VISIT

Bringing Training to Weather Service Forecasters Using a New Distance-Learning Tool

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In the late 1990s, NOAA's National Weather Service (NWS) training requirements began to outpace the availability of travel funds. At the same time, the Internet was becoming more reliable, bandwidths were increasing, and computers were becoming more powerful. The timing was right for the introduction of distance learning. To address this need, the Virtual Institute for Satellite Integration Training (VISIT) was created in 1998 with funding from the National Environmental Satellite, Data, and Information Service (NESDIS) and the NWS.

Since its initially modest beginnings, the VISIT project has grown appreciably. The staff is now comprised of members from a variety of institutions, including the Cooperative Institute for Research in the Atmosphere (CIRA), the Cooperative Institute for Meteorological Satellite Studies (CIMSS), NESDIS, and the NWS training division.

Early in the project, VISIT discovered that it needed to create its own interactive presentation software with specific capabilities not commercially available. To address this need, the VISIT team developed a software package called VISITview (information available online at www.ssec.wisc.edu/visitview).[1] This distance-learning software allows users to simultaneously view and manipulate the images, animation, graphics, and text. The VISITview software is utilized by other NWS training teams, such as the NWS Numerical Weather Prediction team, Interactive Forecast Preparation System (IFPS), Climate and Aviation Training, and staff from NESDIS.

The strength of the VISIT teletraining instructional approach is its ability to bring the instructor directly into the forecast office. The direct interaction between instructor and students establishes an active link that can be difficult to achieve other than with face-to-face instruction. Based on positive student feedback, VISIT teletraining has fulfilled the original goal of providing distance learning to operational forecasters.

TELETRAINING—THE INSTRUCTORS. Instructors for the teletraining sessions include staff from CIRA; CIMSS; Cooperative Program for Operational Meteorology, Education, and Training (COMET); Warning Decision Training Branch; and personnel from other NOAA organizations. Thanks to the flexibility of the VISITview teletraining approach, instructors can be located anywhere in the world. To conduct a live teletraining session, instructors and students need only a PC with a reliable Internet connection and a telephone.

VISITview is easy to use; thus, more instructors have become involved in live teletraining. Several NWS science and operations officers (SOOs) and lead forecasters have created, led, and assisted with teletraining sessions. Staff at the NWS Regional Headquarters and the National Centers for Environmen-

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[1] VISITview software development is funded by NESDIS and the NWS. CIMSS makes the software available free of charge, subject to terms, conditions, and disclaimers as posted on the Web site.

tal Prediction (NCEP) have developed and presented teletraining sessions. Instructors from other programs, such as the NWS Numerical Weather Prediction team and COMET, also use teletraining. These teletraining sessions are developed in coordination with the VISIT staff. The sessions cover a broad range of topics, including satellite and lightning meteorology, NWP, warning decision making, aviation meteorology, medium-range forecasting, climate, and the NWS Interactive Forecast Preparation System (for a listing of sessions, see Table 1 and Fig. 1). The quantity of training being offered is possible only because the instructors do not have to waste valuable design time in travel. Furthermore, the variety of topics covered by VISIT would require a number of different workshops.

Fig. 1. List of the first 23 training sessions as shown on the VISIT page. Note that the microphone icon denotes that the session is available with instructor audio and annotations.

DESIGNING AND PRESENTING TELETRAINING SESSIONS. The teletraining design process begins with the selection of a topic. NWS personnel or VISIT instructors suggest topics. Once a topic is selected, VISIT instructors along with subject matter experts (SMEs) from outside the project decide on an outline for the session.

Creating the first draft involves a number of iterations, with each instructor/SME reviewing and adding material in stages. In addition to theoretical material and background information, most sessions include case studies that allow students to apply the principles. Because the NWS utilizes the Advanced Weather Information Processing System (AWIPS) in its operations, most examples and case studies focus on that format. Sessions are generally designed to last from 60 to 90 min.

Once the first draft of a session is completed, a test run of the lesson is presented to selected NWS offices, SMEs, and other VISIT staff to refine the contents. Attendees provide formal reviewer comments that the authors are required to address (similar to the review process for refereed journal articles). Modifications are made or justifications are provided, should authors disagree with individual comments. When the modifications are completed, dates are selected for instruction, the VISIT teletraining calendar (available online at www.cira.colostate.edu/ramm/visit/ecal.asp) is updated, and a formal announcement is sent via e-mail to NWS offices through their SOOs, who serve as focal points for the teletraining. Offices can sign up for any listed course, though most selections are made based on local training needs. Setup instructions are sent one week before the scheduled date of the session, the SOO/focal point downloads the session file from one of the VISIT servers, and students are asked to review the student guide. This guide contains a variety of information, including session goals/objectives, authors, length and level of difficulty (basic to advanced), prerequisites, teletraining installation instructions, training session options, references, written talking points, and information contacts.

