



Sponsored by Nasa through Topex/Posideon Educational Project



Brent Porter

Margaret Hammer

Sam Rohr

Dr. Robert Stewart



Site navigator on each page Site content example page:

Pages have useful charts, graphics & references to literature

## Site Navigator

### Ocean Topics

- Ocean Role in Weather
- El Nino
- Currents
- Waves
- Icebergs
- Ice Ages
- Satellite Exploration
- Oceanworld Home
- References
- Teacher Workroom
- Ocean Atlas
- Ask Dr Bob
- Book Galley
- Definitions
- Oceanworld Crew
- Four Star Sites
- General Links
- Bookmarks
- Topex/Posideon

## Site History & Usage

Web Server Statistics from August 13, 1998 - September 15, 1999 (398.2 days)  
 General Summary  
 (Figures in parentheses refer to the 7 days to 15-Sep-1999 16:14).  
 Successful requests: 161,364 (6,073)  
 Average successful requests per day: 405 (867)  
 Successful requests for pages: 36,549 (988)  
 Average successful requests for pages per day: 91 (141)  
 Failed requests: 34,420 (600)  
 Redirected requests: 79 (1)  
 Distinct files requested: 580 (211)  
 Distinct hosts served: 6,425 (366) Corrupt logfile lines: 17  
 Data transferred: 1,037 Mbytes (36,026 kbytes)  
 Average data transferred per day: 2,667 kbytes (5,146 kbytes)  
 Busiest month: Feb 1999 (4,374 requests for pages).  
 Top 8 domains requesting website

#reqs : %bytes: domain	Most requested file extensions
40000: 24.94%: .edu (USA Educational)	#reqs : %bytes: extension
31711: 20.48%: .com (Commercial)	29218: 28.19%: .html
28725: 17.89%: .net (Network)	51292: 23.25%: .gif
5888: 3.56%: .us (United States)	35819: 16.96%: .JPG
3485: 2.20%: .ca (Canada)	26022: 12.95%: [no extension]
3258: 2.07%: .au (Australia)	6735: 7.00%: .GIF
2476: 1.51%: .org (NPO's)	33 : 5.71%: .mov
1244: 0.90%: .fr (France)	

## Currents

Background Information  
 A CURRENT IS A CURRENT BY ANY OTHER NAME, BUT WHAT IS A CURRENT?  
 Ocean currents can be divided into two types of flow based on the forces that drive them. Most currents in the upper kilometer of the ocean are driven by the wind. Deeper currents are density-driven (which means that dense water sinks and is replaced by less dense water). Deeper water is affected by long variability of climate. Climate controls salinity and temperature of the water which has everything to do with density. (See our page: "Role of the Ocean and Weather.")

The arrows in the image represent the currents directions. The length of the arrows represents the currents speed. The colors in the image represent the topography of the ocean surface (what the sea surface looks like). The reds and yellows are the "hills" and the blues and purples are the "valleys."  
 Wind-driven currents affect about 20% of the ocean's volume (total water). These are the only currents that most people see. Patterns of the ocean's currents have been charted by sailors for hundreds of years.

TOPEX/Poseidon is the first space mission that allows scientists to use ocean topography (physical features) to calculate the speed and directions of ocean currents almost everywhere in the ocean.  
 Winds in the atmosphere and ocean currents are ultimately created by the sun. Because the equator receives more direct rays from the sun throughout the year, the equatorial oceans "heat up" more than the oceans at higher latitudes (north and south). This creates a temperature imbalance which creates a poleward flow of heat by way of the atmosphere (wind) and the ocean (currents).  
 Unequal heating of the atmosphere on land and the oceans creates winds and circulation.  
 Here's an important distinction! Wind direction indicates the direction the wind originates (comes) from. For example, a "north wind" blows out of the north to the south. This is the opposite of water-current flow. A "northerly current" flows to the north, not out of the north. It's important to keep this distinction in mind when learning about wind and ocean currents.  
 Wind energy is converted to water movements called "currents" by friction between the moving air (wind) and the water surface. The surface currents resemble the surface winds. Once these surface currents are set in motion they are affected by three other factors: Coriolis effect, presence of coasts, and horizontal pressure gradients.  
 Because Earth rotates, the winds and currents are deflected to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. This is referred to as the CORIOLIS EFFECT.

### Coriolis Force

Caused by the earth's rotation

Objects deflect to the right in the Northern hemisphere  
 Objects deflect to the left in the Southern Hemisphere

The presence of coasts (land masses) creates massive barriers, like dams of granite, that deflect the flow of currents. The easterly (flowing to the east) currents bumping into the continents change direction and flow toward the equator. The westerly (flowing to the west) currents hit land masses and flow toward the poles. This creates in the northern hemisphere a closed circulation loop with a clockwise rotation. Only the Antarctic circumpolar current can flow unimpeded (without obstructions or barriers) around Earth.  
 A pressure gradient is a change of pressure across a horizontal distance. Water that is piled up in a mound creates a zone of high pressure. The water tries to respond by flowing down the pressure gradient (kind of like sliding down a water slide or snow hill). The steeper the gradient—the faster the flow of water. The steeper the water slide or snow hill, the faster you'll go down. The less steep, the less speed the water or you will have. You might ask, "How does water mound up? Isn't the ocean always flat?"

