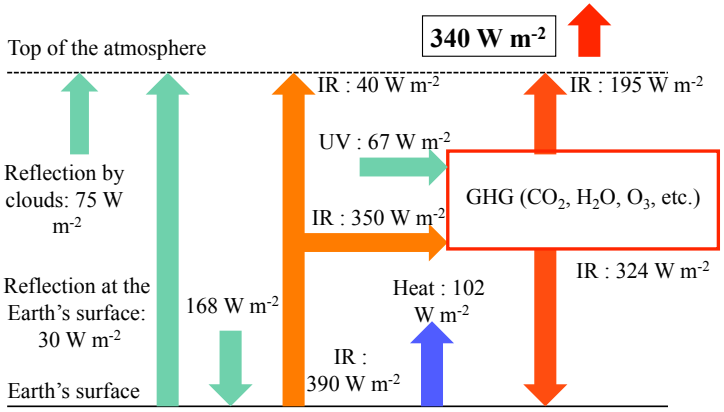
Brief History of Air Pollution

- Global atmospheric environmental problems
  - Climate change
  - Stratospheric ozone layer

- Regional and local air pollution problems
  - London smog
  - Los Angeles photochemical smog
  - Persistent organic pollutants
  - Acid rain
  - Mercury deposition

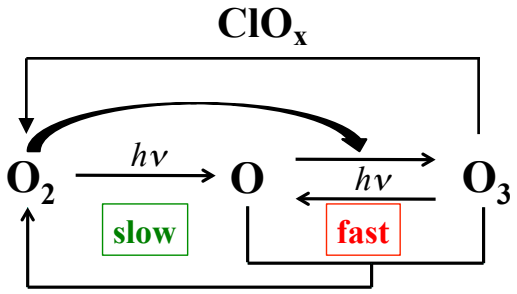
Climate Change

- Climate change (see Chapter 14)
  - It results from the addition of man-made greenhouse gases (GHG), which absorb part of the infrared (IR) radiation emitted by the Earth.
  - On average, the temperature increases.
  - This additional thermal energy leads to changes in weather (frequency and/or intensity) in terms of precipitation, heat waves, etc. and sea level.



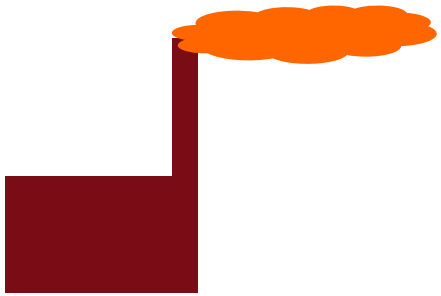
Depletion of the Stratospheric Ozone Layer

- Stratospheric ozone layer (see Chapter 7)
  - It protects the Earth's surface from harmful ultraviolet (UV) radiation
  - It has been partially destroyed by man-made products such as chloroflurocarbons and bromocarbons.



London Smog

- Smog = Smoke + Fog (see Chapters 8, 9, and 10)
  - This term was coined by Harold Antoine des Vœux in 1905 to describe a form of urban/industrial air pollution that combined pollutants emitted from industrial and residential smokestacks with the London fog.
  - It consisted of primary pollutants (i.e., those emitted directly in the atmosphere), such as sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter (PM), and possibly some secondary pollutants (i.e., those formed by chemical reactions in the atmosphere) resulting in part from fog droplet chemistry (e.g., sulfate)
  - The 1952 London smog episode led to several thousands of deaths.

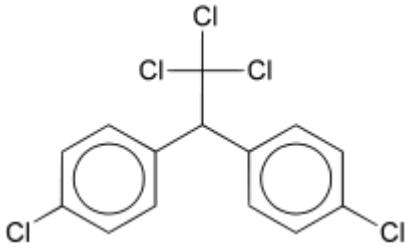


Los Angeles Photochemical Smog

- Photochemical Smog (see Chapters 8 and 9)
  - Aarie Jan Haagen-Smit proposed in 1952 that the air pollution present in the Los Angeles basin, California, was the result of chemical reactions between nitrogen oxides (NO_x) and volatile organic pollutants (VOC) in the presence of sunlight.
  - Major secondary pollutants of photochemical smog (i.e., those formed by atmospheric chemical reactions) include ozone (O_3) and fine PM.

