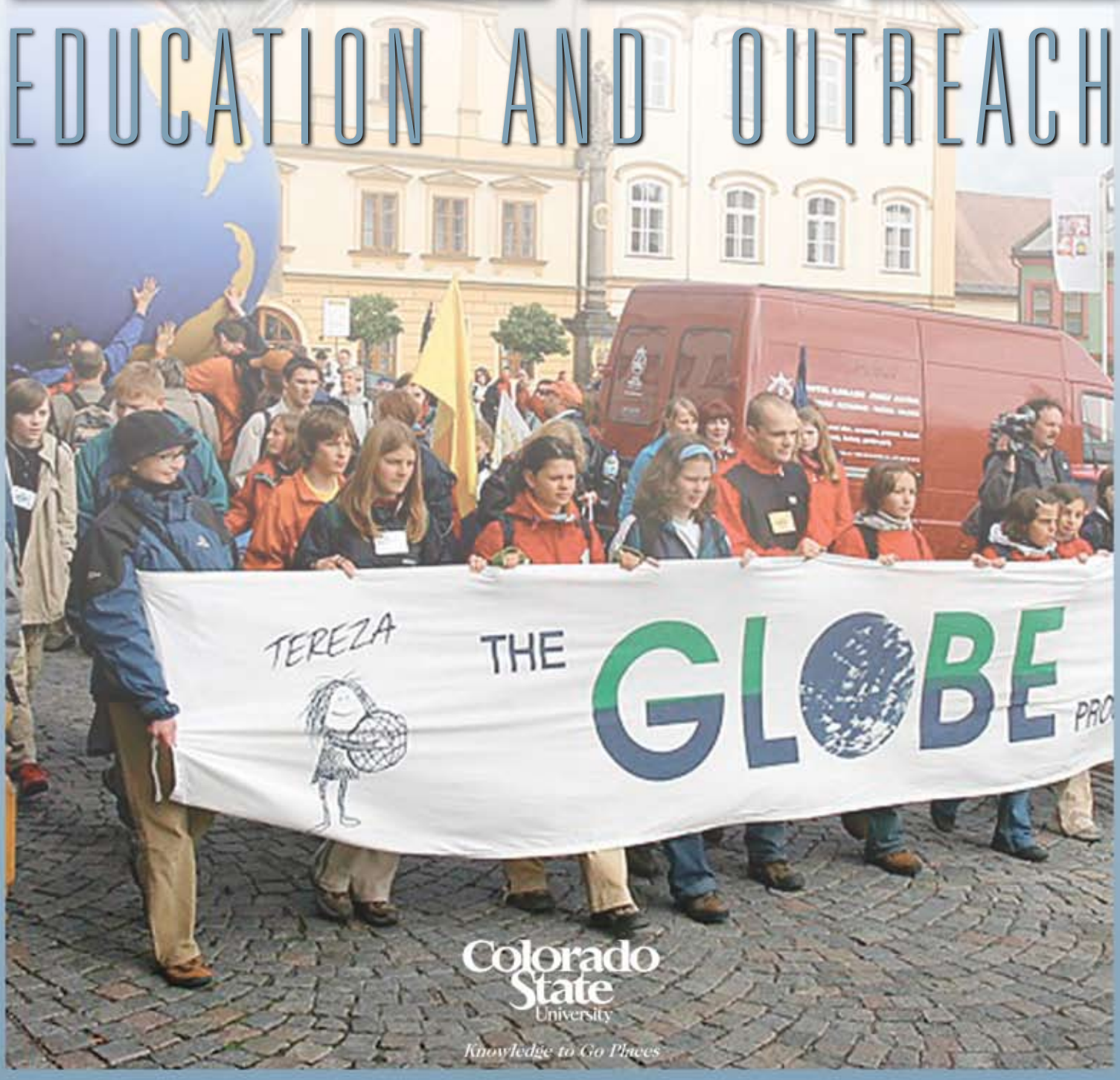
CIRA

EDUCATION AND OUTREACH



Colorado State University

Knowledge to Go Places

VOLUME 24, FALL 2005

About the cover: START students in the Czech Republic welcome guests to the GLOBE conference held in Prague last summer. Tereza is a nonprofit organization in the country: "Tereza loves and is concerned about the health of Planet Earth."

CONTENTS

CIRA
Cooperative Institute for Research in the Atmosphere

www.cira.colostate.edu

AN INTRODUCTION TO
EDUCATION AND OUTREACH

Webster's Third New International Dictionary defines "education" as the act or process of providing with knowledge, skill, competence, or use; and "outreach" as the act or process of reaching out, to surpass or go beyond. Combining these definitions in the context of research conducted at CIRA, one can rephrase "education" and "outreach" to mean what have CIRA researchers learned and how has this learning been conveyed to the general public for their benefit. Thus, the articles in this magazine have been written in a nontechnical manner so that the reader can identify the educational benefits to the general public and how these benefits fit into real-life situations.

The study of atmospheric science is extremely complicated and abundant in science relationships, formulae, modeling, and observations and is subject to a myriad of variables created by the oceans, glaciers and snowfields, the surfaces and sub-surfaces of the earth, and all living creatures. The atmosphere is highly unpredictable, where improved predictability is an elusive goal. In most cases, separate research results coupled with other research efforts, coupled with yet other research conclusions produce a combined, yet better understanding of how the atmosphere works and how mankind can benefit from this understanding. Thus, a minute step toward the over-all goal has been accomplished. However, seldom does a single research effort translate directly to a recognizable public benefit, but it does happen as is the case of the GLOBE program and shows promise in the Science on a Sphere program.

In CIRA's 25 years as a research department within Colorado State University and a Cooperative Institute of the National Oceanic and Atmospheric Administration, education and outreach have always been integral to its research efforts. What is presented in the following pages is a glance at some of these education and outreach projects that have grown, directly or indirectly, out of this CIRA research. We begin with some projects early in CIRA's history and move forward in time to more recent or ongoing efforts. Molded together, these activities represent CIRA's significant contribution to understanding our atmosphere and its effect on Planet Earth and to the health, safety, and welfare of the general public that has diligently supported our research since 1980.

– Dave Cismoski, CIRA Education/Outreach Coordinator

Fellowships in Atmospheric Science and Related Research

The Cooperative Institute for Research in the Atmosphere at Colorado State University (CIRA) offers a limited number of one-year Associate Fellowships to research scientists including those on sabbatical leave or recent Ph.D. recipients. Those receiving the awards will pursue their own research programs, collaborate with existing programs, and participate in Institute seminars and functions. Selection is based on the likelihood of an active exchange of ideas between the Fellows, the National Oceanic and Atmospheric Administration, Colorado State University, and CIRA scientists. Salary is negotiable based on experience, qualifications, and funding support. The program is open to scientists of all countries. Submitted applications should include a curriculum vitae, publications list, brief outline of the intended research, a statement of estimated research support needs, and names and addresses of three professional references.

CIRA is jointly sponsored by Colorado State University and the National Oceanic and Atmospheric Administration. Colorado State University is an equal opportunity employer and complies with all Federal and Colorado State laws, regulations, and executive orders regarding affirmative action requirements. In order to assist Colorado State University in meeting its affirmative action responsibilities, ethnic minorities, women and other protected class members are encouraged to apply and to so identify themselves. The office of Equal Opportunity is in Room 101, Student Services Building. Senior scientists and qualified scientists from foreign countries are encouraged to apply and to combine the CIRA stipend with support they receive from other sources. Applications for positions which begin January 1 are accepted until the prior October 31 and should be sent via electronic means only to: Professor Thomas H. Vonder Haar, Director, CIRA, Colorado State University, humanresources@cira. colostate.edu. Research Fellowships are available in the areas of: Air Quality, Cloud Physics, Mesoscale Studies and Forecasting, Satellite Applications, Climate Studies, Model Evaluation, and Economic and Societal Aspects of Weather and Climate. For more information, visit www.cira.colostate.edu.

EARLY OUTREACH EFFORTS

Applied Research and Technology Interchange Effort established a formal working arrangement for the two-way transfer of ideas, research, and technology between CIRA and the National Weather Service Forecast Office in Cheyenne, Wyoming.

ARTIE

John Weaver and D. Neil Allen

In November 1992, Dr. James Purdom, NOAA/NESDIS's RAMM Branch chief, and William Parker, area manager for the Cheyenne Weather Service Forecast Office (WSFO), completed a working agreement between CIRA and the National Weather Service Forecast Office in Cheyenne, Wyoming. This agreement, Applied Research and Technology Interchange Effort (ARTIE), established a formal working arrangement for the two-way transfer of ideas, research, and technology between these two organizations.

Personnel from CIRA's RAMM Branch and the Cheyenne WSFO had been working together over the past four years and had realized the mutual benefit that could be gained through cooperative efforts between research (CIRA) and operations (WSFO). During that time, a computer-based expert system for severe storm forecasting had been developed and put into operational field testing at the Cheyenne WSFO.

