FALL TERM 1993

COURSE DESCRIPTION

Course 342 Greenhouse Gases: Their Biogeochemical Dynamics

A new global change course to be taught this Fall by Prof. J. Sarmiento of the Geological and Geophysical Sciences Department and staff from the Geophysical Fluid Dynamics Laboratory and Ecology and Evolutionary Biology Department. The course will cover the biogeochemical and human processes which determine the atmospheric composition of greenhouse gases. There will be a strong emphasis on the development of simple radiative balance and biogeochemical cycling models and their application in computer simulation exercises. Vacancies are still available. Class meets on Tuesday and Thursday at 10:30 am to 11:50 am in Guyot Hall, Room 220.

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Outline for
Greenhouse Gases: Their Biogeochemical Dynamics

Each section of the course would have a specific model exercise associated with it that would serve as a partial focal point for the lectures.

I - The Greenhouse Effect (Manabe ~2 weeks).
Model: A radiative-convective equilibrium model of the atmosphere.
(a) Radiation Laws (Kirchoff's Law)
(b) Convection
(c) Radiative-convective equilibrium model

II- The early (Precambrian) evolution of the atmosphere (Hargraves ~1 week)
Model: Application of radiative-convective model
(a) Mantle degassing
(b) Surface weathering

III- The Phanerozoic. (Sarmiento ~1 week)
Model: Application of radiative-convective model
(a) Surface weathering
(b) Metamorphism and crustal degassing.

IV- The Quaternary

A- Oceanic processes (Sarmiento ~2 weeks)
Model: High latitude diffusion-advection (HILDA) model of ocean chemistry
(a) Air-sea gas exchange
(b) Oceanic chemical and biological processes
(c) Ocean circulation

B-Terrestrial vegetation and soil processes (Pacala ~2 weeks)
Model: Box model of the terrestrial biosphere
(a) Atmosphere-biosphere exchange of CO_2, mean and perturbations
(b) Soil processes

C-Atmospheric processes (Levy ~2 weeks)
Model: One-dimensional diffusion, UV dissociation model
(a) Stratospheric UV dissociation and transport
(b) Tropospheric hydroxyl chemistry

V- Anthropogenic perturbations (Levy, Pacala, and Sarmiento ~2 weeks)
Model: Coupled HILDA/atmosphere/terrestrial biosphere CO_2 model
(a) Carbon dioxide
(b) Chlorofluorocarbons
(c) Methane
(d) Nitrous oxide