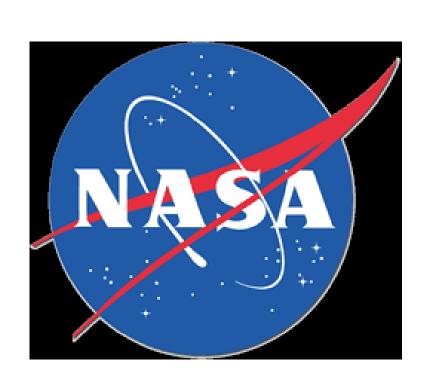
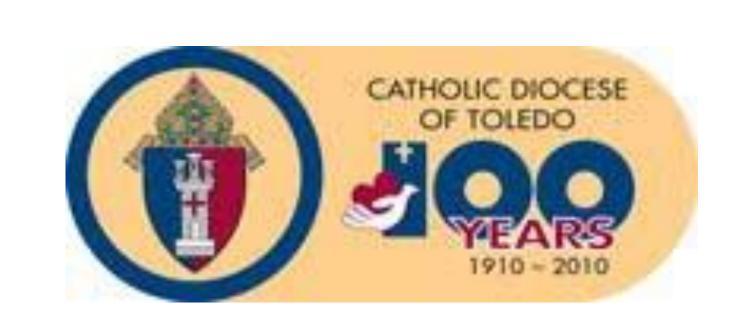


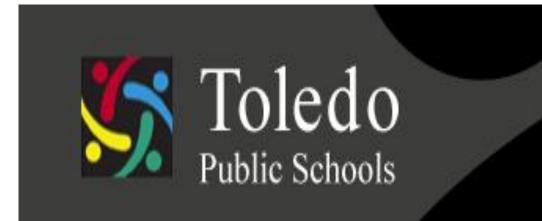


Climate Change Education Initiatives at the University of Toledo

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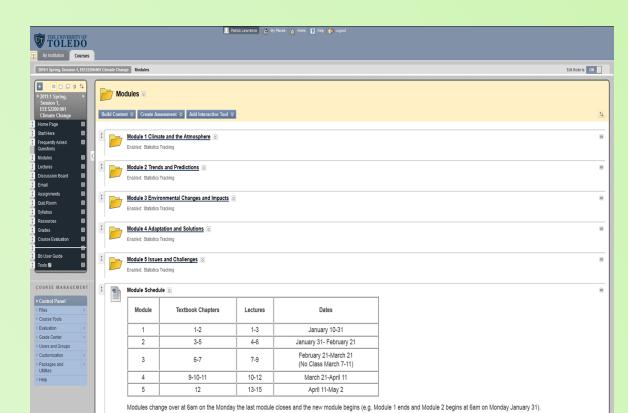
Overview

In recent years faculty, educators, and web designers at the University of Toledo have been engaged in education will summarize these efforts and provide specific examples of educational products and outcomes developed to date from this work. In 2009 two faculty developed and taught a Distance Learning online undergraduate course of ferings to a total enrollment of 125 students. This course was designed to engage and interest students in a range of climate change topics covering both the natural science Foundation grant in support of advancing science education in local schools in the area of renewable energy. One teacher training course developed for this program was in the topic area of climate change and allowed for increased educational and project based science pedagogy by teacher leaders for subsequent adaptation in K-12 classrooms. The NASA Global Climate Change Education program is currently funding a grant for a UT project team for the development of five climate change learning modules that will make use of available and emerging NASA science and data to address common misconceptions regarding climate change and provides such learning materials to local high school science programs.

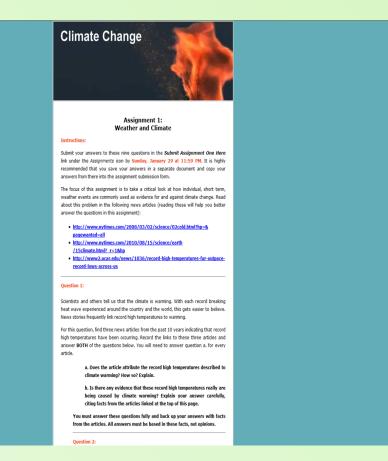
New undergraduate course in Climate Change

In 2009 the Center for Teaching and Learning at the University of Toledo awarded a course development grant in support of new introductory course in climate change to be offered jointly between Geography and Environmental Science