The VISIT Web site contains asynchronous Web-based versions of most sessions, with embedded instructor notes, that can be viewed using a Web browser. A new VISITview feature has the ability to include recorded audio and annotations with the session file. This asynchronous option allows lessons to be played back with the voice and annotations of the instructor. A list of sessions that include instructor audio and annotations is found by choosing the "training sessions" link on the VISIT home page (online at www.cira.colostate.edu/visit) and selecting a session with the microphone icon next to the course title (Fig. 1).

Table 1. VISIT training sessions offered from Apr 1999 to Sep 2003.

Detecting Thunderstorm Outflow Boundaries at Night Using GOES
Tropical Satellite Imagery and Products
CONUS CG Lightning Activity
The Enhanced-V: A Satellite Severe Storm Signature
Using GOES Rapid Scan Operations (RSO) in AWIPS
Using AWIPS to Detect Surface Boundaries
Natural Disaster Information Cards
Diagnosing Elevated Mesoscale Ascent—The Midland Heavy Snow Event
Applying Mesoscale Tools and Techniques to Predict and Detect Severe Thunderstorms
Diagnosing the Potential for Surface Boundaries to Initiate Convection
QuikSCAT
Lake-Effect Snow I
Using AWIPS to Evaluate Model Initializations
An Ingredients-Based Approach to Forecasting Winter Season Precipitation
Lightning Meteorology I
Precipitation Type Forecasting
HPC Medium Range Forecasting
An Application of Pattern Recognition to Medium-Range Forecasting
Using Near-Storm Environment in the Warning Decision-Making Process
Top Ten Misconceptions about NWP Models
GOES Sounder Data and Products
GOES High-Density Winds
Mesoscale Analysis of Convective Weather Using GOES RSO Imagery
Forecasting Mesoscale Convective Systems
Introduction to POES Data and Products
Lightning Meteorology II
Ensemble Prediction Systems
What Can You Expect from the Eta-12?
Fog Detection and Analysis with Satellite Data
Meteorological Uses of ACARS Data
Tornado Warning Guidance 2002
Cyclogenesis: Analysis Utilizing Geostationary Satellite Imagery
POES Tropical Rainfall Potential
Subtropical Cyclone Analysis with Satellite Data
Lake-Effect Snow II
TROWAL Identification
The Satellite Rainfall Hydro-Estimator
Wildland Fire Detection Using Satellite Imagery
Introducing *GOES-12*
Navigating the Climate Prediction Center's Website
Use of GOES RSO with Other Remote Sensor Data for Diagnosing Severe Weather
Water Vapor Channel Satellite Imagery

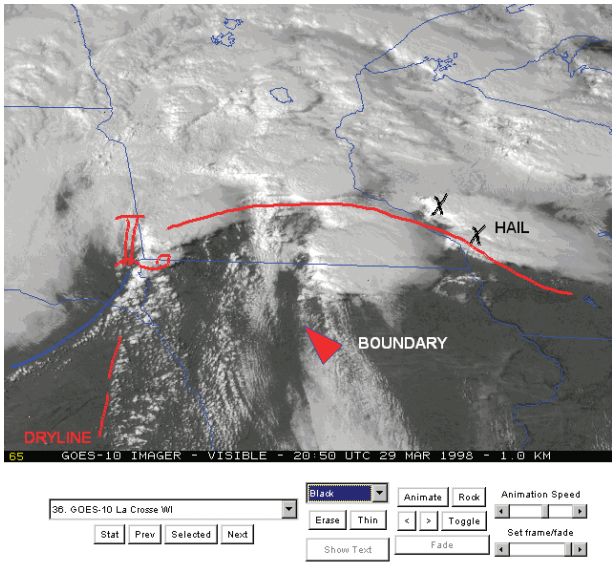

FIG. 2. VISITview panel from the Enhanced-V training session, showing the instructor's annotations on a visible satellite image with the control menu displayed at the bottom.

FIG. 3. VISIT instructor John Weaver at CIRA VISIT (inset) draws annotations on the screen to make his point, while students at the Cleveland, OH, NWS field office watch.

At the scheduled time of the session, offices call in using a telephone conference number. The previously downloaded file is initiated on an office PC. The software automatically connects to the instructor over the Internet, allowing the instructor to control the session remotely. These controls include the advancing of slides, annotations (e.g., Fig. 2), animation controls, etc. Any actions done by the instructor are seen synchronously at every participating office (Fig. 3). During the teletraining session, interactivity is encouraged through instructor questions and case studies. The questions are designed to generate thought-provoking discussion and practical reinforcement of principles for the student. The exchanges often lead to refinements and updates of session material.

