BIO-OPTICAL OCEANOGRAPHY AND REMOTE SENSING
(EOS 725/825 Special Topics Section 2, Fall 2000)

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September 5 Introductions: discussion of goals and strategy, laboratory and field work, computers, student research projects

The field of bio-optical oceanography is a rich subdiscipline of ocean science that combines the physics of light and the biology of photosynthesis. It is also the basis for ocean color remote sensing, which is the focus of our funded research projects. Our goal in this course is to give students an introduction to this fascinating subject, and an appreciation for this field of research. The discipline of teaching this course will help us organize our thinking, and we hope you will derive something of practical use to you in your careers. We will attempt to be as flexible as possible in allowing you to determine what is practical for you.

There are 15 weeks of classes during the semester. The class is scheduled to meet twice a week, Tuesdays and Thursdays from 9:40 to 11:00. This can be modified if there are conflicts with other courses. The class will meet once a week (usually Tuesdays) for lectures and group discussions, and once a week there will be other activities such as laboratory or computer exercises, demonstrations, guest lecturers, and a field trip or two. You should plan to attend the class twice a week, but the "Thursdays" may be cancelled depending on the nature of the other activity.

Grades will be based on: (1) class/lab participation and homework, (2) a written paper, (3) mid-term exam, and (4) final exam. Each will be given approximately equal weight.

Lectures, Class Participation, and Homework

Although this is a graduate-level course, it is also introductory in nature. Students will have a wide range of interests, academic backgrounds, and varying degrees of comfort with math and physics. Thus, I will focus on concepts and vocabulary, and avoid explanations requiring advanced mathematics or physics.

The first half of the course will be based on the text book "Light and Photosynthesis in Aquatic Ecosystems" by JohnT.O. Kirk (Second edition, Cambridge Univ. Press, 1994). Lectures will follow the first 7 chapters of this text. The second half of the course will be on Ocean Color Remote Sensing and there will be a reading list for each lecture.

Homework exercises and reading assignments will usually involve something to hand in each week. This feedback helps me gauge your understanding of the material.

Coastal Marine Bio-Optics Laboratory

This laboratory is equipped with a number of instruments for making in-water optical measurements and for analyzing data brought back from the field. Ken Jacobs will be superivising student projects that make use of this equipment. Ken will also supervise the collection of data in the field and subsequent analysis of water samples. You should keep a notebook of field and laboratory measurements and save data on electronic files. Assignments will require you to use data collected on previous field trips or in laboratory exercises.

Computer Exercises

There will also be assignments involving computers. We have the Hydrolight software (Sequoia Scientific, Inc., Mercer Island, WA) which runs on a PC, and simulates the underwater light field and radiative transfer. In addition, we have specialized image processing software for working with satellite images. Tim Moore is the best computer expert among us. Tim will be available (within reason) to help with computer exercises.

Some of the exercises can be carried out on any PC or Mac (using spreadsheets or other software). Other exercises will involve Unix workstations and software that runs only on these machines. We will arrange for student access to a workstation, and depending on demand, we may ask you to sign up for use of these computer(s) at scheduled times to avoid congestion. You may choose to work alone, or you can work in small groups.

Student Papers

Each student will be asked to write a paper based on a topic which he or she chooses to explore in greater depth. Your paper may be one of two types: a review paper or an original research paper. The **review paper** should summarize existing knowledge about the topic of your choice. This will generally involve reading two or more journal articles on the subject. The **original research paper** (which is riskier but sometimes more fun) should address a scientific question. If you choose to do a research paper, you will probably need to acquire experimental data to answer the question posed (although you may do a theoretical modeling study or computer simulation). Results need not be earth-shattering!

An abstract describing the topic and the data you plan to use is due on November 1. Before the final paper is due, you can give me a draft to review and I will give you my comments. This is optional. The final paper is due on the last day of class (Dec. 12). Beginning on Tuesday, Nov. 28, we will meet twice a week to hear students' presentations based on their research papers. Each presentation should be about 20 minutes long.

Exams

There will be two exams -- both open book and open notes. They will be designed to test your understanding of concepts and vocabulary. The mid-term (October 17) will cover the first six weeks, and the final exam will only cover material presented since the mid-term *including* material from student presentations.

I emphasize vocabulary because there is so much jargon in the fields of bio-optics and remote sensing. Sometimes words with common meanings have evolved to have very specific definitions. Knowing these definitions will help you understand the literature on remote sensing. I also emphasize units of physical measures. Often from the units, one can figure out what a variable is.