ARTIE, on a broad scale, was intended to complement the National Weather Service modernization program and to establish an ongoing working relationship between research and operations that would continue after the modernization program was implemented. On a more specific and forecast benefit to the public, ARTIE 1) brought the use of satellite data into the Cheyenne forecaster's bag of tools, 2) increased the forecaster's confidence in using this new technology, 3) developed improved forecasts for the local area using computer-based satellite analysis techniques, and 4) allowed the research sector to better understand the working and operational environment of National Weather Service Forecast Office.

ARTIE was an example of the now extensive use of satellite data by WSFO meteorologists in preparing local and regional forecasts.

WMO-SHARE PROGRAM

D. Neil Allen

In 1987, the World Meteorological Organization (WMO) initiated a new program known as SHARE, for Software Help in Applications, Research, and Education. SHARE would furnish developing countries computer software to enable them to receive, process, and disseminate weather data. The WMO contracted with CIRA to develop data-handling and display program for SHARE and to serve as a host organization for visiting individuals from developing countries who would participate in the software development and receive training in the use of SHARE products.

Funding for this SHARE coordination was provided through NOAA. Additional support came from CIRA and Colorado State University in the form of equipment, tuition assistance, and facilities. The Digital Equipment Corporation also made direct equipment contributions, provided substantial equipment discounts to participating countries, and supported SHARE exhibits at American Meteorological Society Conferences.

In the initial year, three candidates were selected, one each from Brazil (Mr. Mauro Rezende), China (Mr. Yang Yuming), and Niger (Mr. Issifou Alfari). These three individuals played an important role in SHARE software development. Each of the individuals received a one-year fellowship at CIRA, during which time they received training in advanced technological techniques for processing and displaying meteorological data. After approximately one year of working on the software, each individual returned to their country, installed the software on the DEC provided equipment, and trained others in its use. Complete documentation also was provided including a user's manual, a programmer's technical manual, and video training presentations at various levels of detail.

CIRA's initial involvement in SHARE was for three years and later extended to six years, including formal classroom training at CSU with opportunities to attend workshops, tour local facilities at NOAA and NCAR, and participate in various seminars at CIRA and in the local area. By the spring of 1992, SHARE program fellows at CIRA had included individuals from China, Brazil, Jamaica, Kenya, Mauritius, Niger, Poland, Pakistan, Republic of Yemen, Sri Lanka, Turkey, Venezuela, and the West Indies with additional software installations in Bangladesh and Fiji.

CIRA's SHARE program managers included D. Neil Allen and William Davis. Science support was provided by Dr. David Randel, Kelly Dean, and Chi-Fan Shih. CSU International Programs director at that time, Dr. James R. Meiman, and his staff also provided valuable assistance to the visiting fellows.

MOUNT WASHINGTON OBSERVATORY CENTER PROJECT

Excerpts from articles by Dean Paschall and Jean Hopson, FSL

During a two-year period beginning in 1998, CIRA researchers assisted the Forecast Systems Laboratory (FSL) in its efforts to create a center committed to weather education and outreach for schools and the general public visiting the New England region. This center, the focus of the Mount Washington Observatory (MWO) Center project, is located in North Conway, New Hampshire. This gateway to Mount Washington is known to have "the worst weather in the world" or, from a child's point of view, "the most interesting weather in the world." For example, Mount Washington holds the world's record of 231 mph winds recorded at a surface station on April 12, 1934.

Funded by a NOAA grant, the MWO project demonstrates innovative educational approaches to using weather to link the disciplines of science, math, geography, and history. An integral part of this learning is presented at the Weather Discovery Center that offers an entertaining, interactive discovery experience. Here, visitors can visually experience through interactive exhibits how Mount Washington influences the weather that affects New England residents. They also can discuss the weather with observers at the summit of Mount Washington via a live, interactive connection. Also present is the NOAA Weather Wall – an exhibit area of multiple screens and hands-on displays providing visitors the opportunity to learn about the latest advances in weather forecasting using NOAA's Advanced Weather Interactive Processing System (AWIPS) and the FSL/CIRA-developed Local Data Acquisition and Dissemination System (LDAD).

FSL and CIRA also assisted the MWO in creating a traveling school program that offers weather education lessons to schools and science centers around the New England region. The instructors constantly emphasize the importance of understanding the weather and, in the process, create an army of young weather observers. Many of the teachers at these schools enhance the weather experience by taking their classes to the MWO for further enrichment.

For more information on this New England educational outreach program developed through the efforts of FSL and CIRA support staff, an interactive Web site has been created at: http://www.mountwashington.org.

The MWO project demonstrates innovative educational approaches to using weather to link the disciplines of science, math, geography, and history.

A thick coating of rime ice covers the summit of Mount Washington, including the instrument tower.

A weather observer explains instrumentation to summit visitors.

WEATHER FORECASTING TOOLS

FX-Net's design goal was to offer an inexpensive PC workstation system for use in a variety of forecast, training, education, and research applications.

RAMSDIS to RAMSDIS Online

Hiro Gosden (CIRA), Dave Watson (CIRA), Debra Molenar (NOAA), Kevin Schrab (NWS), James F. W. Purdom (NOAA), Don Hillger (NOAA), Tom Whittaker (SSEC), Todd Smith (SSEC)

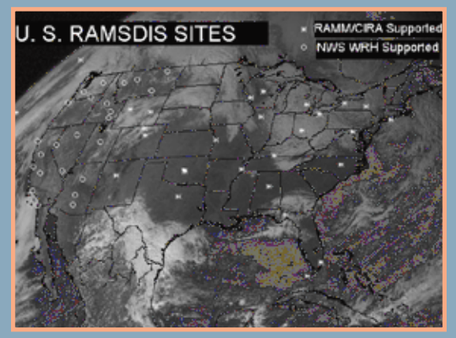
The RAMSDIS project was initiated in 1994. The project goal was to disseminate real-time, high-quality, *digital* GOES satellite data imagery to selected National Weather Service Forecast Offices (NWSFOs) via a powerful, low-cost, PC-based workstation for use in advanced satellite data display and analysis testing.

The project was designed to:

• provide forecaster familiarization with the next generation GOES data sets, in preparation for NOAA's Advanced Weather Interactive Processing System (AWIPS) deployment;

• determine future forecaster training requirements to ensure full utilization of the advanced GOES satellite data sets; and

• provide a platform for forecaster evaluation of GOES "Day-1" products and GOES "Day-2" product determination before the GOES data became operationally available via NOAAPORT.



Above right: A RAMDIS workstation displays real-time data animations.

Right: A satellite image shows RAMSDIS installations forecast offices and research sites around the country.

The workstation was designed to incorporate the University of Wisconsin Space Science and Engineering Center (SSEC) McIDAS http://www.ssec.wisc.edu/mcidas software that allowed for automatic product ingest, display, and analysis applications developed at CIRA. These research RAMSDIS workstations were utilized to demonstrate new and experimental satellite data products.

RAMSDIS workstations were utilized in more than half of the NWSFOs during the period 1995 to 1999. With full deployment of NOAAPORT and AWIPS in 1999, these low-cost RAMSDIS workstations were transitioned to international outreach programs such as the Brazil Fires Project, the Hurricane Mitch Relief Effort, and the WMO Regional Meteorological Training Centers program and to various NOAA Labs, NWSFOs, and universities for joint research projects.

In 1998, RAMSDIS Online (ROL) was developed to provide another alternative for displaying RAMSDIS products. The use of the World Wide Web (WWW) allowed for a much larger audience to view real-time satellite data ingested by RAMSDIS and the resulting imagery generated. Special ROL sections were added to allow the public to view animations of fire coverage, hurricanes/tropical storms, experimental products, and case study data sets of interesting weather events. The general public now had access to some of the same satellite imagery provided to the research community.

FX-Net Workstation

Renate Brummer

In 1997, NOAA's Forecast Systems Laboratory (FSL) began with the development of FX-Net, a network-based meteorological workstation that provided access to the basic display capability of an AWIPS workstation via the Internet. AWIPS, the Advanced Weather Interactive Processing System, was the FSL-built meteorological workstation system used at the National Weather Service Weather Forecast Offices (WFO).

FX-Net's design goal was to offer an inexpensive PC workstation system for use in a variety of forecast, training, education, and research applications not requiring the full capabilities of a WFO-type AWIPS system. Most of the research and development for FX-Net was conducted by CIRA employees. It was designed primarily for Internet use, but FX-Net also accommodated local network, dial-up, and dedicated line use. The user interface of the FX-Net client closely resembled the AWIPS workstation user interface. It was written as a Java application and ran on a number of standard PC platforms, like Windows NT, Windows 2000, or Windows XP. Internet bandwidth down to 56 kbps was considered sufficient to transmit FX-Net products such as satellite data, forecast model graphics and observations, radar imagery, and model imagery.

