

*Department of Atmospheric Sciences*

COURSE ANNOUNCEMENT – SEMESTER II – 2002–2003

**ATMOS 397: Topics in Atmospheric Sciences**  
**Section G: Biogeochemical Cycles and Global Change**

*Call number:* 00821

*Instructor:* Prof. Donald Wuebbles, 106 Atmos. Sci. Bldg., 244-1568

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*Room and Time:* 109 Atmos. Sci. Bldg.; 10:30–11:45 a.m., Tu Th

*Credit:* 4 hours or 1 unit

*Prerequisites:* 300-level course in Atmospheric Sciences, or consent of instructor

Biogeochemical cycles are crucial for the maintenance of life on earth. The vast and complex array of biological, geological, and chemical processes that comprise these cycles determine the chemical and physical properties of our global environment and the way it changes. A thorough understanding of the causes of global environmental change and the implication for life on earth requires an investigation of global biogeochemistry. This course presents the chemical concepts, relevant features of the earth system, and key physical, biological, and chemical aspects that are central to understanding the causes of global climate change. Topics covered include the most recent information on reservoir sizes and fluxes for three major cycles (carbon, nitrogen and sulfur); the biogeochemical cycles of CO<sub>2</sub> and other important atmospheric greenhouse gases, and their significance to the global and climate change; development of numerical models to study the biogeochemicals on the earth and to estimate changes in CO<sub>2</sub> and other important biogenic greenhouse gas concentrations and climatic impacts resulting from historical and assumed future emission scenarios.

Course Content:

1. **Biogeochemical Cycles and Their Role in the Earth System.** An introduction and review of the relevant features of the atmosphere-biosphere-ocean system, and the key physical, biological, and chemical processes involved in the exchanges between each component of the earth system.
2. **Biogeochemical Cycles: Major Reservoirs and Fluxes.** The carbon, nitrogen and sulfur cycles.
3. **Cycles of Important Biogenic Gases.** Discussion of the global budget of CO<sub>2</sub> and other biogenic radiatively active trace gases and aerosol particles; Atmospheric chemistry of biogenic trace gases. Evidence of the relationship between anthropogenic and natural emissions, changing atmospheric concentrations, sources and removal rates.
4. **Modeling Biogeochemical Cycles of Atmospheric Trace gases.** Mathematical representation of the cycles and the various biogeochemical processes; the interactions between the atmosphere, ocean, and terrestrial biosphere; and the lifetime of CO<sub>2</sub> and other important biogenic greenhouse gases; Development of coupled numerical modules representing the carbon cycle, the effects of greenhouse gas emissions on atmospheric composition, the effects on global temperatures, and the processes affecting sea level change.
5. **Biogenic Greenhouse Gases and Climate Change.** The role of biogenic gases in past and present climate change and response. Application of biogeochemical cycle modeling to future climate change, using scenarios for assumed future emissions of biogenic greenhouse gases and climate change and sea level rise.

**Text:** *Biogeochemistry: An Analysis of Global Change*, by W. H. Schlesinger, Academic Press, 1997 (required).

*Biogeochemical Cycles: A Computer-Interactive Study of Earth System Science and Global Change*, W. L. Chameides and E. M. Perdue, Oxford University Press, Inc., 1997 (recommended).