  - 70% of this energy is **absorbed** by the Earth or the atmosphere
  - the rest is **reflected** back out
- **ice caps**
  - important for reflecting out the energy from the Sun. Without these ice caps reflecting the sun's energy the Earth would keep getting warmer



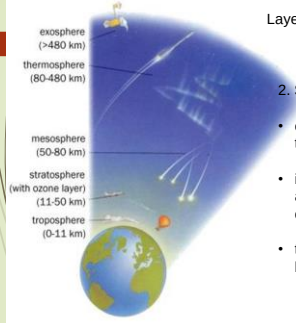
Layers of Earth's Atmosphere

- the atmosphere is split into 5 main layers based on temperature



Layers of Earth's Atmosphere

1. Troposphere (the lowest and thinest)
   - starting at the Earth surface and extending upward to on average 10 km
   - we live in this part of the atm. and **nearly all weather happens here**
   - most clouds appear in here because 99% of the atmosphere's water is found there
   - as you get higher in the troposphere, the air get colder (decrease 6 ºC per km)



Layers of Earth's Atmosphere

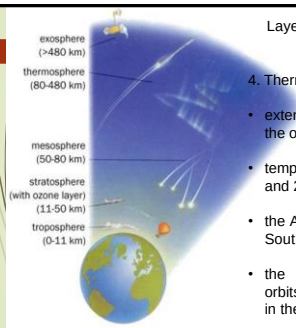
2. Stratosphere

- extends from the top of the troposphere to about 50 km
- it contains the ozone layer, which absorbs high energy UV light converting it into heat
- the air actually gets warmer the higher you go

Layers of Earth's Atmosphere

3. Mesosphere

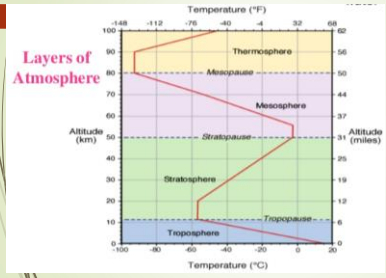
- extends upwards to a height of around 80 km
- gases are less dense
- most meteors burn up in this layer
- it is the coldest layer of the atmosphere (cc. -100ºC)



Layers of Earth's Atmosphere

4. Thermo- and Exosphere

- extends to between 80-500/1000 km and the other sphere is above 500 km
- temperature can vary from between 500 and 2000 ºC and higher
- the Aurora Borealis (the Northern and the Southern Lights) occure in here
- the International Space Station also orbits in thermosphere and satellites orbit in the exosphere



- 75% of the atmospheric mass is within 11 km of the surface
- nearly all weather happens here

Main components of the atmosphere (dry air contais):

- nitrogen (78,084 %)
- oxygen (20,946 %)
- argon (0,934 %)
- other gases

} Persistent gases (till cc.80km)

Variable gases

	Concentration (ppm)	Residental time (year)
CO_2	380	20-150
CH_4	1,77	10
H_2	0,50	2
N_2O	0,32	150
vízgőz	(0,4-400) x 10^2	10
O_3	(0-5) x 10^{-2}	10
NO_2	(0-3) x 10^{-2}	3
CO	(1-20) x 10^{-2}	30

- **residental time:** shows the average amount of time a molecule spends in the atmosphere
  - for persistent gases it can be measured for thousands of years
- **ppm (unit of concentration)=** parts per million: is the number of units of mass of a gas / contaminant per million units of total mass

- **air pollution:** the phenomena of presence of one or more contaminants in air in such amount and duration that may adversely affect human, animal or plants life, property or comfort

- **air pollutants** are airborne particles and gases that occur in concentrations that endanger the health and well-being of organisms or disrupt the orderly functioning of the environment

Source of the air pollution

- natural – volcano, forest fire, dust storms, ect.
- anthropogenic - created by human being

  - pollution due to the use of fertilizers, insecticides and pesticides
  - industrial production and waste
  - smoke
  - vehicular pollution

Type of source:

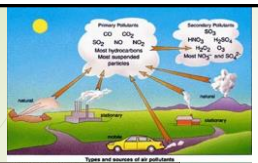
- STATIONARY sources

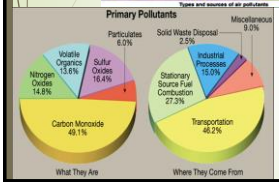
  - point sources (industrial porcessing, power plants, fuels combustion, ect.)
  - area sources (residental heating coal, gas, and oil, open birning, ect.)

- MOBILE sources (automobile, ect.)
- LINE sources (highway vehicles, railroad locomotives, chanel vessels, ect.)

Two of the most important **atmospheric conditions** affecting the dispersion of pollutants are:

- the strength of the wind
- stability of the air





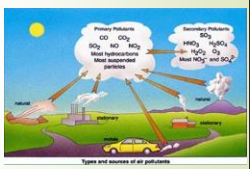
1. **Primary pollutants**: which are **emitted directly** from identifiable sources, materials released directly into the atmosphere **in unmodified form**

- particulate matter
- SO_2
- NO_x
- VOCs (volatile organic compounds)
- CO
- CO_2

2. secondary pollutants: which **are produced in the atmosphere** when certain **chemical reactions** take place among primary pollutants

(one example atmospheric sulfur acid)

- acid rain occurs when SO_2 and NOx are emitted into the atmosphere undergo chemical transformations and are absorbed by water droplets in clouds
- effects of acid rain:
  - acidification of bodies of water
  - damage of vegetation
  - damage of building materials, statues, ect.)



