Countries and culture: research experiences build new perspectives

For SOARS protégés, research can bring not only new scientific understandings, but also the chance to experience new cultures. Julien Wang and Marco Orozco both spent their spring breaks in Veracruz, Mexico, participating in the Mega Cities Impacts on Regional and Global Environment (MIRAGE) field campaign. While in Mexico, Julien and Marco flew aboard research planes collecting air quality measurements and also worked with the ground crew responsible for weather and chemistry briefings. “It was a great opportunity,” Marco says. “I got to fly on the C130 research plane on an eight-hour flight.” During the flight, Marco watched the NCAR plane’s instruments as they sampled air quality during three passes over Mexico City. “When we flew over a pollution plume, you could see the numbers spike,” he remarks.

Julien flew aboard the U.S. Forest Service’s Twin Otter in search of forest fires. “When we found one, the plane would spiral downward to collect measurements. It would be very turbulent and the air would be very brown,” she says. Although the data collected during MIRAGE had not been quality assured and released in time for her summer research, she says that seeing how much effort goes into setting up the instruments, flying the planes, and monitoring the plane’s flight from the ground gave her a new appreciation for the work involved in putting together the atmospheric chemistry data used for her SOARS project.

The protégés described how working with other countries and cultures helped them see their science relating to broader and more global issues. During his six days at MIRAGE, Marco discovered that many of the local residents wanted to know about the project, and that there were tours set up for students from a nearby university. Julien expects that the results from their science relating to broader and more global issues. During his six days at MIRAGE, Marco discovered that many of the local residents wanted to know about the project, and that there were tours set up for students from a nearby university. Julien expects that the results from

Marco Orozco (right) and science research mentor Lee Mauldin check an instrument used to monitor air quality in a pine forest.

The SOARS program is administered by the University Corporation for Atmospheric Research (UCAR), which manages the National Center for Atmospheric Research (NCAR) and the UCAR Office of Programs (UOP). Program funding is provided by: NSF, CIRES, NOAA, and UCAR/NCAR/UOP. • Visit the SOARS Web site at www.soars.ucar.edu

IT’S A FACT

Chris Castro is the first SOARS alumnus to start a tenure-track faculty position in the atmospheric and related sciences.

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Researching wild weather: Protégés focus on hurricanes

Every mile of coastline evacuated under the threat of a hurricane results in a cost of approximately $1 million, according to Talea Mayo, a first-year protégé from Grambling State University. To help improve hurricane predictions and reduce costly false evacuations, Talea worked with science research mentors John Braun and Teresa Van Hove in the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) program on quantifying the amount of water vapor needed to sustain a storm at hurricane strength. “We were able to correlate Global Positioning System (GPS) measurements of water vapor from specific sectors of the storm with overall intensity,” she explains. “This knowledge can help improve our understanding of these storms as well as our ability to predict them.”

In the wake of last year’s active hurricane season, it is no wonder Talea and four of her fellow protégés chose hurricane-related research for their summer projects. First-year protégé Michael Kevin Hernandez, a junior at the University of Miami, also worked in COSMIC, with mentor Bill Kuo. Michael compared GPS radio occultation (RO) data with storm parameters predicted by the Global Forecast System model. Looking at data for seven different storms as well as corresponding non-storm conditions, he found consistent errors in the model output—particularly near the core of the tropical cyclone. These errors were highest at atmospheric altitudes of 5 to 10 km, where water vapor plays a significant role. “The results were subtle,” he says. “It would be interesting to investigate whether incorporating RO data into the model will help reduce these errors.”

Kimberly Trent, a first-year protégé from Yale University, explored how areas of deeper warm water in the Gulf of Mexico affect hurricane intensity. Kimberly and her science mentors, Warren Washington of Climate and Global Dynamics Division and David Randall of Colorado State University, compared a realistic simulation of Hurricane Katrina to other simulations with different ocean conditions. She found that changes in the depth and location of the warmest water directly influenced the simulated storm’s intensity. Her results also indicated that a storm’s intensity can influence changes in the storm’s track: a stronger intensity was found to push the storm over areas of deeper warm water, which in turn further strengthened the storm’s intensity. “This strengthening in intensity is even more of a concern when warmer ocean temperatures, as are expected by 2100, are used in the model,” remarks Kimberly.

