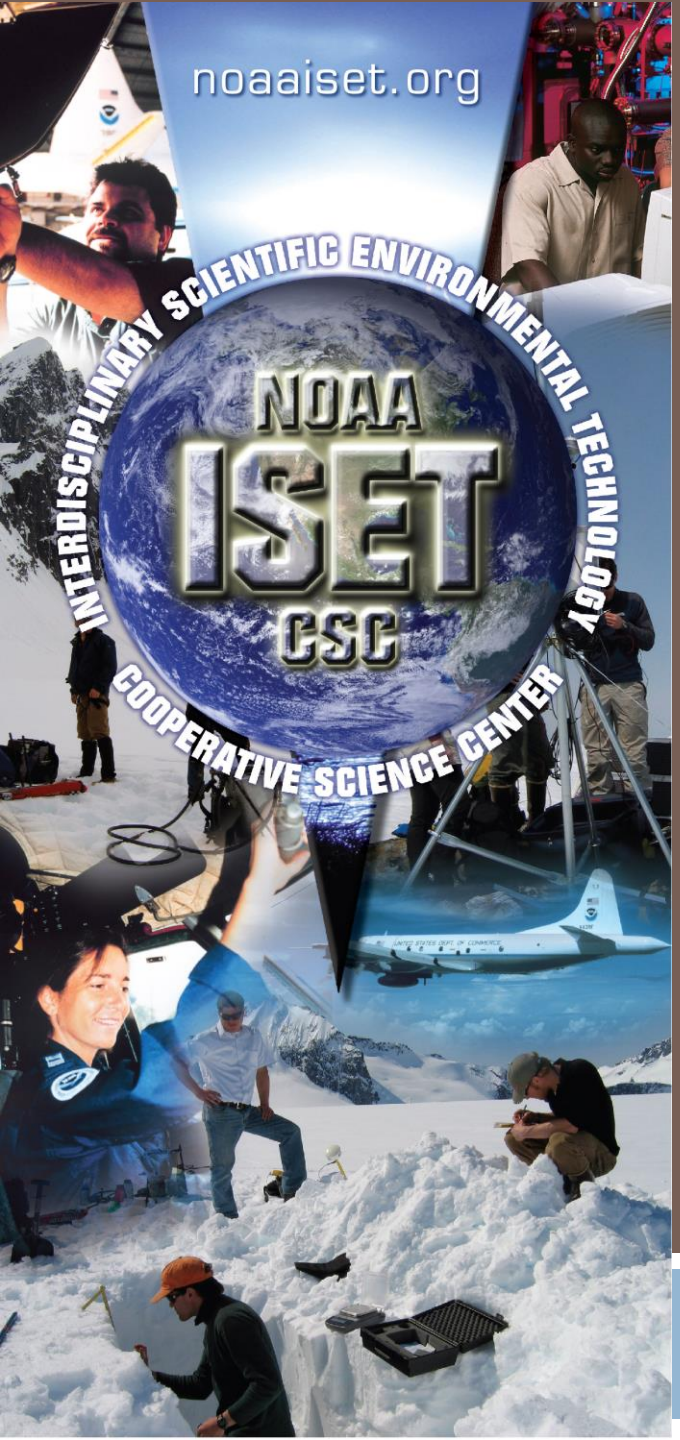


2015 GSA Meeting

Successful Model for Increasing Diversity and Capacity in Geosciences through a NOAA Cooperative Science Center

Keith Schimmel
Energy & Environmental Systems Department, Chair
NC A&T State University

Solomon Bililign
Physics, NC A&T State University

Facts About ISET Cooperative Science Center

Partner Institutions

- North Carolina A&T State University - Lead
- North Carolina State University
- University of Minnesota
- Fisk University-Tennessee
- California State University-Fresno
- University of Alaska Southeast
- City University of New York

Aligned with the NOAA Office of Atmospheric Research

Nine Academic Departments

MISSION

Train students in NOAA scientific areas and develop technology and analysis techniques of global data sets for improved understanding of climate and environmental change

