A Non-Science Major Undergraduate Seminar on the NASA Earth Observing System (EOS): A Student Perspective

V. Weatherford[1], J. Redemann[2]

[1]University of California -Los Angeles, Los Angeles CA; [2]Bay Area Environmental Research Institute, Sonoma CA

ABSTRACT

Titled Change From Space—what tools do we have?" this non-science major freshman seminar at UCLA is the culmination of a year-long interdisciplinary program sponsored by the Institute of the Environment and the College Honors programs at the University. Focusing on the anthropogenic and natural causes of climate change, students study climate forcings and learn about satellite and other technological means of monitoring climate and weather. NASA's Terra satellite is highlighted as one of the most recent and comprehensive monitoring systems put into space and the role of future NASA platforms in the "A-train"- constellation of satellites is discussed. Course material is typically presented in a Power-Point presentation by the instructor, with assigned supplementary reading to stimulate class discussion. In addition to preparing lectures for class presentation, students work on a final term paper and oral presentation which constitutes the majority of their grade. Field trips to the San Gabriel mountains to take atmospheric measurements with handheld sunphotometers and to JPL, Pasadena (CA) to listen to a NASA scientist discuss the MISR instrument aboard the Terra satellite help bring a real-world perspective to the science learned in the classroom. In this paper, we will describe the objectives and structure of this class and present measurement results taken during the field trip to the San Gabriel Mountains. In this context we will discuss the potential relevance of hands-on experience to meeting class objectives and give a student perspective of the overall class experience.

Motives and Organization

The College Honors program at UCLA provides freshmen with the opportunity to enroll in year-long "cluster" courses focused on particular themes while fulfilling Honors as well as General Education requirements. This seminar was a part of the "Global Environment" cluster, taking a multidisciplinary approach to learning about the many interconnected Earth systems and the dangers they face by increasingly destructive human activities. While the first two quarters provided a general overview of ecology, water resources, energy and air, and human populations, student choose to enroll in area-specific seminars for the spring quarter.

An important goal of this, as well as the several other seminars, was to attract professors with a research background to lead the seminar, bringing a "real world" perspective into the classroom. This background is considered important to enhancing the academic experience of students by providing them with faculty members who can provide a means of finding solutions to some of the most pressing problems facing Earth today. Seminars are designed to give students the opportunity to conduct research of their own, and professors prove an indispensable resource in guiding this research as well as providing information and teaching the skills needed to perform valid scientific research.

NASA continues its commitment to studying Earth's changing environment and the effects it has on climate and weather. The Earth Observing System (EOS) is a series of satellites whose mission is to monitor factors like wind, snow, ice, clouds, land, and aerosols simultaneously; broadening our knowledge of the Earth and helping scientists understand how these factors interact with one another. Part of the EOS mission includes sharing this knowledge and reaching out to the public to increase interest and awareness in the global environment. This seminar was developed to bring EOS closer to students at the undergraduate level, purposefully targeting those with a non-science background. The eventual goal of this approach is to spark interest in the science behind monitoring Earth's climate, taking the information learned beyond the classroom and applying it to a multitude of disciplines.

TERRA MISSION LOGO

TERRA: EOS flagship satellite

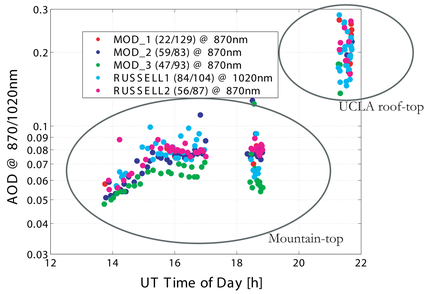
CLASS OUTLINE

Date	Topic	Group Presenting Summary
Mar. 31	Logistics/schedule; Earth as a climate system	---
Apr. 7	Earth Radiation; What comes in must go out-or does it?	1-Earth as a climate system
Apr.14	Greenhouse Effect: How do we know it exists?	2-Earth Radiation
Apr. 21	What NASA does to study changes to the Earth system; EOS	3-Greenhouse Effect
Apr. 28	Field trip to the Jet Propulsion Laboratory: Guest seminar	4-NASA EOS
May 5	Climate Forcing: warming vs. cooling; Feedback Mechanisms	
May 9-10	Field trip to Pasadena and/or Table Mountain Observatory: Taking climate-relevant measurements	
May 12	Consequences of Global Climate Change 2-page outline of term paper topic due w/references	5-Climate Forcing
May 19	Discussion and analysis of measurements taken on field trip.	6-Consequences of Climate Change

SAN GABRIEL FIELD TRIP

A weekend trip to Wrightwood in the San Gabriel Mountains gave the class the chance to put into practice what had been learned in seminar. The main focus of this trip was to collect atmospheric data with sunphotometers which would later be compared with data collected from UCLA. Several hours were spent collecting measurements with the intent of studying aerosol optical depth (proportional to concentration) over time.

Measurements of aerosol optical depth (AOD) using handheld sunphotometers



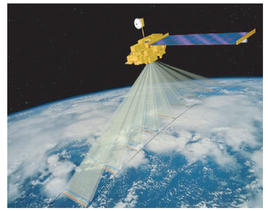
Time series of data collected on the field trip to the San Gabriel mountains and at UCLA (not on the same day), showing higher AOD at the urban (UCLA) site, possibly still cloud-contaminated.

One of the handheld sunphotometers used to collect the data shown in the scatterplot.

Group photo of class posing with sunphotometers.

JPL PASADENA FIELDTRIP

A half-day trip to the MISR lab at JPL (Pasadena, CA) provided students with the chance to observe the working environment of NASA scientists and to learn directly from an expert involved with the MISR instrument. After touring the facilities, students listened to a short lecture presentation providing an overview of the MISR instrument, its mission, and its place as a part of the TERRA satellite. A slideshow of images collected by the instrument and display of a camera similar to those used on the MISR instrument to take its multi-angled images of Earth were also included. Following the presentation, students were invited to ask questions about the instrument and the TERRA satellite, and discussed their relevancy to issues such as climate change, aerospace education, weather monitoring, and environmental awareness.



An artist rendition of the MISR instrument taking pictures of the Earth at four different wavelengths using its multiple, angled cameras.

SUMMARY-Student perspective

Some of the most successful attributes of the seminar were those regarding direct student involvement in the direction and scope of the course. Student group presentations of course material succeeded in challenging students to find entertaining means of conveying important concepts. The field trip to JPL Pasadena allowed students to learn from and question scientists working directly on the MISR instrument, while the weekend trip to the San Gabriel Mountains provided a fun and exciting environment to directly test the concepts learned in the classroom and collect real data. Both of these trips were well worth the time spent outside of the classroom and the associated inconveniences of organization and planning. The quarter-long research projects allowed students to pursue a topic of special interest in greater depth than covered in lecture, and the final presentation of the papers was informative and demonstrative of the many different avenues available to pursue in atmospheric research.

Although the overall course experience was overwhelmingly positive, there were some aspects that could be improved upon for future years. Among these was the relatively little amount of class discussion in the seminar compared to time spent lecturing on new material by the professor and presenting of older material by students. This could be improved by incorporating current news stories related to Earth's climate and the EOS mission into the seminar, enhancing the relationship between conducting scientific research and solving real life problems.

ACKNOWLEDGEMENTS

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