Density Currents: Application of Science to Education

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Fostering partnerships between researchers and teachers to better science education
Density is one factor that drives currents in the oceans and estuaries.

Density differences are set up by salinity and temperature.
Lock Exchange Experiment

Demonstration shows density driven currents resulting from salinity differences.
Sea Surface Temperatures
Gulf Stream in red

Density = driver of major Ocean currents

CZCS Image. NOAA

After Broker 1987
Basic Concepts

• Density—Temperature and Salinity
• Buoyancy—Floatation
• Stratification
• Motion of Air and Water—Flow
How scientists study these basic concepts

Observing systems provide real-time data and information about our oceans
Salinity measured by “Scanfish” towed behind a ship.

Data are digitized to depict salinities in the Chesapeake Bay

Down estuary

Dry year = higher salinity

Wet year = lower salinity
Fig. 4. Frontogenesis, the formation of a gravity current, after the turbulence ceases. In this example the fluid was vertically mixed and the buoyancy difference between the ends of the tank when the bubbles were turned off was $g' = 0.05 \text{ m s}^{-2}$ and the depth $H = 0.12 \text{ m}$. The photographs were taken at (a) 8.9 s, (b) 10.8 s and (c) 17.4 s after the bubbling ceased.
WHY DENSITY?
Density addresses 5 of 7 National Science Education Standards:

Ø Science as inquiry
Ø Physical Science
Ø Life Science
Ø Earth and Space
Ø Science and Technology

http://www.nap.edu/readingroom/

Density addresses 3 of 7 Ocean Literacy Principles:

Ø The earth has one big ocean with many features
Ø The ocean supports a great diversity of life and ecosystems
Ø The ocean is largely unexplored

http://www.coexploration.org/oceanliteracy
Density is a component of the following courses:

Ø Environmental Science: Ocean currents and estuaries
Ø Physical science: Physical properties
Ø Physics: Fluids and buoyant force
Ø Chemistry: Matter and physical properties
Ø Earth and Space Science: Oceans