Anthony Didlake, a third-year protégé who graduated from Yale last spring, examined cloud clusters in the Eastern Pacific to determine why some developed into tropical cyclones while others did not. His mentor, Chris Davis in the Mesoscale and Microscale Meteorology Division, pointed him toward identifying environmental factors associated with storm development, which led Anthony to the greater challenge of evaluating whether these factors were the cause of tropical cyclone formation, or the effect. “It was a classic ‘chicken and egg’ problem,” says Anthony. “Ultimately, we were able to conclude that environments with larger fields of increased temperature, moisture, and potential vorticity were most conducive to storm development.”

The work each of the protégés completed this summer is integral to answering ongoing questions about hurricanes and their behavior. Given the widespread destruction possible from these storms—estimated at approximately $200 billion in 13 states for the 2005 season alone—it’s an important topic. The results of this summer’s research contribute to better understanding and ultimately better prediction of hurricane formation and evolution.
**DEGREES COMPLETED**

- **Sarah Tessendorf**, PhD, Atmospheric Science, Colorado State University, May 2006. Dissertation title: “Relationships between kinematics, microphysics, and lightning in High Plains storms observed during the Severe Thunderstorm Electrification and Precipitation Study.”
- **Samuel Ajayi**, MS, Engineering Management, University of Texas at Austin, Summer 2006.
- **Rebecca Chan**, MS, Geosciences, University of Massachusetts, Amherst, May 2006.
- **Kate Dollen Musgrave**, MS, Atmospheric Science, Colorado State University, August 2006.
- **Aisha Reed**, MS, Atmospheric Science, Purdue University, May 2006.
- **Anthony Didlake**, BS, Geology and Geophysics, Yale University, May 2006.
- **Nicole Ngo**, BS, Earth and Environmental Science; BA, Economics, University of California, Irvine, Spring 2006.
- **Marco Orozco**, BS, Chemistry, California State University, Los Angeles, Spring 2006.
- **Andro Rios**, BS, Chemistry, California State University, Sacramento, May 2006.
- **Luna Rodriguez**, BS, Physics, University of Puerto Rico Rio Piedras, May 2006.

