ESSEA: Using GLOBE in Earth System Science Approaches

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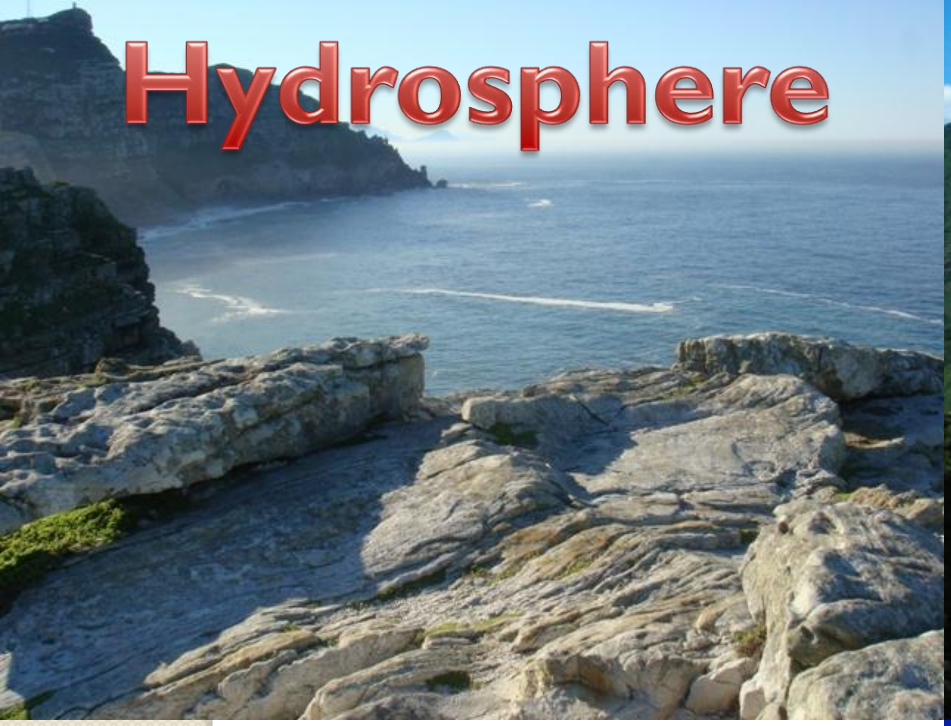
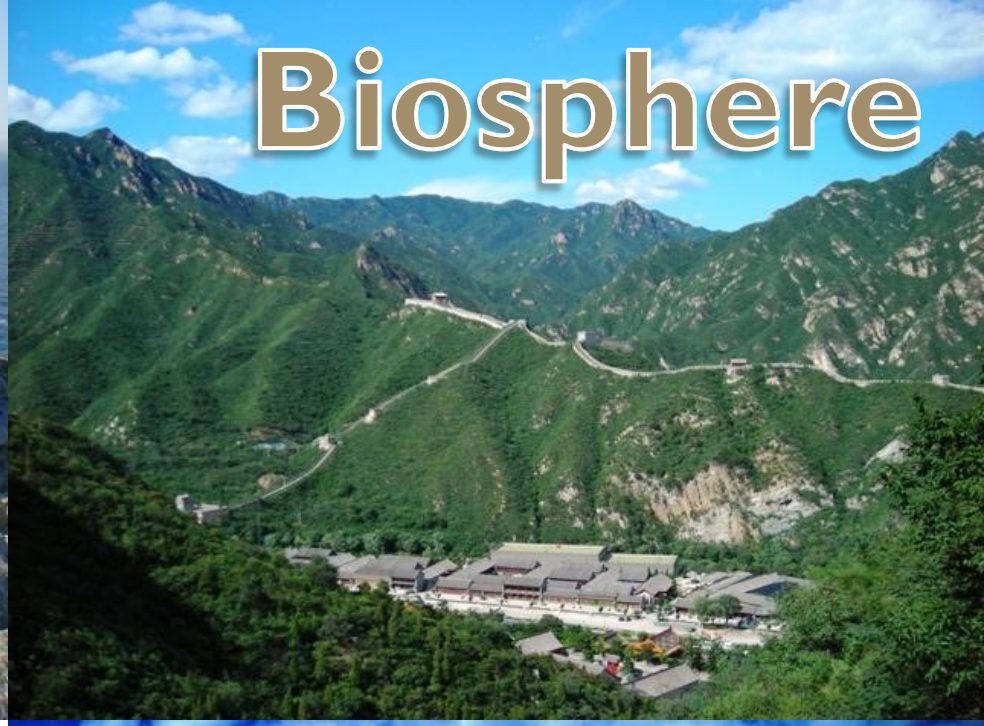
Sheraton Philadelphia City Center
Philadelphia, Pennsylvania
Wednesday, 17 March 2010
1:00 – 1:15 PM