The first FX-Net customers could be found in the university and research environment. In 1998, the FX-Net team installed the PC client workstation software at Plymouth State College in New Hampshire in support of their meteorology classes and meteorological research. During the next three years, installations at the University of New Hampshire, the University of Northern Iowa, and Colorado State University followed.

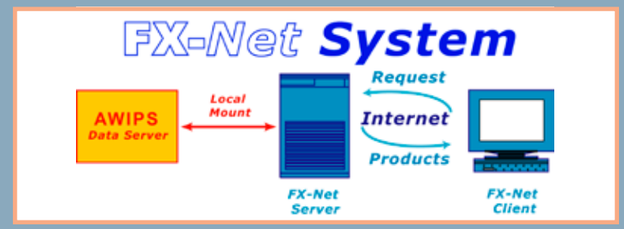
During the summer of 2001, the FX-Net team developed a variety of new functionalities to permit its use at the National Interagency Fire Center (NIFC) and at the Geographic Area Coordination Centers (GACC). Starting with the fire season of 2002, the workstation became an important tool for the fire forecasters at NIFC and GACC.

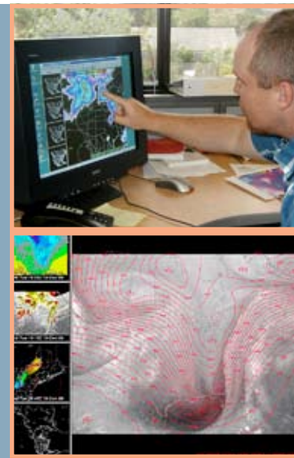
In the year 2002, FX-Net became quite famous as it was being used successfully for the winter weather forecasting at the 2002 Salt Lake City Winter Olympics. Forecasting offices at each of the five different Winter Olympics outdoor venues were equipped with FX-Net PC clients.

Also during the summer of 2002, FX-Net supported the AIRMAP Program, a University of New Hampshire-based, NOAA-funded program that focused on the long-term monitoring and forecasting of air quality parameters including nitrogen oxides, sulfur dioxide, carbon monoxide, and low-level ozone. The primary mission of AIRMAP was to develop a detailed understanding of climate variability and the source of persistent air pollutants in New England. The availability of a real-time display station like FX-Net became very important to the program's success.

During 2003, four complete FX-Net systems were installed at four NWS regional headquarters to support Incident Meteorologists (IMETs) in the field as well as to provide remote data collection offices with AWIPS-like products.

In summary, the FX-Net workstation turned out to be an extremely successful forecaster workstation supporting reliable forecasts for fire weather, sports events, field experiments, training, and research environments.

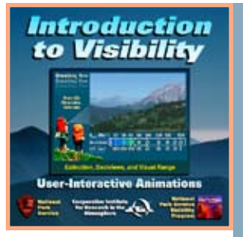




Top: A weather forecaster uses an FX-Net workstation.

Bottom: Screen shot of the FX-Net user interface.

COMMUNITY OUTREACH



Introduction to Visibility CD-ROM cover (above) and book cover (right).

The preservation or improvement of visibility requires an understanding of which particles in the atmosphere impair visibility as well as the origins of these particles.

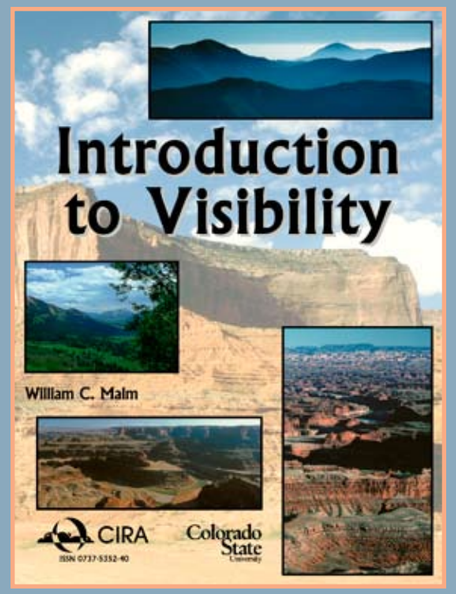
Introduction to Visibility Textbook

William C. Malm, NPS

Historically "visibility" has been defined as "the greatest distance" at which an observer can just see a black object viewed against the horizon. Nevertheless, visibility is much more than being able to see this black object at a distance. Visibility is more closely associated with conditions that allow appreciation of the inherent beauty of landscape features. The ability to recognize and appreciate form and contrast detail and color of near and distant features is important. Perception of visibility is a personal value judgment affected by the physical interaction of light with particles in the atmosphere. Understanding the psychological thought process involved in viewing a scenic resource and establishing a link between this process and the physical reality of the situation is important in visibility studies. The preservation or improvement of visibility requires an understanding of which particles in the atmosphere impair visibility as well as the origins of these particles.

Scientists know that the introduction of particulate matter and certain gasses into the atmosphere interferes with the ability of an observer to see landscape features. Monitoring, modeling, and controlling sources of visibility-reducing particulate matter and gasses depend on scientific and technical understanding of how these pollutants interact with light, transform from a gas into particles that impair visibility, and are dispersed across land masses and into local canyons and valleys. Scientific knowledge of some of these issues is more complete than of others. The goal of *Introduction to Visibility* is to assist the reader in developing basic knowledge of those concepts for which there is an understanding and to indicate the areas that need further research.

Introduction to Visibility is a 68-page document loaded with color pictures and graphics and accompanied by a CD-ROM with user-interactive animations.



The following eight sections are highlighted:

- On the Nature of Light
- Interaction of Light and Particles
- Vision Through the Atmosphere
- Transport and Transformation of Atmospheric Particulates and Gasses Affecting Visibility
- Visibility Measurements
- Particle Concentration and Visibility Trends
- Identification of Sources Contributing to Visibility Impairment
- Human Perception of Visual Air Quality

This easily read educational publication has been a partnership effort between NPS employees, CIRA staff, The University of California at Davis, Air Resource Specialists of Fort Collins, and many external reviewers. Contact Helene Bennett, (970) 491-8292 or bennett@cira.colostate.edu, for the availability of this document.

Community Collaborative Rain, Hail, and Snow Network (CoCoRaHS)

Nolan J. Doesken, Department of Atmospheric Science, and Henry W. Reges

In 1998, a small group of weather volunteers in Northern Colorado under the direction of the Colorado Climate Center at Colorado State University began measuring rainfall and hail at their homes to help track local precipitation patterns from summer thunderstorms. Since that time, the project has grown into a multi-state network of more than 2,000 citizens measuring and reporting precipitation amounts year-round.

There are no electronic measurement devices in CoCoRaHS. Volunteers use clear plastic rain gauges to manually measure the quantity of precipitation. During winter, the depth of snow is measured using rulers and "snow boards." Snow boards are flat, white surfaces placed on the ground in representative locations to aid in measuring the accumulation of snow. Quantitative measurements of hail are taken using "hail pads," squares of Styrofoam wrapped with aluminum foil. The hail stones leave dents on the pads, making it very easy to count and measure the number, size, hardness, and trajectory of hail stones hitting the surface. Together, this suite of measurements allows a very comprehensive assessment of the moisture falling from the sky.

A Web site has been developed where volunteers enter their data each day: http://www.cocorahs.org.

State, county, and city maps are automatically updated each day. Precipitation patterns for each day since the project began can be accessed and viewed. Summary reports can be quickly generated. It only takes a few clicks of the mouse to see how many days have had hail each year and what the distribution of stone sizes have been. As of August 19, 2005, there had been 794 reports of hail in 2005. The largest stones measured had a diameter of three inches, but only 8 percent of all storm reports included stones of 1 inch diameter or greater.

Scientists are using CoCoRaHS data as ground truth in evaluating and calibrating radar and satellite data. Hydrologists are incorporating CoCoRaHS data in watershed modeling, streamflow prediction, and groundwater assessments. The National Weather Service utilizes CoCoRaHS data for forecast verification and as input for issuing local severe weather warnings. Many teachers are getting students involved in CoCoRaHS to learn how scientists collect and analyze scientific data. Most importantly, volunteers of all ages and backgrounds are learning about their local climate and the importance of precipitation in daily life.

The National Science Foundation's Informal Science Education program is the primary sponsor of CoCoRaHS, but many other federal, state, and local organizations are pitching in. CIRA sponsors a science teacher internship program in which teachers work directly with CoCoRaHS scientists to develop and test educational materials and lesson plans. Interest in CoCoRaHS continues to grow. Nearly 20 additional states have inquired about getting involved in the project, and current plans are to add Pennsylvania, Virginia, Maryland, and the District of Columbia in the very near future.