Thirty one scientists and engineers in seven institutions

Partnerships

GOVERNMENT

- *NOAA National Severe Storm Laboratory*
- *Naval Research Lab, Stennis, MS*
- *NOAA Atlantic Oceanic and Meteorological Laboratory*
- *NOAA National Weather Service*
- *NOAA Southeast River Forecast Center*
- *NASA Goddard, NASA GISS, NY*
- *NYC Department of Health and NYC Office of Emergency Management*
- *National Center for Atmospheric Research (NCAR)*

INDUSTRY

- *Maxion Technologies*
- *MTECH Systems*
- *Vaisala*
- *WETLabs Inc.*

ACADEMIC

- *Pennsylvania State University*
- *Princeton University*
- *University of Maryland, College Park*
- *University of Florida*
- *Georgia Tech*
- *University of Colorado*

Background on NOAA Cooperative Science Centers

Geosciences awards the fewest undergraduate degrees—less than 1 percent—of all of the science, technology, engineering and math (STEM) fields, according to the National Science Foundation's report on *Women, Minorities and Persons with Disabilities in Science and Engineering* (January 2009).

Graduate students account for only 5.8 percent of degrees awarded in the earth, atmospheric and ocean sciences—the lowest in all STEM fields, according to NSF.

2001 Congress mandated the establishment of 4 NOAA Cooperative Science Centers (CSCs).

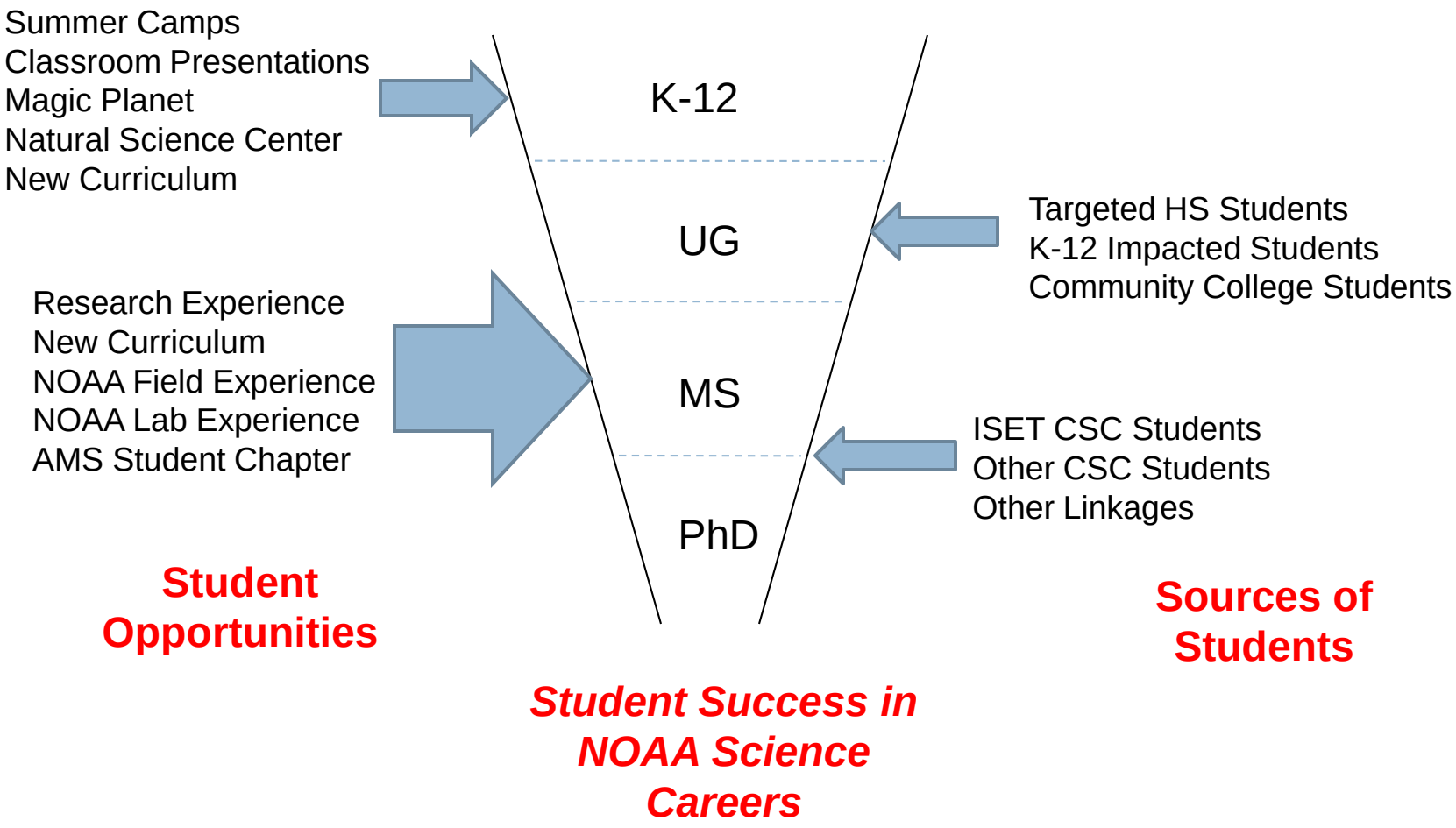
2006 NOAA-EPP established 5 CSCs at Minority Serving Institutions (MSIs) to advance collaborative research in the NOAA-mission sciences.