What is Earth System Science?

Earth System Science takes the main components of the Earth (Land, Water, Air, and Life) and looks for major patterns and processes to explain how the Earth works. The major premise to the ESS model is understanding the processes that go on within each component and the interactions between these components.


Hydrosphere


Biosphere

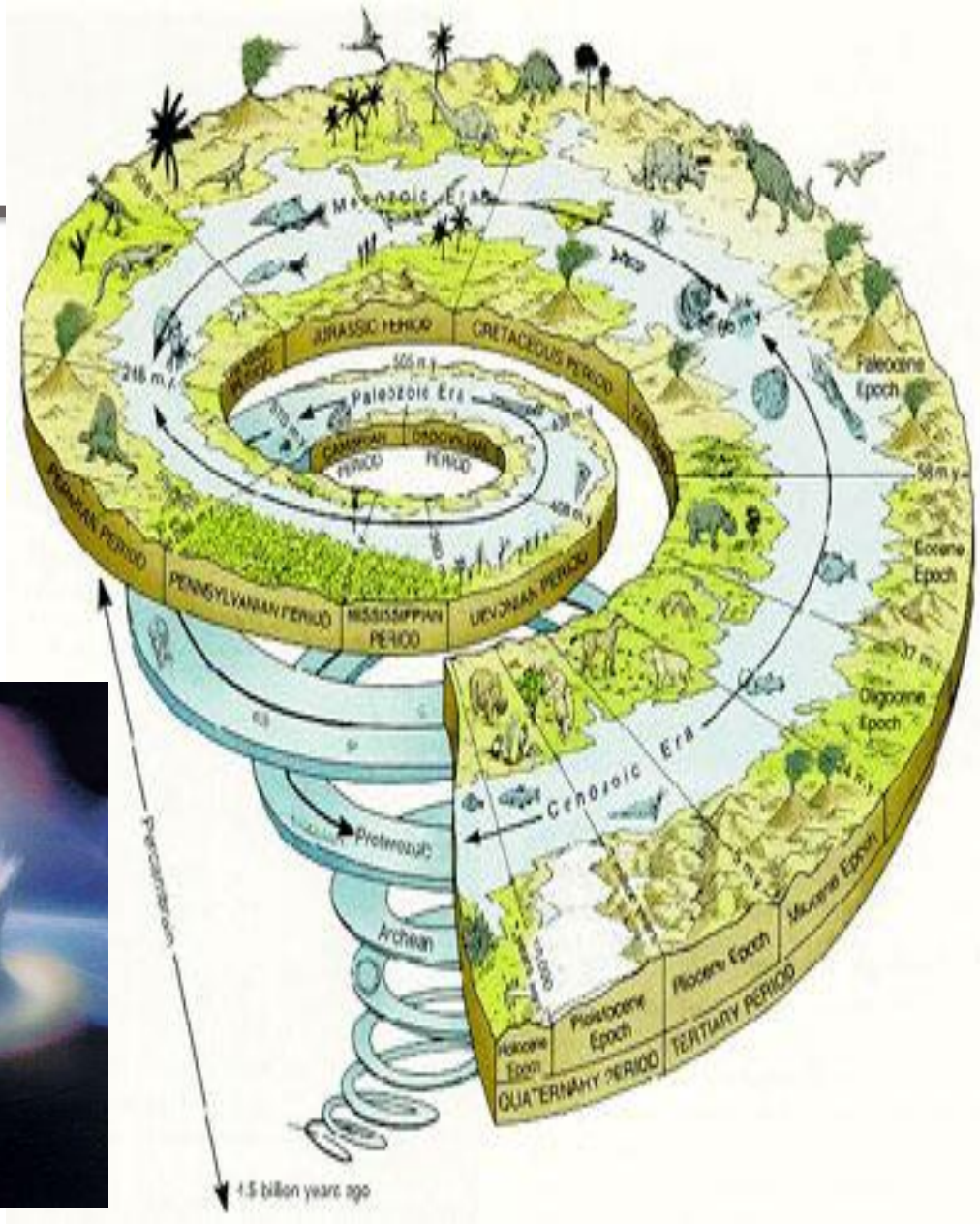
Lithosphere

Atmosphere

Cryosphere

Anthrosphere

The Instant vs Deep Time



What is Earth System Science?

- Lawton (2001) explains, "It is the need to study and understand these within component and between-component interactions that defines ESS as a discipline in its own right."

Integrating GLOBE data

Group Investigation is a pedagogy for engaging and guiding students' involvement in learning. Students become active learners shaping events in their classroom. By communicating freely and cooperating in planning and carrying out their topic of investigation, they can achieve more than they would as individuals. The final result of the group's work reflects each member's contribution, but it is intellectually richer than work done individually by the same students. (ESSEA)

The 2004 Boxing Day Tsunami and the Aftermath

Topic:

Scenario: The 2004 Indian Ocean Earthquake with a magnitude between 9.0 and 9.3 caused a series of tsunamis impacting the land bordering the Indian Ocean. This was the second largest earthquake ever recorded and lasted between 8.3 and 10 minutes. National Geographic reports forces had been building up for hundreds of years and were released on December 26, impacting the lives of millions. The quake itself is called the Sumatra-Andaman earthquake. The resulting tsunami itself is given various names, including the 2004 Indian Ocean tsunami, Asian Tsunami, Indonesian Tsunami, and Boxing Day Tsunami.

