

UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DISCIPLINE/DEPARTMENT: Geography/Economics **IMPLEMENTATION DATE:** 1997

Revised: _____

<u>Geography 401</u>	<u>Global Climatology</u>	<u>4</u>
SUBJECT/NUMBER OF COURSE CREDITS	DESCRIPTIVE TITLE	UCFV

CALENDAR DESCRIPTION: An advanced course in global climatology. Exploration of the global climate system. Examination of past, present, and possible future climate scenarios. Environmental and socio-economic impacts of nuclear winter, ozone holes, and global warming. Policy responses.

RATIONALE: This course is part of a series of upper level geography courses that builds on our lower level physical geography offerings. It is designed to give the student an advanced understanding of the study of applied climatology at the global scale.

COURSE PREREQUISITES: Geography 201 AND Math 104 or 106

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT	Lecture	30	hrs		Student Directed Learning	
	Laboratory	45	hrs		Other - specify:	hrs
	Seminar		hrs			
	Field Experience		hrs			
				TOTAL	75	HRS

MAXIMUM ENROLMENT: 25

Is transfer credit requested? **9** Yes **:** No

AUTHORIZATION SIGNATURES:

Course Designer(s): Ian T. Okabe **Chairperson:** D. Gibson

Curriculum Committee

Department Head: D. Gibson **Dean:** J.D. Tunstall

PAC: Approval in Principle _____ **PAC: Final Approval:** November 27, 1996

(Date) **(Date)**

Geography 401
NAME & NUMBER OF COURSE

SYNONYMOUS COURSES:

(a) replaces _____
 (course #)

(b) cannot take _____ for further credit
 (course #)

SUPPLIES/MATERIALS:

Students will be expected to have scientific calculators.

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

Bruce, J., Lee, Hoesung, Haites, E. (eds.), 1996: Climate Change 1995 - Economic and Social Dimensions of Climate Change, Cambridge University Press.

Hartmann, Dennis L., 1994: Global Physical Climatology, Academic Press, San Diego.

Houghton, John T., Jenkins, G.J., Ephraums, J.J. (eds.), 1990: Climate Change - The IPCC Scientific Assessment, Cambridge University Press.

Houghton, John T. (ed.), 1992: Climate Change 1992, Cambridge University Press.

Houghton, John T. et al. (eds.), 1995 Climate Change 1994 - Radiative Forcing of Climate and an Evaluation of the IPCC IS92 Emission Scenarios, Cambridge University Press.

Houghton, John T. et al. (eds.), 1996: Climate Change 1995 - The Science of Climate Change, Cambridge University Press.

Watson, R.T., Zinyowera, M.C., Moss, R.H. (eds.), 1996: Climate Change 1995 - Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses, Cambridge University Press.

OBJECTIVES:

This course is intended to provide students with the advanced scientific principles that modern climatology is based upon. Physical and dynamical processes of the atmosphere will be examined at the global scale. Upon successful completion of the course the student will be able to 1) demonstrate an advanced understanding of the global climate system, 2) critically analyse both the scientific evidence and scientific uncertainties, 3) understand the human impacts of global climate change.

METHODS:

The format of the course includes lectures, laboratory sessions and assignments, assigned readings, and out-of-class projects. The lecture topics will emphasize conceptual and theoretical issues and will be supplemented by the use of audio visual aids throughout the course. Laboratory assignments will emphasize both the application of climatological data, and the impacts of global change.

STUDENT EVALUATION PROCEDURE:

Laboratory exercises	25%
Global warming debate	10%
Research presentation	15%
Mid-term examination	20%
Final examination	30%

COURSE CONTENT

Lecture Topics

1. Introduction to the Climate System
Atmosphere, Hydrosphere, Cryosphere, and Biosphere. Atmospheric Temperature, Moisture, and Composition. Atmospheric Motion and Radiation. Climate Processes.
2. Global Energy Balance
Solar Energy. Planetary Energy Balances and Emission Temperature. Greenhouse Effect. Global Radiative Flux Energy Balance. Poleward Energy Flux. Surface Energy Budget. Atmospheric Boundary Layer. Diurnal and Seasonal Variation of the Surface Energy Balance. Surface Energy Flux Components over the Oceans.
3. Global Water Balance
Hydrologic Cycle. Surface Water Storage and Runoff. Precipitation, Evaporation, and Transpiration. Modelling the Land Surface Water Balance. Annual Variation of the Terrestrial Water Balance.
4. Atmospheric General Circulation
Energy Balance of the Atmosphere. Atmospheric Motions and the Meridional Transport of Energy. Angular Momentum Balance. Large-Scale Circulation Patterns and Climate.
5. Ocean General Circulation
Properties of Sea Water. Wind-Driven Circulation and the Mixed Layer. The Deep Thermohaline Circulation. Transport of Energy in the Ocean. Mechanisms of Transport.
6. Past Climates
History and Evolution of the Earth's Climate. Paleoclimatic Analysis and Proxies for Temperature Data. Instrumental and Historical Records.
7. Climate Feedback Mechanisms
Measures of Climate Sensitivity and Feedback. Basic Radiative Feedback Processes. Ice-Albedo Feedback. Dynamical Feedbacks and Meridional Energy Transport. Longwave and Evaporation Feedbacks in the Surface Energy Balance. Cloud Feedback. Biogeochemical Feedbacks.
8. Global Climate Models
Mathematical Modelling. Simulated Atmospheric, Land, and Ocean Components. Validation of Climate Model Simulations, Sensitivity Estimates from Climate Models with Mixed-Layer Oceans. Coupled Atmosphere-Ocean Processes and the Thermohaline Circulation.

9. Natural Climate Change
Natural Forcing of Climate Change. Solar Luminosity Variations. Natural Aerosols and Climate. Volcanic Eruptions and Stratospheric Aerosols. The Orbital Parameter Theory of Ice Ages. Modelling of Ice Age Climates.
10. Anthropogenic Climate Change
Humans and the Greenhouse Effect. Anthropogenic Aerosols and Atmospheric Sulphur. Changing Surface Conditions. Equilibrium Climate Changes. Time-Dependent Climate Changes. Detection of Climate Change.
11. The Future
Global Warming, Nuclear Winter, and Ozone Depletion. Global and Local Impacts. Social and Economic Costs. Adaptation and Mitigation Strategies. Policy Responses.

Laboratory Exercises are an essential component of the course and are designed to complement the lecture material.

1. Population Growth, Energy Use, and Pollution: the Driving Forces of Global Change
2. The Geography of Greenhouse Gas Emissions
3. Living in the Biosphere: Production, Pattern, Population, and Diversity
4. Land Use/Land Cover Changes as Driving Forces
5. Linking Local and Global Communities in Environmental Change
6. Overview of the Human Dimensions of Global Change
7. Health Effects of Global Change
8. Risks/Hazards and Global Change
9. Urbanization and Global Environmental Change
10. Technological Change/Industrial Metabolism