Persistent Organic Pollutants

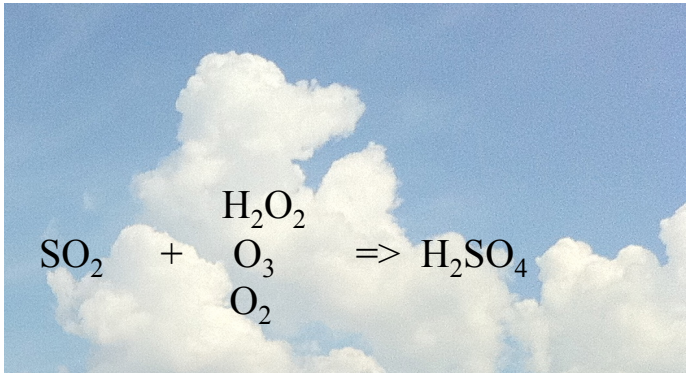
- Persistent Organic Pollutants : POP (see Chapter 13)
  - The book *Silent Spring*, which was published in 1962 by Rachel Carson, alerted the public to the potential harmful effects of some pesticides (e.g., DDT) on birds.
  - Scientific studies followed that demonstrated that several organic compounds had long lifetimes in the environment, bioaccumulated in the food chain, and could have harmful effects on fauna and humans.



DDT

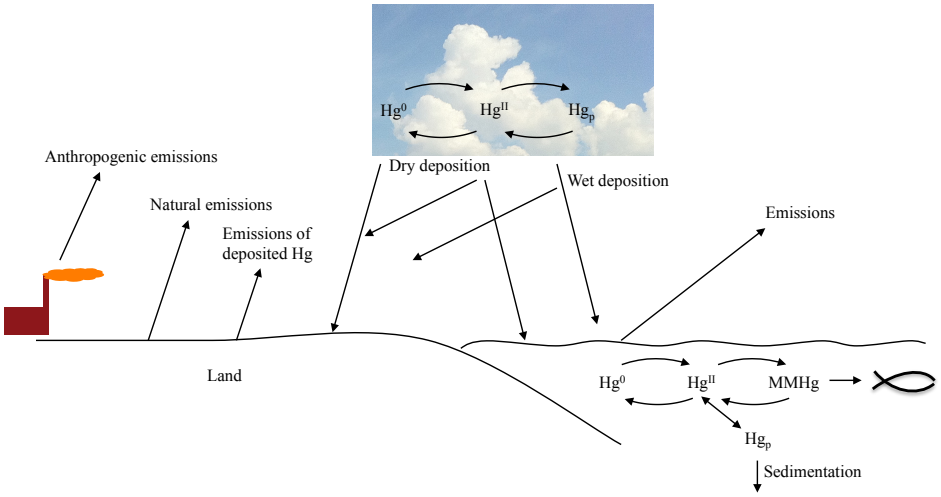
Acid Rain

- Acid deposition (see Chapters 10 and 13)
  - Acid deposition includes both wet deposition (mostly rain) and dry deposition of acid species, such as sulfuric acid (H_2SO_4) and nitric acid (HNO_3).
  - In the 1970s, forests and lakes in Europe and North America showed harmful effects of acid deposition.
  - H_2SO_4 and HNO_3 are secondary pollutants produced by the oxidation of SO_2 and NO_x, respectively.



Mercury Deposition

- Mercury deposition (see Chapter 13)
  - In the 1950s, contamination of fish in Minamata Bay in Japan alerted the public to the harmful effects of mercury, which bioaccumulated in the aquatic food chain.
  - In the 1990s, atmospheric mercury was identified as a major source of contamination of surface waters via atmospheric deposition.



Outline

- Chapter 2: Emissions and Control Technologies
- Chapter 3: Meteorology - General Circulation
- Chapter 4: Air Pollution Meteorology
- Chapter 5: Atmospheric Radiation and Visibility
- Chapter 6: Atmospheric Dispersion
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- Chapter 10: Cloud Chemistry and Acid Rain
- Chapter 11: Atmospheric Deposition and Emissions from Surfaces
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- Chapter 14: Climate Change and Air Pollution
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