The earthquake was the result of the India plate sliding under the section called the Burma plate. This process has been going on for millions of years. The result on December 26, 2004 was a rupture the USGS estimates was more than 600 miles (1,000 kilometers) long, moving the seafloor above the rupture by approximately 10 yards (about 10 meters) horizontally and several yards vertically. Charles Ammon, associate professor of geosciences at Penn State University reported "Globally, this earthquake was large enough to basically vibrate the whole planet as much as half an inch, or a centimeter. Everywhere we had instruments, we could see motions."

Scenario Images

December 26, 2004

January 1, 2004

Studies for Academically Talented Students Program and Carolina Biological Supply Company Partner to Aid GLOBE Thailand Tsunami Research Project

Boulder, CO, June 22, 2005 - Studies for Academically Talented Students (StATS), a Branch Intermediate School District (BISD) Gifted and Talented Program of Coldwater, Michigan and Carolina Biological Supply Company of Burlington, North Carolina (www.carolina.com) have partnered to support GLOBE Thailand's tsunami project entitled, "The Effects of a Tsunami on Marine Invertebrates, Water Quality, Ecology and Atmosphere By Means of GLOBE." Ms. Sharon Ferriss, StATS instructor and Curriculum Coordinator and Gifted Specialist for the Quincy Community Schools (Member of Branch Intermediate School District), initiated the project shortly after the tsunami occurred on December 26th, 2004 in the Andaman Sea. Ms. Ferriss originally approached GLOBE with the desire to assist a GLOBE School affected by the tsunami. Through consultation with the GLOBE Program, this developed into assisting a Research Project that the Thai Partner quickly established in the tsunami affected areas of Thailand. Ms. Ferriss coordinated the funding of ,000 through BISD's Studies for Academically Talented Students (StATS) Program. While searching for a supplier to provide the equipment, Carolina Biological Supply Company graciously offered to match BISD's generous donation through negotiating discounts with the LaMotte Company for water quality analysis kits and supplying logistical support for delivery of the scientific equipment.

