

# 12808: Physical Oceanography: 12.808 Introduction to Physical Oceanography

Welcome to the homepage for the course: [Introduction to Observational Physical Oceanography for Fall 2010.](#)

## Fall 2010

Classes: Tuesdays and Thursdays 1:00PM to 2:30PM  
Classroom: WHOI Clark 331 and MIT 24-411  
All classes will be video-linked between WHOI and MIT.  
Videos of previous lectures are available online, thanks to CIS!

### Instructors:

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(Earth from space from [www.trueearth.com](http://www.trueearth.com)  
(Daniel Raden))

## Overview

This course is an introduction to the results and the methods of observational physical oceanography, a very rapidly developing field. Rapid development is a response to the pressing societal need to understand how the physical state of the oceans might be changing as part of a changing Earth climate --- Are the oceans warming? Is the ocean circulation slowing? Rapid development on these and other questions is made possible by new technology, e.g., satellite measurement systems and autonomous floats and gliders that enable more efficient and more comprehensive observation of the ocean.

Topics are organized around concepts and processes, rather than geography, and, like modern oceanography generally, our approach will be quantitative rather than merely descriptive. Emphasis will be on large-scale distributions and processes and especially those that are central to the ocean's role in Earth's climate and biosphere.

This course is available to all Joint Program and MIT students regardless of discipline. It is, as advertised, an introduction to physical oceanography that is intended for students who have had little or no experience in ocean science. If you have had quantitative courses in oceanography or Earth system science or climate, then you should check with your advisor or with the course instructors to decide whether this course will be the best use of your time.

## Goal

The broad goal of this course is to understand how the oceans contribute to Earth's climate and biosphere by storing and transporting properties and materials, e.g., heat (energy) and nutrients. Four specific objectives are to: 1) Know (be able to interpret) the large-scale distributions of the ocean's physical properties, e.g., temperature, salinity and currents, and how these are observed. 2) Understand (be able to explain) the basic principles of ocean physics, e.g., equation of state of sea water, consequences of stratification, effects of Earth's rotation, transport by mean and fluctuating ocean currents. 3) Learn how to estimate ocean processes from the observations, e.g., meridional heat transport by geostrophic and Ekman layer currents. 4) Examine critically some of the modern observational evidence and arguments for a changing ocean as summarized in Ch. 5 of 'IPCC Climate Change 2007: The physical science basis'. 5) Foster interdisciplinary understanding and interaction from the diverse background of course participants.

## Textbooks and References

Two texts are recommended for this course:

Ocean Circulation, 2nd Ed. (2001) by the Open University (hereafter OC01).

*This is modern, well-illustrated and a very good source for much of the descriptive (geographic) material we will encounter. It is recommended (but not required) that you have a personal copy; about \$40.*

Introduction to Physical Oceanography, 2nd Ed. (2005) by John Knauss, Waveland Press Inc (hereafter K05).

*This is a clearly written and well-rounded introductory survey of physical oceanography that covers many of the topics of interest to this course. Sections on equation of state of sea water, the conservation equations and the Gulf Stream are especially good. It is recommended (but not required) that you have a personal copy; available for about \$50 from [Waveland Press](#)*

### Other Recommended Texts

Ocean Chemistry and Deep Sea Sediments (1989), Open University and Pergamon Press(hereafter OC89)

*This text has a very good introduction to geochemical cycles in Ch. 2.*

All of these texts will be on reserve in the Physical Oceanography reading room in Clark 3, WHOI, and at the Lindgren Library in the Green Building, MIT.

Two other notable textbooks on physical oceanography are available online

[Introduction to Physical Oceanography](#), 2006, by Robert Stewart.

*Modern and has several very good chapters, notably the chapter on geostrophy.*

[Regional Oceanography: an Introduction](#), 2003, by Matthias Tomczak and Stuart Godfrey

*This text is organized around geographic regions (Atlantic Ocean, Pacific Ocean .....) and can thus serve to make a useful cross-cut on the topics that we will address in this course, which is organized around concepts and processes.*

#### Other References

[Baum, S., 2004](#). 'A glossary of Physical Oceanography'.

*All of the oceanography jargon that you will run into.*

[Encyclopedia of Ocean Sciences, 2002](#). Ed. by J. Steele, S. Thorpe and K. Turekian. Elsevier Press.

*An up-to-date collection of accessible articles on many of the topics that you will encounter in this class and in oceanography, generally. If you are using a WHOI computer, you have access to an electronic copy at this link: [Encyclopedia - WHOI](#).*

[Talley, Lynne, George Pickard, William Emery, and James Swift, 'Descriptive Physical Oceanography, sixth edition'](#), 2010.

*Lynne Tally has kindly made available this preprint in electronic form, a ~500 Mb file. **Please do not distribute or place a link on your personal webpage.** In return she has requested that we send her our comments, questions and corrections. If the zip-file in the above link is too large for you, please find a lighter zip-file (~30Mb) with lower resolutions figures [here](#).*

[IPCC, 2007: Climate Change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment'](#). Ed. by Solomon, S., D. Qin, M. Manning, D. Chen, M. Marquis, K. B. Avryt, M. Tignor and H. R. Miller. Cambridge Univ. Press.

*This remarkable document summarizes our present knowledge of Earth's climate, including a detailed report on the world ocean, Ch. 5. This is too condensed to make an ideal, primary reference for an introductory course. However, it does make an ideal target --- at the end of this course you will have read critically some of its most important primary references and you should understand much of the content of Ch. 5.*

[Summerhayes, C. P. and S. A. Thorpe, 1996, 'Oceanography, An Illustrated Guide'](#). Wiley and Sons, New York.

*A look at a wide range of topics in ocean science including: Large scale tracer distributions, Ch. 11; Air-sea interaction, Ch. 2; Oceans and climate change, and measurement methods.*

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