The climate change course is designed for online Distance Learning format using the Blackboard platform. The course is organized around five learning modules each consisting of three topics – with a topic having a short multiple choice quiz – and each module also includes an assignment and a discussion board that requires posts and replies on a module related question. The course is open to all students with no prerequisites and is a requirement for the new undergraduate minor in renewable energy as well as meeting major requirements for the BA Geography and BA/BS Environmental Studies/Science

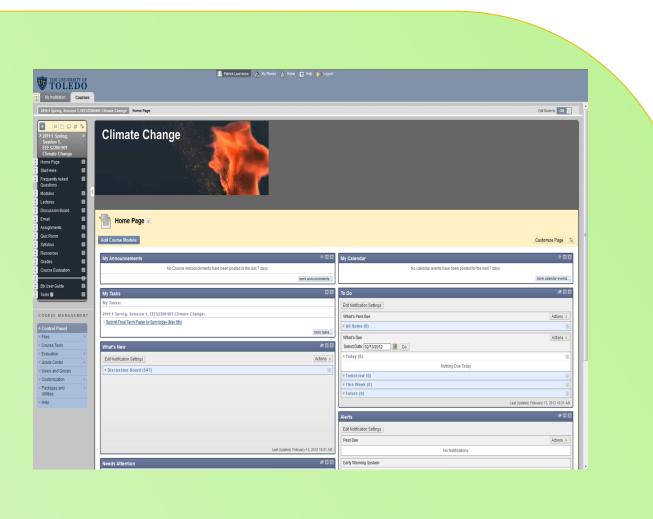


A typical topic page (see example on right) consists of an overview to introduce the topic to be covered. Learning outcomes are provided so the student is aware of the key concepts, ideas and facts they need to understand from this topic. The course has two required readings: a course textbook (Mann and Kemp, 2009) and the 2007 IPCC Reports (Summaries for Policymakers) with selected readings identified for the topic. Each topic consists of a series of web link and additional resources, both intended to supplement the readings.



Another important aspect of the course is the discussion board posts assigned to each module. The instructors post a question to which each student must post one original reply and two content specific replies to other student posts. This encourages active debate among the students and enhances the interaction component of the learning experience.

With three course offerings since 2010, 125 students have completed the course with an average mean final grade of B+ and student evaluations generally positive.



Each learning module is self contained and allows for self paced learning over a three week period. All course materials are housed and organized with the Blackboard course webpage including the syllabus, a welcome page and FAQ pages that provide an introduction and background to the course arrangements and schedule. A discussion board tool allows for posting of course updates and enquires from students. The course covers the range of climate change topics from the basic physical science through impacts, mitigation and adaptation.

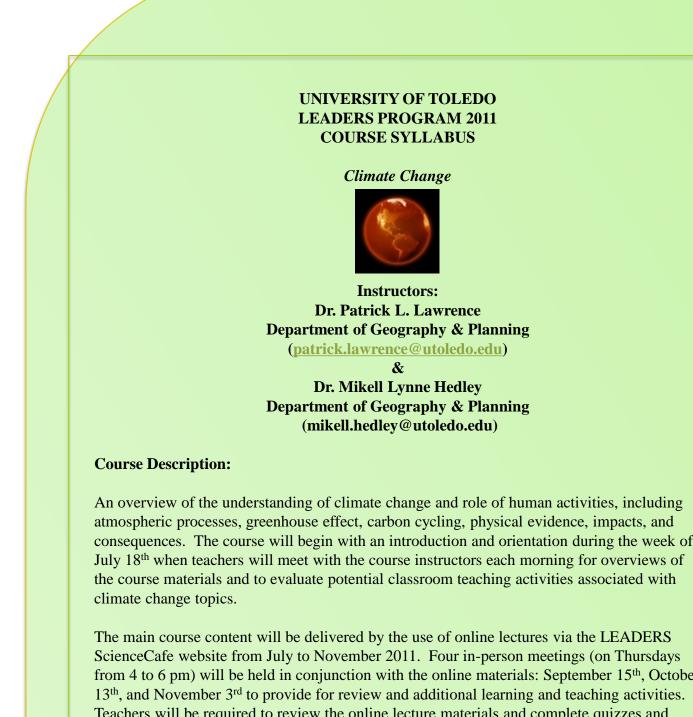
> Topic #1 The Earth's Climate and Atmosphere interaction of heart energy with the atmosphere and the surface of the earth, and the Identify the role of the Sun's output of energy in global climate variations Understand the basic structure of the atmosphere in terms of its composition and Mann and Kump (2009), Dire Predictions pp. 10-35 IPCC Working Group I: Physical Basis, Summary for Policymakers, pp. 1-5. Basics of Geography: Climate (video) Basic Climate Science (website) Additional Resources The Atmosphere (PDF)

As part of the student learning evaluation (grading), each topic has one assignment that is related to the topic theme and intended to have the student explore one aspect in greater detail. An assignment typically provides an overview of an issue, often providing a case study or set of readings to which the student completes a set of tasks or questions examining key questions presented with the topic.