2012 Number of CSCs decreased back to 4.

ISET CSC Education Vision

- Center that is *innovative* in applied science and technological *research* as well as *teaching* that will have a *national impact* on the number of *underrepresented students earning graduate degrees*, the *retention of underrepresented faculty* in NOAA disciplines, the *awareness* by underrepresented students of *NOAA's mission*, and the *environmental literacy* of underrepresented students.
- *Collaborative partnerships and linkages* are truly integrated and diverse and lead to the *transfer of NOAA-related research* findings to *diverse user groups* and the offering of *courses and seminars between partner institutions and to other Minority Serving Institutions.*
- *Cooperative* with other *NOAA centers* and research facilities as well as other *organizations performing climate change and scientific environmental technology research.*

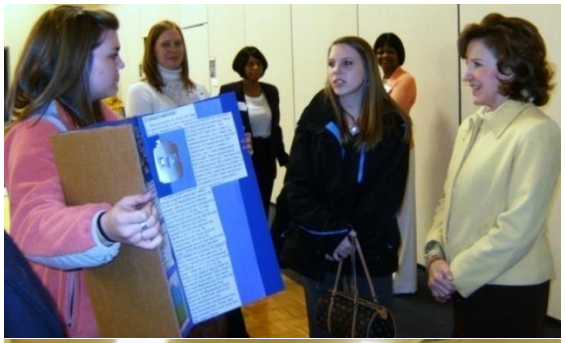
Student Pipeline (Funnel) Strategy

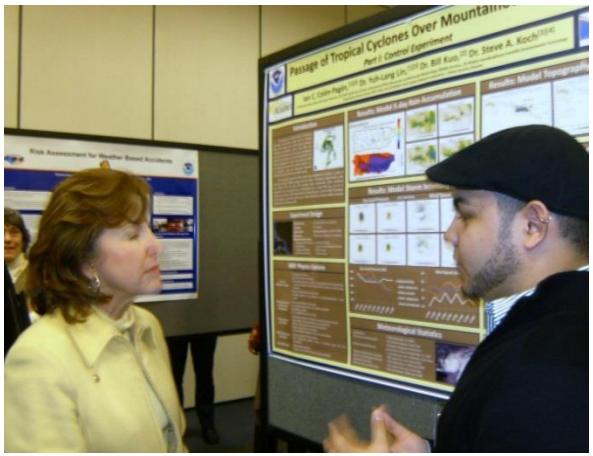


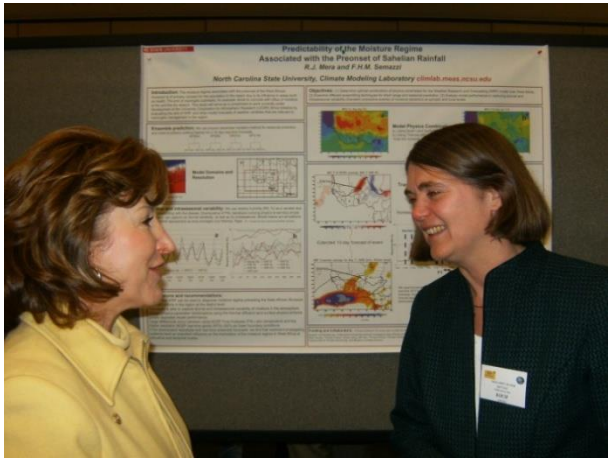
ISET CSC Summer Camps

In 4 year period, ISET partners served over 200 high school teachers, over 200 high school students, and hundreds of middle and elementary students.