**PROTÉGÉ ACHIEVEMENTS**

- **Christopher Castro** (PhD, 2005; Atmospheric Science, Colorado State University) is an assistant professor in the atmospheric sciences department at Arizona State University in Tempe, Arizona.
- **Waleska Rivera Rios** has begun a new job teaching high school science at Ysleta Independent School District in El Paso, Texas. She is working on obtaining teacher certification from the University of Texas at El Paso.
- **Tamara Singleton** was awarded an appointment in the NASA Goddard Space Flight Center’s Graduate Student Summer Program. She also gave an oral presentation of her graduate research at the NASA Administrator’s Fellowship Program (NAFP), the Harriet G. Jenkins Pre-doctoral Fellowship Program (JFPP) and the Curriculum Improvement Partnership Award Program (CIPA) Symposium held in Huntsville, Alabama, at the NASA Marshall Space Flight Center.
- **Deanna Hence** received a 2006 NASA Earth System Science (ESS) fellowship to continue her graduate studies at the University of Washington. She presented a talk titled “Rainband structures observed in RAINEX” at the 2006 American Meteorological Society Hurricane and Tropical Meteorology Conference as well as at the RAINEX workshop in June.
- **Nancy Rivera Rivera** received a travel scholarship to attend the International Conference of Aeolian Research (ICAR VI), where she presented a poster titled “Detection and characterization of dust source areas in the Chihuahuan Desert, southwestern North America, through remote sensing.” The conference was held in Guelph, Ontario, Canada from July 24-28, 2006.
- **Rei Ueyama** presented a talk “Diurnal and semidiurnal surface wind variations over the tropical Pacific Ocean” at the University of Washington Program on Climate Change Graduate Research Conference, April 7-9, 2006, and at the American Meteorological Society 27th Conference on Hurricanes and Tropical Meteorology in Monterey, California, April 24-28, 2006. Rei is participating in the University of Bergen/University of Washington Summer School and Workshop on Multidecadal Climate Variability and Teleconnection Dynamics in Norway, September 10-23.
- **Rebecca Chan** has begun a doctoral program in atmospheric science at Colorado State University working with David Randall.
- **Anthony Didlake** received an American Meteorological Society graduate fellowship sponsored by the National Science Foundation and is beginning graduate studies in atmospheric sciences at the University of Washington.
- **Kate Dollen Musgrave** has begun work on a PhD in atmospheric science at Colorado State University.
- **Marco Orozco** is beginning a graduate program in chemistry at the University of California, Irvine.
- **Andro Rios** is beginning a graduate program in chemistry at the University of California, San Diego.
- **Dione Rossiter** is beginning a graduate program in atmospheric science through the Earth sciences department at the University of California, Santa Cruz.
- **Luna Rodriguez** has begun a graduate program in meteorology at The Pennsylvania State University.
- **Sarah Tessendorf** begins a post-doctoral fellowship with the Cooperative Institute for Research in Environmental Sciences (CIRES) this fall and was a Scientist Participant in CIRES’ Earthworks teacher workshop in June. She received an award for best student oral presentation for her talk titled “Observations of two positive cloud-to-ground storms observed during STEPS” at the American Meteorological Society 2nd Conference on the Meteorological Applications of Lightning Data in Atlanta, Georgia, in January 2006.
with Brant Liebmann at the National Oceanic and Atmospheric Administration to diagnose and try to predict extreme precipitation events in southeastern Brazil. The project enhanced her interest in meteorology, she says, and helped her connect what she was learning in her classes to actual weather phenomena.

Aisha’s graduate work at Purdue University focused on winter tornado occurrences in Mississippi. Mississippi ranks second in the nation for tornado-caused fatalities, and Aisha explored whether these cool season tornado occurrences and problems predicting them might contribute to the high fatality rate. Her work revealed that from 1950 to 2000, 476 tornadoes occurred during the cool season, and 138 of these resulted in a total of 255 deaths and 3,574 injuries. “More deaths were associated with the cool season tornadoes than with ‘normal’ occurrences,” she says. “It might be because many of these tornadoes occur at night, or because forecasters are either not looking as carefully for tornadic development or not wanting to issue false alarms.”

In Washington, Aisha will work with Bennie Thompson from Mississippi, the ranking Democrat on the Homeland Security committee. Her appointment, sponsored by the Congressional Black Caucus Foundation, will last for nine months and can be followed by an optional three-month summer placement. During her time as a fellow, Aisha will work as a congressional staff person, take public policy classes, and also focus on a specific project. The details of Aisha’s project won’t be available until her appointment begins, but given her interests and background, the docket is likely to include evaluating current policy and assessing the preparedness of the population to weather or other natural hazards.

“I’m particularly interested in working with the Federal Emergency Management Agency to explore how the effects of weather are tied into emergency management response.”

– Aisha Reed, SOARS alumna

**LONG-TERM MENTORS RECOGNIZED**

SOARS Mentor Awards

Ten Years of Mentoring

Brian Bevirt received the first-ever award for ten years as a SOARS mentor.

SOARS recognized long-term mentors for their service at the end-of-summer reception on August 10. The following individuals received acknowledgement for five years of service to the SOARS community:

**Five Years of Mentoring**

Chris Davis
Leslie Hartten
Barry Lefer
Lesley Smith
Jeff Weber
Cindy Worster

Ten-year mentor Brian Bevirt with his protégé this year, Alisha Fernandez.

www.soars.ucar.edu
RESESS protégé measures continental drift in East Africa

Stephen Hernandez left for Tanzania the day after presenting his research at the end-of-summer colloquium. Stephen is a second-year protégé in Research Experience in Solid Earth Science for Students (RESESS), a partner program of SOARS. His summer project explored plate movement along the East African Rift, which runs north-south through the eastern part of the African continent. With his science research mentor, Eric Calais from Purdue University, Stephen helped deploy Global Positioning System (GPS) receivers and move them to 30 different measurement sites along the East African Rift System.