CIRA COMMUNIQUÉ

From top: New employees Kerrie Lapoehn and Nick Matheson

Welcome

Kerrie Lapoehn

Kerrie is CIRA's new procurement coordinator and accounting assistant. She comes to us from University Development and Advancement's Information Services office at CSU. Kerrie's duties include procurement, updating financial spreadsheets, and preparing monthly copy and infrastructure billings. Her energy and problem-solving skills are a welcome addition to the Central Services staff. Kerrie began at CIRA Fort Collins on July 11, and Lance Noble is her supervisor.

Nick Matheson

Nick is a Research Associate I, who joined the Real-Time Verification System (RTVS) team at the NOAA/Forecast Systems Lab (FSL at CIRA in Boulder) on June 27. He will participate in the re-engineering and development of the RTVS support architecture. Nick's supervisor is Sean Madine.

Walt Naylor

Walt, a senior research associate, transferred to CIRA from the CSU Department of Atmospheric Science on July 1 to work part-time. Walt comes to CIRA after a career as department manager for Atmospheric Science. In his new assignment, Walt will assist in facilities issues (following his successful involvement in the new Atmospheric Chemistry building project) and will develop a future building study. Mary McInnis-Efaw is Walt's supervisor.

Melissa Petty

Missy is a Research Associate II who joined the RTVS team at FSL (CIRA in Boulder) on August 8. After departing NCAR in 2001 for a four-year stint in the business world in Virginia, she returns to Boulder to assist in the technical leadership for software design, development, and implementation involving the RTVS. Missy will be responsible for defining and documenting the high-level system architecture, and Sean Madine will be her immediate supervisor.

Farewell

Gerald Browning

Jerry, one of CIRA's senior research scientists in Boulder, retired from CSU on July 31 after nearly 14 years of service. Since joining CIRA in 1991 to conduct collaborative research with the Director's Office at the NOAA Forecast Systems Lab, he successfully applied mathematical theories to solve many operational numerical weather and oceanic prediction problems. Results of his cutting-edge research are published in numerous peer-reviewed, professional mathematical, atmospheric science, and oceanography journals. In 1998, Jerry received the NOAA Environmental Research Laboratories' Outstanding Scientific Paper Award for his manuscript entitled "The Role of Gravity Waves in Slowly Varying in Time Mesoscale Motions," which he co-authored with Professor Heinz Kreiss.

Chris Marshall

Chris, a student-hourly intern/nonstudent-hourly coordinator, graduated from CSU in May and left CIRA Fort Collins on July 15, after a three-year term. He was CIRA's procurement coordinator and assisted CIRA's financial manager, Lance Noble.

Phil Shott

Phil, a Research Associate II at CIRA Fort Collins, departed on August 12. While at CIRA, Phil has been working with Andy Jones, Cindy Combs, John Forsythe, Ron Kessler, and many of the students related to a variety of DPEAS data processing activities. The global microwave surface emissivity research, toward which Phil has contributed, continues to be heavily used by CIRA researchers, scientists, and students.

Phil Stephens

As a Postdoctoral Fellow for CIRA in Fort Collins, Phil's work focused primarily on a series of innovative and practical improvements to the Backus-Gilbert spatial filter theory resulting in several manuscripts. He worked with Andy Jones, Phil Shott, John Forsythe, Ron Kessler, and Matt Nielsen and made significant collaborative contributions to the AMSU-B Antenna Pattern Correction research activities. Phil exited on July 29.

Recent Promotions

Cindy Combs

Cindy currently works on the Cloud Climatology project for the RAMM Branch at CIRA in Fort Collins, where she supervises two student-hourly employees and writes software to process Windsat data for a CG/AR project managed by Andy Jones. Cindy was promoted to Research Associate III.

Jennifer Hand

Jenny is an atmospheric chemist who specializes in aerosols and works for the CIRA National Park Service (NPS) air quality research group in Fort Collins. She specializes in atmospheric aerosols, especially relationships between their physical, chemical, and optical properties. She has contributed to our understanding of how aerosols take up water and change their optical properties, to the fundamental structure of organic aerosols, and to how aerosols affect satellite observations. Jenny has authored or co-authored more than 20 publications and technical reports, has offered numerous presentations at scientific conferences, and has been promoted to Research Scientist II.

Matthew Hansen

Two years ago, Matt joined CIRA in Boulder, and since then, his contributions to various GLOBE Web site interface projects have grown steadily. At present, he is the lead on overall Web page and database development related to the GLOBE Partner Administration section of the Web site. He is also in charge of maintenance of version control code. Matt was promoted to Research Associate II.

Patrick Hildreth

Patrick joined the Data Systems Group at FSL, CIRA in Boulder, in February 2004. Since then, he quickly has assumed independent oversight of several project tasks and garnered praise on his implementation of a creative Open LDAP scheme for monitoring access to the MADIS database. Patrick was promoted to Research Associate II.

Chungu Lu

Chungu has been a member of the CIRA Boulder research staff for 11 years and was promoted to Research Scientist III. Recently, he has investigated wavelet and spectral analyses applied to both numerical model and research aircraft data in his pursuit of a theory to explain how the generation of a packet of mesoscale gravity waves is related to unbalanced flow in the vicinity of upper-level jet stream.

Karen Milberger

Since joining the CIRA GLOBE team in Boulder two years ago, Karen has become the program's visualization systems expert and has taken the lead in the visualization software porting process over to a Linux platform. Karen was promoted to Research Associate II.

Robin Paschall

Robin has been with CIRA in Boulder for 10 years. As the FSL Web manager and the chair of the FSL WWW working group, she was the lead on the successful development and implementation of a newly redesigned FSL Web site architecture this past year. Robin was promoted to Research Associate III.

Evan Polster

Evan has been with the CIRA FX-Net team in Boulder for six years and assumed the technical lead role for the project's Java client development and configuration management responsibilities this past year. He was promoted to Research Associate III.

Sherri Schranz

Sher has been with CIRA in Boulder for more than five years and has provided senior-level, technical leadership for the seven-member FX-Net project at FSL for the past two years. Previously, she was the lab's focal point for technical outreach and technology transfer, and more recently, she has guided the delivery of FX-Net enhancements for fire weather support and has expanded the program into the air quality community. Sher was promoted to Research Associate IV.

From top: New employees Walt Naylor and Melissa Petty

CIRA COMMUNIQUÉ

From top: Jebb Stewart, July FSL Team Member of the Month. Dr. Vonder Haar (left) presents the CIRA Research Initiative Award to Steve Albers.

Ken Eis and Dr. Vonder Haar present a Research Initiative Award to Don Reinke.

Dusanka Zupanski

Dusanka contributes significantly to research efforts at CIRA Fort Collins in the area of data assimilation and model error estimation. Through collaborations with various research groups from CSU and NASA, she has developed several complex data assimilation and prediction systems based on either variational or ensemble data assimilation methods. These systems include various dynamic models such as RAMS, GEOS-5 single-column model, LPDM, and PCTM. Dusanka's main research interests lie in data assimilation, model error and parameter estimation, information theory, and predictability. Dusanka was promoted to Research Scientist III.

Team Member of the Month

The following nomination for FSL Team Member of the Month – July 2005 comes from Technology Outreach Division Chief Bill Bendel.

"Jebb Stewart – TOD/FX-Net software program analyst – is designated as FSL's Team Member of the Month for July 2005. He is receiving this in recognition for outstanding efforts in furthering the FX-Net technology and projects. In particular: contributing innovative ideas and expert programming skills to measurably improve the FX-Net system; meeting many difficult deadlines for several of the ongoing projects; providing numerous demonstrations and discussions regarding FX-Net features to customers at exhibits and at FSL; leading the development of the gridded W4 system for fire weather and other applications; being an overall team player; and providing outstanding technical leadership." Congratulations, Jebb!

Research Initiative Awards

Each year, CIRA is proud to recognize two employees (or groups) as Research Initiative Award winners. In short, these folks have significantly contributed to the success of CIRA's research effort. The selection criteria used to evaluate nominations include resourcefulness and/or creativity via the use of innovative techniques and/or technology in daily research activities; team leadership and/or mentoring capability to fellow workers; "cutting-edge research," which is reflected in publications, reports, and deliverables; and noteworthy accomplishment that results in substantial impact on the CIRA, CSU, or sponsoring agency research mission. Award recipient(s) receive a commemorative plaque and are awarded $2,000 to be held in a CIRA account for use towards work travel, professional development courses, computer upgrades, or other research-related activities and materials.

This year, Steve Albers was awarded a CIRA Research Initiative Award on August 3 at the All Hands meeting in Boulder. He was recognized for helping to create the Precision Airdrop System, or PADS, in response to a request from the U.S. Army's Natick Soldier Systems Center and the U.S. Air Force Air Mobility Command. The laptop-based system developed in part by the NOAA Forecast Systems Laboratory allows military air crews to combine high-resolution weather forecasts with local low-level meteorological data and terrain maps into a real-time picture of their operating area.

