

### 3.6 PHYSICAL OCEANOGRAPHY IN THE CLASSROOM: INTERACTIVE AND RELEVANT

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#### 1. INTRODUCTION

In today's world there is a growing awareness that the oceans play a great role in weather and climate and that understanding the oceans is key to understanding the Earth as a system. Tools are now available that enable teachers to bring physical oceanography into the classroom through a series of engaging activities that align with the National Education Standards. One such tool, 'Visit to an Ocean Planet,' is a CD-ROM produced by the TOPEX/Poseidon project at the Jet Propulsion Laboratory (JPL) on behalf of a mission jointly managed by NASA and CNES (Centre National d'Etudes Spatiale - the French space agency). The CD-ROM complements other materials, including posters, activities such as 'Make an El Niño pudding', a coloring book, a suite of brochures and lithographs, slides and a website. Many of the hard-copy materials are also available on the web. Materials and activities are designed such that relatively complex oceanographic and climatic events such as El Niño and La Niña can be demonstrated and understood through basic concepts and inquiry.

#### 2. AN INTERACTIVE EDUCATIONAL CD-ROM

The 'Visit to an Ocean Planet' CD-ROM is designed for middle school science students but it can be used at many levels including the university undergraduate level. The CD-ROM is divided into three sections, the 'Mission' which concentrates on basics of satellites, orbits, measurement systems and the TOPEX/Poseidon satellite, a 'Guide' which contains teaching materials in ocean sciences, and 'Expeditions' which contains exploratory material. These sections provide a first hand look into the world of science, engineering and research principles as well as conveying basic science concepts. The highlights of the Mission section are perhaps movies that show

the influences on sea surface height, and an entertaining game where students have to decide what orbit satellites should be in based on their function. The 'Guide' section contains teaching materials ready for direct import into the class. They consist of background materials, classroom activities, movies and images for three topics: climate, oceans, and life. Within each topic, materials are provided for the themes of measurements, systems and interactions, process and change, human interactions, scale and structure, and energy. The classroom activities, contributed by a number of oceans education groups and individual educators, are very effective. Guidelines linked to the text show how the material is aligned with the National Education Standards. The 'Expedition' section allows students to interactively plan a scientific expedition, to the Gulf of Mexico, based on real data from a variety of oceanographic satellites. Data and handbooks are provided to engage students in the types of decisions made by research scientists. Also in this section, students can investigate oceanography as a career by following the studies of a group of contemporary oceanographers. A unit on the 1997-98 El Niño completes this section.

#### 3. INTERACTIVE EL NIÑO ACTIVITIES

Units on El Niño have a popular appeal because of the magnitude of the '97-'98 event and the impact on many peoples lives. One of the difficulties is in conveying the basic ocean response to the trade winds that in turn drives the phenomena as manifested in the ocean. There are three activities that have proven to be successful. The first is an El Niño demonstration developed by the JPL Physical Oceanography Distributed Active Archive Center (PO.DAAC), and adapted for use in the classroom, is available on the web site <http://topex-www.jpl.nasa.gov/education/class-activities.html>. The activity uses readily available and inexpensive materials; an oblong plastic box, water, food coloring, mineral oil and a hair dryer. Blue water in the plastic box represents cool water and oil placed on top

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represents warm water, the hair dryer simulates the trade winds. With the 'trade winds' blowing over the surface the warm water is seen to pond in the east end of the box and with some more granular dyes, upwelling can be seen. This is the normal situation across the tropical Pacific Ocean. When the 'trade winds' are cut off, a bulge of surface warm water, the ocean portion of the El Niño, travels across to the east. It is this bulge of warm water that we see in altimeter imagery, and which causes perturbations in the weather and climate.

Secondly, for younger children, an El Niño skit, which involves a minimum of 10 students, has proved to be very successful. Children act the roles of the land, water, atmosphere and people in the affected countries. This activity is available through <http://topex-www.jpl.nasa.gov/education/class-activities.html>.

The third activity has a lot of appeal because of its appearance and because it can be eaten. On the acclaimed SpacePlace website at [http://spaceplace.jpl.nasa.gov/topex\\_make1.htm](http://spaceplace.jpl.nasa.gov/topex_make1.htm), this activity contains a readily understandable explanation of El Niño and the recipe. The unit is aimed at 6<sup>th</sup> grade students but much of the supporting educational material can be used at many levels.

#### **4. POSTER WITH ACTIVITIES**

An El Niño poster is available for classroom use. Colorful imagery shows the rise and fall of the '97 - '98 El Niño, and the back contains panels of explanation and classroom activities. The poster is available folded as part of an physical oceanography teacher package orderable through the PO.DAAC web site at <http://podaac.jpl.nasa.gov>. A poster on heavier stock for more permanent display is available from the TOPEX/Poseidon project office at [topex@jpl.nasa.gov](mailto:topex@jpl.nasa.gov). Also available through the TOPEX/Poseidon project office is a suite of hardcopy materials concerning radar altimetry

that are available to educators doing more in-depth oceans/remote sensing programs.

#### **5. EDUCATORS NEEDED AS JPL EARTH SCIENCE ENVOYS**

To extend the reach of exciting and contemporary physical oceanography education in the classroom, the TOPEX/Poseidon altimeter project, is recruiting 'Envoys'. As part of the JPL Earth Science Flight Projects the project is looking for a limited number of volunteers nation-wide, and world wide, to present interactive Earth Science materials to educators and/or the general public. The program will concentrate on Oceans in its initial phases. People interested in being a JPL Earth Science Flight outreach should contact Tom Nolan through [topex@jpl.nasa.gov](mailto:topex@jpl.nasa.gov).

#### **6. AVAILABILITY OF EDUCATIONAL MATERIALS**

The 'Visit to an Ocean Planet' CD-ROM, and most educational materials are available through the web at <http://topex-www.jpl.nasa.gov> or by contacting [topex@jpl.nasa.gov](mailto:topex@jpl.nasa.gov). Packages of materials are available for workshops from [topex@jpl.nasa.gov](mailto:topex@jpl.nasa.gov). Most materials are free of charge in an effort to make them available to all educators.

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