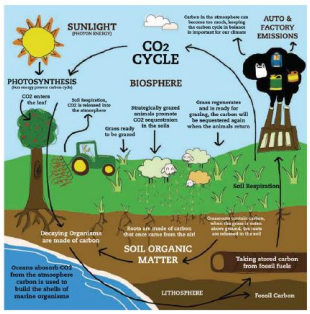
Primary pollutants – Carbone Dioxide (CO_2)

- colorless and odorless gas
- is created nature and by humans - in the atmosphere causes global warming
- creation of CO_2

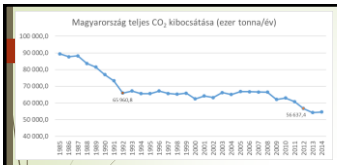
NATURAL	REMOVAL PROCESSES
- animal respiration	- plants
- ocean-atmosphere exchange	- oceans
- volcanic eruptions	

- power stations burn coal, oil or gas to make electricity
- cars, trucks, buses run on gas or diesel
- heating houses and uses electricity
- factories use energy for heating and electricity

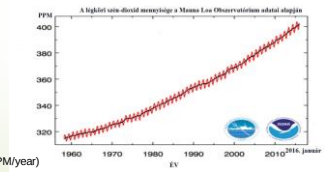
ANTOPHOGENIC



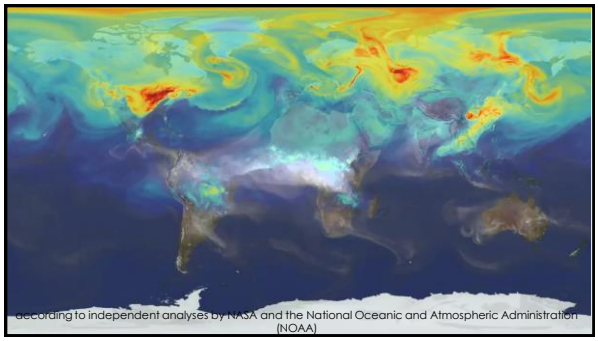
- when in balance, the total CO_2 emissions and removals from the entire carbon cycle are roughly **equal**
- human activities since the industrial revolution in the 1700s has drastically increased CO_2 concentrations in the atmosphere



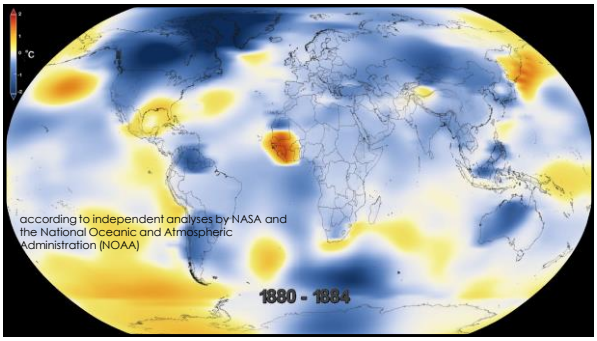
CO_2 emission in Hungary (thousand ton/year)



CO_2 emission in the World (PPM/year)



according to independent analyses by NASA and the National Oceanic and Atmospheric Administration (NOAA)



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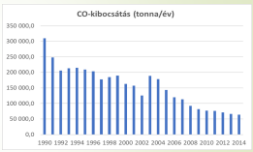
Primary pollutants – Carbone monoxide (CO)

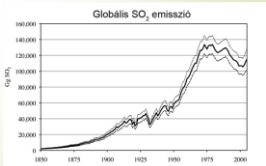
- produced by burning of organic materials (coal, gas, wood, trash, etc.)
- automobiles biggest source (~80%)
- not a persistent pollutant, combines with O_2 to form CO_2
- toxic, because binds to hemoglobin and reduces oxygen in blood



CO emission in Hungary (ton/year)

Primary pollutants – Suplhur Dioxide (SO_2)

- produced by burning sulfur containing fossil fuels (coal, oil)
- major source is the power plant (coal-burning)
- reacts in atmosphere to produce acids
- toxic, because we inhaled and it can be very corrosive to lung tissue



Global SO_2 emission

„Smog" – type of air pollution, was first used in 1905 to describe sulfur dioxide (SO_2) emission

Type of smog:

- **Photochemical** smog in summer

  - **a noxious mixture of gases and particles**, in produced when **strong sunlight** triggers **photochemical reactions** in the atmosphere
  - the major component of photochemical smog is ozone (near the surface)
  - mainly in summer in the big cities (Peking, Mexico City, Los Angeles, ect.)

- **Sulfurous** smog
- the Great Smog of '52 or Big Smoke

during 1950's - 60's most factories polluted their einvironment

- affected London during December 1952
- a period of **cold weather**, combined with an anticyclone and **windless conditions**, collected airborne **pollutants** mostly from the use of coal to form a thick layer of smog over the city
- it dispersed quickly after a change of weather
- in England 4,000 people had died prematurely and 100,000 more were made ill because of the smog's effects on the human respiratory tract

Primary pollutants – Nitrogen Oxides (NO_2, NO, N_2O)

- produced by burning of fossil fuels (coal, oil)
- contributes to acid rain and smog
- we have some new technology, it has helped to reduce, but still
- the main source is the automoblie engine

Primary pollutants – Particulates

- small pieces of solid materials and liquid droplets (2,5 mm – 10 mm)
  - ash from fires
  - asbestos from brakes and insulation
  - dust
- mainly from nature (cc. 80-90%), but human activity is increasing
- can accumulate in lungs, some particulates known carcinogens

SUMMARY

- **The climate** of the Earth **has always been changing**. **There have been ice ages and there have been warm periods. These changes happened slowly** over tens of thousands of years. However, scientists say they are 99% sure that the Earth is becoming warmer **now**, and that **this increase in temperature** is happening **much quicker than normal**.
- https://www.nationalgeographic.com/environment/global-warming/pollution/#preparingEmail