"The system has proven to vastly increase the accuracy of cargo airdrops, potentially making both military and humanitarian supply missions far safer," said NOAA researcher John McGinley.

Don Reinke was the other recipient of this year's award. Don was honored for his tremendous contributions to the CloudSat Data Processing Center (DPC), related projects, and managerial accomplishments. As the DPC manager, Don has worked with the CloudSat science team, management, and data providers to ensure CIRA's ability to provide a flexible and reliable service that offers a great deal of value-added benefits to the scientists who will use CloudSat data in their research. As a supervisor, he provides invaluable guidance, encouragement, and mentoring advice. J. Adam Kankiewicz has been under the direction of Don for seven years and states, "Don routinely goes above and beyond the call of duty required to be an adequate supervisor and researcher. He is an incredible asset to CIRA and idealizes the employee sought for the CIRA Research Initiative Award."

University Distinguished Professor

CSU President Larry Edward Penley named Professor Graeme Stephens, a longtime CIRA collaborator, a University Distinguished Professor in April. The highest academic recognition awarded by the University, the title "University Distinguished Professor" is bestowed upon no more than 12 professors at any one time on the basis of outstanding scholarship and achievement. Professors receiving this title hold the distinction for the duration of their association with the University. Please join in on congratulating Graeme on this outstanding achievement!

Fulbright Award Recipient

CIRA research scientist Tomislava Vukicevic has been selected as a Fulbright Scholar to teach at the University of Beograd in Serbia and Montenegro. Vukicevic, who is originally from Yugoslavia and still has family in the area, applied for the Fulbright as an opportunity to support promising new scientists in her native land. She will assist the university in rebuilding its once world-class atmospheric science program and write a textbook in collaboration with a graduate student and colleagues from the University of Reading, England. The Fulbright program, established in 1946, is sponsored by the U.S. Department of State. The highly prestigious program sends 800 U.S. faculty and professionals abroad each year to lecture and conduct research in a wide variety of academic and professional fields.

"Dr. Vukicevic is a fine researcher, teacher, and mentor of young scientists," said Thomas H. Vonder Haar, director of CIRA and University Distinguished Professor of Atmospheric Science. "Her selection for the Fulbright attests to her fine record. It also signifies the long-term involvement of Colorado State University atmospheric scientists with key international programs and projects."

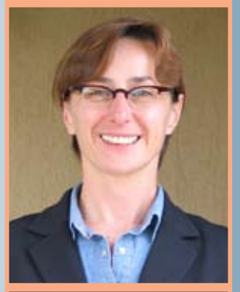
SOARS (Significant Opportunities in Atmospheric Research and Science)

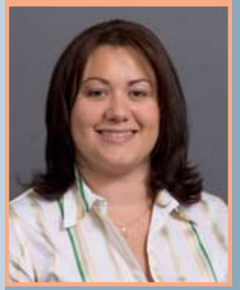
CIRA was pleased to host a student intern under the supervision of Drs. Doug Fox and Jenny Hand this summer. Nancy Rivera came to CIRA under the auspices of the SOARS program as sponsored by UCAR in Boulder. SOARS offers summer research internships to undergraduates exploring a career in an atmospheric science or related field such as biology, chemistry, computer science, earth science, engineering, environmental science, mathematics, meteorology, oceanography, physics, or social science. Proteges work 40 hours per week and earn a competitive wage. Furnished apartments are provided at no cost to the proteges, and they are provided a means of transportation as well.

Nancy is working on her M.S. at the University of Texas at El Paso (graduate students also participate in SOARS). While at CIRA, she worked on trying to utilize the ground-level data collected at our IMPROVE monitoring sites with satellite observations of major dust "events" in the southwestern United States.

Dr. Hand commented, "I very much enjoyed working with Nancy; she is very bright and self-motivated. I was also very impressed by all the SOARS program offers. In addition to their research duties, the proteges attend writing and presentation workshops every week, and at the end of the summer, they present their research during an oral symposium, as well as summarize it in a written paper. I attended one day of oral presentations by several of the SOARS proteges and was very impressed by the quality of their research and presentations. These students are becoming well prepared for a career in science."

More information on the program can be found online: http://www.ucar.edu/soars.





From top: Graeme Stephens, University Distinguished Professor; Dr. Tomislava Vukicevic, Fulbright winner; SOARS intern, Nancy Rivera

If history were to tell us anything, it would be that droughts do occur often enough in Colorado that we should expect long-term episodes of drought.

Drought in Colorado: Can We Let Our Guard Down?

Dustin Rapp

During the intense drought of 2002, many Coloradans realized once again how detrimental a drought can be as water supplies dwindled and wildfire risks increased. However, an extremely wet spring this past year helped to diminish drought concerns for at least the early part of the summer. To get an idea of how wet this spring really was, the National Weather Service (NWS) reported June 2005 was the fourth wettest June in Denver since rainfall records were first recorded in 1872. In neighboring Wyoming, Laramie reported the third wettest June since it began keeping records in 1948, and Cheyenne reported the second wettest June since its records began in 1873. According to NOAA (http://www.noaanews.noaa.gov/stories2005/s2474.htm), as of June 2005, this has been the 12th wettest out of 111 years across Colorado. Certainly, this extra water has been a welcome relief to many in the region since the risk of forest fires became much lower and many areas were painted a shade of green during the past spring. But after such a wet episode, many questions are being raised about how much we truly can let our guard down: Is it really safe to say that the effects of the intense 2002 drought are long gone? Has the drought weather pattern broken, and are we in for a long-term reprieve? And ultimately, are Coloradans' water concerns now allayed? Colorado state climatologist, Dr. Roger Pielke Sr., was contacted to discuss these and other drought related questions.

One of the first things discovered during the interview with Pielke was that the questions raised above are not necessarily easy to answer. According to Pielke, "Drought is multidimensional." By this, he means that it is not always straightforward to identify when and where a drought is occurring. For example, drought can be associated with definitions like a number of days below a certain precipitation

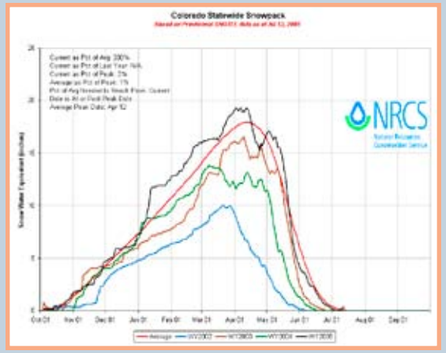


Figure 1. Snowpack in Colorado as of July 12, 2005, using provisional data. Note that the amount of snowpack this past spring has been above average. The amount of snowpack has a great impact on possible water concerns along the Front Range. (Figure from Natural Resources Conservation Service: http://www.nrcs.usda.gov)

amount, soil moisture deficiencies, crop impact, and snowpack deficits. Different people are concerned with different definitions of drought. For example, farmers may not care about how many days the daily precipitation fell below a certain amount but do care a lot about whether there is sufficient precipitation so that their crops are growing. Ski resorts may only consider themselves to be in a drought situation if enough snow falls to keep the slopes open. Thus, the same weather pattern may bring drought to a farmer but not to a ski resort, or vice versa. Each industry is affected by the weather in different ways, and each industry will have a different concept of what a drought really is. Pielke believes these are important concepts to keep in mind when discussing drought issues.

For the Front Range, often the biggest drought worries come about due to a lack of spring snowpack in the mountains, since according to Mike Gillespie of the National Resources Conservation Service (NRCS) Snow Survey Group, up to 80 percent of surface water comes from melting snowpack. Even if rain falls along the Front Range, a lack of snowpack high in the mountains still can cause serious irrigation troubles, as many reservoirs depend on mountain snows. Therefore, "drought" along the Front Range often is associated with how much snow fell in the mountains. This past spring, the snowpack across the Rocky Mountains in Colorado has been higher than average (see Figure 1). Because of the higher amounts of snowpack, snowmelt water increased and reservoirs also were running high this past spring. Water concerns have therefore been small. For this reason, Pielke does believe that we finally have escaped the grips of the 2002-2003 drought, but he also believes it is not a time to be lax in our preparation for drought.

There is very good reason why Pielke doesn't think we should let our guard down. Being involved in climatology research, Pielke does not believe the weather community has much skill in forecasting long-term drought. He adds that if history were to tell us anything, it would be that droughts do occur often enough in Colorado that we should expect long-term episodes of drought. The drought history of Colorado can be seen using the Standardized Precipitation Index (SPI).