Other training programs also use the VISITview software. An example is the Weather Service Radar Distance Learning Operations Course (DLOC), which is taught by the NWS Warning Decision Training Branch in Norman, Oklahoma. DLOC requires an on-station time commitment of approximately 100 h per student. VISITview is also used for the World Meteorological Organization (WMO) Virtual Laboratory for Training in Satellite Meteorology. VISITview sessions were used for training workshops held in China, at the Australian Meteorological Bureau in Melbourne, and at the Finnish Meteorological Institute.

TABLE 2. Some example student comments, followed by the resulting actions taken.

"High-quality graphics are a big plus"	More graphics are now taken directly from AWIPS
"Interactions between instructors and students are important"	Instructors and quiz questions have been added
"Animations are very useful"	Loop sizes have been increased, full animation controls enabled, animated loop overlays
"VISITview-based sessions are easy to install and use"	User-friendly installation instructions, single self-extracting file
"Linking the training to specific forecaster problems and cases is very positive"	Focused sessions on forecasting topics, case studies highlighting specific regional and geographic problems

THE EVALUATION PROCESS. Upon completion of each teletraining session, evaluation forms are e-mailed to attending offices. Once the student evaluations are completed and returned, certificates of completion are generated and mailed to each responding participant. The issuing of certificates provides an incentive for completing and returning evaluations. Results from evaluations are utilized to track instructor performance, provide course feedback, enhance VISITview capabilities, and identify unusual or unexpected problems. The evaluations also ask offices to notify VISIT staff of any cases in which the course material was used effectively in operations. A study encompassing results from 1991 to 2000 for the DLOC found that teletraining is at least as effective as classroom training (Fig. 4).

The student evaluations provide useful insight into the teletraining sessions. When sessions are first offered, student comments frequently result in improved versions before the session is offered again. Student comments also highlight features important to them that are then included in future sessions. Some example comments from students that have helped improve the sessions can be found in Table 2. Other quotations regarding the quality of the training include the following:

- "Excellent medium that provided expert instruction with appropriate case studies. Very informative and provided forecasters here with additional knowledge that can be applied to their forecasting skills."
- "I must say that this has been the *best* VISIT training session thus far. . . . The instructors did a fabulous job of conveying the information . . . the length was appropriate . . . kept the group involved. Nice to have an operational forecaster giving one of these sessions . . . he kept it operationally focused."
- "Overall, you guys do an excellent job with all the teletraining that's being provided; given tight schedules at local WFOs, please continue to offer sessions as often as possible so the maximum number of staff members can attend; thanks!"
- "I want to thank both instructors for an excellent presentation. There were several points that I will take away from this presentation that I can apply operationally. The interaction was very good and enhanced the learning process."
- "We have had two days (Monday and Tuesday) where storms with positive lightning-dominated cores produced significant hail and extremely heavy rainfall. . . . I suspect we might see a similar type storm tonight and again tomorrow. These cases definitely reinforce the concepts of the Lightning Meteorology II VISIT teletraining."

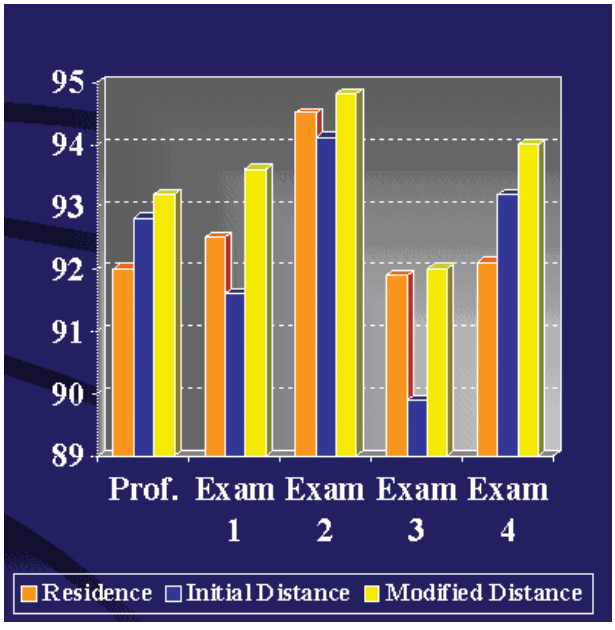

FIG. 4. Graph showing actual examination scores (%) from the Weather Surveillance Radar-1988 Doppler Operations course. Red bars show results from 100% residence training, blue bars from when the course was converted to distance learning via CD-ROMs and limited teletraining, and yellow bars from the same course taught utilizing expanded teletraining (replacing CD-ROMs) with a concluding workshop. The scores are similar scores, regardless of the training forum, with perhaps a slight increase for the teletraining method. "Prof" in the chart indicates scores for a hands-on proficiency exam now proctored on station. Exam 1 covers basic principles, exam 2 covers base products, exam 3 covers derived products, and exam 4 covers system operations. Graph supplied by the Warning Decision Training Branch in Norman, OK.