Integrating GLOBE data

Problem-based learning (PBL) is designed to "simultaneously develop both problem solving strategies and disciplinary knowledge bases and skills by placing students in the active role of problem-solvers confronted with an ill-structured problem that mirrors real-world problems. PBL models may be implemented using a variety of strategies but are generally characterized by the following steps:

1. the presentation of a problem to a small group of students,
2. discussion of the problem among the students which produces tentative explanations of the problem, and
3. an attempt to solve the problem.(ESSEA)

The Copenhagen Accord, Carbon Sequestration

Topic:

Scenario: In February 2007, the IPCC (Intergovernmental Panel on Climate Change) issued its latest assessment report on climate change, which concluded that global warming is "unequivocal" and gave the strongest warning yet that it is very likely (> 90%) caused by human activities. http://www.carbonfootprint.com/evidence.html

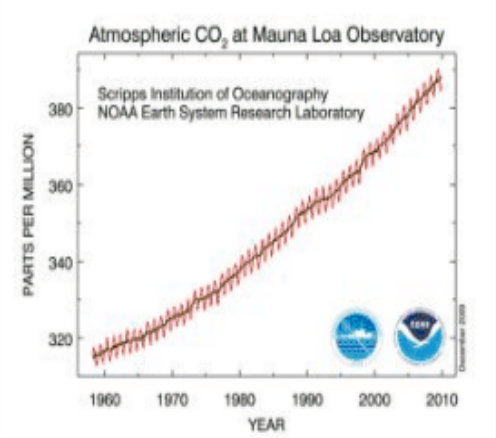
The evidence for global warming and climate change includes the following:-
Sea temperatures have risen by on average 0.5 degrees C (0.9 degree F) over the last 40 years [Tim Barnett, Scripps Institution of Oceanography in La Jolla, California]

20,000 square kilometers of fresh water ice melted in the Arctic between 1965 and 1995 [Ruth Curry, Woods Hole Oceanographic Institution in Connecticut]
Worldwide measurements from tidal gauges indicate that global mean sea level has risen between 10 and 25 cm (18 cm average) during the last 100 years [Warrick et al., 1996]

Global surface temperatures have risen about 0.7 degrees C in the past 100 years [Met Office]

11 of the last 12 years rank amongst the 12 warmest years on record for global temperatures (since 1850) [IPCC, 2007]

Scenario Images



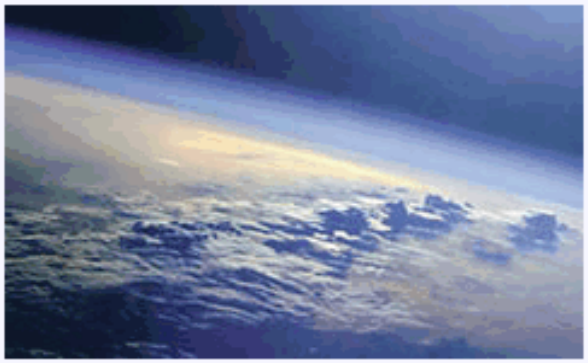
Monthly mean atmospheric carbon dioxide at Mauna Loa Observatory, Hawaii The carbon dioxide data, measured as the mole fraction in dry air, on Mauna Loa constitute the longest record of direct measurements of CO2 in the atmosphere. They were started by C. David Keeling of the Scripps Institution of Oceanography in March of 1958 at a facility of the National Oceanic and Atmospheric Administration (Keeling, 1976). NOAA started its own CO2 measurements in May of 1974, and they have run in parallel with those made by Scripps since then (Thoning, 1989)

GLOBE Student Climate Research Campaign

Engaging Youth to Understand Climate

Coming September 2011

The GLOBE Student Climate Research Campaign (SCRC) **is a two-year event that engages students from around the world in the process of investigating and researching their local climate and sharing their findings globally.** SCRC is comprised of learning activities, international collaborative discussions on climate, data collection, and short-term and longer-term research investigations.



All participants will gain a fundamental understanding of climate and the climate system through **inquiry-based**, **hands-on activities** and **international collaboration** before exploring climate through research. Climate is the critical issue of our time and understanding climate from a scientific perspective is critical to addressing local climate impacts.

MEXICAN KITCHEN

Resources

- John Lawton (15 June 2001) Earth System Science *Science* **292** (5524), 1965. [DOI: 10.1126/science.292.5524.1965]
- http://www.GLOBE.gov
- http://esseacourses.strategies.org/
- http://serc.carleton.edu/teachearth/index.html