The SPI is one of the tools that Tom McKee, Nolan Doesken, and John Kleist of the Colorado Climate Center developed to help quantify the severity of drought across a large area. Although it does not take into account the above-mentioned factors that influence people's perception of drought, it works well for performing research on drought. Using the SPI, the fraction of Colorado experiencing drought conditions can be determined (see Figure 2). From Figure 2, it can be seen that the past couple of decades have been relatively wet when compared with previous decades. It also can be seen that there have been many episodes in the past century when a large portion of Colorado was affected by dry conditions for much longer periods of time than a couple of years, and the 2002 drought actually was relatively short-lived. According to Pielke, the popularized 2002 drought actually was just a short, intense "flash" drought and that the lack of water that resulted from such a short drought demonstrates our vulnerability to nature's idiosyncrasies. Population growth (and thus increased water usage) within the past couple of decades would increase the severity of another long-term drought. Unfortunately, since Colorado has been witness to many long-term droughts throughout history, Pielke sees no reason why they will not continue to be a part of Colorado's future.

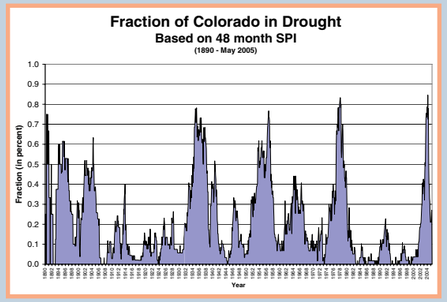


Figure 2. Amount of Colorado in Drought as determined by Standardized Precipitation Index (SPI). According to the 48-month SPI index (1890-May 2005), there have been many episodes of drought in Colorado history. The past 30-40 years actually have been relatively wet years.

In conclusion, during wet periods such as the one experienced this past spring, we should enjoy the green grass and mountain waterfalls but not forget that our water resources in Colorado are limited and that a long-term drought could be lurking around the corner. In fact, by the time you are reading this article, we could be drying out again, since July 2005 actually became the eighth driest July in Fort Collins using a 116-year record. This statistic only emphasizes Pielke's conclusion that drought will be a continual concern in Colorado; for this reason, using water resources carefully and replenishing our reservoirs are ongoing duties that Coloradans should be performing in preparation for drier times.

Acknowledgements

The author would especially like to thank Roger Pielke Sr. and Odie Bliss of the Colorado Climate Center for supplying information, resources, and data for this article.

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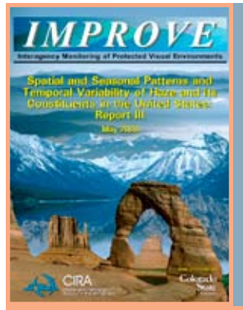
OUTREACH ON AIR QUALITY



IMPROVE and VIEWS

Doug Fox, Shawn McClure, Rodger Ames, and Bret Schichtel (NPS)

Recognizing the importance of visual air quality in our national parks and wilderness areas, Congress has included legislation in the 1977 and 1990 Clean Air Acts to prevent future, and remedy existing, visibility impairment in these pristine reserves. To aid in this legislation, a visibility monitoring program was developed, the Interagency Monitoring of Protected Visual Environments (IMPROVE). In 1990, the EPA issued a complex set of regulations designed to achieve the goals set in the Clean Air Act particularly with respect to eliminating unnatural "regional haze" in these pristine areas. The Regional Haze regulations have spawned a wide range of activities including establishing Regional Planning Organizations (RPOs) to organize technical information, monitoring data, model simulations, and analysis to identify sources of haze. The Western Regional Air Partnership (WRAP) is the planning organization for the western United States. Since more than 75 percent of the pristine areas are located in the West, WRAP has the biggest job of all these RPOs. CIRA staff have been intimately involved in the regional haze program, in establishing and implementing the IMPROVE program, in analyzing its data, and in assisting the RPOs in general and the WRAP in particular in implementing their work. In support of both IMPROVE and the RPOs, CIRA currently supports two Web sites that are accessible not only to the research community, but to the general public as well.

IMPROVE is located at: http://vista.cira.colostate.edu/improve. This Web site was designed to provide federal, state, and local air quality regulatory agencies, as well as the general public, access to visibility data. This information includes monitoring a site's location, topography, and air quality measurements over time, along with pictures

of the site and surroundings. A special feature is photographs documenting the spectrum of visibility conditions at each site. For the public, there is an educational section that will guide people through the visibility science and regulatory information at their own pace. Animations, voice, and still images convey the basic concepts of visibility science, air quality data analysis and haze (see "Introduction to Visibility" on page 6).

VIEWS is located at: http://vista.cira.colostate.edu/views, This Web site was designed to help all the RPO partners (states, local air agencies, Indian tribes, federal land managers) to accumulate, access, and analyze the widest possible array of air quality data. The Web site contains online data links to measured air quality data sets from throughout the country. The addition of aerosol, optical, and meteorological data from more than 20 different monitoring networks differentiate this site from the IMPROVE site. Public access to this site is encouraged, as here one will find a living inventory of distributed air quality data resources for the western United States.

Air Quality Education with Interactive CD-ROM and Touch-Screen Kiosks

Julie Winchester

The National Park Service Visibility Research group at CIRA is using interactive technology to tell visitors how human activities impact environmental systems within the national parks.

An interactive air quality kiosk was developed to attract visitors to the Oconnaluftee Visitor Center in Great Smoky Mountains National Park, Tennessee. A colorful touch-screen display entices visitors to learn more about how air pollution has affected the air, water, soil, plants, and animals in the park. In "Shrinking Views," visitors learn where haze comes from and its effect on views in the park. In "Ozone Pollution," they see the adverse effect that ozone has on more than 30 species of plants in the park. The "Acid Overload" section explores how acid rain impacts sensitive aquatic life and how soils are impacted by high levels of nitrogen. Pictures, colorful graphics, and animated sequences tell the stories in an entertaining yet informative way. Many of the more than one million people who visit the Great Smoky Mountains each year will leave with a better understanding of how park environmental resources are damaged and a clear picture of what each can do to help solve the problems.

A similar presentation was developed for the Grants Grove Visitor Center at Kings Canyon National Park, California. As the visitor center was being completely redesigned and updated, the park looked toward utilizing higher technology to share their air quality message. Two touch screens and two large-screen plasma displays invite visitors to explore ozone effects on giant sequoia and pine forests, acid rain and its effects on sensitive amphibian species, and the effects of air-borne pollutants on views within the park. Visitors also can take a virtual tour flying over the San Joaquin Valley to see how pollutants accumulate before they are pushed into the park, and there is an animated recycling challenge that allows visitors to test their knowledge of product recycling. The program is presented in both Spanish and English with the intent of reaching a much larger and diverse audience.

Park presentations about air quality are based on 20 years of air quality research efforts at CIRA and in national parks around the country. Current programs have been very successful and provide a foundation for similar national park visitor center kiosks throughout the country.

Many of the more than one million people who visit the Great Smoky Mountains each year will leave with a better understanding of how park environmental resources are damaged and a clear picture of what each can do to help solve the problems.

Snapshots of kiosk presentations developed by CIRA researchers.

NATURAL DISASTER MITIGATION

Rescue workers during the Fort Collins flood of 1997.

911 DISPATCH CARDS

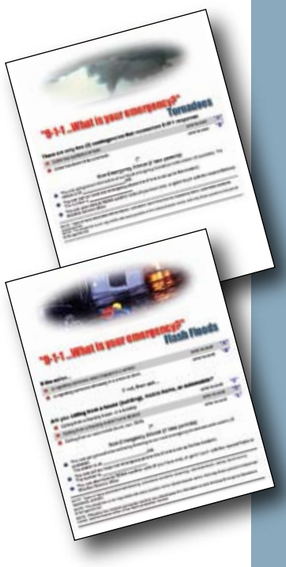
John Weaver-NESDIS

As a result of the Fort Collins flood of July 28, 1997, a joint effort between the City of Fort Collins Office of Emergency Management, the National Weather Service, NOAA, FEMA, and CIRA was initiated to assist overburdened dispatch centers and emergency managers. The focus of this cooperation was to develop a process to quickly address frequently asked questions that overwhelmed these centers and managers during a natural disaster. After numerous meetings, a solution came in the form of a PowerPoint presentation that performed like a flowchart. Each PowerPoint screen became a "what-to-do" information form specific to a particular disaster or emergency. These screens became cards called Natural Disaster Information Cards (NDIC) and were used in teletraining courses around the country funded through the CIRA VISIT program.

Dispatchers and emergency managers could choose any of five natural disasters that they were confronted with – blizzards, floods, lightning, hail, or tornadoes – and then follow their computer screen or card sequence to best handle the call and what sound advice to dispense. A further development placed these cards in HTML format to simplify use of the system.

The most frequent uses of the 911 Dispatch Cards are 1) for in-service training for which general weather knowledge from a dispatch perspective is required; 2) for a pre-event review of specific problems and procedures for a day on which a dangerous event is expected; and 3) emergency directions that can be used in real-time to answer specific questions. The 911 Dispatch Cards have been featured in several dispatch magazines, and access to these materials continues to be requested.

For examples of these cards, visit the following Web site: ftp://ftp.cira.colostate.edu/Weaver/ndic-html.



