Lecture 38. Stratospheric ozone chemistry.

Part 4: Potential impacts of ozone depletion and global warning.

Objectives:

1. Discussion of potential impacts of ozone depletion and global warming due to greenhouse gases.

Readings: Turco: p.386-397; 416-421; Brimblecombe: 184-189, 197-201; and the following websites:
http://www.unep.ch/iucc/factcont.html
http://www.epa.gov/ozone/

Please find a few examples of potential impacts of ozone depletion and global warming due to greenhouse gases on the climate system. Discuss these examples in the class.

General:

- "Positive feedbacks" involving water vapor, snow, and ice may amplify the direct response to greenhouse gas emissions by a factor of two to three.
- Changes in cloud cover, ocean currents, and chemistry and biology, may either amplify or reduce the response.
- In the future, global climate change may significantly affect the frequency, magnitude, and location of extreme events.

Atmospheric chemistry:

Climate change will influence atmospheric chemistry through:

- temperature change (which leads to change in the rate of chemical reactions),
- precipitation change (affects acid rains distribution, aqueous chemistry, etc.),
- changes in atmospheric transport processes (alter the rate of export of pollutants from urban/regional environment to the global),
- changes in the budgets of species with biological sources (which respond to temperature and moisture changes),
- changes in vegetative cover (alter dry deposition rates),

Water resources:

- Climate change will lead to more precipitation - but also to more evaporation. Precipitation will probably increase in some areas and decline in others.

Sea level:

- The global average sea level has risen by 10 to 25 cm over the past 100 years. It is likely that much of this rise is related to an increase of 0.3-0.6^{o}C in the lower atmosphere's global average temperature since 1860. Models project that sea levels will rise another 15 to 95 cm by the year 2100 (with a "best estimate" of 50 cm).
- Flooding and coastal erosion would worsen.

Ecosystem:

- Forests adapt slowly to changing conditions, but they play an important role in the climate system (as reservoirs of CO2).
- Deserts and arid and semi-arid ecosystems may become more extreme.
- Rangelands may experience altered growing seasons.
- Mountain regions are already under considerable stress from human activities.
- The cryosphere will shrink.

Agriculture:

- Some agricultural regions will be threatened by climate change, while others may benefit.
- Soil moisture will be affected by changing precipitation patterns.
- Higher temperatures will influence production patterns.

Human health:

- There is along list of other potential health effects.
- Warmer temperatures would enable insects and other disease carriers to expand their range.
- Food- and water-related diseases will also increase.

Ozone depletion in the stratosphere:

- alters temperature in the stratosphere,
- health effects,
- environmental effects,