OUTREACH AT THE COOPERATIVE INSTITUTE FOR OCEANOGRAPHIC SATELLITE STUDIES

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ABSTRACT

Located in the College of Oceanic and Atmospheric Sciences (COAS) at Oregon State University (OSU), the Cooperative Institute for Oceanographic Satellite Studies (CIOSS) addresses *outreach to the scientific community* through workshops related to its four Research Themes: **Satellite Sensors and Techniques**, **Ocean-Atmosphere Fields and Fluxes**, **Ocean-Atmosphere Models and Data Assimilation**, and **Ocean-Atmosphere Analyse**s. CIOSS addresses *outreach to the general public* through its fifth theme, **Outreach,** consisting of: Formal Education; Informal Education; and Data Products and Access. Development of **Data Products** is accomplished by working with the CoastWatch program within NOAA/NESDIS. In the area of **Formal Education**, CIOSS is helping the Science and Math Investigative Learning Experiences (SMILE) program to develop its high school curriculum and activities in the thematic areas of Oceanography and Remote Sensing. In the area of **Informal Education**, CIOSS is helping Hatfield Marine Science Center (HMSC) to build an interactive public display that will highlight the use of remote sensing to monitor the coastal ocean off Oregon and in other coastal locations.

1. CIOSS AND OUTREACH TO THE SCIENTIFIC COMMUNITY

Outreach is an integral activity at the Cooperative Institute for Oceanographic Satellite Studies (CIOSS), the newest cooperative institute sponsored by NOAA/NESDIS.

Located in the College of Oceanic and Atmospheric Sciences (COAS) at Oregon State University (OSU), CIOSS addresses **outreach to the scientific community** through workshops related to its four Research Themes (see abstract above). Examples of previous workshops are described below. Future workshops are being planned on topics such as the design of pilot observation/modeling systems in the California Current and data assimilation in coastal circulation models.

Examples of recent workshops include:

- A workshop entitled, “Satellite Measurements of Ocean Vector Winds: Present Capabilities and Future Trends” was held at Florida International University in Miami on February 8-10, 2005, hosted by CIOSS and the National Hurricane Center. The workshop brought together research and operational users to examine present and potential future missions and data sets related to near-surface ocean vector wind measurements. Participants established the measurement requirements for research and operational applications of satellite observations of ocean vector winds. Participants formulated and provided recommendations to NASA and NOAA regarding their development of future missions, new data products, and support for new scientific investigations. Powerpoint presentations and the agenda of the workshop can be found on the CIOSS web site (http://cioss.coas.oregonstate.edu/) under “Workshops and Meetings/Miami (FL) Workshop on Ocean Winds, Feb 2005”.

- The first of several workshops on Ocean Color Climate Data Records (CDR) was held in Corvallis on August 11-12, 2005. The aim of the workshop was to gather participants, representing both users and producers of ocean color variables, to help define science applications and requirements, and identify ocean color CDRs in support of NOAA's mission. Presentations made at the meeting are posted on the CIOSS web site under “Workshops and Meetings/Ocean Color CDR Workshop, Aug 2005”.

- A multi-institutional team of research scientists who use ocean optics to study phytoplankton has been assembled to help NOAA/NESDIS prepare for a new sensor on the next generation of geostationary satellites (called GOES-R).

The sensor is a Coastal Waters (CW) imager and is a subset of the Hyperspectral Environmental Suite (HES-CW). The team, called COAST (Coastal Ocean Applications and Science Team) held its third workshop on September 7-8, 2005 in Corvallis. The meeting objectives were to: review the status of HES procurement and HES-CW requirements; review the proposal and plans for "Risk Reduction" (specifications, algorithm development, etc) for HES-CW); continue planning for risk reduction activities, which include field experiments to collect appropriate optical data sets (with which to develop/test algorithms) in locations off the West Coast, East Coast and Gulf Coast; and develop an initial plan for the first of those field campaigns, a September 2006 Monterey Bay experiment. Presentations made at the meeting are posted on the CIOSS web site under "Workshops and Meetings/COAST Meeting #3, Sept 2005".