Sample 911 Dispatch Cards

The 911 Dispatch Card System is an example of a cooperative education and outreach effort between state, federal and university organizations in which CIRA has taken a lead role in devising a hands-on approach to assist disaster centers and emergency managers when natural disasters occur.

JOINT HURRICANE TESTBED

John Knaff

The months of June through November are critical for the development of severe storms that often create devastation along the Eastern and Gulf States of the United States. These storms are part of a phenomena called "tropical cyclones," which begin as tropical disturbances, grow to tropical depressions, mature into hurricanes (typhoons in the western North Pacific Ocean), and normally die out as tropical storms over land.

The Joint Hurricane Testbed (JHT) has the mission to transfer, more rapidly and smoothly, new technology, research results, and observational advances of the United States Weather Research Program (USWRP) into improved tropical cyclone analysis and prediction at operational centers. The current operational method to determine the likelihood of experiencing tropical cyclone conditions is a long-standing operational strike probability product, which gives the probability of a storm's center being within 75 statute miles from a given location.

To improve on the output of the current operational product, a new model has been developed as part of the CIRA JHT project. This new model estimates the probability of experiencing tropical storm or hurricane conditions using a Monte Carlo Probability (MCP) model, where a large set of plausible tracks and intensities are determined by randomly sampling historical forecast error distributions. Special procedures have been developed to account for the effects of land, for the persistence of the track and intensity forecast errors, and for the relationships between intensity and wind structure.

These probabilities provide all users with information that enhances their ability to make preparedness decisions specific to their own situations and risk tolerance.

The MCP model and related graphical text products are produced experimentally in real-time for the Atlantic, East Pacific, Central Pacific, and Western Pacific tropical cyclone (typhoon) basins. These new products are about the weather, not just the storm location. That is, these wind speed probabilities provide the chances of wind speeds equal to or exceeding familiar thresholds (e.g., tropical storm force, hurricane force) at individual locations in the form of a text product and graphic. Therefore, the probabilities have more direct meaning and impact to users than just the strike probability. These probabilities provide all users with information that enhances their ability to make preparedness decisions specific to their own situations and risk tolerance.

This research has the potential to become a standard operational product and to be translated into an outreach forecast for the general public that provides the wind probabilities for specific areas within the tropical cyclone path. A good example is shown in Figure 1: a five-day, 34-knot (39-mph) wind probability graphic associated with Tropical Storm Dennis on July 7, 2005, at 12 universal time.

HURRICANE MITCH

Bernadette Connell and Mark DeMaria

In October 1998, Hurricane Mitch made landfall in Honduras. The rainfall associated with this immense storm caused extensive flooding and landslides in many Central America countries, and the loss of life was tremendous. The need for immediate assistance in forecasting and disseminating severe storm warnings was readily apparent.

During 1999-2001, the U. S. Agency for International Development (AID) provided education and outreach funding to the CIRA RAMM team to develop and improve forecasting capabilities in Central America, with Costa Rica as the focus country for development. This development effort included the installation of a ground receiving station and server at the National Meteorological Service (IMN) in Costa Rica to provide real time satellite data to Costa Rica and to other Central American countries. Each of the Central American countries (Costa Rica, Panama, Nicaragua, Honduras, El Salvador, Guatemala, and Belize) received two RAMSDIS (Regional and Mesoscale Meteorology Team Advanced Meteorological Satellite Demonstration and Interpretation System) to ingest and display this satellite imagery. The countries also received on-site training of the systems as well as a two-week training session in Costa Rica on how to better utilize satellite imagery in everyday forecasting tasks.

A second educational and outreach effort funded by AID was directed towards adaptation of satellite techniques to better identify and quantify heavy rain events. Rosario Alfaro from the IMN in Costa Rica was selected as a CIRA visiting scientist to work with the NOAA/NESDIS hydrology team in Camp Springs, Maryland. Rosario was in Maryland from August 2000 through December 2001 learning how to use and adapt satellite-based rainfall techniques to assist in the public forecast and warning process. This project was possible because of established collaborations with Dr. Vilma Castro Leon at the University of Costa Rica (UCR). UCR is a designated Regional Meteorological Training Center for Regions III and IV of the World Meteorological Organization (WMO).

Top: Forecasters from throughout Central America received training from CIRA researchers on better forecasting tools.

Figure 1 (below): Example of the five-day, 34-knot (39-mph) wind probability graphic associated with Tropical Storm Dennis on July 7 at 12 universal time.

GLOBAL OUTREACH EFFORTS

At right: A training session in progress.

This new resource has enabled those trained in Costa Rica to return home and more effectively use the information to train others.

Global Outreach with the World Meteorological Organization: The Virtual Laboratory for Satellite Training and Data Utilization

Jim Purdom

The Virtual Laboratory for Satellite Training and Data Utilization (VL) has been established to maximize the exploitation of satellite data worldwide. It is a collaborative effort joining the major operational satellite operators across the globe (United States, Europe, China, and Japan) with the World Meteorological Organization (WMO) centers of excellence (COEs) in satellite meteorology. These centers of excellence – located in Costa Rica, Barbados, China, Australia, Kenya, and Niger – serve as satellite-focused training resources for WMO members. Trainers from member countries come to learn about using satellite data and return home to train others.

The VL traces it origin to work undertaken by CIRA in the mid-1990s. That effort was aimed at providing online case study data and selected real-time satellite data (using the Internet for data distribution) to train U.S. National Weather Service (NWS) office staff to fully utilize digital data from NOAA's new generation of GOES satellites. The concept soon expanded to provide both online case study data and near real-time data to the WMO Regional Meteorological Training Centers (RMTCs) in Barbados and Costa Rica. As with the NWS effort, CIRA provided specialized software and data analysis systems to the RMTCs. Ultimately, the CIRA activity grew to include the global satellite operators and COEs mentioned above. In conjunction with its VL partners, CIRA serves as a conduit for much of the outreach and training activity within the VL, and since its inception, the VL successfully has supported training activities at all COEs. CIRA's work in that area not only has improved the capacity of VL partners to utilize the

VL, but also has improved the ability of VL students to meet their mission as satellite focal-point trainers for their various countries.

In March 2005, CIRA introduced a new concept in training at the COE in Costa Rica. In the past, VL participants have left courses with a variety of materials, often cumbersome and difficult for those from developing countries to effectively use. To remedy that hindrance and to assure that the most up-to-date materials were always available for participants, CIRA developed and distributed (via the WMO) electronic resource notebooks to all participants. Each electronic notebook contains all of the materials used in the training course as well as a complete Virtual Resource Library. Now after the actual course work, this new resource has enabled those trained in Costa Rica to return home and more effectively use the information to train others. Through the WMO, CIRA has now provided electronic notebooks, or copies of their contents, to each of the satellite sponsors as well as to each of the COEs. The success of this activity is helping CIRA to meet its international outreach goal of advancing the utilization of satellite data.

To learn more about the VL and to tour CIRA's virtual resource library, visit the CIRA Web site at http://rammb.cira.colostate.edu/wmovl/vrl.

GLOBE

Renate Brummer and Cliff Matsumoto

The GLOBE Program came to life in the early 1990s. Its roots originated as an idea by former vice president Al Gore, who envisioned a program that would increase scientific understanding of the Earth as a system, support improved student achievement in science and mathematics, and enhance environmental awareness through inquiry-based learning activities. In essence, students all over the world would collect environmental data to help monitor the health of our planet Earth. The program was named the Global Learning and Observations to Benefit the Environment (GLOBE) program, and it was officially announced on Earth Day in 1994. The initial GLOBE measurements were in the areas of atmosphere and climate, hydrology and water chemistry, and biology.

Working with the NOAA Forecast Systems Laboratory, a CIRA team of nine computer scientists, meteorologists, and teachers was responsible for designing and developing a GLOBE Web server with numerous pages describing the program and its scientific protocols. Data-entry pages were designed to allow schools to send their data either by using GLOBE Web pages or simply by e-mail. A data acquisition system capable of ingesting and

archiving GLOBE student data from all over the world was created. By the summer of 2005, GLOBE included 107 countries, more than 16,000 schools, and a GLOBE database that held more than 13 million GLOBE data records. Continuously and on a yearly basis, GLOBE scientists improve and refine existing protocols and add new measurement protocols so that the Web site now has more than 1,000 dynamic pages. Hundreds of GLOBE partner organizations have volunteered to conduct the GLOBE training for interested teachers worldwide.

During its successful 10-year existence, the GLOBE program has changed from a NOAA-NASA-NSF interagency program to a NASA outreach and education program with NSF continuing to support the science side of GLOBE. GLOBE currently is managed by the University Corporation for Atmospheric Research in partnership with Colorado State University. CIRA has inherited the overall responsibility for the development and maintenance of the entire GLOBE Web site, database, and real-time data acquisition system, including visualization of all student data and the acquisition and display of reference data. CSU's Department of Atmospheric Science has assumed a predominant role for developing and supporting all GLOBE science measurement protocols, including detailed description of protocols and instrument specifications, in collaboration with NSF-funded science investigators. The department also plays the role of liaison to the science community and ensures the scientific validity of GLOBE data. Atmospheric Science staff also are responsible for the support of the GLOBE Help Desk.