ISET CSC Day




Passage of Tropical Cyclones Over Mountains
Part I: Control Experiment


Predictability of the Moisture Regime
Associated with the Preonset of Sahelian Rainfall
R.J. Mera and F.H.M. Semazzi
North Carolina State University, Climate Modeling Laboratory climlab.meas.ncsu.edu

Geoscience Capacity Growth

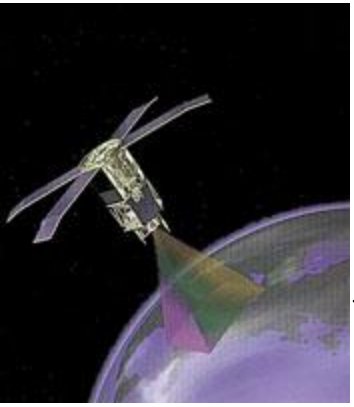
Before 2006

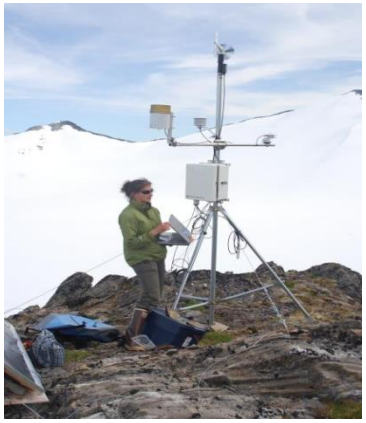
- No degree programs in Atmospheric Sciences and Meteorology
- No courses offered in Atmospheric Sciences

Since 2006

- A BS in Atmospheric Sciences in meteorology – second in the Nation at an HBCU
- A PhD concentration in Atmospheric Sciences (EES)
- Developed 18 undergraduate and 8 graduate courses in atmospheric sciences and atmospheric technology
- Expanded MS thesis projects in atmospheric sciences in STEM departments
- Five Atmospheric Sciences Faculty Hired
- Geosciences courses as general education courses offered