As noted earlier, VISIT sessions—unlike many classroom training presentations—are peer reviewed before presentation. Future plans to include level-2 and -3 evaluations are dependent on the new NWS Learning Management System.

TELETRAINING SESSIONS—RESULTS. The VISIT project has been very successful from its inception. For example, for the period from April 1999 through November 2003, the VISIT project has pro-

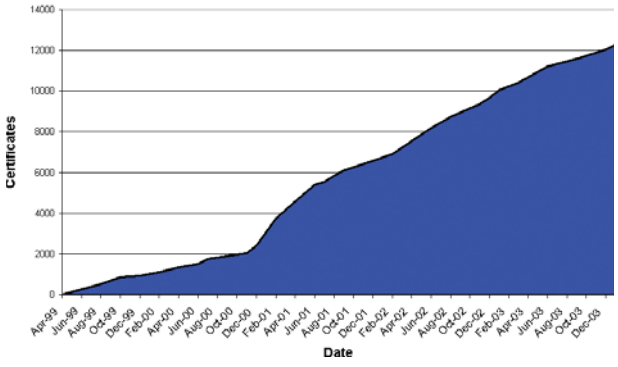

FIG. 5. Cumulative number of Integrated Sensor Training VISIT training certificates issued from Apr 1999 through Mar 2003.

duced the following:

- 742 training sessions conducted on 45 topics;
- an average of five offices per session for a total of 3721 office sign-ups;[2] and
- over 12,000 training certificates issued[2] (Fig. 5).[3]

All 122 NWS forecast offices have participated. These offices include the 116 offices in the contiguous United States; the office in San Juan, Puerto Rico; three offices in the Alaska region; and two in the Pacific region. Most of the NWS National Centers for Environmental Prediction, River Forecast Centers, and Central Weather Service Unit offices have participated, and several non-NOAA organizations have taken teletraining, including the U.S. Navy, emergency managers from a number of cities and counties, and the Canadian Meteorological Centre. From these metrics we calculated that 835 unique students had taken five or more sessions, which is equivalent to roughly one day of classroom training. Thus, considerable travel expenses plus time out of the office have been saved. Preparation for the VISIT material takes more time than comparable classroom presentations, given the extensive peer-review process used for the teletraining. However, the benefit gained by teletraining more than outweighs the expenditure for classroom training. Another benefit of teletraining is the use of the asynchronous versions for students who cannot attend the live teletraining.

As information on the success of the VISIT approach to teletraining spreads, the potential for even more programs to use VISITview for their training grows. The need for training and briefing tools offered via distance learning is greater than ever as training needs continue to outpace the availability of travel funds. The VISIT project is working with other offices in NOAA and with other agencies, including the Department of Defense and WMO, to support the spread of the teletraining approach.

SUMMARY. In the late 1990s, the National Weather Service decided to begin a transition from classroom training to distance learning. In response to this requirement, the Virtual Institute for Satellite Integration Training project was established with the goal of bringing meteorological instructors into forecast offices remotely, using a combination of the Internet and a conference phone line. To carry out its mission more effectively, the VISIT project developed a software application package known as VISITview, which provides several new capabilities, including live two-way interactions. Additionally, VISITview allows for the continuing expansion of teletraining functionality needed in today's environment of rapidly evolving technology and tight training budgets.

Based on extensive feedback from participants, the VISIT project has fulfilled the original goal identified in 1998. The number of topics addressed, and participating students, has increased appreciably. A typical monthly training calendar now contains 20–30 teletraining sessions over a wide variety of topics. To date, over 10,000 training certificates have been awarded, and most student feedback suggests a direct applicability to current forecast problems. The VISIT Web site (online at www.cira.colostate.edu/visit) contains stand-alone versions of most sessions, with embedded instructor notes, that can be viewed using a Web browser. There are audio versions with instructor's annotations for selected sessions. The Web/audio versions make it possible to view the material at any time. VISIT teletraining applications continue 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.

[2] Most participants have taken multiple sessions, and many offices have signed up for the same session multiple times.

[3] Figure 5 shows a sharp increase in cumulative certificates until early 2001, followed by a lesser but steady increase thereafter. The reason for this trend is that the total number of sessions remains approximately constant as older sessions are transitioned to asynchronous versions and new teletraining sessions are developed.

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FOR FURTHER READING

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