

A Jason educational program

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Our program produces teaching materials used by students and teachers at all levels. They include teachers of science, mathematics, and technology, students in elementary, middle, and high schools, and students and professors in colleges and universities. Our goal is to make widely known the results of the TOPEX/POSEIDON and Jason missions and related oceanographic experiments such as the World Ocean Circulation Experiment. All material is distributed through the web. This allows us to update the material quickly, and it allows us to reach a much larger group than we could reach with printed material.

Jason Mission Work

Our program is designed to bring the ocean to the classroom.

Our work is organized into five tasks:

1. The continued development of a web site, OceanWorld (<http://oceanworld.tamu.edu>), to serve students and teachers in elementary, middle, and high school. The primary emphasis of the site is middle-school students and teachers.
2. Continuous update of a textbook *Introduction to Physical Oceanography* for undergraduate and graduate students. The book includes the latest information about physical processes and the global data sets used to study the processes, especially data from oceanic satellites such as TOPEX/POSEIDON.
3. Development of web-based material for a physical oceanography course for undergraduates and graduate students in meteorology, ocean engineering, and oceanography. The course is built

around *Introduction to Physical Oceanography*.

4. Development of web-based material for a problem-based, general oceanography course for undergraduates.

5. Train teachers in the use of the NASA/CNES materials in the classroom.

OceanWorld Web Site

Through the TOPEX/POSEIDON Educational Program we developed a web site for students and teachers, primarily at the middle-school level. The site was based on our survey of needs of teachers, on-going discussions with teachers, and evaluation of methods to bring scientific material to a very large group of students and teachers. The site is based on technical, scientific, and pedagogical criteria for effective web sites based on ideas developed by Yale University for the design of web sites, on national standards for integrated science education, on Texas Essential Knowledge and Skills for all science courses taught in the state of Texas, and on widely accepted pedagogical criteria for good teaching. In addition we use the same criteria to evaluate other web sites that are linked to OceanWorld.



For students, the site includes introductions to key topics such as coral reefs, currents, El Niño and the role of the ocean in weather, fisheries, ice ages and the role of the ocean in climate, icebergs, Jason-1, how satellites measure the ocean, and the new Volvo Ocean Adventure tied to their around-the-world yacht race which starts in September 2001. Each topic includes oceanic art, quotes from famous works of literature, basic information about the oceanic problems, links to sites with further educational material, and links to sites with useful real-time data. We include questions to further challenge students and teachers, and on-line quizzes to test students understanding of the material.

For teachers, the site includes information on the use of technology in the classroom, how the material relates to national and state standards, and resources for the classroom including lesson-modules, hands-on activities, and CD-ROM-based material.

The site is widely used by teachers, and it has won five awards. We are a recognized Bridge site for oceanographic materials, we won a Featured Xpert Award from XpertSite.com, we were recognized by Webivore Knowledge Systems and StudyWeb, and we are an approved site for an educational Internet service called WebPath Express.

Oceanographic Textbook

Dr. Robert Stewart is writing a textbook on *Introduction to Physical Oceanography*. The book includes much new material resulting from the new global oceanographic programs including TOPEX/POSEIDON, WOCE, TOGA/TAO, and the new high-resolution numerical models of the ocean. The text includes information on sea-floor

maps, heat fluxes through the sea surface, dynamical processes such as Ekman, inertial and geostrophic currents, waves, and tides, and processes such as El Niño, deep convection, the Antarctic Circumpolar Current, and western boundary currents such as the Gulf Stream.

The book is in electronic form, and it is available through the web in html and Adobe PDF format. The book is used by college professors at many universities. The book is now being incorporated into the Columbia University Press Earthscape web site (<http://www.earthscape.org>) for educational material.

Oceanographic Course in Physical Oceanography

We have developed two similar courses for students interested in physical oceanography. One is for undergraduate students in meteorology, ocean engineering, and oceanography. The other is for graduate students. The material includes information for lectures, problems to be discussed in class, homework and laboratory assignments, and quiz questions.

The course is based on the idea that "Learning is not a spectator sport." Learning requires students to be active participants in class discussions. Through discussions, students learn about important physical processes and how to compare and select sources of data useful for studying the processes. In particular, students learn to:

- Analyze and describe the important physical processes in the ocean.
- Compare and select sources of data



useful for the study of important physical variables and particular processes.

- Describe the major currents and water masses in the ocean, the processes that govern their distribution, and the interaction of the ocean with the atmosphere.

Oceanographic Course in General Oceanography

We have begun to develop a problem-based course in general oceanography for upper-division college students. This course also emphasizes in-class discussions. The course includes:

- The CO₂ problem, global warming, and the role of the oceans in climate. Will global warming plunge the world into the next ice age?
- El Niño and the role of the ocean in changing weather patterns. Does El Niño really influence all our weather? Does it cause drought in Texas?
- Fisheries and sustainable resources. How many fish can be caught?
- Coastal pollution and its consequences. What causes the dead zones off Mississippi in the summer?

- What processes influence beaches? Why do some beaches lose so much sand that houses are destroyed?

Training Teachers

We train teachers in the use of our material through information included on the web pages, and through workshops at the annual Conference for the Advancement of Science Teaching sponsored by the Science Teachers Association of Texas.

References

OceanWorld:
<http://oceanworld.tamu.edu/index.html>

Undergraduate Physical Oceanography Course: <http://www-ocean.tamu.edu/education/ocean410/index.html>

Graduate Physical Oceanography Course: <http://www-ocean.tamu.edu/education/ocean608/index.html>

General Oceanography Course: <http://www-ocean.tamu.edu/education/ocean401/ocng401.html>

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