ISET CSC RESEARCH THRUSTS



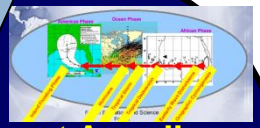


Data assimilation

Sensor Data

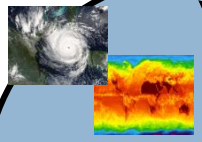
Sun photometer

Thrust Area I
Sensor science and technology



Thrust Area II
Global Observing systems: numerical and physical research

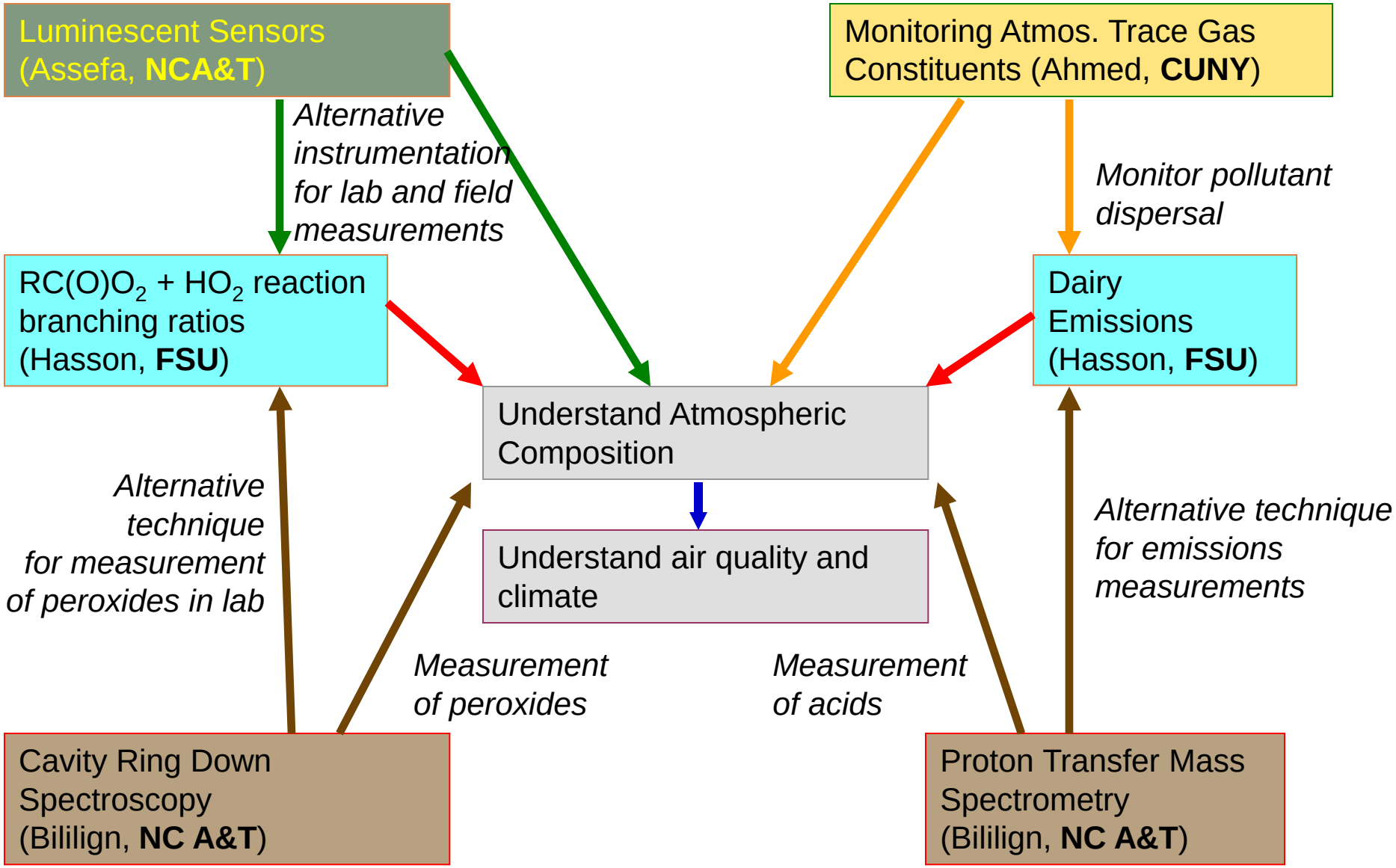
Understanding Climate And Environmental Change



