The Pale Blue Dot: Utilizing Real World Globes in High School and Undergraduate Oceanography Classrooms

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Introduction

- Disciplines within earth science require a significant degree of spatial reasoning and three-dimensional visualization. Research by Bamford (2011) demonstrates that **lessons that incorporate three-dimensional visualization to illustrate complex processes enhances student comprehension.** Consequently, lessons in geoscience often include activities which emphasize spatial intelligence in conjunction with core conceptual material.
- While some geoscience courses tend to bake-in lessons on visualization, other disciplines in earth science, such as **oceanography**, tend to rely on students' prior spatial abilities. Augmenting traditional instruction of oceanography with kinesthetic activities has the potential to more clearly illustrate to students the relationship between features and processes within the world's oceans.
- Presented here are two oceanographic activities that utilize Real World Globes' dry-erase globes to complement traditional lessons on thermohaline and surface ocean circulation. **These lessons touch on the processes that govern global ocean circulation, the principles of radiocarbon dating, and the various patterns exhibited by surface ocean currents, while simultaneously promoting basic plotting techniques, calculations, and unit conversions.**

Real World Globes

"Our products are designed to facilitate fun and rewarding learning experiences by employing hands-on visual and spatial learning techniques. These techniques complement and augment typical classroom instruction and enable breakthroughs in understanding and learning."

Go see Doug Rogers in the AGU Expo (Booth #1556) for more information!

AGU FALL MEETING

Lesson #1: Thermohaline Circulation

An oceanographic vessel has just returned from two months at sea. The research team traveled along the center of the Atlantic Ocean from Rekjavík, Iceland to South Georgia Island near the Antarctic Peninsula. Along their transect of the Atlantic Ocean, they stopped at a number of stations and took vertical measurements of the radiocarbon concentration.

Data visualization and pattern recognition.

Students work with a fictitious data set and plot in order to observe inherent patterns or trends.

How does water mass age vary with depth? How about from the poles to the equator?

Water mass velocity calculations with radiocarbon concentrations.

Provided a change in radiocarbon age and distance of travel, students can compare the velocities of different water masses.

Based on the meridional distribution of radiocarbon age, which water mass is faster, NADW or AAIW?

Purpose:
- To discuss "thermohaline circulation", the mechanisms by which it operates, and the measures implemented to calculate water mass age.
- To exercise basic plotting techniques and perform basic velocity calculations.

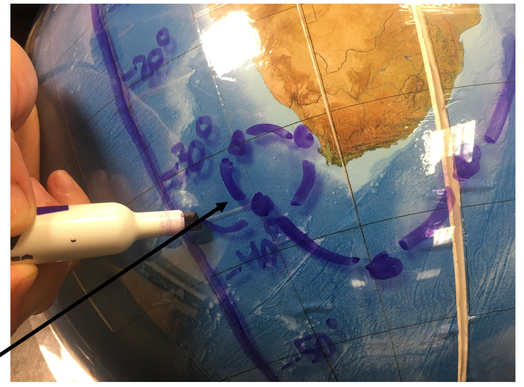
Intended audience: Non-science and Science major undergraduate students.

Lesson #2: Surface Circulation

Just over a year ago, floating oceanographic instruments called drifters were released into the Atlantic, Indian and Pacific Oceans. Over the course of their journey, the drifters relayed GPS coordinates back to the research team so that the oceans' surface currents could be mapped.

Purpose:
- To illustrate the different patterns surface currents exhibit around the globe.
- To exercise basic plotting techniques and perform basic velocity calculations.

Intended audience: High school science students



Gyre?
Eddy?
Western Boundary Current?

Pattern Recognition.

Plotting the relayed GPS data illustrates the track of the ocean drifter.

Which surface ocean current feature is depicted from the Indian Ocean drifter data?

Earth Systems Science: the larger perspective.

Knowing what causes surface ocean currents and what they transport allows students to perform thought experiments regarding the larger climate system.

What would happen to the surface currents if we reversed the direction of the Trade Winds?

All activity materials presented above (and many others!) with answer keys can be downloaded FOR FREE on the Real World Globes website at http://www.realworldglobes.com/. Globes, water mass overlays, spherical rulers, and any other Real World Globes products can be purchased online or at the Real World Globes booth in the AGU Expo!

Resources: Bamford, A. (2011). The 3d in education white paper. Technical report, International Research Agency.