- A meeting of the CIOSS Working Groups was held September 8-9, 2005 in Corvallis. The 4 working groups include: Ocean Vector Winds; Dynamics (models and altimeter); Product Development; and Ecosystems (COAST). The goal of the meeting was to allow the working groups to meet and make progress on their specific action items. Summaries of the working group discussions are posted on the CIOSS web site under "Workshops and Meetings/CIOSS Working Groups Meeting, Sept 2005".

CIOSS addresses outreach to the general public through its fifth theme, Outreach, consisting of: Formal Education; Informal Education; and Data Products and Access. Improved data products and data access are primarily accomplished through collaborations with the NOAA CoastWatch/OceanWatch program.

2. CIOSS AND FORMAL EDUCATION – THE SMILE PROGRAM

CIOSS addresses **outreach to the general public** through both formal and informal education. Within the realm of formal education, CIOSS is helping the Science and Math Investigative Learning Experiences (SMILE) program to develop its high school curriculum and activities in the thematic areas of Oceanography and Remote Sensing.

The SMILE Program works to address issues of higher education readiness, access and diversity through academic enrichment and outreach in science and mathematics for pre-college students in grades 4-12. The work of SMILE is intended to significantly improve the educational outcomes of underrepresented and underserved students.

2.1. Project Goals

The short-term and long-term goals of the NOAA/CIOSS partnership with The SMILE Program, are to: 1) engage researchers and graduate students in the development and delivery of club activities and problem-based scenarios in the context of ocean sciences; 2) provide learning opportunities in ocean sciences for high school students in club settings and through a final on-campus challenge event; 3) involve undergraduate and graduate students as mentors to facilitate team engagement and progress and to serve as college-student and career role models; 4) promote greater aspirations and preparations for higher education among SMILE high school students; and 5) increase awareness of, and preparation for, science-based careers among SMILE high school students.

2.2. Afterschool SMILE Clubs

SMILE Clubs, consisting of approximately 20 students and two classroom teachers serving as club advisors, meet weekly after school. The clubs provide content and process skills enrichment through instructional materials linked to Oregon standards and benchmarks. In the club setting, advisors engage students in activities that support their preparation for the spring problem solving High School Challenge. Approximately, one-third of the club time is allocated to activities connected to the science and process skills of ocean sciences and the specific content and process skills students need to successfully engage in the challenge. Pre-challenge club activities include remote sensing, satellite (GPS), wind-surface interactions, ocean currents, meteorological data, real-time surface conditions, mapping, and ocean drifters.

2.3. April 2005 SMILE High School Challenge

The NOAA/CIOSS partnership with The SMILE Program is designed to engage SMILE high school students in club activities that lead to a culminating problem-solving event, based upon oceanography, mapping and oceanographic remote sensing.

The SMILE High School Challenge during April 14-15, 2005 was a one-and-a-half-day event during which SMILE high school club members, teachers, and volunteers convened at Western Oregon University and Oregon State University to play out a realistic oil-spill scenario. This year's challenge was called, "Reaction, Action and Remediation of an Oil Spill". Members of the NOAA/NOS HazMat team in Seattle contributed to the scenario by making available the GNOME trajectory model, which the students used to asses the possible paths the oil spill might take. Mixed teams of students (several schools represented on each team) collected and examined data to learn the extent of the spill, the direction of coastal currents, weather impacts, and the marine and coastal ecology of the area involved. Students collected data pertinent to the developing situation, examined options for oil recovery or remediation, developed a plan, informed by the data, and implemented strategies to communicate that plan (Fig. 1). Their plans were presented at the end of the second day to volunteers who role-played members of the community with different interests. The teams learned a tremendous amount of material in the 24 hours they had to prepare and present their plans.