Thrust Area III
Data mining & Fusion Distributed architecture

1. Climate prediction
2. Pattern recognition for seasonal hurricane forecasts

Interactions Among Research Thrust I Projects

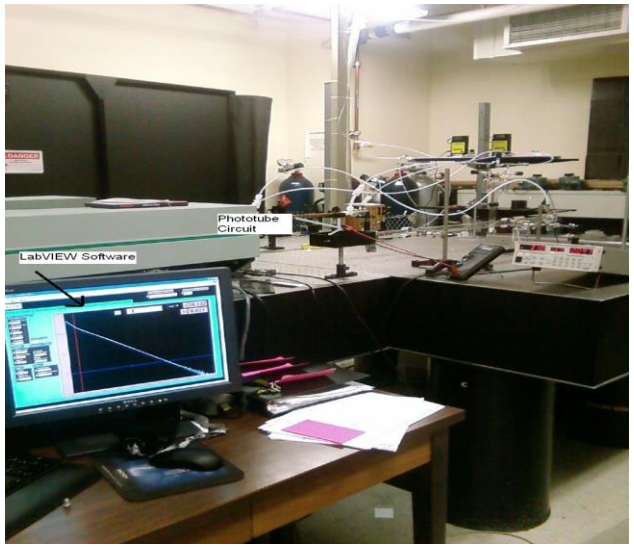


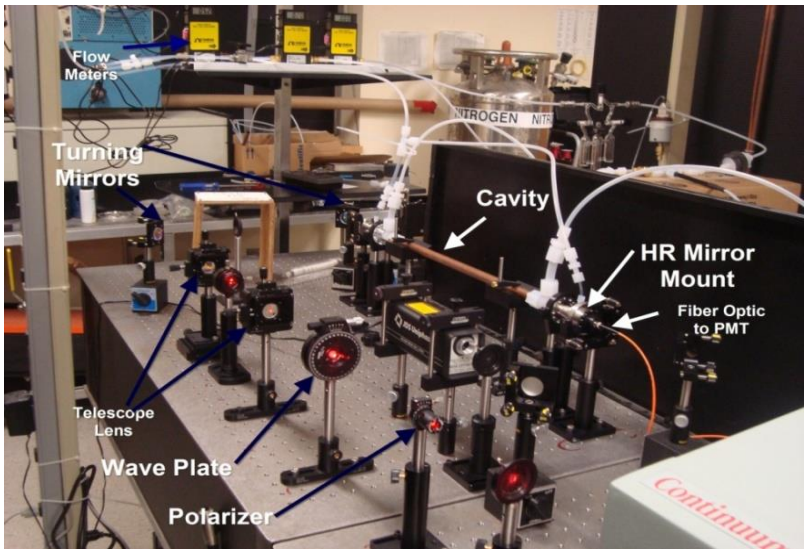
Cavity Ring Down Spectroscopy

Goals

- Develop and calibrate a cavity ring down spectroscopy setup for trace gas detection.
- Investigate vibrational overtone initiated photodissociation processes that are significant sources of atmospheric radicals for glyoxal, carboxylic acids and methyl hydroperoxide.
- Measure the absorption cross-section for the fourth OH overtone of organic acids.

We now have a CRD instrument that has a sensitivity to measure absorption as low as 10^{-9} $cm^{-1}Hz^{1/2}$.





Field Measurements - CUNY

Brooklyn Marina

NJ cruise, R/V Connecticut

Research Thrust I: Sensor Science and Technology

NC A&T Atmospheric Physics

CUNY Sensor Technology group

NC A&T Sensor Science group

Fresno Atmospheric Chemistry group

Research Thrust II:
Global Observing Systems

NC A&T, NCSU, CUNY

NC A&T Modeling group

Atmospheric Sciences and Meteorology Majors

Instrumentation - Alaska


Pressure Transducer


Met Station


Temp, DO, pH, Turbidity, Conductivity


GPS


Pan-Tilt-Zoom Camera

Research Thrust III: Data Mining, Fusion, Distributed Architecture

Distributed Architecture -NC A&T

Data Mining-Minnesota

Boulder, CO

Data Fusion-NC A&T

Distributed Architecture -Alaska

Data Mining-Fisk

Students in NOAA Labs (2010)

- Two ISETCSC undergraduates **Malcolm Blow and Martin Blow** are NOAA EPP Undergraduate Scholarship Program scholars
- National Weather Service (NWS): **Ndifreke Amama**, graduate student (MS) in atmospheric chemistry traveled to Ghana with the NCAS-AEROSE (April 26-May 26, 2010) team on the NOAA Ron Brown ship.
- **Keren Cepero** (graduate student, NCSU) (Paul Liu, advisor) worked on watershed modeling and has been intensively involved in the collaborations with NOAA, the National Weather Service (NWS), and the Office of Hydrologic Development (OHD) in Silver Springs, MD, in 2009 and 2010.
- National Marine Fisheries Service (NMFS): Fisk student **Wilsharo Scott** contacts Carlos Rivero (NMFS) almost every week. He also visited Carlos during the spring break and has an NMFS internship in Miami.

Developing and Expanding Partnerships - NCAR

- NCAR scientists providing lectures and course modules though webinar or web. A course in Atmospheric Chemistry will be offered for graduate students at NC A&T and Fresno.
- NCAR provided support for speakers to come to NCA&T, give seminars, spend time with students and faculty, and to provide training on some areas of common interest.