Thread Detail		
The Thread Detail Page provides a complete view of the Thread and its contents. Options for viewing and man	aging the thread are located here <u>More Help</u>	Search
Module 1 discussion question		Reply Quote Edit Set Fla
Author: Michael Weinfraub Posted Date: Monday, January 10, 2011 11:41:07 AM EST Edited Date: Monday, January 10, 2011 11:41:07 AM EST	Total views: 293 (Your views: 1)	
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LEADERS: Climate Change course for teachers in MA Education program in renewable energy

This program is designed to provide graduate degrees in Education focusing on aspects of renewable energy, including the related aspects of climate change



The main course content will be delivered by the use of online lectures via the LEADERS ScienceCafe website from July to November 2011. Four in-person meetings (on Thursdays from 4 to 6 pm) will be held in conjunction with the online materials: September 15th, October 13th, and November 3rd to provide for review and additional learning and teaching activities. assignments **before** attending the subsequent class meeting. On Thursday November 17th (4pm to 9pm) the class will conclude with poster project presentations by each teacher on a topic related to climate change.

Climate and the Atmosphere – Online Content opens Monday June 27th The Earth's Climate Atmospheric Processes The Greenhouse Effect 2. Trends and Predictions – Online content opens Monday <u>August 22nd</u> Carbon Cycling Historical Global Climates and Temperature Trends Climate Modeling 3. Environmental Changes and Impacts – Online Content opens Monday September 19th Evidence for Climate Change Human Activities and Climate Change Impacts and Consequences

Lecture Modules:

Throughout the course the LEADER teachers were exposed to a variety of Project Based Science (PBS) classroom activities that they were encouraged to sample and evaluate for potential application in their classrooms – see below.

> Purpose: Students will use real satellite data to determine the changes in near-surface air temperature at different times of the year over the Caribbean Sea. Estimated Time for Completing Activity: 50 minutes http://mynasadata.larc.nasa.gov/preview_lesson.php?&passid=53 What's Up With the Weather? Classroom Activity Materials | Procedure | Activity Answer | Links & Books | Standards Objective To use a statistical analysis technique, the moving average, to search for meaningful trends in regional raw temperature data. http://www.pbs.org/wgbh/nova/teachers/activities/27gw_warming.html HOW'S THE WEATHER TODAY? K-2 This lesson asks students to think about the weather in their area and introduces them to weather and temperature trends in different latitudes of the United States. They will look at today's weather map and record the high temperatures for a few cities. Students will conclude by

Surface Air Temperature Trends of the Caribbean

influence the annual temperature pattern of a region and develop hypotheses regarding how and why they think these factors influence temperature develop plans how they might investigate Objectives ☐ Students will be able to interpret real-time real world data from a map; understand that weather varies with location; & develop hypotheses for how and why several factors influence the annual temperature pattern of a

drawing pictures of themselves outdoors in their hometown and in another place that has

Overview Students will draw on their previous knowledge and experience with weather to

their predictions with real world data. Then, they will be provided with several factors that

predict approximate temperatures around the world and in their home country and then compare

http://www.nationalgeographic.com/xpeditions/lessons/07/gk2/weathertoday.html

Lesson C1: Factors that influence temperature

http://www.ciese.org/curriculum/weatherproj2/en/lessonC1.shtml

The climate change course for the LEADERS MA Education program consisted of a hybrid classroom/online course using ScienceCafe as the primary website for content delivery. The course was designed to cover the scientific basis for climate change, well providing opportunities to develop 7-12 grade classroom content and student learning through Project Based Science (PBS). The course syllabus from the summer/fall 2011 offering is shown at left. A total of 12 senior elementary and high school science teachers (from private and public school systems) were in the LEADERS program in 2011.