Figure 1. Students at the 2005 High School Challenge

2.4. Professional Development within SMILE

This project provides professional development learning opportunities for high school teachers serving as SMILE Club advisors. Workshop sessions are developed to help these teachers gain content knowledge, enhance pedagogical skills, and experience the activities that they will lead with their students during club meetings. Workshops are held three times per year, with sessions presented in August, February and May. In addition, during the year approximately 35 undergraduate and graduate students from science disciplines across campus receive several hours of training on mentoring and on the Challenge problem. These college students serve as mentors to the SMILE high school students during the Challenge. Scientists and graduate students from CIOSS, COAS, Geosciences and other OSU departments gain skills and experience in outreach to precollege teachers and students, preparing them for future obligations to do outreach as part of research grants.

2.5. Populations Served

This project supports NOAA's education plan to increase the number of people, particularly in underrepresented groups, who choose education and careers supporting NOAA's mission. This project directly serves approximately 220 high school students and 22 teachers in 11 high schools all over Oregon. SMILE high school students are from

underrepresented minority (54% Hispanic, 17% Native American, 1.5% African American, 6% two or more ethnic backgrounds), low-income, and rural families. Sixty percent are girls. Overall, 71% of SMILE students are from schools rated medium to very-high poverty level, and most communities with SMILE Clubs are have higher rates of high school dropouts and lower rates of college entrance than the state averages for these occurrences. In addition to serving as SMILE Club advisors, the 22 SMILE high school teachers have regular high school teaching positions in science and mathematics. Thus, SMILE professional development workshops for teachers impact more students than simply those in the program. In addition, 35 university students receive training and experience in mentoring outreach.

2.6. Evaluation

SMILE's formative evaluation provides information that will be useful in the planning and design of future curricula, teacher workshop sessions, and model replication efforts. Their summative evaluation will assess longer-term outcomes for students. Elements used in the evaluation include Teacher Workshop evaluation surveys, Club logs and a student data base that tracks student participation through the program and beyond high school.

An important assessment focus in SMILE is specific student learning outcomes at all levels of SMILE student programming. In terms of the high school club activities and the Challenge, SMILE assesses changes in students':

- awareness of ocean sciences careers
- awareness of the pathways to ocean sciences careers;
- interest in STEM careers, in general, and ocean-sciences careers, specifically;
- attitudes toward science;
- expectations for going to college; and
- personal connections to higher education.

2.7. Summary

CIOSS is working to impact pre-college audiences by sharing its content expertise with K-12 teachers and students and by assisting in the development of activities that facilitate learning by these audiences. The SMILE Program's campus-based Challenge Event is an important part of Oregon State University's efforts to provide opportunities for underrepresented minority and other underserved students to get excited about learning science and math, to prepare for the academics of college, and to develop self-reliance and visions for the future. Challenge problems on oceanographic and remote sensing topics will allow SMILE students to gain awareness of oceanography content and related technology far beyond what would be available to them in or out of the classroom. For some, it may spark an interest in pursuing a career in oceanography and/or remote sensing.

3. CIOSS AND HMSC – INFORMAL EDUCATION

3.1. Interactive Display Design

In the area of informal education, CIOSS is supporting efforts by PhD student Molly Phipps in designing an interactive Satellite Oceanography exhibit to be placed at the HMSC Visitor Center. This exhibit will use the conceptual framework of a Goal-Based Scenario (GBS).

GBSs are interactive computer-based learning-aids that provide structured frameworks for learning, where the learner assumes a role within a simulation. In order to achieve this goal the learner needs to acquire particular skills and knowledge. This is where the learning is taking place. Goals in this context refer to the successful completion of the task, not the achievement of grades. A GBS serves to motivate learners and give them the opportunity to "learn by doing". As long as a goal is of inherent interest to learners, and the skills needed to accomplish those goals are the targeted learning outcomes, we have a match and a workable GBS [1]. The important idea here is that a GBS is organized around "performance" skills and the result is a student who can perform the specified tasks.