Summary of Center-wide Accomplishments 2006-2011

Educational and Research Metrics	Accomplishments
Number of students supported by ISET CSC across all institutions 93% MIs at NCAT, 74% MIs overall, 36% female	342 (All students who received some form of support) 69 MS, 36 PhD
Number of graduates	38 MS, 12 PhD, 385 BS
Number of students who participated in summer research at NOAA labs	60
Refereed publications by faculty published and under review	92
Student and faculty conference presentations	475
NOAA relevant seminars and colloquium	8-15/year
Leveraged funding (171 proposals)	$35,583,900
New faculty	6
Number of collaborative projects with NOAA scientists	45

Student and Instructor Surveys and Student Interviews

- Fall 2010 Report
- Amy Germuth, PhD

  President, EvalWorks, LLC; Durham, NC
- 43 students (22 graduate and 21 undergraduate) responded to Student Surveys
- 21 instructors responded to Instructor Surveys
- 21 NC A&T students (undergraduates and graduates) participated in student interviews

Engagement in Strategies Designed to Improve Research-related Skills/Competencies

	%	n	Under-graduate	Graduate
Research experiences on campus	88.4%	38	19	19
Attending seminars and/or conferences	81.4%	35	15	20
Presenting at seminars and/or conferences	62.8%	27	11	16
Mentoring (by a NOAA ISET professor)	58.1%	25	11	14
Research experiences at NOAA labs	39.5%	17	7	10
Web-based tutorials	18.6%	8	1	7
NOAA ISET Courses	18.6%	8	1	7
Field study experiences	14.0%	6	5	1
Industrial internship experiences	7.0%	3	3	0

Overview of Skills/Competencies Students Gained by Strategy

	Research experiences	Mentoring	Attending seminars and/or conferences	Research experiences at NOAA labs	Presenting at seminars and/or conferences	Field study experiences	Web-based tutorials	Industrial internship experiences	NOAA ISET Courses	*Total*
Networking	19	24	36	21	24	14	5	14	7	***164***
Knowledge of research area	35	25	25	18	16	16	7	10	10	***162***
Technical presentation	21	16	26	14	32	7	10	7	6	***139***
Data analysis and presentation	28	21	19	18	19	8	10	8	8	***139***
Scientific method	31	19	13	19	9	15	9	7	9	***131***
Research ethics awareness	25	16	17	14	9	15	10	8	7	***121***
Knowledge of NOAA	15	22	24	16	9	4	5	5	12	***112***
Career planning	18	21	18	13	8	10	5	9	5	***107***
Creativity	20	15	13	13	13	11	8	8	6	***107***
Technical writing	16	16	11	9	17	9	10	4	9	***101***
Independence	25	14	5	15	11	11	3	10	2	***96***
Computer software	27	14	9	16	5	6	7	7	4	***95***
Literature review	23	19	11	8	9	3	8	4	8	***93***
Leadership / Mentoring	18	22	5	9	9	8	3	4	5	***83***
Teaching	11	14	9	4	10	5	6	1	5	***65***
Hardware troubleshooting	17	11	1	12	1	5	5	4	1	***57***
TOTAL	***349***	***289***	***242***	***219***	***201***	***147***	***111***	***110***	***104***	***1772***

Instructor Ratings of Student Competencies

	n	Min.	Max	Mean	sd
Technical presentation	20	2	5	3.80	0.768
Literature review	20	2	5	3.70	0.865
Data analysis and presentation	20	1	5	3.65	1.182
Knowledge of research area	20	2	5	3.65	1.137
Scientific method	20	2	5	3.60	0.995
Career planning	19	2	5	3.58	0.902
Research ethics awareness	20	2	5	3.55	0.826
Independence	20	1	5	3.45	0.945
Knowledge of NOAA	20	2	5	3.40	0.883
Leadership / Mentoring	19	1	5	3.37	1.116
Technical writing	20	2	5	3.35	0.875
Creativity	20	1	4	3.30	0.865
Networking	18	1	5	3.28	0.895
Computer software	19	1	5	3.26	1.046
Teaching	18	2	4	3.06	0.639
Hardware troubleshooting	19	1	5	2.79	1.134

UG Interview Findings

- Freshmen noted that their experiences with the NOAA ISET program were minimal and they were not always clear what the benefits of the program were beyond receiving financial support.