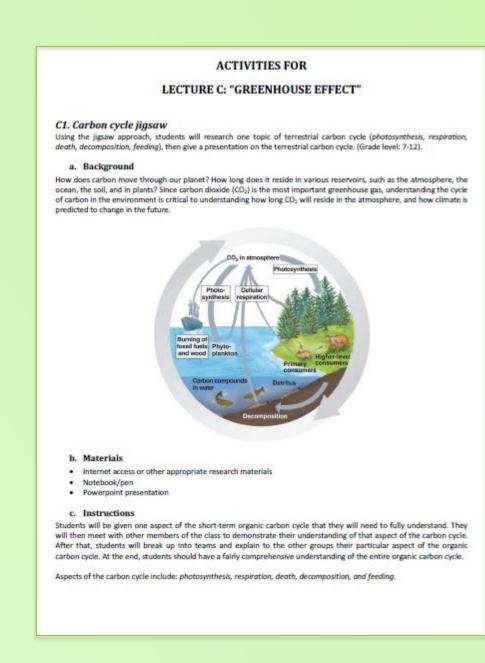
Engages for Week of July 18-22 Interactive atmosphere to get to know the atmosphere July 19th: http://eo.ucar.edu/asl/ep1.html Essential Principals of Atmospheric Science World climate zones: Koeppen's Climate Classifications July 21st: http://news.bbc.co.uk/2/hi/in depth/sci tech/2009/copenhagen/8386319.str

BBC's animated journey through history of Earth's climate

Damocles animated greenhouse effect.

During each class day with the LEADER teachers "on hand" learning activities were introduced to engage the leaders on the topic in order to enhance their learning and to consider means by which to bring this topic into the classroom through online activities or tasks. The list above provides a set of online engagement activities for the first week of the course where the focus was on basic understanding of the climate and atmosphere.

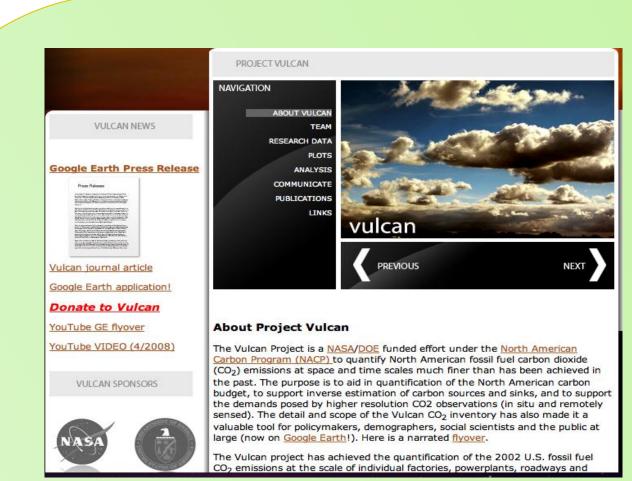
July 22nd: http://www.damocles-eu.org/education/Animation_about_the_greenhouse_effect_182.shtml



For each course module two or three learning activities were introduced and the LEADER teachers, divided into smaller working groups, completed the tasks for the activity and discussed the learning gained from the activity with consideration of its utility by students in their classrooms (sample above). LEADER teachers also developed their own projects resulting in presentations to fellow teachers to assist in their classroom instruction on climate change topics linked to state science standards.

High School Learning Modules to address common climate change misconceptions

The aim of this project is to develop learning modules for high school students to examine common misconceptions regarding climate change



The module will clearly demonstrate that uncertainty can be incorporated into the benefit-cost analysis (BCA) and highlight that the only remaining debate amongst environmental economists is how much reduction how soon? For every "dirty job" that is lost, there is a "clean job" created somewhere else in a low greenhouse gas emitting sector of the economy. In Figure 1, a simple Production Possibility Frontier (PPF) Model illustrates the transfer as, e.g., we move from pt. A on the PPF to pt. B.