The Six Steps for a GBS [2] are the following:

- Identify target skills (what the instruction is attempting to accomplish, e.g. write a proposal, develop a newscast, form an oil spill remediation plan): goal-based scenarios are constructed around skills and processes (e.g. evaluate, synthesize, compare);
- Develop missions that require the target skills: the mission is the goal or the final destination of the project;
- Choose a focus or a general class of skills the student will learn: e.g. diagnosis – analyze or explain problems faced by a group; discovery – apply techniques or strategies from one group to another; control - manage simulated setting;
- Create a cover story for the mission: establish the context (e.g., half the world is starving, you can help), gain attention, interest of the learner, emphasize importance of the topic;
- Plan the operations: specific activities for students, small units of activity (e.g., answering question, using a tool or simulation, searching for information);
- Plan learning environments to support the target skills: simulated work environments (e.g., hospitals, computer labs, TV news stations, foreign affairs office).

GBSs rely on the idea that skills must be learned in the appropriate context and that the context cannot be separated from learning the context-appropriate skills [3]. The open-ended nature of GBSs affords a more realistic idea of the scientific world and the nature of science. The basic idea of GBSs is that learners learn best, and are more engaged, when an exhibit is interactive and has a clear goal. There should be some problem that the visitors need to solve and the information portrayed should be presented as a tool to solve the problem they are faced with.

3.2. Relation to Informal Education at CIOSS

Located on the coast, approximately 75 minutes from OSU, the Hatfield Marine Science Center houses marine science laboratories from OSU, NOAA, EPA and the State Department of Fish and Wildlife. It also houses the OSU Hatfield Marine Science Visitor Center – a unique, dynamic environment for lifelong exploration and discovery. The Visitor Center encourages adults and children to enjoy marine science. The Visitor Center also provides opportunities for conducting research on devices, methods, and concepts for informal science education that will advance the art of public education. It effectively provides a “laboratory” for informal education.

As mentioned above, CIOSS is supporting the development of an interactive display on oceanography and remote sensing. This activity forms the research for the PhD thesis of OSU student Molly Phipps, whose research topic is Informal Education. Present plans are to create a GBS with satellite oceanography as a tool for visitors and to use the recent spate of seabird deaths as the hook for the exhibit. Visitors will assume the role of a scientist trying to determine what is killing so many birds along the Oregon Coast. This topic has received attention in the West Coast media, and is a subject of common interest, according to an informal survey. By trying to figure out what is killing the birds, visitors will be able to ask questions and see video clip responses from science experts. An interactive, touch-screen display (Fig. 2) will allow visitors to explore satellite data sets showing the surface of the ocean, as well as in situ data sets that allow the visitor to fly through the ocean underneath the surface.

Figure 2. An existing interactive exhibit

4. LINKS FOR ADDITIONAL INFORMATION

Cooperative Institute for Oceanographic Satellite Studies (CIOSS)
http://cioss.coas.oregonstate.edu/
College of Oceanic and Atmospheric Sciences (COAS)
http://www.coas.oregonstate.edu/
Center for Satellite Applications and Research (STAR)
http://www.orbit.nesdis.noaa.gov/star/
Science and Math Investigative Learning Experiences (SMILE) Program
http://smile.oregonstate.edu/
Hatfield Marine Science Center (HMSC)
http://hmsc.oregonstate.edu/

5. REFERENCES

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2. Schank, R., Fano, A, Bell, B, & Jona, M., 1993/1994. The design of goal-based scenarios. *The Journal of the Learning Sciences, 3-4 305-345.*
3. Oliver, K. (2000). *Goal Based Scenarios*. Retrieved March 9, 2006, from www.edtech.vt.edu/edtech/id/models/powerpoint/gbs.pdf.