Objectives for ReGenesis Game Design

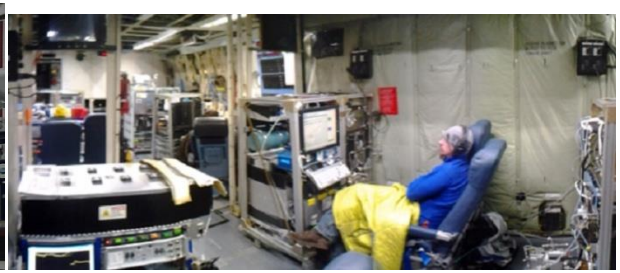
1. Increase NOAA ISETCSC undergraduate and graduate student knowledge of NOAA, particularly OAR Line Office
2. Motivate students to pursue careers with NOAA and NOAA contractors
3. Determine if 3D Gaming is an effective tool for accomplishing “1” and “2”
4. Determine the development challenges

Productivity Since the End of NOAA Funding 2011-Present

Number of Proposals Submitted	**45 by 6 Core ISET Faculty**
Number of Proposals Funded	16
Number of Published Articles	37
Number of Presentations	140
Number of PhD Students	13 New PhD Atm. Sci. students enrolled since 2011; 9 PhD Atm. Sci. graduates; 27 PhD Atm. Sci. students enrolled during part of the time period
MS students	13 (Physics and Math majors)

Active Collaborations

- WINTER - an atmospheric chemistry campaign that focuses on wintertime emissions and chemical processes in the Northeastern US. AGU special session in Dec 2015



•The Front Range Air Pollution and Photochemistry Éxperiment (FRAPPÉ) field campaign took place from 7/16 to 8/16, 2014.

•Fire Influence on Regional and Global Environments Experiment (FIREX)-The Impact of Biomass Burning on Climate and Air Quality: NOAA Field and Laboratory Studies during 2015-2019.

CSU-Fresno Story (Dr. Hasson)

- I first came across Samuel Hernandez in an upper division chemistry class in Spring 2007. I noticed that this student had aced the first midterm, but I had no idea who he was. I quickly realized that he was the student who sneaked into the back of the room just as I started lecturing and who disappeared through the door as soon as the class ended. He never spoke in class, or asked a question, or came to office hours for the entire semester, but continued to set the curve.

CSU-Fresno Story

- At the end of the semester, I approached him and talked to him about the ISET Center. Up to that point, his goal had been to get through the degree program, get out, and get a job. He was the first member of his family to attend college and the idea that a student could get paid to do research, let alone make a career doing this, was beyond his comprehension. Sam was interested in the program, but his GPA was just below 3.0. (I later learned that he has a learning disability and has struggled to overcome a stammer).

CSU-Fresno Story

- We realized that Sam would be able to raise his GPA above 3.0 if he got straight A's the following semester. During Fall 2007 we met regularly through the semester to check on his progress. Over the winter break, he proudly showed me his transcript, and we were able to accept him into the ISET program. His research the following semester led to a journal article and several conference presentations. He applied to our graduate program and began his MS in Chemistry last Fall. Since his involvement in ISET he has a GPA of 4.0. This Fall, he will apply to PhD programs in Chemistry, with UCLA being his likely first choice. In his own words, "Two years ago, I didn't know if I would finish my BS degree. Now I want to push myself and see how far I am able to go."

Lessons Learned

- MSI/Government Lab/Industry partnership can be effective model for leveraging resources to provide best practices for increasing diversity:

-Student research and field study experiences

-Clear paths to student job/career opportunities

-Hands-on course work

-Community building/networking/mentoring

-Faculty Development

Recommendations

- NOAA CSC type partnerships should be a high priority for MSI funding due to demonstrated success in building sustainable capacity for increasing geoscience diversity.
- Development of academic rewards for departments and faculty involvement in interdisciplinary geoscience programs is critical to closing the geosciences diversity gap.
- Increased accountability of universities to funding agencies needed in terms of sustainability plan.