The answer to your second question is, "No!" If you could walk across the watery surface of the ocean you would find yourself moving up hills and down into valleys. Far too small to see by casual observance, the hills are usually no more than 1 m (3 ft) high over a space of 100 km (60 miles). The hills might be only 1 meter high measured from the valley trough, but they have a profound (very important) effect on circulation of the ocean waters. Now, back to your first question--How does water in the ocean mound up? Read on, please.

Steady winds blowing on the sea surface produce a thin, horizontal boundary layer called the Ekman Layer. This layer may be 10 m, 50 m, or at most 100 m thick. This may not sound "thin" to you, but when compared to the depths of the ocean--it is thin. Each layer of the ocean affects the layer beneath it through its movement. Each successively (following in order) deeper layer moves at a slower speed than the layer above and moves (in the northern hemisphere) slightly to the right of the layer above. The change in direction is created by the coriolis effect and is known as the Ekman Spiral

Sea-to-air Transfer, Wind, Net Water Movement (Ekman Transport), Warm Shallow Current, Cold and Salty Deep Current

## El Nino

Each Site is rated on several criteria. A brief synopsis of each site is also provided

Site Title	Site Producer	Science Info	Reading Level	Useful Graphics	Student Staff	Synopsis
Reports to the Nation on our changing planet	NOAA	✓✓✓	Teacher			Click Here
What is an El Nino (ENSO)?	NOAA	✓✓	Teacher	✓		Click Here
El Nino Primer	NASA: Goddard SpaceFlight Center	✓	Middle School	✓✓		Click Here
El Nino: The child returns Page	NASA: Classroom of the future	✓	Upper Elementary	✓	✓	Click Here
El Nino Visualizations	NASA: Goddard SpaceFlight Center	✓	Middle School	✓✓		Click Here
El Nino or El Nono	Poway (CA) Unified School District	✓	Upper Middle School	✓	✓✓	Click Here
El Nino Animations	NASA: Jet Propulsion Laboratory	✓	Middle School	✓✓		Click Here

Before & after image of 1997 ElNino,

## Teacher's Workroom

### List of Links

#### Technology Lab Stations

an innovative integration of science & technology

#### Classroom Activities

activities to increase students comprehension of ocean science

#### Technology Training

online tutorials & hints on using different technology tools.

## waves

None of them knew the color of the sky. Their eyes glanced level, and were fastened upon the waves that swept toward them. These waves were of the hue of slate, save for the tops, which were of foaming white, and all of the men knew the colors of the sea. The horizon narrowed and widened, and dipped and rose, and at all times its edge was jagged with waves that seemed thrust up in points like rocks.  
 Many a man ought to have a bath-tub larger than the boat which here rode upon the sea. These waves were most wrongfully and barbarously abrupt and tall, and each froth-top was a problem in small boat navigation...  
 A seat in this boat was not unlike a seat upon a bucking bronco, and by the same token, a bronco is not much smaller. The craft pranced and reared, and plunged like an animal. As each wave came, and she rose for it, she seemed like a horse making a fence outrageously high. The manner of her scramble over these walls of water is a mystic thing, and, moreover, at the top of them were ordinarily these problems in white water, the foam racing down from the summit of each wave, requiring a new leap and a leap from the air. Then, after scornfully bumping a crest, she would slide and race, and splash down a long incline and arrive bobbing and nodding in front of the next menace.  
 Stephen Crane from The Open Boat

WAVE LENGTH, WAVE HEIGHT, CALM SEA

Wave height (M)

We try to provide useful scientific images as well as explanations in simple language to make the web site to maximize the accessibility to both educators & students.

## Four Star Websites

After looking at many educational sites and challenging them against our criteria, we have come up with a top list of sites. Don't get us wrong, this list is no where near complete. It is just a working list of what we have found so far.

- Athena** - full of lesson plans and teaching materials for grades K-12 on space, Earth, oceans, and weather. Also contains wonderful teacher information on using the Web and incorporating it into the classroom. <http://www.athena.ivv.nasa.gov>
- NVE** - Bill Nye is stocked with daily experiments and teaching materials. This site focuses on various topics in life, physical and planetary sciences. Also, past aired shows are indexed based on science area covered. <http://nyelabs.kets.org>
- Discovery CHANNEL SCHOOL** - seasonal themes offer a variety of teaching resources for many subject areas. Each theme comes equipped with an overview, list of programs, complete classroom activities, online links, discussion forum, and related catalog products. <http://school.discovery.com>
- Spring 1998**
- K8** - covers several areas of aeronautics for classroom use. There are links for the textbook, curriculum bridges, lesson plans, activities, and many other helpful outlets. The textbook is offered in Spanish and for varying reading levels. <http://wings.ucdavis.edu>
- The Franklin Institute Science Museum offers a very comprehensive unit on Living Things. Starting with the individual, this site works its way up through families, neighborhoods, and the circle of life. Each level explores its subject, giving background information and hands on activities. <http://www.fi.edu/units/life/life.html>
- The Science Education Gateway provides teachers with teaching materials dealing with Earth, space, the sun, weather, light, cycles, or the Solar System. A very exciting site that offers online lesson plans and classroom activities for immediate use. <http://www.cse.ssl.berkeley.edu/SEGway/>
- Volcano World - a NASA sponsored site that spans every facet of volcanoes imaginable. This site is set up for immediate use in the classroom. <http://volcano.und.nodak.edu>
- WhaleNet focuses on whales and marine research. It is sponsored by Wheelock College in Boston Massachusetts with support from the National Science Foundation. This site offers information for students, teachers, and the public. It is also available in different languages. <http://whale.wheelock.edu/>