GLOBE is the most extensive educational and outreach program that CIRA has been involved with. As GLOBE country and student participation continues to increase, so does the role of satellite data imported into the GLOBE reference database.

Students all over the world collect environmental data to help monitor the health of our planet Earth.

TRAINING EFFORTS

NOAA offices turn to this approach as a cost-effective solution to the problem of increased training requirements coupled with shrinking training and travel budgets.

SOS presentation in an elementary school classroom in Broomfield, Colo.

It is hoped that SOS will plant the "seeds of inquiry" into the minds of youth who one day will become our future science leaders.

SCIENCE ON A SPHERE

Michael Biere and Steve Albers

CIRA personnel currently are involved with NOAA's Forecast Systems Laboratory in the design and implementation of an exciting project to visualize the wonders of the Earth, other planets and moons, and even the sun via a six-foot sphere suspended in space. The visual impact of Science on a Sphere (SOS) will stimulate one's imagination and the desire to learn more about our living planet and its surrounding space.

SOS is essentially a six-foot spherical screen with a set of computer-driven projectors shining on it. Customized software provides the magical look of projected data onto a seamless animated globe. Global infrared satellite imagery, sea surface temperatures, climate models, X-ray sun imagery, earth bathymetry, and surface elevations data are among the NOAA datasets displayed on the screen. Future imagery will include re-projected global maps of Jupiter and Saturn and a movie showing the history of Earth's population growth, as well as improved displays of the Sun and the Moon.

The value of SOS as an educational and outreach tool is undoubted. Pilot demonstrations at Broomfield Heights Middle School and the Maryland Science Center both have resulted in survey feedback indicating that viewing SOS is a rich and successful learning experience. It is hoped that SOS will plant the "seeds of inquiry" into the minds of youth who one day will become our future science leaders.

SOS is in its infancy. The next challenge for this evolving project is to get the system out of the lab and into museums and science centers where its educational potential can be realized. SOS project personnel envision a NOAA Planet Theater featuring SOS, akin to the IMAX theaters and planetariums currently in such venues. This will require more projectors to increase the visual level of detail and brightness on the displayed datasets, adding interactive capabilities for viewer interaction via a kiosk display, and developing a narration and annotated media for use when dedicated personnel are not physically present for presentations. With CIRA and FSL working together, SOS is becoming one of the most visually interesting educational tools created by the science community.

More information about Science on a Sphere can be found at http://www.fsl.noaa.gov/sos.

The VISIT Program

Jeff Braun

The Virtual Institute for Satellite Integration Training (VISIT) program originally was created in 1998 with funding provided by the National Oceanic and Atmospheric Administration (NOAA). The need for the VISIT program was two-fold in that it grew out of an environment in which the training requirements for a meteorologist were beginning to outpace the availability of funds needed for residence training. Thus, along with a software package called VISITview, which was developed at the Cooperative Institute for Meteorological Satellite Studies (CIMSS), a means for allowing a synchronous teletraining session – with up to 15 National Weather Service (NWS) offices at any one time – was devised. The VISIT program is administered by staff from CIMSS; the NWS training division; the National Environmental Satellite, Data, and Information Service (NESDIS); and the Cooperative Institute for Research in the Atmosphere (CIRA).

Just how does the teletraining process begin? It starts with the selection of a topic that usually is recommended by either NWS personnel or VISIT instructors. Once a topic is selected, VISIT instructors, along with experts dealing with the particular subject matter from outside the project, put together a session that includes theoretical background knowledge of a particular topic followed and supported by several individual case studies. The VISITview software package lends itself particularly well to this application by allowing the use of text windows, images (single or animated), and interactive graphics to be used together in a live conference setting.

The sessions go through a rigorous internal and external review. When the session is ready to go, dates and times are selected and posted on the VISIT Web site calendar for instruction. NWS offices contact VISIT via e-mail and sign up for any of a variety of teletraining sessions that are offered each month. The office receives set-up instructions by means of e-mail about a week before the session is scheduled to begin. The set-up instructions contain download information for the file to be used for the training as well as a conference call phone number and password.

On the day that the session is scheduled to take place, all participating offices call in to the conference center. The previously downloaded VISITview file is initiated and run on the individual office's PC. The VISITview software automatically connects and synchronizes to the instructor's PC over an Internet connection, allowing the instructor to control the session remotely. The controls include advancing of slides, annotations, and animation controls (Figure 1). Any actions done by the instructor are seen synchronously at every participating office (Figure 2).

Through August 2005, 60 session topics have been developed, 20 of which were developed at CIRA. More than 975 VISIT teletraining sessions have been administered during that same time period, with more than 15,000 certificates of completion having been awarded to the teletraining participants. The VISIT Web site (http://rammb.cira.colostate.edu/visit) contains stand-alone versions of most sessions, many of which are audio (recorded) and some of which contain embedded instructor notes that can be viewed using a Web browser. The Web/audio versions make it possible to view the material at any time.

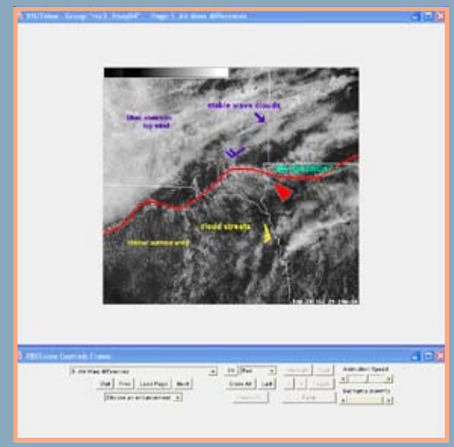
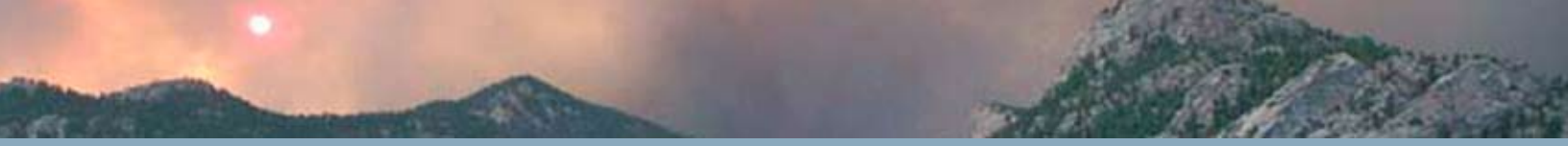


Figure 1. An example of a screen during a VISIT teletraining session developed at CIRA. The software allows instructors and students to view and manipulate the material synchronously. This includes annotations and animated loop controls, as well as many other features.

VISIT teletraining applications have continued to expand as more NOAA offices turn to this approach as a cost-effective solution to the problem of increased training requirements coupled with shrinking training and travel budgets. On the heels of the VISIT program is the development of a Satellite Hydrology and Meteorology Training (SHyMet) course. The ShyMet course under development at CIRA and CIMSS will pull together distance training modules from many sources, including VISIT, into an organized learning path. The course will touch on Geostationary and Polar orbiting satellite basics, remote-sensing basics necessary for the correct interpretation of satellite imagery, identification of atmospheric and surface phenomena, and the integration of meteorological techniques with satellite-observing capabilities. The goal is to train participants to be certified in the use of satellite data and products as part of the NWS forecasting and warning training program.

Figure 2. VISIT instructor John Weaver (inset) leads a teletraining session as the NWS Office in Cleveland, Ohio, follows along. (Cleveland photo courtesy R. LaPlante)



CIRA Mission

The mission of the Institute is to conduct research in the atmospheric sciences of mutual benefit to NOAA, the University, the State, and the Nation. The Institute strives to provide a center for cooperation in specified research program areas by scientists, staff, and students and to enhance the training of atmospheric scientists. Special effort is directed toward the transition of research results into practical applications in the weather and climate areas. In addition, multidisciplinary research programs are emphasized, and all university and NOAA organizational elements are invited to participate in CIRA's atmospheric research programs.

The Institute's research is concentrated in several theme areas that include global and regional climate, local and mesoscale weather forecasting and evaluation, applied cloud physics, applications of satellite observations, air quality and visibility, and societal and economic impacts, along with cross-cutting research areas of numerical modeling and education, training, and outreach. In addition to CIRA's relationship with NOAA, the National Park Service also has an ongoing cooperation in air quality and visibility research that involves scientists from numerous disciplines, and the Center for Geosciences/Atmospheric Research based at CIRA is a long-term program sponsored by the Department of Defense.

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