“This particular campaign was part of a five-year project, with data being collected in the first, third, and fifth years,” explains Stephen. The measurements involved the collaboration of the Tanzanian Mapping Agency as well as universities and research institutions in South Africa, Belgium, France, and the U.S.

New protégés from Jackson State study pollution, sea surface temperatures

When protégés Douglas Gavin and Imani Morris found out they were accepted to SOARS, it was a cause for joint celebration. Douglas and Imani are both meteorology majors at Jackson State University and had been encouraged by faculty in the department to apply. For both, the fit has been a good one, and the results from their summer research have helped address some important scientific questions.

Imani, a junior this fall, worked with Steve Massie in the Atmospheric Chemistry Division to examine changes in nitrogen dioxide emissions in very large cities. “My goal was to determine the relationship between pollution levels and increasing population, and in all but two of the 14 cases studied, nitrogen dioxide levels had decreased,” she says.

Imani explains that regulations on emissions have likely been successful in contributing to the cleaner air. “One of the sites that did show an increase was Beijing, where nitrogen dioxide went up by 72%. When I looked into it more, I found out that industrial activity in China had increased dramatically over the same time period.”

Combining his interest in meteorology and oceanography, Douglas analyzed sea surface temperatures (SSTs) over a region of the eastern Pacific. Working with Leslie Hartten in NOAA’s Earth System Research Laboratory, he extended previous work investigating wind flow and its relation to ocean temperatures. “The link between oceans and winds is an interesting question,” he says. “The wind flow determines the amount of vertical mixing, and over the ocean this has typically been something not well understood.”

Overall, both Douglas and Imani speak very enthusiastically about their summer experiences. While his interest in meteorology has gotten him to his senior year of college with plans to go to graduate school, Douglas says SOARS has taught him new things, particularly about working in a professional setting. “In terms of working with groups and participating in meetings, I probably learned more this summer than I have in three years of college,” he concludes. Imani says SOARS has reinforced her aspirations for a meteorology career: “I know this is what I want to do. If I wasn’t doing meteorology, I wouldn’t be happy.”
Research experiences build new perspectives (continued from page 1)

the campaign will be of interest to the Mexican government as it addresses air quality and attempts to regulate pollution.

The experience gained through these opportunities can lead to improved understanding of the interconnections of humans and the physical environment around the world. As Marco observes, “Mexico City is a very large urban area and home to a lot of people. It’s important to know what’s happening, especially as even a little bit of pollution can do damage.”

Protégé Bret Harper, as part of a SOARS contingent including director Raj Pandya and alumnus Casey Thornbrugh, participated in a three-day symposium addressing the “Impact of Climate Change on Indigenous Peoples.” The symposium at Haskell Indian Nations University in Lawrence, Kansas, examined the role of Traditional Ecological Knowledge (TEK) in climate research. Bret explains that TEK incorporates observations of the connections and relationships among all things in the environment, and can therefore offer an interdisciplinary approach to forming a more complete understanding of climate change.

Bret is aware that there are challenges in bringing TEK into mainstream science and also speaks of differences between Native learning about science and the environment, as compared to the more rigorously defined traditional scientific method. “Native students’ understanding of how the universe is, and what their own place is in it, are combined,” he explains. Because this perspective seems to conflict with the dominant scientific thinking, Bret says that Native students seeking higher education might feel that they have to abandon their own ways of knowing in favor of the ‘scientific method.’ Looking toward the future of Earth science research, he says, “Exposing more people to both ways of knowing as legitimate and rigorous might attract more Native scientists; who will, in turn, bring with them new paradigms, resulting in revolutionary advances in the study of environmental change.”