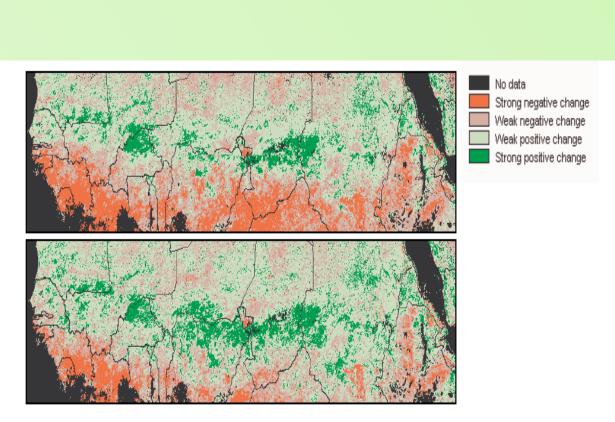
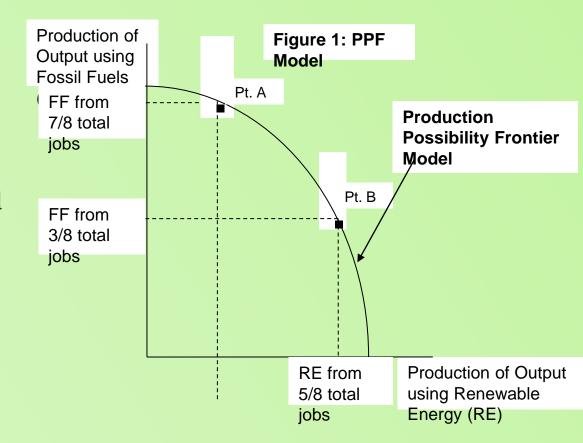


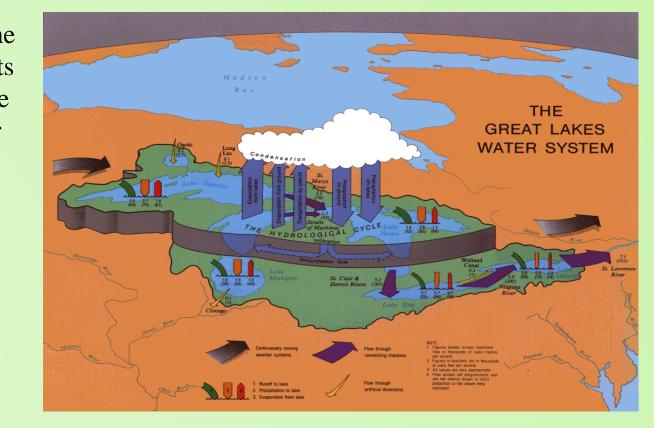
Figure 1. Trend in amplitude NDVI (top) and integrated NDVI (bottom) in the Sahel (between 6 and 20 degrees latitude north) over the period 1982-2002.

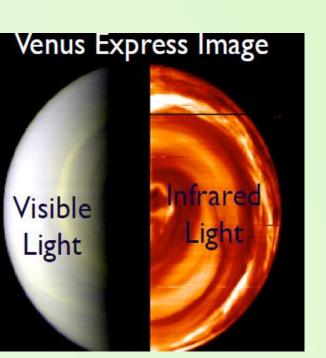
This learning module will provide an opportunity to examine the issue of short term versus long term trends of the impacts on climate on water resources in the Great Lakes basin. The fluctuations in water supply to the basin and resulting water levels in the Great Lakes are well documented and understood natural processes leading to long term regional water balance. Short term weather conditions have been shown to drive the system through input (precipitation) and output (evaporation, discharge, outflows), whereas longer term climate conditions are superimposed on these factors resulting in cycles or periods of changes to stream flow conditions and water levels.

"Individuals cannot make a difference" is a misconception often held by students. This nisconception can largely impede our society's ability to reduce emissions. If individuals assume there is nothing they can do, they might not think about any solutions or ways they can help reduce greenhouse gas emissions. To be able to answer this question, students and teachers will have to first investigate how their actions and lifestyles may or may not contribute to global climate change through a personal carbon calculator.



In this module, students will analyze climate variation in North Africa, and its effect on vegetation health in the Sahel. The Sahel region of North Africa has overall undergone a period of drying over the last century. During the late portion of the 20th century, this was briefly reversed. Students will examine the impacts of varying water inputs and demands as well as increasing temperature on this system.





Studies have shown that students and the general public have significant misconceptions about the role and nature of greenhouse gases (e.g., Kempton 1997), the nature of the Earth's atmosphere, and the connection with the "ozone hole" (e.g., Jeffries et al 2001). We propose to address these misconceptions through a comparative study of the terrestrial planets, using NASA datasets. This module is designed to adapt an astronomy/planetary science approach to help students understand how and why carbon dioxide plays a major role in determining the surface temperatures of not just the Earth, but all the terrestrial planets with atmospheres. We will address how variations in incident sunlight, greenhouse gas concentrations, and albedo can affect surface temperatures, and what this comparison can tell us about possible future climate change on Earth.